FANUC

GE Fanuc Automation

Programmable Control Products

Series Six™ Programmable Controllers

Data Sheets

GE Fanuc Automation

Programmable Control Products

ATTENTION

This Product has not been reviewed for application in compliance with the European Machinery Directive 89/392/EEC. Machine Builders that elect to use these products on machines to be installed within the European Union are responsible for determining and implementing special measures necessary for compliance with the Machinery Directive.

ATTENTION

La possibilité d'utiliser ce produit sur une machine devant être conforme à la directive européenne 89/392/EEC n'à pas été contrôlée. En cas d'utilisation de ce produit sur une machine installée dans l'Union Européenne, le constructeur de la machine est reponsable de la determination et de l'implémentation des mesures nécessaires à la mise en conformité de la machine par rapport à la directive européenne 89/392/EEC.

ACHTUNG

Dieses Produkt wurde nicht auf den Einsatz in Maschinen gemäß der Europäischen Maschinen Richtlinie 89/392/EEC überprüft. Maschinenhersteller, die dieses Produkt in Maschinen, welche in Ländern der Europäische Gemeinschaft installiert werden, einsetzen möchten, sind verpflichtet alle notwendigen Maßnahmen zu ergreifen, daß die o.g. Maschinen-Richtlinien erfüllt werden.

ATTENZIONE

La possibilità di utilizzare questo prodotto su una macchina che deve essere conforme alla direttiva europea 89/392/EEC, non è stata verificata. In caso di utilizzo di questo prodotto su una macchina all'interno dell'Unione Europea, il costruttore della macchina è responsabile della determinazione e della realizzazione delle misure necessarie a soddisfare la conformità della macchina alla direttiva europea 89/392/EEC.

ATENCION

Este producto no ha sido revisado, para aplicaciones en maquinaria de acuerdo con la normativa 89/392/EEC. En caso de la utilización de éste producto en una máquina instalada dentro de la Comunidad Europea, el constructor de la máquina será responsable de le determinación y la aplicación de las medidas necesarias para que la máquina cumpla con dicha normativa.

GFZ-0095 **January 1995**

Series Six ™ Programmable Controllers

Data Sheets

GEK-25367E

January 1990

WARNINGS, CAUTIONS, AND NOTES AS USED IN THIS PUBLICATION

WARNING

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

CAUTION

Caution notices are used where equipment might be damaged if care is not taken.

NOTE

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

Preface

This manual includes all available Series Six and Series Six Plus PLC data sheets under a single GE Fanuc-NA publication number: GEK-25367. On a module-by module, and a unit-by-unit basis, this manual provides a description of the Series Six and Series Six Plus PLC Programmable Controller product line. The Table of Contents lists the data sheets two ways. First, in alphabetical order by module type; second, in sequential order by GEK and GFK publication numbers.

A data sheet is a user-oriented document, packaged with each Series Six or Series Six Plus PLC module, which contains information specific to the module it accompanies. The format of the data sheet is standardized and includes the following sections:

General Description

Features and Benefits

Specifications

User Items

Installation

Calibration and Data Format (when appropriate)

Ordering Information

The data sheet provides information for installation of the module in the Series Six or Series Six Plus system. Operation and programming of the modules are discussed in other Series Six or Series Six Plus documents.

The audience for these documents is assumed to include electricians, technicians, engineers and those people familiar with digital electronics and industrial control equipment.

Table of Contents - By Module Type

GEK-25367

Table of Contents - By Module Type

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SERIES SIX

PROGRAMMABLE CONTROLLERS

REGISTER MEMORY MODULE

GEK-83500B

1K 16-bit words of Register Memory

GENERAL DESCRIPTION

The Register Memory module is utilized in the Model 600 Central Processor Units (CPU) to provide 1024 (1K), 16-bit words of battery-backed, Complimentary Metal-Oxide Semiconductor (CMOS) memory reserved for Register-memory data. This module can be used with any functional level (Basic, Extended or Advanced). The features and benefits of this module are summarized in Table 1.

The module contains a two-tiered circuit board. The top tier, or "daughter" board, contains the CMOS memory devices; the bottom tier, or "mother" board, contains memory control circuitry, a Lithium battery and Light-Emitting Diode (LED) indicators.

The LEDs, marked "PARITY" and "BATTERY", are visible through a markable lens on the faceplate. The "PARITY" LED turns off if there is a Register memory or Table memory (contained on the Internal Memory module) parity error; the "BATTERY" LED indicates the status of the on-board Lithium battery. The LEDs operate only when the module is installed in a properly powered CPU rack.

Refer to Figure 1 for Register Memory module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Battery-Backed CMOS memory.	Retains Register memory after power-down or power failure.
Two LED indicators: • BATTERY • PARITY	Simplifies troubleshooting.

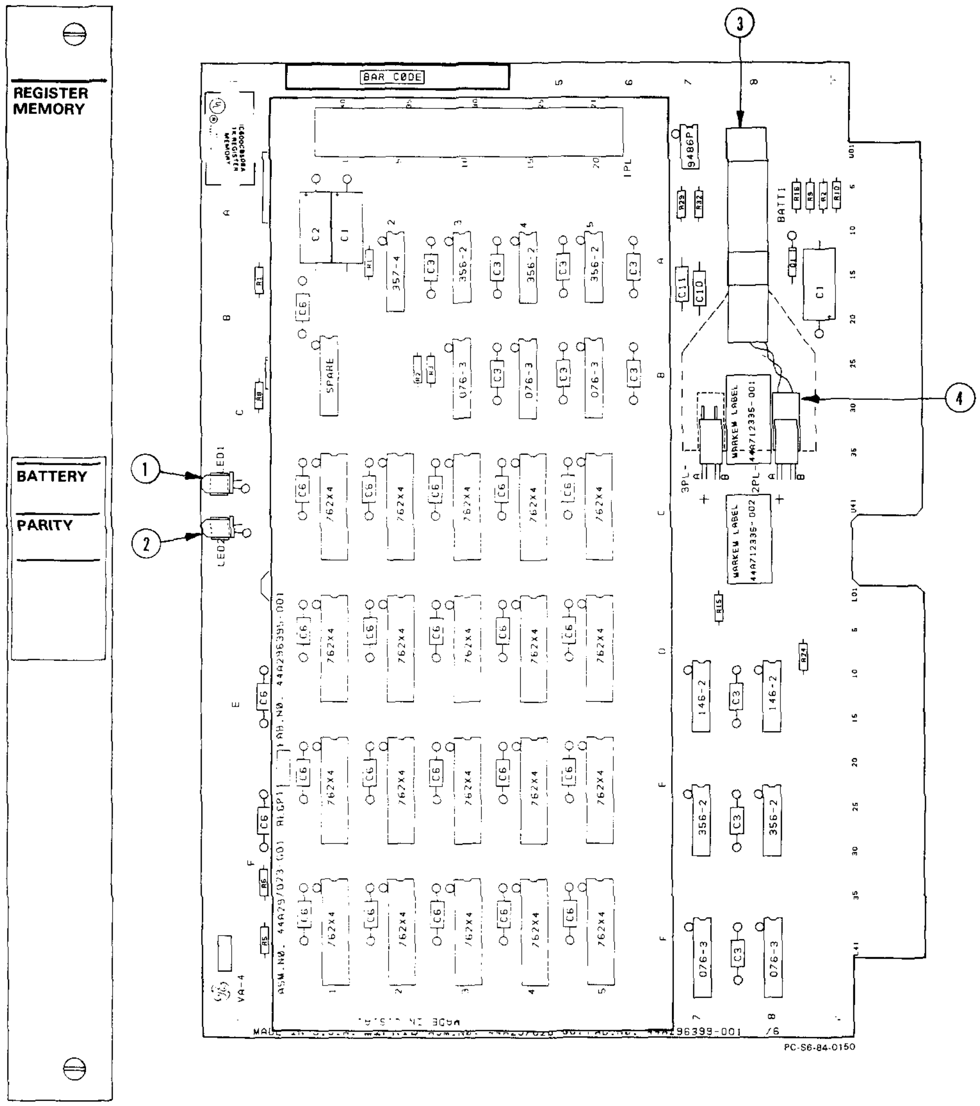
- Dimensions:

  Circuit Board:
  8.15 x 11.0 (inches)
  208 x 280 (mm)

  Faceplate:
  12.46 x 1.175 (inches)
  317x30 (mm)

- Power Requirements: 5 Vdc, 800 mA (Supplied by CPU power supply)
- Storage Temperature: 0° to 70°C
- Operating Temperature: 0° to 60°C
- Humidity: 5% - 95% (non-condensing)

FIGURE 1. SPECIFICATIONS



(1) BATTERY Light:

Steady On: Battery Normal

Flashing: Battery Low: CPU continues running. No. 2 alarm is activated. To protect the memory contents, replace the battery before it fails.

Steady Off: Battery Failed: CPU continues running, but will not restart if stopped. No. 2 alarm remains activated. Memory contents will be lost when power is switched off or lost.

For battery replacement information consult the <u>Series Six Installation and Maintenance Manual</u>, GEK-25361.

(2) PARITY Light

On: Table Memory and Register Memory parity is OK.

Off: Table Memory and/or Register Memory parity error exists. An error message appears in the work area of the Program Development Terminal display.

(3) Lithium-Manganese Dioxide Battery

(4) Battery Jacks

FIGURE 2. USER ITEMS

INSTALLATION

The Register Memory module can be installed in a Model 600 CPU. The card slot to the immediate left of the Internal Memory module is reserved for this module. Follow these steps:

1. Remove top board cover after pinching white, plastic fasteners.
2. Connect 2-pin Lithium battery connector to either of male jacks beneath battery.
3. Place top board cover over component side of circuit board, making sure that white fasteners open and catch.
4. Use extraction/insertion tool furnished with CPU to insert (or remove) module into rack.
5. Secure faceplate to rack using thumbscrews at top and bottom.
6. Clear parity errors detected at initial power-up of the CPU. Refer to Chapter 2, Series Six Programming Manual (GEK-25362)) for further details.

CAUTION

Relatively small amounts of excess charge can cause very intense electrostatic fields in metal-oxide-semiconductor (MOS) devices, damaging their gate structure. When the board covers have been removed, avoid handling this circuit board in a manner which might cause electrostatic charges. Failure to observe this CAUTION could result in the destruction of the CMOS-RAM devices in this module. With the board covers in place, it is unlikely that normal handling of this module would cause any damage.

WARNING

Do not place a short circuit between the contacts and the ends of the battery. Do not attempt to recharge the battery. Failure to observe either of these WARNINGS will cause the battery to explode, possibly resulting in personal injury.

ORDERING INFORMATION

Circuit Board and Faceplate	Faceplate
IC600CB508A	IC600FP508A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

MARCH, 1984

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83501B

8K Words of CMOS Memory

INTERNAL MEMORY MODULE

GENERAL DESCRIPTION

The Internal Memory module is utilized in the Series Six Model 600 and 6000 Central Processor Units (CPU) to provide Complimentary Metal-Oxide Semiconductor (CMOS), battery-backed, storage of I/O and Series Six Programmable Controller (PC) status data. The features and benefits of this module are summarized in Table 1.

The module contains Table and Scratchpad memory. The Table memory is categorized into three groups: Status Table, Override Table and Transition Table. The Scratchpad memory contains miscellaneous information pertaining to the Series Six PC and the user program. The contents of the Internal Memory module, as described above, are accessible to the user at the Program Development Terminal (PDT).

This module also provides an array of Dual In-Line Package (DIP) switches by which the user can indicate to the CPU the size of the total user memory space (called Logic Memory), in 2K increments.

Two Light-Emitting Diodes (LEDs) are visible through a lens on the module faceplate. An LED marked, "BATTERY", indicates the charge of the on-board Lithium battery; another, marked, "PARITY", indicates a parity error resulting from a Logic Memory access. The LEDs operate only when the module is installed in a properly powered CPU rack.

Refer to Figure 1 for Internal Memory module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Battery back-up of CMOS Memory.	Protects Table and Scratch Pad data after power-down or power failure.
Parity-error indicator.	Simplifies troubleshooting.
Battery-Status indicator.	Warns user of need for battery replacement.

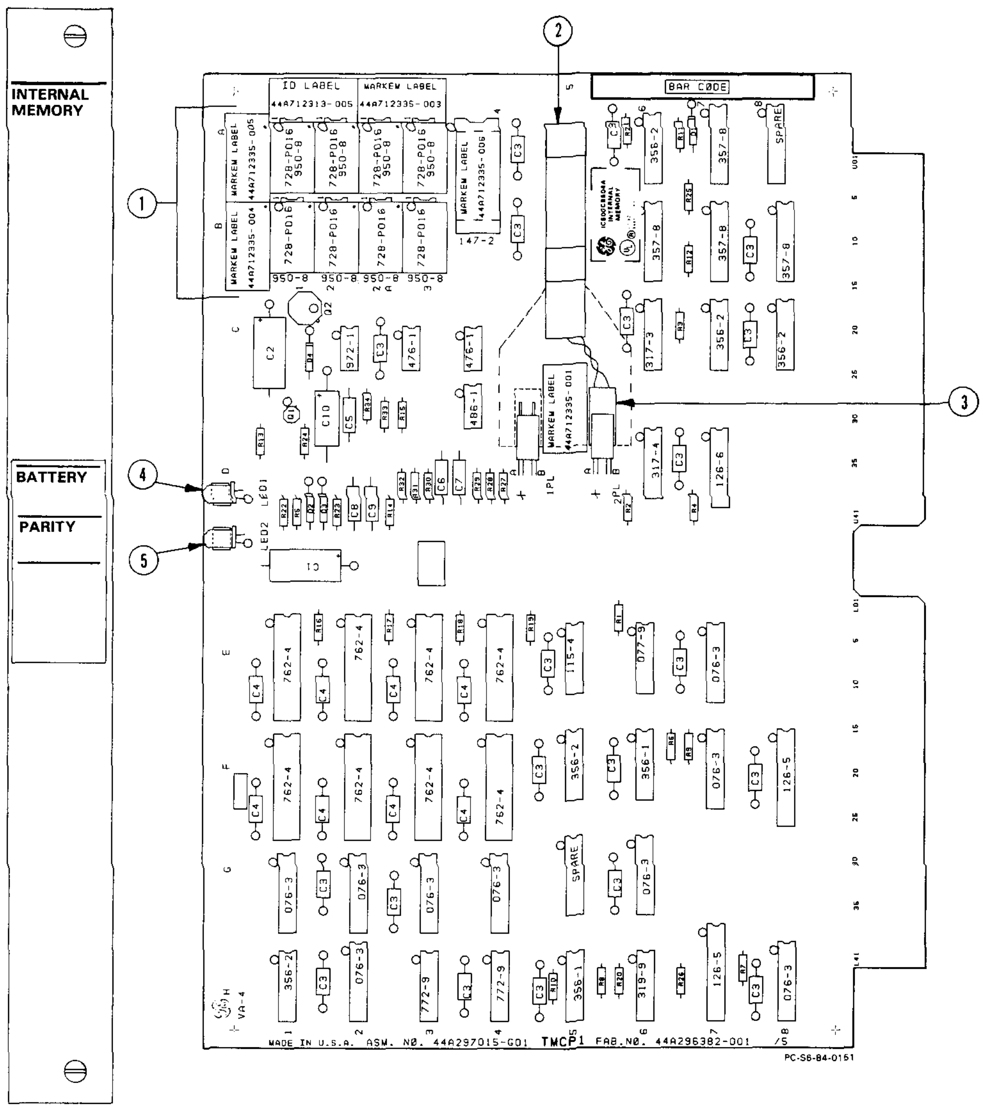
- Dimensions:

  Circuit Board:
  8.15 x 11.0 (inches)
  208 x 280 (mm)

  Faceplate:
  12.45 x 1.175 (inches)
  317x 30 (mm)

- Power Requirements: 5 Vdc, 650 mA maximum (Supplied by CPU power supply)
- Storage Temperature: 0o co 70oC
- Operating Temperature: 0" to 60°C
- Humidity: So/o-95% (non-condensing)

FIGURE 1. SPECIFICATIONS



(1) Programming Switches for Logic Memory: Sixteen, 2K-increment switches for each logic memory slot: A, B, C, and D. To set switches, consult the Installation setion of this sheet and/or the Series Six Installation and Maintenance Manual (GEK-25361).

(2) Lithium-Manganese Dioxide (Li/MnO_2) Battery

(3) Battery Connectors

(4) BATTERY Light

Steady On: Battery Normal

Flashing: Battery Low: CPU continues running. No. 2 alarm is activated. To protect the memory contents, replace the battery before it fails.

Steady Off: Battery Failed: CPU continues running, but does not restart of stopped. No. 2 alarm remains activated. Memory contents are lost when power is switched-off, or lost.

For battery replacement information, consult the Series Six Installation and Maintenance Manual.

(4) PARITY Light:
ON: Logic memory parity is OK.

Off: Logic Memory parity error exists. An error message appears in the work area of the Program Development Terminal display.

FIGURE 2. USER ITEMS

INSTALLATION

The Internal Memory module can be installed in the Model 600 and Model 6000 CPU. However, before inserting the module into the CPU rack, the array of Dual-In-Line-Package (DIP) switches (Refer to Figure 3) must be set to indicate to the Series Six CPU the amount and position of the Logic Memory (user memory) resident in the rack.

WARNING

Do not change the settings of the programming switches on this module with a program loaded into the logic memory system. Failure to observe this WARNING will cause the user program to be run out of sequence and could result in damage to plant equipment and/or injury to personnel.

The columns, D, C, B and A correspond to the Logic Memory module slots in the Model 6000 CPU as indicated in Figure 4. (The Model 600 CPU utilizes slot “A”, only). The 2K increments are selectable by individual rocker switches as indicated on the right side of the DIP-switch array. No more than 8K of memory (four, 2K increments) can be assigned to a Logic Memory slot (D, C, B or A); the user *is* advised to assign a consecutive addressing scheme (as shown in Figure 3) starting with slot A, then B, then C, and finally D. (32K of Logic Memory, or sixteen, 2K increments, is the maximum amount of Logic Memory in a Model 6000 CPU rack.) Further discussion of the DIP-switch array programming can be found in the Installation section of the installation and Maintenance Manual, GEK-25361.

Having set the DIP-switch array, follow these steps:

1. Remove top board cover after pinching white, plastic fasteners.
2. Connect 2-pin Lithium battery connector to either of male jacks beneath battery.
3. Place top board cover over component side of circuit board, making sure that white fasteners open and catch.
4. Use extraction/insertion tool furnished with CPU to insert (or remove) module into rack.
5. Secure faceplate to rack using thumbscrews at top and bottom.
6. Clear parity errors detected at initial power-up of the CPU. Refer to Chapter 2, Series Six Programming Manual (GEK-25362) for further details.

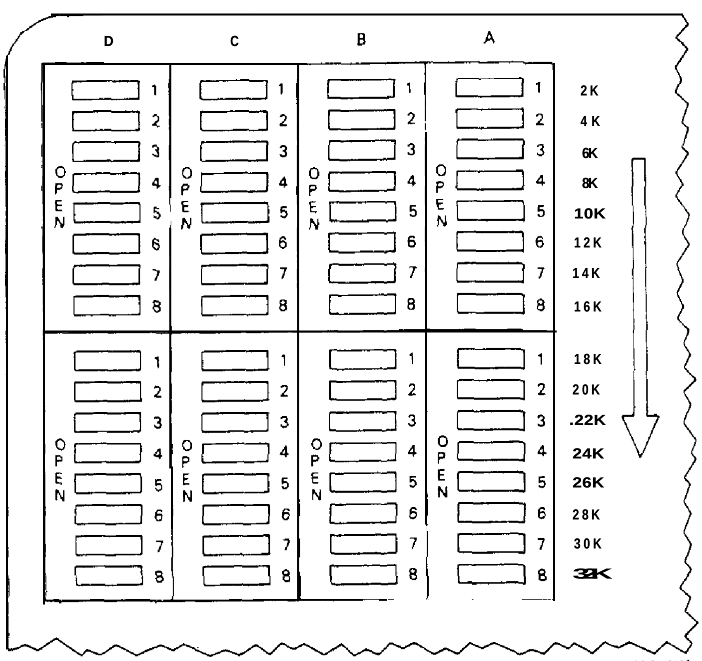


FIGURE 3. DIP-SWITCH ARRAY

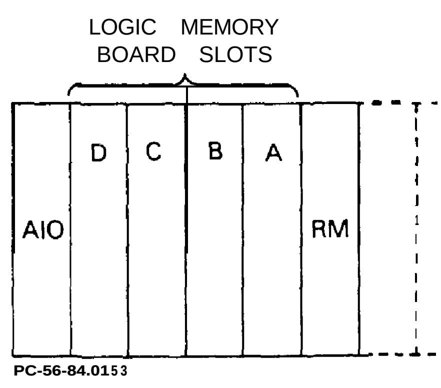


FIGURE 4. 6000 CPU

Ref. PC-S6-84-0152
PC-S&84-0153

CAUTION

Relatively small amounts of excess charge can cause very intense electrostatic fields in *metal-oxide-semiconductor* (MOS) *devices, damaging their gate structure*. When the board covers have been removed, avoid handling this circuit board in a manner which might cause electrostatic charges. Failure to observe this CAUTION could result in the destruction of the CMOS-RAM devices in this module. With the board covers in place, it is unlikely that normal handling of this module would cause any damage.

WARNING

Do not place a short circuit between the contacts at the ends of the battery. Do not attempt to recharge the battery. Failure to observe either of these WARNINGS will cause the battery to explode, possibly resulting in personal injury.

CAUTION

Do not allow the bottom of this circuit board to come into contact with a conductive (metal) surface when the board covers are removed. Failure to observe this CAUTION could result in the discharge of the non-rechargeable lithium battery and the loss of the memory contents.

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
IC600BF504A	IC600CB504A	IC600FP504A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

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GE Fanuc Automation North America, Inc., Charlottesville, Virginia

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SERIES SIX

PROGRAMMABLE CONTROLLERS

CPU/DPU POWER SUPPLY MODULE

GEK-83505B

Source Voltage:
95 to 260 Vac
Output Voltages:
+5, +12,-12Vdc

GENERAL DESCRIPTION

The CPU/DPU Power Supply module, utilized in both the Central Processor Unit (CPU) and the Data Processor Unit (DPU), is available to be used with a power source from 95 to 260 Vac. The features and benefits of this module are summarized in Table 1.

The CPU/DPU Power Supply module provides regulated + 12, -12 and + 5 DC voltages to the rack backplane. The input (or source voltage), which can range in frequency from 47 Hz to 63 Hz, is applied to terminals on the front panel, then routed through a line filter, switch, and fuse to a switching power supply.

The module provides electromechanical relay contacts for connection to user indicators, or any device to be activated during an alarm condition. The module also provides a voltage regulator for an optional, auxiliary battery that provides battery back-up of CMOS memory contained in the processor rack.

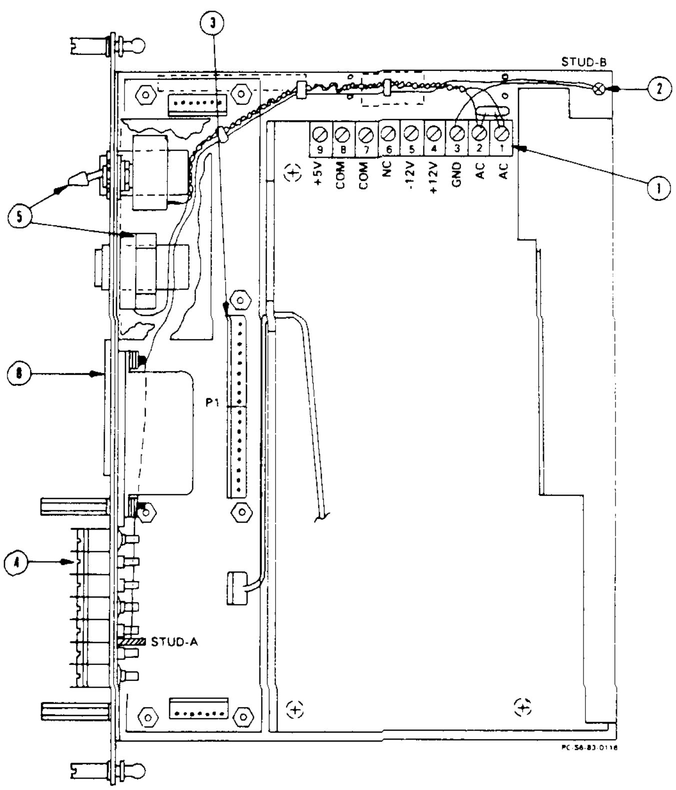
A Keyswitch mounted on the front panel is used to select either the RUN or the STOP mode for the processor; a second Keyswitch allows the user to protect the contents of the processor memories by placing them in a READ ONLY mode. The same key operates both Keyswitches. Refer to Figure 1 (next page) for the CPU/DPU Power Supply module specifications.

TABLE 1. FEATURES AND BENEFITS

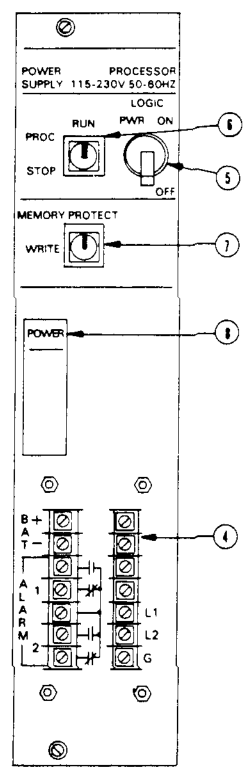
FEATURES	BENEFITS
Available in one version to include both 115 Vac and 230 Vac applications:	Compatible with variety of power sources
Can be utilized in CPU and DPU racks	Reduced spare-parts inventory
Provides electromechanical-relay contacts for alarm indications	Activates user-supplied power indicators
Contains voltage regulator for auxiliary battery	External battery back-up of CMOS memory

- Input: 95-260 Vac, 250 VA max.
  Frequency: 47-63 Hz
- Output:
  +5 Vdc, 16.5 A max.
  +12 Vdc, 1.5 A max.
  -12 Vdc, 1.0 A max.
  Total power from all outputs must be less than 90 watts.
- Allowable Power Interruption:
  33ms minimum at 115 Vac line.
- Noise Immunity: Meets requirements of NEMA ICS 2-230 and ANSI C37.90A.
- Auxiliary Battery Input: 8-28 Vdc
- Dimensions: 12.46 x 9.00 x 2.75 (inches)
  317 x 229 x 70 (mm)
- Operating Temperature: 0^{o} to $60^{o}C$
  (outside of the rack)
- Storage Temperature: $-20^{o}C$ to $+80^{o}C$
- Humidity: 5%-95% (non-condensing)

FIGURE 1. SPECIFICATIONS



SIDE VIEW



FRONT PANEL

1. Internal Terminal Strip (Refer to Figure 3)
2. Chassis Ground Terminal
3. 18-Pin Connector: Connects signal cable from rack backplane
4. Front-Panel Connector Block (Refer to Figure 4)
5. Power Switch/Fuse
6. CPU RUN/STOP Key Switch
7. MEMORY PROTECT Key Switch
8. POWER Light

   On: The voltage levels of all three DC outputs (+12V, -12V, +5V) are within tolerance
   Off: At least one of these voltage levels is too low

FIGURE 2. USER ITEMS

Ref. PC-S6-83-0116
PC-S6-83-0117

INSTALLATION

These steps define the procedures to be followed when a power supply is to be replaced on a Series Six CPU or DPU rack. The tools needed are a regular screwdriver, Phillips screwdriver, and a 5/16" wrench or nut driver.

1. Stop the system by switching the top key on the CPU to "STOP".
2. Switch off all units in the system, including the user's power supplies.
3. Remove all power from the system, preferably at the source (i.e. throw the main circuit breaker for the system).
4. Locate the power supply to be changed. The power supply is in the far right side of the CPU/DPU rack.
5. Remove the plastic cover on the lower portion of the power supply and, using a volt-meter, make sure there is no AC power present.
6. Take note of the location and color of the AC wires and then remove them, Also, remove Auxiliary battery and/or Alarm connection(s) .
7. At the top and bottom of the power supply, there are 1/4 turn thumbscrews. To loosen, turn the thumbscrews approximately 1/4 turn counterclockwise.
8. Grasp the thumbscrews and gently pull outward. Be careful not to damage the internal wiring while pulling the supply out.
9. Locate the wires that extend from the back of the rack to the terminal on the power supply. These wires should be labeled or stamped with their location; the circuit boards have wire locations stamped on them also. (Refer to Table 3.) Remove these wires. There is also a plastic wire clamp holding these wires in place. Detach this from the frame if there is not a similar item on the replacement power supply, or cut the clamp if there is one on the new supply.

   Remove the 18-pin (PI) molex connector that is on the narrow board in the front part of the power supply. The power supply should now be completely detached from the rack.
10. Take the replacement power supply and attach the wires as shown in Figure 3. Be sure to connect the 18-pin molex connector (P1) to the power supply. Attach the wire clamp on the upper stud of the power supply frame, or if there is a clamp already there, wrap the wires in it.
11. Slide the power supply into the rack, being careful not to damage the wires. When the power supply is all the way in, turn the thumbscrews clockwise until they lock in.
12. Remove the plastic cover on the lower portion of the power supply and attach the AC wires as they were on the original supply (Refer to Step 6). Replace the plastic cover.
13. Restore system power. Turn on the CPU/DPU unit. Check to see if the POWER light is on. If it is, turn on the rest of the system and resume normal operation.
14. If the POWER light does not come on, the power supply is bad or there are other problems within the rack. When this occurs, you can call the Programmable Control Service Center EMERGENCY SERVICE NUMBER (804) 978-5747 for assistance.

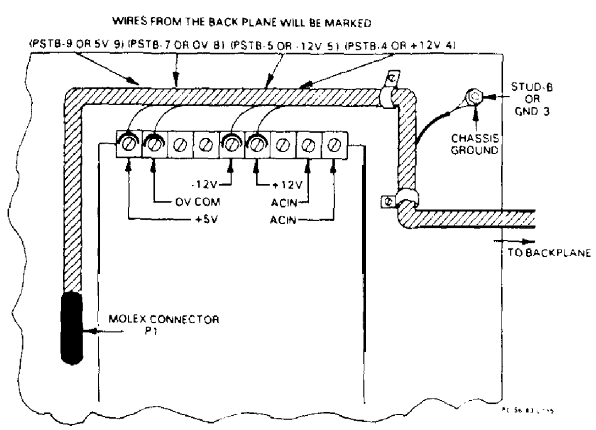


FIGURE 3. POWER SUPPLY EXTERNAL WIRING DIAGRAM

CAUTION

If a memory auxiliary battery is used, the circuit connecting it to this module should be isolated from the rest of the system. If this CAUTION is not observed, the battery could be short-circuited.

The alarm contacts consist of two sets of normally-opened and normally-closed contacts. The terminals marked "1 NO" and "1 NC" are associated with Alarm Type No. 1; the terminals marked "2 NO" and "2 NC" with Alarm type No. 2. (Refer to Installation and Maintenance Manual, GEK-25361 for further information on Alarm Nos. 1 and 2.)

CAUTION

The user devices connected to each set of Alarm terminals on this module should present a resistive load drawing no more than one amp of current at no greater than 115 Vac/28 Vdc. Failure to observe this CAUTION may result in damage to the circuit board.

NOTE

During normal operation the alarm relays are energized. During an alarm condition the contacts marked 1NO and 2NO, open, and those marked 1NC and 2NC, close.

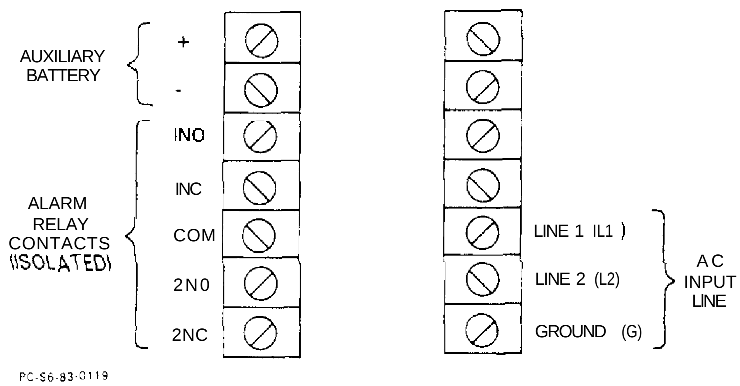


FIGURE 4. FRONT-PANEL TERMINAL BLOCK

ORDERING INFORMATION

Module	Power Supply Module
95 to 260 Vac	IC600PM500B

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

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GE Fanuc Automation North America, Inc., Charlottesviile, Virginia

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83506B

DPU, PDT and User I/O interfaces

I/O CONTROL MODULE

GENERAL DESCRIPTION

The I/O (Input/Output) Control module is utilized in the Series Six Central Processing Unit (CPU) to provide an interface between the CPU and the primary I/O chain; it also controls data transfers between the CPU and peripheral devices such as the Program Development Terminal (PDT) and the Data Processor Unit (DPU). The features and benefits of this module are summarized in Table 1.

The module provides four Light-Emitting Diodes (LED's), visible through a lens on the faceplate, which indicate I/O-chain parity and continuity conditions, whether user I/O are enabled, and problems with the DPU interface. The LEDs operate only when the module is installed in a properly powered CPU rack.

Two, 37-pin "D" type connectors are available for cable connections. One, marked "I/O", can be used for linking an I/O Receiver module up to 50 feet away; the other connector, marked "PP/DPU", can be used to connect a cable from the DPU or the PDT.

The user has the option of selecting (by jumper) whether the CPU enters the STOP mode (and Alarm No. 1 and No. 2 are activated) if there is a Data Processor Window failure and/or a Communications Window failure (between the I/O Control and the Communications Control Module (CCM)), in the course of an execution sequence by the CPU. If these options are not selected, the CPU closes the window to the DPU and/or CCM at the occurrence of a window failure, and an Alarm Condition No. 2 prevails.

Refer to Figure 1 (next page) for I/O Control module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Contains I/O and Communication Interfaces.	Centralized control of CPU Interface operations.
Four LED indicators: CHAINOK PARITY ENABLED DPU	Simplifies troubleshooting.
Can be used in Models 60,600 and 6000 CPUs.	Reduced spare-parts inventory.

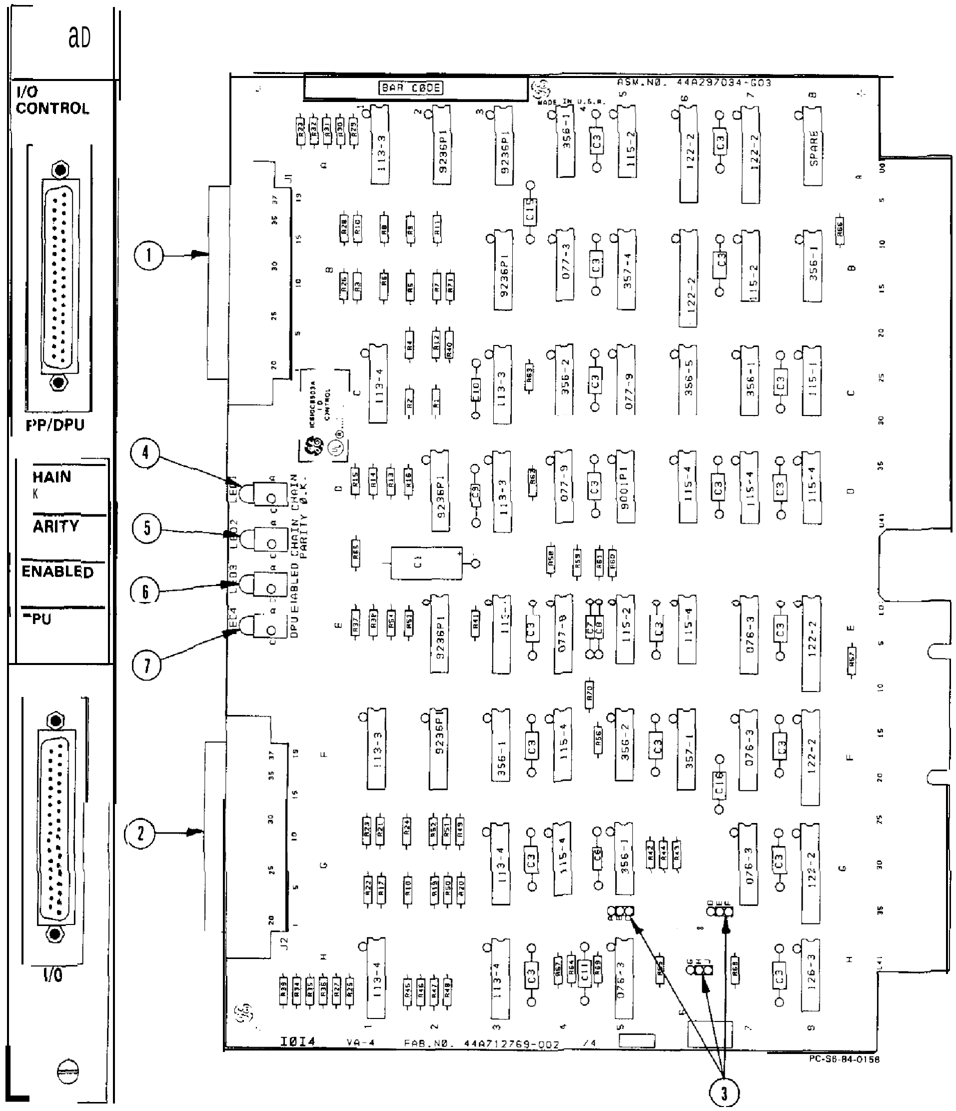
- Dimensions:

  Circuit Board: 8.15 x 11.0 (inches)
  208 x 280 (mm)

  Faceplate: 12.46 x 1.175 (inches)
  317 x 30 (mm)

- Power Requirements: 5 Vdc, 1.0 A (Supplied by CPU power supply)
- Storage Temperature: 0^0 to 70°C
- Operating Temperature: 0^0 to 60°C
- Humidity: 5% - 95% (non-condensing)

FIGURE I. SPECIFICATIONS



1 D-Type 37-Pin Connector to PDT or DPU

2 D-Type 37-Pin Connector to Primary I/O Chain
Connects to I/O Receiver module in nearest I/O rack in primary chain.

3 User Selection Jumpers
See the "Installation" section of this Data Sheet.

4 CHAIN OK Light
- On: Continuity, power, and output-data parity are OK at all I/O stations in the primary chain.
- off: A continuity or power problem or output data parity error exists at one or more primary-chain I/O stations.

5 PARITY Light
- On: Input-data parity is OK at the I/O Control module.
- Off: Input-data parity error exists.

6 ENABLED Light
- On: The outputs are enabled. CPU is operating in the RUN ENABLED mode.
- Off: The outputs are disabled. CPU is in the RUN DISABLED or the STOP mode.

7 DPU Light
- On: Data Processor is OK.
- Off: A continuity error or other type of problem exists with the DPU.

FIGURE 2. USER ITEMS

INSTALLATION

Before installing the I/O Control module in either the Model 60, 600 or 6000 **CPU,** refer to Table 2 and determine if the User Selection jumpers are in the appropriate positions.

A further discussion of these jumper selections is provided in the General Description section of this data sheet.

Install this module to the immediate left of the CPU power supply. Use the extraction/insertion tool supplied with the CPU to insert (or remove) this module in the appropriate card slot. Secure the faceplate to the rack using the thumbscrews at the top and bottom.

Connect an I/O cable (Part No. IC600WDXXXA, where "XXX" is a three-digit number corresponding to the cable length) between the I/O Receiver module in the nearest I/O rack in the primary chain and the faceplate connector on this module; secure the connector using the furnished screws.

NOTE

The total length of I/O cable interconnetting the I/O racks in the I/O station, including the cable connecting this module to the nearest I/O receiver, can not exceed 50 feet (15 meters),

*TABLE 2. USER SELECTION JUMPERS

JUMPER	POSITION	FUNCTION
B	A-B	DPU present
B	B-C	DPU not present
E	D-E	DPU fault causes Alarms No. 1 and 2
E	E-F	DPU fault causes Alarm No. 2
H	G-H	CCM fault causes Alarms No. 1 and 2
H	H-I	CCM fault causes Alarm No. 1

NOTE: Alarm No. 1 results in the CPU entering the STOP mode; Alarm No. 2 is an advisory condition.

ORDERING INFORMATION

Circuit Board and Faceplate	Faceplate
IC600CB503A	IC600FP509A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

JANUARY,

GE FANUC	**SERIES SIX** PROGRAMMABLE CONTROLLERS AUXILIARY I/O MODULE	GEK-83507C Interface up to 8000 Inputs and 8000 Outputs

GENERAL DESCRIPTION

The Auxiliary Input/Output (I/O) module is used in the Series Six Plus and Series Six model 6000 Central Processing Unit (CPU) as an interface to the Auxiliary I/O chain and thereby allows the Series Six to support an additional I/O chain. The features and benefits of this module are summarized in Table 1.

The Auxiliary I/O chain is functionally identical to the primary I/O chain. (The I/O override capability is not available, however.) Connection to the auxiliary chain is made through a faceplate connector on the Auxiliary I/O module.

Visible through a lens on the faceplate are three Light-Emitting Diodes (LEDs) that indicate chain continuity, parity conditions and if the outputs are enabled In the Auxiliary I/O chain. The LEDs operate only when the module is installed In a properly powered CPU rack and the dip shunts are in their proper locations.

The module comes from the factory configured for installation in the Series SIX Plus CPU. If the module is to be Installed in a model 6000 CPU the 4 DIP shunts must be removed from the factory-installed locattons and inserted into DIP-shunt location B Refer to figure 2).

Refer to Figure 2 (below) for Auxiliary I/O module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Provides interface to auxiliary I/O chain.	Additional 1000 Inputs and 1000 Outputs available with a model 6000 CPU Additional 8000 Inputs and 8000 Outputs available with a Series six Plus CPU
Three LED indicators: CHAIN OK PARITY ENABLED (outputs	Simplifies troubleshooting

TABLE 2. SPECIFICATIONS

- Dimensions: Circuit Board: 8.15 Y 11.0 (inches) 208 x 280 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)	- Power Requirements:5 Vdc, 500 mA (Supplied by CPU power supply) -Storage Temperature: 0 to 70C -Operating Temperature: 0 to 60C - Humidity5% - 95% (non-condensing)

TPK.A.40762

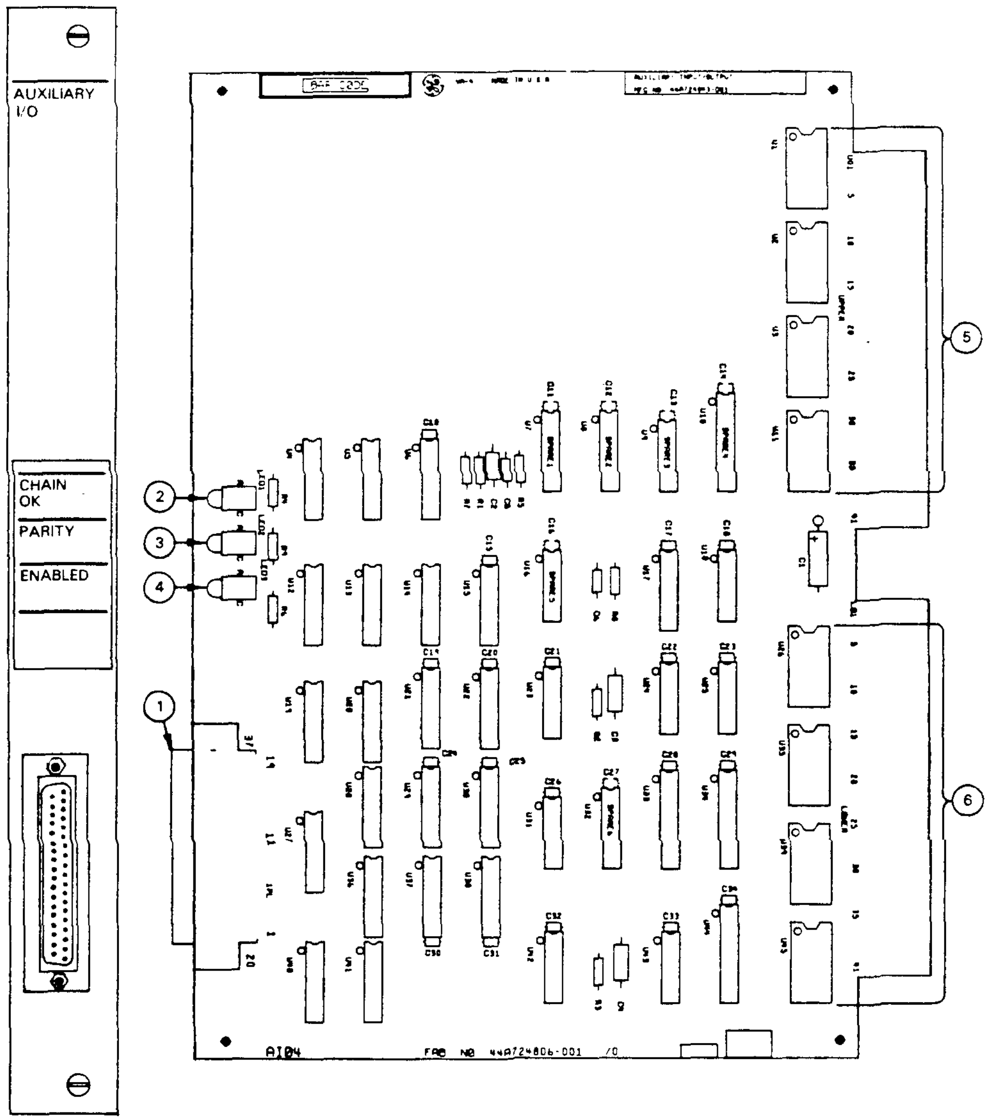


FIGURE 1. USER ITEMS

1. D-Type 37-Pin Connector to Auxiliary I/O Chain Connects to I/O Receiver module in nearest I/O rack in auxiliary chain.

2. CHAIN OK LED
   On: Continuity, power, and output-data parity are OK at all I/O stations in the auxiliary chain.

   Off: A continuity, power problem or output-data parity error exists at one or more auxiliary-chain I/O station(s).

3. PARITY LED
   On: Input-data parity is OK at the Auxiliary I/O module.

   Off: Input-data parity error exists.

4. ENABLED LED
   On: The outputs are enabled. CPU is operating in the RUN ENABLED mode.

   Off: The outputs are disabled. CPU in the RUN DISABLED or the STOP mode.

5. Dip Shunt location A (Factory installed location).

6. Dip Shunt location B.

INSTALLATION

The Auxiliary I/O module can be installed in slots 5, 6, or 7 in the Series Six Plus CPU rack. In the Model 6000 CPU the module is installed in the left most slot. Use the extraction/insertion tool supplied with the CPU to insert (or remove) this module. Secure the faceplate to the rack using the thumbscrews at the top and bottom.

Connect an I/O cable (Part No. IC600WDXXXA, where "XXX" is a three-digit number corresponding to the cable length) between the I/O Receiver or Advanced I/O receiver module in the nearest I/O rack in the auxiliary chain and the faceplate connector on this module; secure the connector using the furnished screws.

NOTE

The total length of I/O cable interconnecting the I/O racks in the I/O station, including the cable connecting this module to the nearest receiver, can not exceed 50 feet.

ORDERING INFORMATION

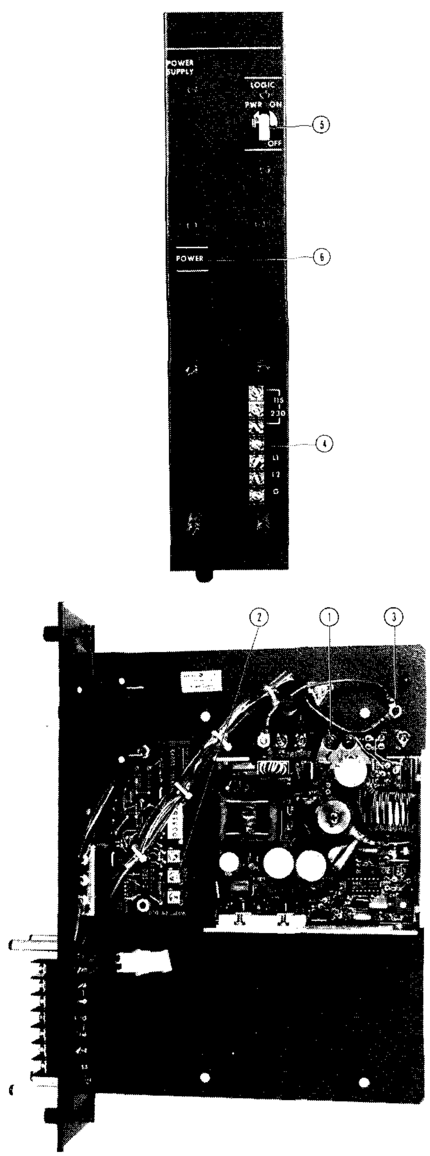
Circuit Board and Faceplate	Faceplate
IC600CB513C	IC600FP513A

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

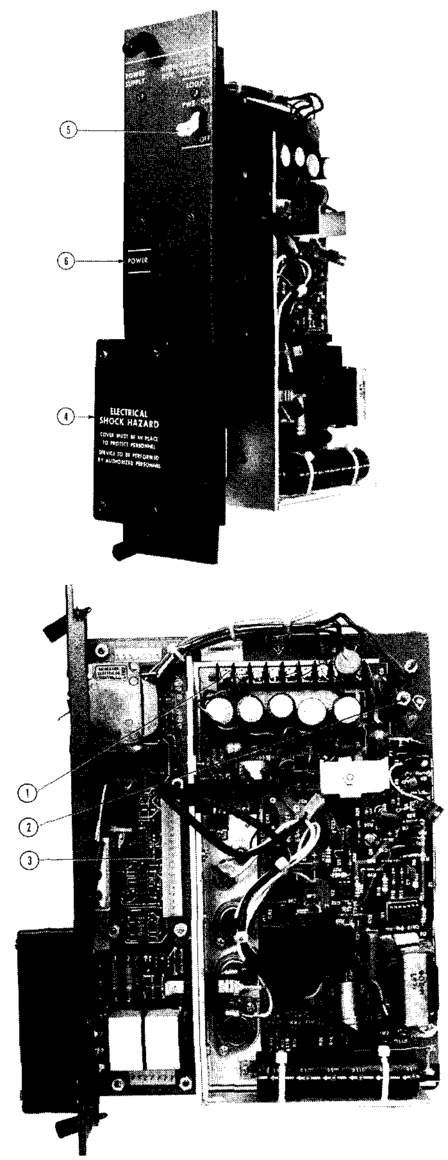
For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

JULY, 1986



STANDARD I/O POWER SUPPLY



HIGH-CAPACITY I/O POWER SUPPLY

Ref. 81-PC-49
Ref. 81-PC-46
Ref. 82-PC-8
Ref. 82-PC-9

Figure 1. User Items (Part 1 of 2)

Series Six PLC
Programmable Controllers

GEK-83511B
July, 1989

I/O Rack Power Supplies

General Description

The I/O Rack Power Supplies, which provide power for Series Six I/O modules, are available in two versions: Standard and High Capacity. The Standard I/O power supply is integral to the Standard I/O Rack; likewise, the High Capacity I/O power supply is integral to the High Capacity I/O Rack. The features and benefits of these power supplies are summarized in Table 1.

The Standard I/O power supply provides a regulated +5 Vdc voltage to the I/O Rack backplane at a maximum current rating of 6.1 amps. The High Capacity supply provides regulated +5V, +12V and -12 Vdc to the I/O Rack backplane at a maximum current rating of 16.5 amps (+5V only). This power supply provides power for high-current I/O module configurations and remote I/O applications.

The I/O Rack Power Supplies can operate from input voltages ranging from 95V -130 vac, or from 190V - 260 Vac, at frequencies of 47 to 63 Hz. The input power is applied to a terminal block on the front panel, routed through a circuit breaker and a line filter, then rectified and regulated by a switching power supply.

On the front panel of the I/O Rack power supply is a DC output ON/OFF switch called, LOGIC POWER; visible through a lens is a Light-Emitting Diode (LED) that lights when the LOGIC POWER switch is in the ON position; and underneath a black, plastic cover is an AC-input terminal block.

The I/O Rack Power Supplies also generate a power-fail signal (PSOK) which is used for system-level error indications.

Refer to Table 4 for I/O Rack Power Supply specifications.

Table 1. **Features and Benefits**

Features	**Benefits**
Input voltage can be 115 V AC or 230 V AC, 47 or 63 Hz.	Can be utilized in most installations.
"POWER" indicator on front panel. Power-fail signal supplied to I/O rack to generate system failure indications,	Simplified troubleshooting.
Available in Standard and High-Capacity versions	Useful in a variety of applications

1. DC-Output Terminals (on large circuit board)
2. Power-Fail-Signal Terminal (on small circuit board)
3. Ground Terminal
4. Front-Panel Terminal Block
5. Power Switch/Circuit Breaker
6. POWER Light
   On: The voltage level of the +5V DC output is within tolerance.
   Off: This voltage level is too low.

Standard I O Power Supply

1. Main-Circuit-Board Terminal Strip
2. Ground Terminal
3. Auxiliary-Circuit-Board Connector
4. Front-Panel Connector Block
5. Power Switch/Circuit Breaker
6. POWER Light
   On: The voltage levels of all three DC outputs (+12V, -12V, +5V) are within tolerance.
   Off: At least one of these voltage levels is too low.

High-Capacity I/O Power Supply

Figure 1. User Items (Part 2 of 2)

Installation

Verify that the I/O Power Supply to be installed can accommodate the estimated load. Total the current units as indicated in Table 2, per the I/O modules to be utilized.

If installing a Standard Power Supply, the input voltage mode must be established by jumper on the front panel terminal block. Figure 2 indicates the two input modes selectable, 115V AC or 230V AC, and the corresponding positions of the jumper strap. The High Capacity power supply input mode cannot be altered from that established at the GE factory.

These steps defme the procedures to be followed when a power supply is to be replaced on a Series Six I/O Rack. The tools needed are a regular screwdriver, Phillips screwdriver, and a 5/16" wrench or nut driver.

1. Stop the system by switching the top key on the CPU to "STOP".
2. Switch off all units in the system, including the user's power supplies.
3. Remove all power from the system, preferably at the source (i.e. throw the *main* circuit breaker for the system).
4. Locate the I/O rack power supply to be changed. The power supply is in the far right side of the I/O rack.
5. Remove the plastic cover on the lower portion of the power supply and, using a volt-meter, make sure there is no AC power present.
6. Take note of the location and color of the AC wires and then remove them.
7. At the top and bottom of the power supply, there are l/4-turn thumbscrews. To loosen, turn the thumbscrews approximately l/4 turn counterclockwise.
8. Grasp the thumbscrews and gently pull outward. Be careful while removing the power supply of the wires inside; pull the power supply completely out.
9. Locate the wires that extend from the back of the I/O rack to the terminal on the power supply. These wires should be labeled or stamped with their location; the circuit boards have wire locations stamped on them also, (Refer to Table 3.) Remove these wires. There is also a plastic wire clamp holding these wires in place. Detach this from the frame if there is not a similar item on the replacement power supply, or cut the clamp if there is one on the new supply.

   On the High Capacity rack, remove the 18-pin (Pl) molex connector that is on the narrow board in the front part of the power supply. The power supply should now be completely detached from the I/O rack.
10. Take the replacement power supply and attach the wires as shown in Table 3. On the High Capacity rack be sure to connect the 18-pin molex connector (Pl) to the power supply. Attach the wire clamp on the upper stud of the power supply frame, or if there is a clamp already there, wrap the wires in it.
11. Slide the power supply into the rack, being careful of the wires. When the power supply is all the way in, turn the thumbscrews clockwise l/4 turn, or until they lock in.

12. Remove the plastic cover on the lower portion of the power supply and attach the AC wires as they were on the original supply (Refer to Step 6). Replace the plastic cover.
13. Restore system power. Turn on the I/O Rack. Check to see if the "Power" light is on. If it is, turn on the rest of the system and resume normal operation.
14. If it does not come on, the power supply is bad or there are other problems within the I/O Rack. When this occurs, you can call the Programmable Control Service Center EMERGENCY SERVICE NUMBER (804) 978-5747 for assistance.
15. Repack the power supply removed from the I/O Rack and return to Industrial Control Department, General Electric Company for proper credit.

Table 2. Summary of Units of Load for I/O Modules

Catalog Number	Module Description	Units of Load (1)		
		+5 V	+12 V	-12 V
IC600BF800	I/O Receiver	9	-	-
IC600BF801	Remote I/O Receiver	42	10	10(2)
IC600BF802	24 to 48 V dc Input	2	-	-
IC600BF804	115 V ac/dc Input	2	-	-
IC600BF805	230 V ac/dc Input	2	-	-
IC600BF806	12 V ac/dc Input	2	-	-
IC600BF808	Interrupt Input	3	-	-
IC600BF810	115 V ac/dc Isolated Input	2	-	-
IC600BF813	Type J Thermocouple Input	29	-	-
IC600BF814	Type K+ Thermocouple Input	29	-	-
IC600BF815	Type S Thermocouple Input	29	-	-
IC600BF816	Type T Thermocouple Input	29	-	-
IC600BF817	Type B Thermocouple Input	29	-	-
IC600BF818	Type E Thermocouple Input	29	-	-
IC600BF819	Type R Thermocouple Input	29	-	-
IC600BF827	High Speed Counter	19	-	-
IC600BF830	Advanced I/O Receiver	12	-	-
IC600BF831	High Density Input	4	-	-
IC600BF841	0 to 10 V dc Analog Input	29	-	-
IC600BF842	10 V dc Analog Input	29	-	-
IC600BF843	4 to 20 mA Analog Input	29	-	-
IC600BF900	I/O Transmitter	34	-	-
IC600BF901	Remote I/O Driver	38	10	10(2)
IC600BF902	24 V dc Sink Output	7	-	-
IC600BF903	48 V dc Sink Output	7	-	-
IC600BF904	115 V ac Output	9	-	-
IC600BF905	230 V ac Output	9	-	-
IC600BF906	12 V dc Sink Output	7	-	-
IC600BF907	12 V dc Source Output	7	-	-
IC600BF908	24 V dc Source Output	7	-	-
IC600BF909	48 V dc Source Output	7	-	-
IC600BF910	115 V ac Isolated Output	8	-	-
IC600BF912	230 V ac Isolated Output	8	-	-
IC600BF914	Reed relay output	13	-	-

Table 2. Summary of Units of Load for I/O Modules - Continued

Catalog Number	Module Description	Units of Load (1)		
		+5 V	+12 V	-12 V
IC600BF915	Axis Positioning Module, Type 1	23	7	3
IC600BF917	Axis Positioning Module, Type 2	21	11	6
IC600BF921	5 V TTL Output	3	-	-
IC600BF923	10 to 50 V dc Sink Output	3	-	-
IC600BF924	120 V dc Output	5	-	-
IC600BF929	10 to 50 V dc Source output	3	-	-
IC600BF930	115 V ac Protected Output	8	-	-
IC600BF941	*0 to 10 V dc Analog Output*	29	-	-
IC600BF942	10 V dc Analog Output	29	-	-
IC600BF943	4 to 20 mA Analog Output	29	-	-
IC600BF944	ASCII/BASIC Module (12K)	20	12	-
IC600BF949	ASCII/BASIC Module (28K)	20	12	-
IC600BF946	Loop Management Module	20	12	-
IC600BF947	I/O Link Local	20	12	-
IC600BF948	I/O CCM	20	12	-
IC600BF950	I/O CCM4	20	12	-
IC660CBB900	Genius Bus Controller	20	2	-
IC660CB902	Genius Bus Controller w/Diag.	20	2	-
IC660CBB901	Genius Bus Controller	20	2	-
IC660CB903	Genius Bus Controll wo/Diag.	20	2	

(1) For +5 V dc, 1 unit of load equals 60 mA (300 mw of power). For +12 and -12 V dc, 1 unit of load equals 25 mA (300 mw of power).

(2) +12 V and -12 V current is less than 1 unit of load if RS-232 mode is not used.

Ref. 70.6

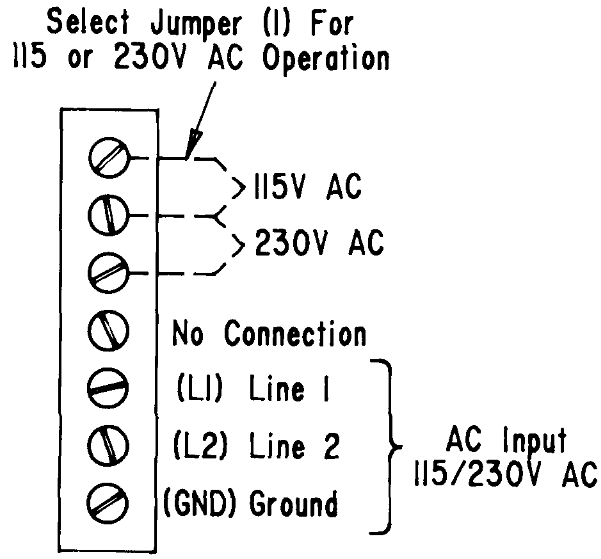


Figure 2. Standard I/O Power Supply Front-Panel Terminal Block

Table 3. Power Supply To I/O Rack Wiring

Standard Power Supply To I/ORack Wiring

Wire	Function	Location
Black wire (heavy insulation)	+5V	(+) Terminal-large board
White wire (heavy insulation)	0V	(-) Terminal-large board
Black wire (from within gray cable)	+5V	+5V Terminal-small board
White wire (from within gray cable)	PSOK	PSOK Terminal-small board
Bare wire (clear insulation)	GND	GND Terminal-small board
Green wire	GND	Stud on power supply frame

High-Capacity Power Supply To I/O Rack Wiring

Wire	Function	Terminal
Black wire "Plus 12V-6"	+12V DC	2
Black wire "-12V-5"	-12V DC	3
White wire "0V-8"	DC common	COM
Black wire "Plus 5V-9"	+5V DC	+5

Table 4. Specifications

• **Dimensions:**	12.46 x 9.00 x 2.75 (inches) 317 x 229 x 70 (mm)
• **Input:**	95 - 130 Vac, 700 mA (max.) 190 - 260 Vac, 350 mA (max.) 47-63 Hz
• **Operating Temperature:**	0° to 60°C
• **Storage Temperature:**	-20° to +80°C
• **Humidity:**	5% - 95% (non-condensing)
• **Output:**	High-Capacity: + 5 Vdc, 16.5 A (max.) +12 Vdc, 1.5 A (max.) -12 Vdc, 1.0 A (max.) **** Total power is limited to 90 watts** Standard: +5 Vdc, 6.1 A (max.)

Table 5. Ordering Information

	115V AC Input	230V AC Input
Standard Power Supply	IC600PM502A	IC6OOPM502A
High Capacity Power Supply	IC600PM503A	ICBOOPMS03A

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

SERIES SIX

GE FANUC

GEK-83512C

PROGRAMMABLE CONTROLLERS

I/O RECEIVER MODULE

GENERAL DESCRIPTION

The Input/Output (I/O) Receiver module is utilized in all I/O racks (except for the first I/O rack in a Remote I/O station) to provide an interface for address, data, and control signals between the Series Six CPU and I/O modules; it also provides a link in a daisy chain to other I/O racks. The I/O Receiver module features and benefits are summarized in Table 1.

The I/O Receiver module monitors three types of error conditions: Daisy-chain power and continuity of I/O racks downstream (CHAIN OK); parity of data output by CPU (LOCAL PARITY); parity of CPU output data, driven by an I/O Transmitter module, as detected by other I/O Receiver module(s) downstream (CHAIN PARITY).

Corresponding LED indicators, visible through the module faceplate, turn off when the module detects errors and function as troublshooting aids.

The module comes from the factory configured for installation in all intermediate I/O racks in the daisy chain; however, the user is instructed to reconfigure this module to ensure proper termination of the I/O Bus if the module is to be installed at the end of the I/O station daisy chain. (Refer to NOTE on this page,)

The module also adds parity bits to bytes of data generated by resident I/O modules and transfers parity bits generated by I/O modules downstream.

Refer to Figure 1 (next page) for I/O Receiver module specifications.

NOTE

I/O Receiver module Model IC600BF800B differs from Model IC600BF800A with regard to the module configurations described above. With the 800A model, users were instructed to remove a pair of DIP-shunts from all modules to be installed in intermediate (non-terminating) I/O racks. In the 800B model, however, a jumper-pack is installed at the factory for use in intermediate racks and a pair of DIP-shunts are provided for installation in the terminating, or last, I/O rack.

The user should also note that these models are electrically compatible and can be utilized in the same I/O station.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Error detection lights.	Simplifies troubleshooting.
Contains parity detection/generation circuitry.	I/O data integrity protected.
Provides DIP-shunts for I/O Bus termination.	Flexibility in I/O station set-up.
Usable in all Series Six t/O stations.	Reduced spare-parts inventory.

- Dimensions:

  Circuit Board:
  8.15 x 11.0 x 1.20 (inches)
  208 x 280 x 31 (mm)

  Faceplate:
  12.46 x 1.175 (inches)
  317 x 30 (mm)

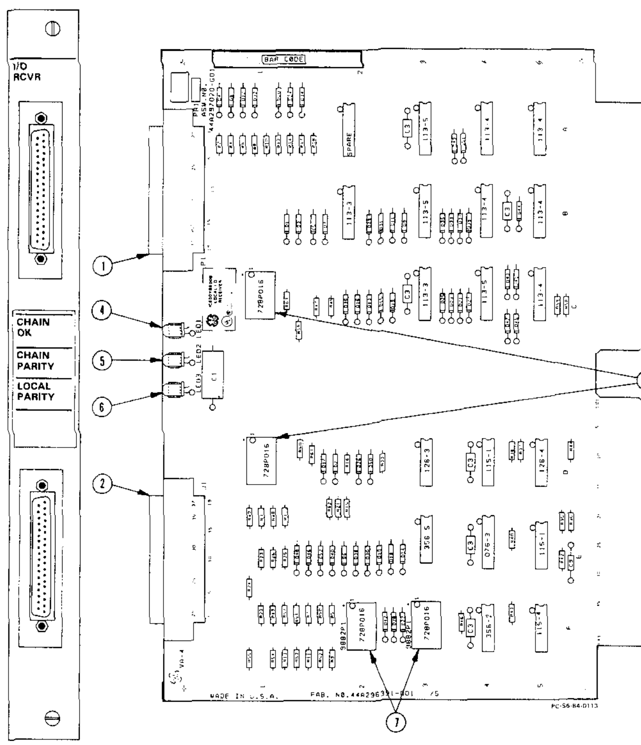
- Power Requirements: 5V DC, 750 mA maximum. Supplied by I/O power supply.

- Operating Temperature: 0^{o} - 60^{o}C (at the outside of the rack)

- Storage Temperature: -20^{o} to + 80^{o}C

- Humidity: 5% - 95% (non-condensing)

FIGURE 1. SPECIFICATIONS



① P1: D-Type 37-Pin Connector to Upstream I/O Receiver, I/O Transmitter, I/O Control, or Remote I/O Receiver Module.

② J1: D-Type 37-Pin Connector to Downstream I/O Receiver Module.

③ Locations C1 and D1:
Jumper-pack or DIP-shunts are installed in these locations. (Refer to Figure 3.)

④ CHAIN OK Light:
On: Power is OK in this and all downstream racks and stations, and continuity is OK to all downstream points.
Off: At least one of these conditions is not met.

⑤ CHAIN PARITY Light:
On: Output parity is OK at all downstream stations which are connected through an I/O Transmitter in this rack.
Off: There is an output parity error at one (or more) of these stations.

⑥ LOCAL PARITY Light:
On: Output parity is OK at this module.
Off: This module has detected an output parity error.

⑦ Locations F3 and F4:
DIP-SHUNTS and JUMPER-PACK Holders:
(Refer to Figure 3.)

FIGURE 2. USER ITEMS

INSTALLATION

Before installing the I/O Receiver module in an I/O rack, determine if the module is to be situated at the end of the I/O station daisy chain. If it is, remove the jumper-pack from its factory-installed location and insert DIP-shunts in locations C1 and D1. (Refer to Figure 3.)

The I/O Receiver module is normally installed in the left-most slot of the I/O Rack; however, it could be placed in any slot in the I/O Rack if need be.

NOTE

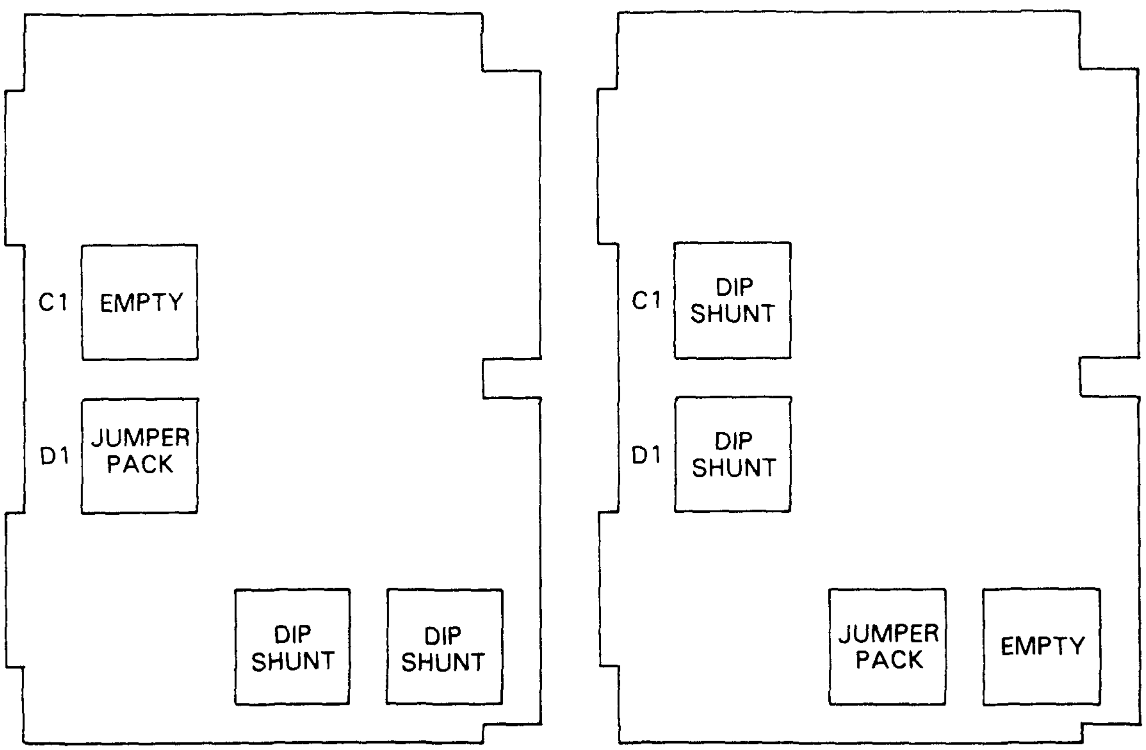
Turn off the LOGIC POWER switch on the I/O Rack before inserting this module in the I/O Rack. This puts the CPU in the Stop mode.

Use the extraction/insertion tool furnished with the CPU to remove or install the circuit board. With the board in the rack, ensure that the faceplate is slipped over the circuit board so that proper contact is made; then secure the faceplate to the rack using the thumbscrews at the top and bottom.

Connect an I/O cable from the upper front-panel connector (P1) on this module upstream to an I/O Receiver (or Remote I/O Receiver) in the same I/O station, to an I/O Transmitter in another I/O station, or to the I/O Control (or Auxiliary I/O) module in the CPU. If the module is not to be installed at the end of the daisy chain, connect an I/O cable from the lower front-panel connector (J1) downstream to another I/O Receiver in the same I/O station; then secure all connectors using the furnished screws.

NOTE

When the LOGIC POWER switch is turned back on, the CPU will automatically restart.



Intermediate I/O Rack Installation (As shipped from Factory)

Last I/O Rack in Daisy-Chain

FIGURE 3. I/O RECEIVER MODULE CONFIGURATIONS

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
IC600BF800B	IC600YI3800B	IC600FP800A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the **same** equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

JANUARY, 1984

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83513C

8 inputs per module

AC/DC INPUT MODULES

GENERAL DESCRIPTION

The AC/DC Input modules detect bipolar AC and DC voltages supplied by, and controlled by, the user. The modules are available in four versions: 12 Vac/dc, 24-48 Vac/dc, 115 Vac/dc, and 230 Vac/dc. The features and benefits of these modules are summarized in Table 1.

A module contains eight inputs, divided into two groups, each group sharing a neutral circuit (either N1 or N2).

An input circuit contains a rectifier, a noise filter to reduce common mode transients, an opto-isolator, and a Schmitt trigger (one-shot), which fires to indicate that a voltage (AC or DC) in a specified range has been detected. An active input circuit is indicated by a Light-Emitting Diode (LED), visible through a lens on the faceplate.

Refer to Figure 1 (next page) for AC/DC Input module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Four modules available: 12 Vac/dc 24-48 Vac/dc 115 Vac/dc 230 Vac/dc	Useful in a variety of applications.
LED for each input/Color-coded faceplates.	Allows visual inspection of I/O operations,
Eight inputs per module.	Efficient use of I/O rack spare.
Optically-coupled inputs.	Provides electrical isolation between user power supplies and Series Six Programmable Controller.
APPLICATIONS	
* Monitor:	
* Limit Switches	* Cam Switches
* Toggle Switches	* Relays

- Dimensions:

  Circuit Board:
  8.15 x 11.0 (inches)
  208 x 280 (mm)

  Faceplate:
  12.46 x 1.175 (inches)
  317 x 30 (mm)

- Power Requirements: 5V DC, 104 ma maximum
  Supplied by I/O power supply.

  The user must supply power for the input devices.

- Number of Inputs:
  Eight (8), in two groups of 4 inputs with a common, neutral connection.

- Operating Temperature: 0^{o} to $60^{o}C$
  (At the outside of rack)

- Storage Temperature: -20^{o} to $+80^{o}C$

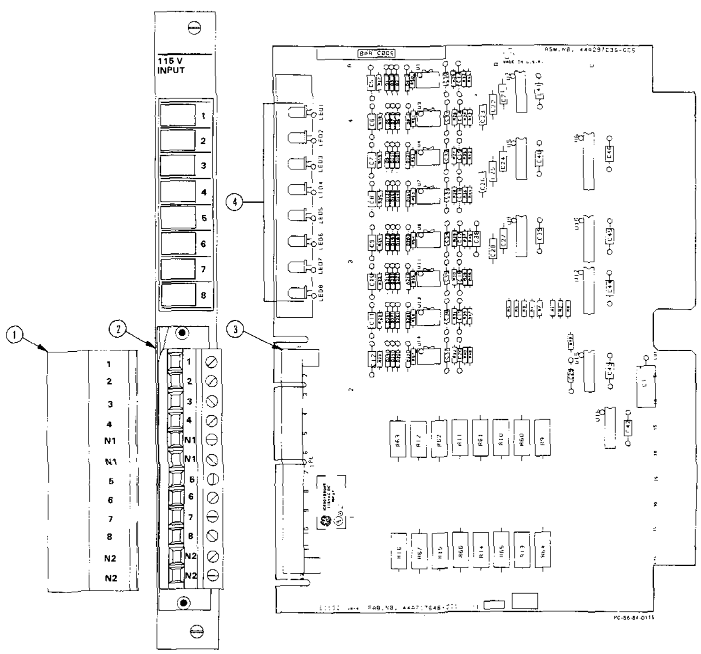
- Humidity: 5 to 95% (non-condensing)

Module	ON Range	OFF Range	Input Loading
12V Input (AC/DC)	10-20V	0-4V	1 k Ω (7.0 ma @ 12V)
24-48V Input (AC/DC)	20-60V	0-8V	3 k Ω (6.3 ma @ 24V)
115V Input (AC/DC)	90-130V	0-30V	20 k Ω(5.5 ma @ 115V)
230V Input (AC/DC)	180-260V	0-50V	39 k Ω(5.8 ma @ 230V)

ON Delay: 10-20 ms

OFF Delay: 20-50 ms

FIGURE 1. SPECIFICATIONS



① Terminal Cover

② User Terminal Block: Accepts connections from user input devices. See the "Installation" section and Figure 3 of this Data Sheet.

③ Circuit Board Terminal Block: Mates with the user terminal block.

④ Input Lights: 1 through 8
ON: The associated input is in the ON state.
OFF: The associated input is in the OFF state.

FIGURE 2. USER ITEMS

INSTALLATION

The AC/DC Input modules can be installed in an I/O rack or the I/O rack section of the Model 60 Central Processor Unit (CPU). Follow these steps:

1. Set the Dual-In-Line-Package (DIP) switches directly behind the card slot on the rack backplane to establish the correct correspondence between the input terminals on this module and a group of eight consecutive input numbers in the user program. For further information on I/O DIP-switch settings, refer to the Installation Section of the Series -Six Installation and Maintenance Manual (GEK-25361).

2. Use to the extraction/insertion tool furnished with the Series Six CPU to insert (or remove) this module in the card slot.

3. Guide the faceplate over the circuit board so that the terminals near the bottom of each are mated; secure the faceplate to the rack using the thumb-screws at the top and bottom.

4. Refer to Figure 3. Connect one side of the user circuit to the appropriate input terminal (1 through 8). Circuits connected to inputs 1 through 4 must have their opposite sides connected to either of the Nl terminals. Likewise, circuits connected to inputs 5 through 8 must have their opposite sides connected to either of the N2 terminals.

   In reference to Figure 3, note that wires connected to the Nl terminals are at the same potential, as are wires connected to the N2 terminals.

   Each input terminal can accommodate one No. 12 AWG wire or two No. 14 AWG wires.

5. Guide the terminal cover onto the top of the terminal block, then slide it downward over the terminals.

A markable area is provided on the plastic lens beside each LED for noting the function or source of each input. The faceplates are color coded:

Green:	12V or 24-48V
Orange:	115v
White:	230V

WARNING

Voltages from user field devices may be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

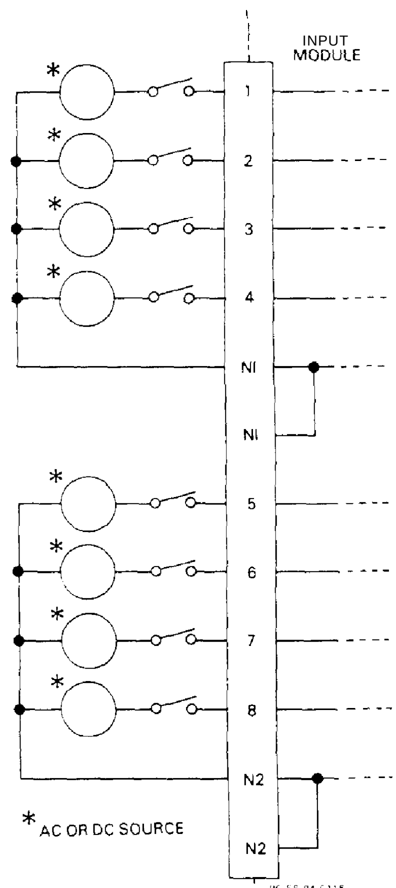


FIGURE 3. TYPICAL USER INPUT CONNECTIONS

ORDERING INFORMATION

Module	Circuit Board and Faceplate	Circuit Board	Faceplate
12 Vac/dc	IC600BF806B	IC600YB806B	IC600FP806A
24-48 Vac/dc	IC600BF802B	IC600YB802B	IC600FP802A
115 Vac/dc	IC600BF804B	IC600YB804B	IC600FP804A
230 Vac/dc	IC600BF805B	IC600YB805B	IC600FP805A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83514C

8 outputs @
115 Vac
230 Vac

AC OUTPUT MODULES

GENERAL DESCRIPTION

The AC output modules function as discrete switching devices between user AC power sources and user loads. The modules are available in two versions: 11 S Vac and 230 Vac. The features and benefits of these modules are summarized in Table 1.

A module contains eight outputs, divided into two groups, each group capable of connecting a common power source. Each output circuit utilizes a TRIAC as a switching device that connects the associated output terminal to the high side of the user power source when the output is in the ON state.

Provision is made in the Series Six Programmable Controller (PC) to automatically disable the outputs of the AC Output modules in the event of an Input/Output I/O chain failure or a Central Processor Unit (CPU) failure.

Visible through a lens on the faceplate are pairs of neon lamps associated with each output. One lamp indicates that the output is in the ON state; the other indicates the status of a fuse also included in each of the eight output circuits.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Two modules available: 115Vac 230Vac	Useful in a variety of applications
Indicator lights for each output: ON/OFF light Blown Fuse light	Simplifies troubleshooting.
Eight inputs per module.	Efficient use of I/O rack space.
Optically-coupled inputs.	Provides electrical isolation between power sources and Series Six PC.

APPLICATIONS	
* Solenoids	* Motors
* Indicator lights	* Motor starters

- Power Requirements: 5V DC, 535 mA maximum
  Supplied by I/O power supply.

Module	User-Supplied Voltage	Leakage (OFF)
115V AC	90-130V AC	1.7mA @ 115V
230V AC	180-260V AC	1.0mA @ 230V

- ON-State Current:

  Maximum: 2 A @ 40°C (Derate to 50% duty cycle @ 60°C).

  Minimum: 5 mA

- ON-State Voltage Drop: 1.5V typical 2.5V max.
- Humidity: 5-95% (non-condensing)
- Storage Temperature: -20° to +80°C
- Dimensions:

  Circuit Board: 8.15 x 11.0 x 1.20 (inches)
  208 x 280 x 31 (mm)

  Faceplate: 12.46 x 1.175 (inches)
  317 x 30 (mm)

- Inrush Current: 12 A for 33 ms (max.)
- ON Delay: less than 1 ms
- OFF Delay: Less than 1/2 cycle
- Number of Outputs:

  Eight (8), in two groups of 4 outputs with common high and neutral connections.

- Operating Temperature: 0-60°C
  (at the outside of the rack)

FIGURE 1. SPECIFICATIONS

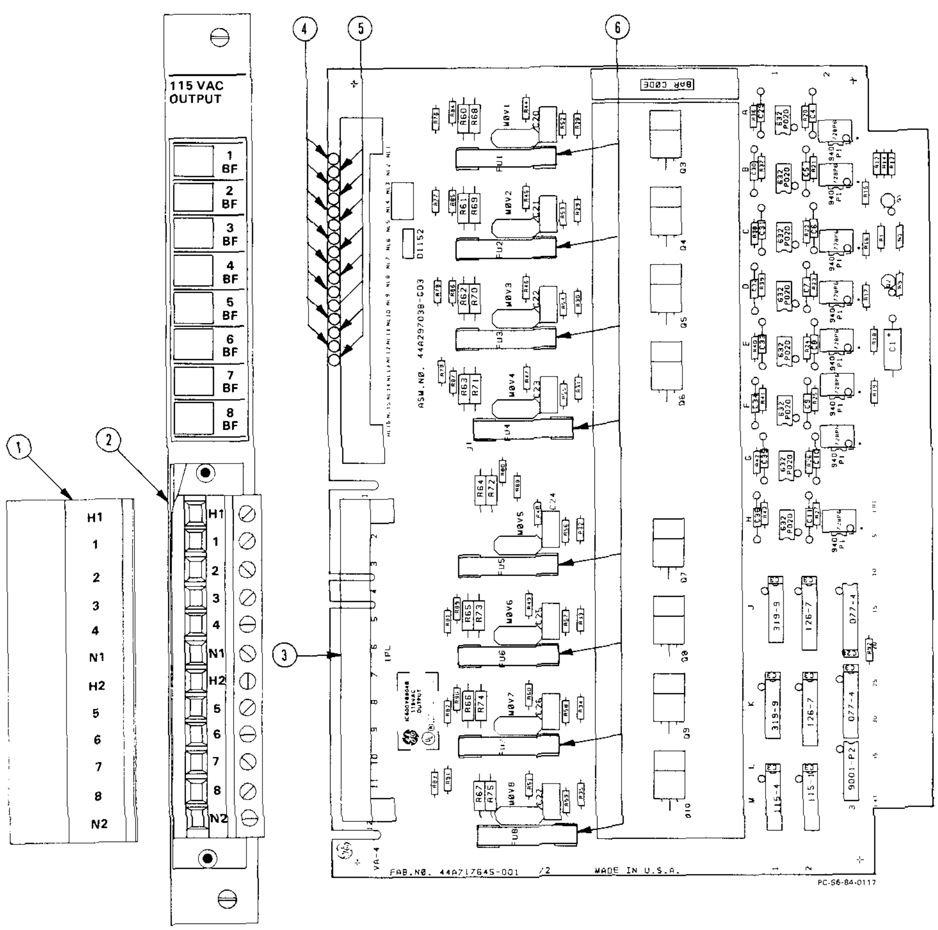


FIGURE 2. USER ITEMS

(1) Terminal Cover

(2) User Terminal Block:
Accepts connections from user output devices and the AC power source(s). See the "Installation" section of this Data Sheet.

(3) Circuit-Board Terminal Block:
Mates with the user termina1 block.

(4) Output Lights: 1 through 8

Off: Corresponding output is in the ON state.

Off: Corresponding output is in the OFF state.

(5) BF (Blown Fuse) Lights

On: The fuse for corresponding output is open (blown).

Off: The fuse for corresponding output is OK.

(6) Output-Circuit Fuses (3 A normal blow).

FIGURE 2. USER ITEMS (Part 2 of 2)

INSTALLATION

The AC Output modules can be installed in an I/O rack *or* the I/O rack section of the Model 60 Central Processor Unit (CPU). Follow these steps:

1. Set the Dual-In-Line Package (DIP) switches directly behind the card slot on the rack backplane to establish the correct correspondence between the input terminals on this module and a group of eight consecutive input numbers in the user program. For further information on I/O DIP switch settings. refer to the lnstallation section of the Series Six Installation and Maintenance Manual (GEK-25361).

2. Use the extraction/insertion tool furnished with the Series Six CPU to insert (or remove> this module in the card slot.

3. Guide the faceplate over the circuit board so that the terminals near the bottom of each are mated; secure the faceplate to the rack using the thumbscrews at the top and bottom.

4. Refer to Figure 3. Connect one side of the user circuit to the appropriate input terminal (1 through 8). Circuits connected to inputs 1 through 4 must have their opposite sides connected to either of the Nl terminals. Likewise, circuit connected to inputs 5 through 8 must have their opposite sides connected to either of the N2 terminals.

   In reference to Figure 3, note that wires connected to the N1 terminals are at the same potential, as are wires connected to the N2 terminals.

   Each input terminal can accommodate one No. 12 AWG wire or two No. 14 AWG wires.

5. Guide the terminal cover onto the top of the terminal block, then slide it downward over the terminals.

A markable area is provided on the plastic lens beside each Light-Emitting Diode (LED) for noting the function or source of each input. The faceplates are color coded:

Yellow:	115 Vac
Red:	230 Vac

WARNING

Voltages from user field devices may be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handing the faceplate of this module or any wires connected to it.

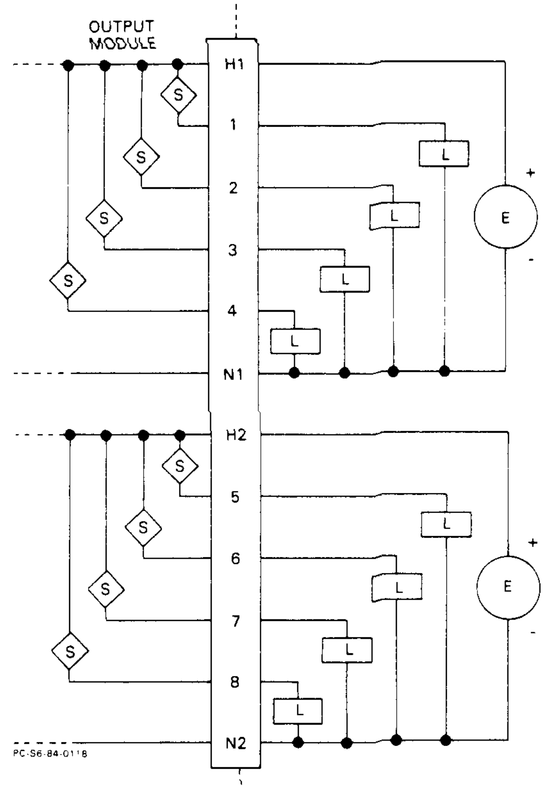


FIGURE 3. TYPICAL USER OUTPUT CONNECTIONS

ORDERING INFORMATION

Module	Circuit Board and Faceplate	Circuit Board	Faceplate
115 Vac	IC600BF904B	IC600YB904B	IC600FP904B
230 Vac	IC600BF905B	IC600YB905B	IC600FP905B

CATALOG NUMBER REVISION SUFFIX

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For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

SERIES SIX

PROGRAMMABLE CONTROLLERS

I/O TRANSMITTER MODULE

GENERAL DESCRIPTION

The Input/Output (I/O) Transmitter module provides an interface between the I/O rack it resides in and an I/O rack, downstream, up to 500 feet (150meters) away. The features and benefits of this module are summarized in table 1.

A DC-to-DC converter on the circuit board provides a +5 Vdc supply voltage to circuits connected to the I/O Bus. Consequently, I/O stations downstream from the I/O Transmitter module are electrically isolated from I/O stations upstream and the Series Six Central Processor Unit (CPU).

This module is jumper selectable to work in either NORMAL or EXPANDED I/O modes. The NORMAL I/O mode allows 1 I/O chain per CPU (default setting). The EXPANDED I/O mode allows up to 8 I/O chains (16 including AUX) per CPU. This feature yields a system maximum of 16K I/O points (32K including AUX).

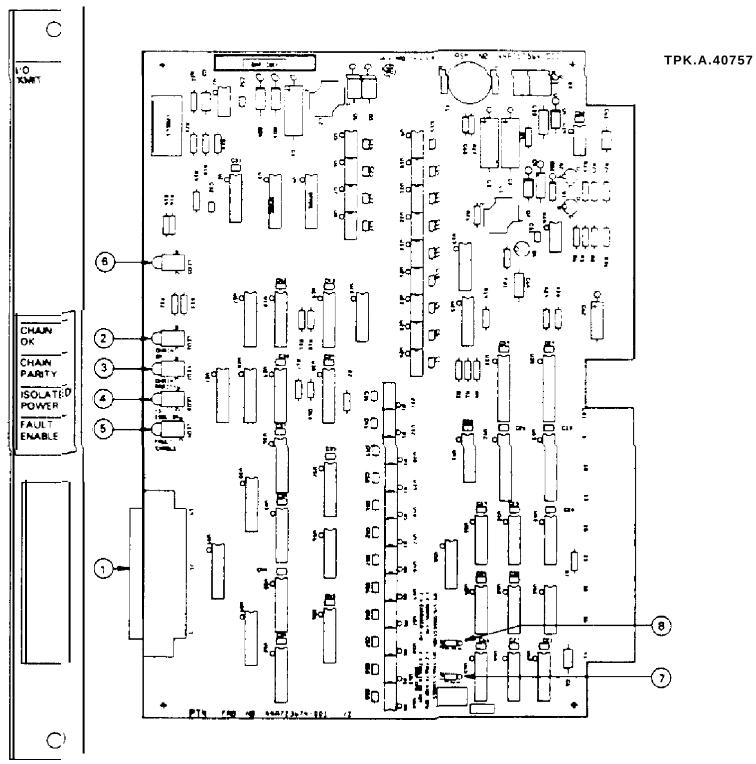
Refer to figure 1 (below) for I/O Transmitter module specifications.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
DC-to-DC converter.	Provides electrical isolation of I/O stations downstream. Separate grounds can be used at different I/O stations separated by an t/O transmitter.
Four LED indicators: - CHAIN OK - CHAIN PARITY - 1SOLATED POWER - FAULT ENABLED	Simplifies troubleshooting.
I/O fault isolation,	User can select system response to I/O faults (CPU stop or continue).
I/O Connection	User can select to use 1 chain or multiplex up to 8 chains per CPU (16 chains including AUX).

- Dimensions: Circuit Board: 8.15 x 1 I .0 (inches) 208 x 280 (mm) Faceplate: 12.46 x 1.1'75 (inches) 317 x 30 (mm)	Power Requirements: 5 Vdc, 1.65 A maximum (Supplied by I/O rack power supply) - Operating Temperature: 0° to 60°C (at the outside of the rack) - Storage Temperature: -20° to + 80°C - Humidity: 50% to 95% (non-condensing)

Figure I. SPECIFICATIONS



1 D-Type 37-Pin Connector to I/O Receiver module in Downstream Local I/O station.

2 CHAIN OK Light:

ON: Power is OK at all downstream stations and continuity is OK to all downstream points.

OFF: At least one of these conditions is not met.

3 CHAIN PARITY Light:

ON: Output parity is OK at all downstream stations.

OFF: There is an output parity error at one (or more> of these stations.

4 ISOLATED POWER Light:

ON: The output voltage of the + 5V isolated power converter is within tolerance.

OFF: This voltage is too low.

5 FAULT ENABLE Light:

ON: The module is customer selected to stop the system for a local fault condition.

OFF: The module is customer selected such that a local fault condition does not stop the system.

6 CHAIN ACTIVE LIGHT:

NOTE: Not visible with faceplate in place, for use in system set up only - EXPANDED I/O MODE.

ON: Indicates that chain is active

OFF: Indicates that chain is inactive.

7 FAULT ENABLE/DISABLE Selector:

a. Place the jumper over pins 2-3 to enable system stop for a local fault.

b. Place the jumper over pins l-2 for a local fault not to stop the system.

8 NORMAL/EXPANDED I/O SELECTOR:

a. Place the jumper (JP2) over pins l-2 for NORMAL I/O. One nonselectable I/O chain.

b. Place the jumper (JP2) over pins 2-3 for EXPANDED l/O. Selectable 1 to 8 chains.

Figure 2. USER ITEMS

INSTALLATION

The I/O Transmitter Module can be installed in either a standard or High Capacity I/O rack, a model 60 CPU rack or a Series Six Plus CPU rack in any available I/O slot, except the extreme left slot. However, GE recommends that the slot to the extreme left, in an I/O rack, be reserved for the I/O Receiver Module. If the card is to be used in the NORMAL I/O mode, follow the steps listed below. For use in the EXPANDED I/O mode, a chain number will have to be assigned via the backplane dip switches, refer to figure 3.

Follow these steps:

1. Connect the green, faceplate ground wire to the terminal next to the card slot.
2. Select FAULT ENABLE/DISABLE mode (see item 7 on previous page).
3. Use the extraction/insertion tool furnished with the Series Six CPU to insert (or remove) this module in the card slot.
4. Secure the faceplate to the rack using the thumbscrews at the top and bottom.
5. Connect an I/O cable (Part No. IC600WDXXXA, where XXX is a 3-digit number corresponding to the length of the cable) from the front panel connector on this module, downstream to the first I/O Receiver in the next Local I/O station.
6. Secure all connectors using the furnished screws.

NOTE

There is a maximum distance of 500 feet (150 meters) from a CPU or Local I/O station to the next Local station, and no Local station can interface more than four I/O Transmitters upstream to the Series Six CPU.

CHAIN NUMBER	DIP SWITCH POSITION		
	3	2	1
0			
1			X
2		X	
3		X	X
4	X		
5	X		X
6	X	X	
7	X	X	X

$\boxed{X}$ =SWITCH IN OPEN POSITION (DEPRESSED TO THE LEFT1

SWITCH NUMBERS 4-7=DON'T CARE

Figure 3. DIP SWITCH SETTINGS

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
lC600BF900C	IC600Y B900C	IC600FP900B

CATALOG NUMBER REVISION SUFFIX

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GE Fanuc Automation North America, inc., Charlottesville, Virginia

APRIL, 1986

GE FANUC

Series Six™ PLC
Programmable Controllers

GER-83516D

July, 1989

Standard & High-Capacity Rack
Input/Output Rack

General Description

The Series Six Input/Output (I/O) rack provides the regulated DC power, backplane and enclosure for the Series Six I/O modules; and is available in two versions: Standard and High-Capacity. The Standard I/O rack satisfies most applications of the Series Six Programmable Controller. The High Capacity I/O rack provides adequate current for applications utilizing I/O modules that demand collectively more than 6.1 amps. The I/O rack features and benefits are summarized in Table 1.

Up to ten I/O modules can be installed in an I/O rack in addition to an I/O receiver module (Local I/O receiver or Remote I/O receiver). On the backplane adjacent to each of the ten I/O module card slots (inside the rack enclosure) are Dual-In-line-Package (DIP) switches which allow the user to set the addresses for the corresponding I/O modules.

The Standard I/O Rack provides +5 Vdc to its backplane and operates from 115 Vac or 230 Vac sources (at 47 to 63 Hz). The input voltage is jumper-selectable by the user.

The High-Capacity I/O rack provides +5, +12, and -12 Vdc to its backplane. Input voltage is 95 to 260 Vac (no jumper selection required) at 47 to 63 Hz.

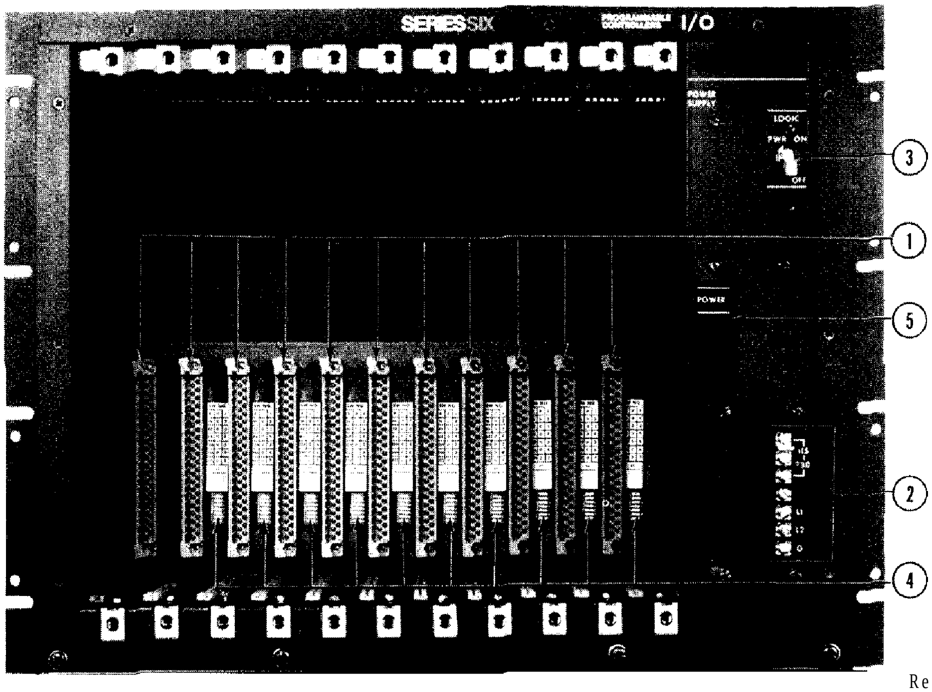
The Standard I/O rack may be upgraded to a High-Capacity I/O rack by replacing the power supply with a High-Capacity power supply.

A Light-Emitting Diode (LED) on the faceplate of the I/O rack power supply indicates that the DC power supplied by tie rack. is within tolerance.

Refer to Table 4 for I/O Rack specifications.

Table 1. Features and Benefits

Features	Benefits
Available with Interchangeable Standard or High-Capacity Power Supply module: 115 Vac or 230 Vac Operation 47Hz to 63Hz Operation	Can accommodate numerous types of I/O modules.
Compatible with all Series Six CPUs. Used in all I/O locations.	Reduced spare-parts inventory cost.
Equipped with dual-purpose mounting brackets.	Can be rack-mounted or panel-mounted
Removeable power supply module.	Reduced downtime and inventory cost.
Addressing switches on backplane.	Easy installation of I/O modules,



Ref. 81-PC-52

Figure 1. User Items

(Standard I/O Rack shown)

1. 41 -Pin Backplane Connector
   Mates with the connector on a plug-in module.
2. Power-Supply Front-Panel Terminal Block
   See the "Installation" section and Figure 4 of this Data Sheet.
3. Logic-Power Switch
4. DIP Switches to Set I/O module address
5. POWER Light
   On: The DC voltage output of the power supply is within tolerance.
   Off: DC voltage is out of tolerance.

Installation

The following procedures summarize the proper installation of the I/O rack. Further details on each step can be found in the Series Six Installation & Maintenance Manual, GEK-25361.

1. The I/O rack can be rack-mounted or panel-mounted. The location and orientation of the mounting brackets depends on the mount. Refer to Figure 2.

WARNING

Extreme care should be taken when making connections to the terminal block - - - 115 Vac or 230 Vac may be present.

2. Refer to Figure 3. Connect a power cord capable of carrying the current drawn by the power supply to the terminal block on the front panel. The ground terminal on the terminal block must be connected to an adequate earth ground. Ensure that the input voltage jumper is positioned correctly and secured (Standard I/O rack only). After the connections have been made, mount the protective cover over the terminalblock with the screws provided; make sure that the wires are routed through the opening in the cover.
3. Install in the card slot at the extreme left in the rack an I/O Receiver module (or Remote I/O Receiver if this is the first rack in a Remote station).

4. Any combination of Input, Output, I/O Transmitter and/or Remote I/O Driver modules can be installed in the other ten card slots in the rack, after the DIP switches (Figure 4) for each have been set to the appropriate address as indicated in Table 2. Note that an optional wiring trough is available to facilitate field-wiring to the various modules.

NOTE

If the POWER LED does not light at power-up, or intermittent errors occur in the course of operation, the current-rating of the I/O rack could be exceeded. Refer to Table 3, I/O Current Units to determine the total current requirements within a rack.

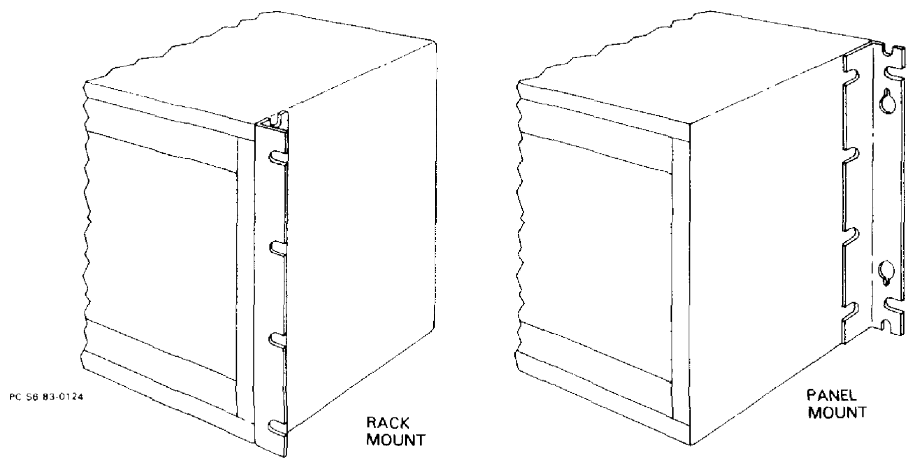


Figure 2, Use **of Mounting Brackets**

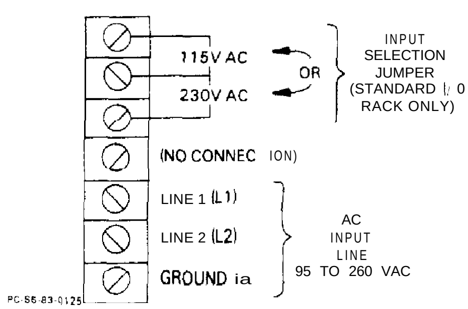


Figure 3. I/O Rack Front-Panel Terminal Block

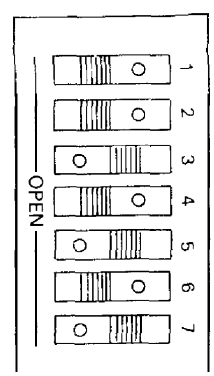


Figure 4. Dip Switch

Table 2. Dip Switch Settings for I/O Point Selection for Eight-Circuit Modules

I/O Point	Dip Switch Position						
	7	6	5	4	3	2	1
1- 8							
9- 16							X
17- 24						X	
25- 32						X	X
33- 40					X		
41- 48					X		X
49- 56					X	X	
57- 64					X	X	X
65- 72				X			
73- 80				X			X
81- 88				X		X	
89- 96				X		X	X
97-104				X	X		
105-112				X	X		X
113-120				X	X	X	
121-128				X	X	X	X
129-136			X				
137-144			X				X
145-152			X			X	
153-160			X			X	X
161-168			X		X		
169-176			X		X		X
177-184			X		X	X	
185-192			X		X	X	X
193-200			X	X			
201-208			X	X			X
209-216			X	X		X	
217-224			X	X		X	X
225-232			X	X	X		
233-240			X	X	X		X
241-248			X	X	X	X	
249-256			X	X	X	X	X
257-264		X					
265-272		X					X
273-280		X				X	
281-288		X				X	X
289-296		X			X		
297-304		X			X		X
305-312		X			X	X	
313-320		X			X	X	X
321-328		X		X			
329-336		X		X			X

I/O Point	Dip Switch Position						
	7	6	5	4	3	2	1
337-344		X		X		X	
345-352		X		X		X	X
353-360		X		X	X		
361-368		X		X	X		X
369-376		X		X	X	X	
377-384		X		X	X	X	X
385-392		X	X				
393-400		X	X				X
401-408		X	X			X	
409-416		X	X			X	X
417-424		X	X		X		
425-432		X	X		X		X
433-440		X	X		X	X	
441-448		X	X		X	X	X
449-456		X	X	X			
457-464		X	X	X			X
465-472		X	X	X		X	
473-480		X	X	X		X	X
481-488		X	X	X	X		
489-496		X	X	X	X		X
497-504		X	X	X	X	X	
505-512		X	X	X	X	X	X
513-520	X						
521-528	X						X
529-536	X					X	
537-544	X					X	X
545-552	X				X		
553-560	X				X		X
561-568	X				X	X	
569-576	X				X	X	X
577-584	X			X			
585-592	X			X			X
593-600	X			X		X	
601-608	X			X		X	X
609-616	X			X	X		
617-624	X			X	X		X
625-632	X			X	X	X	
633-640	X			X	X	X	X
641-648	X		X				
649-656	X		X				X
657-664	X		X			X	
665-672	X		X			X	X

I/O Point	Dip Switch Position						
	7	6	5	4	3	2	1
673-680	X		X		X		
681-688	X		X		X		X
689-696	X		X		X	X	
697-704	X		X		X	X	X
705-712	X		X	X			
713-720	X		X	X			X
721-728	X		X	X		X	
729-736	X		X	X		X	X
737-744	X		X	X	X		
745-752	X		X	X	X		X
753-760	X		X	X	X	X	
761-768	X		X	X	X	X	X
769-776	X	X					
777-784	X	X					X
785-792	X	X				X	
793-800	X	X				X	X
801-808	X	X			X		
809-816	X	X			X		X
817-824	X	X			X	X	
825-832	X	X			X	X	X
833-840	X	X		X			
841-848	X	X		X			X
849-856	X	X		X		X	
857-864	X	X		X		X	X
865-872	X	X		X	X		
873-880	X	X		X	X		X
881-888	X	X		X	X	X	
889-896	X	X		X	X	X	X
897-904	X	X	X				
905-912	X	X	X				X
913-920	X	X	X			X	
921-928	X	X	X			X	X
929-936	X	X	X		X		
937-944	X	X	X		X		X
945-952	X	X	X		X	X	
953-960	X	X	X		X	X	X
961-968	X	X	X	X			
969-976	X	X	X	X			X
977-984	X	X	X	X		X	
985-992	X	X	X	X		X	X
993-1000	X	X	X	X	X		

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left).

Table 3. Summary of Units of Load for I/0 Modules

Catalog Number	Module Description	Units of Load (1)		
		+5 v	+12 v	-12 v
IC600BF800	I/O Receiver	9		s
IC600BF801	Remote I/O Receiver	42	10	10(2)
IC600BF802	24 to 48 V dc Input	2		
1C600BF804	115 V ac/dc Input	2	*	
IC600BF805	230 V ac/dc Input	2		
IC600BF806	12 V ac/dc Input	2		
IC600BF808	Interrupt Input	3		
[C600BF810	115 V ac/dc Isolated Input	2		I
IC600BF813	Type J **Thermocouple** Input	29	*	-
IC600BF814	Type K+ Thermocouple Input	29		
IC600BF815	Type S Thermocouple Input	29		
EC6OOBF816	Type T Thermocouple Input	29		•
IC600BF817	Type B Thermocouple Input	29		•
IC60OBF818	Type E Thermocouple Input	29		
IC600BF819	Type R Thermocouple Input	29		
IC600BF827	High Speed Counter	19	•	
IC600BF830	Advanced I/O Receiver	12		
IC600BF831	High Density Input	4		
IC600BF841	0 to 10 V dc Analog Input	29	•	
IC600BF842	10 V dc Analog Input	29	•	
IC600BF843	4 to 20 mA Analog Input	29	•	•
IC600BF900	I/O Transmitter	34		
IC600BF901	Remote I/O Driver	38	10	10(2)
IC600BF902	24 **V** dc Sink Output	7	b	
IC600BF903	48 V dc Sink Output	7	•	
IC600BF904	115 V ac Output	9		
IC600BF905	230 V ac Output	9		
IC600BF906	12 V dc Sink Output	7		
IC600BF907	12 V dc Source Output	7	•	
IC600BF908	24 V dc Source Output	7		
IC600BF909	48 V dc Source Output	7		
IC600BF910	115 V ac Isolated Output	8	•	
IC600BF912	230 V ac Isolated Output	8		
IC600BF914	Reed **relay** output	13		
IC6OOBF915	Axis Positioning Module, Type 1	23	7	3
IC6OOBF917	Axis Positioning Module, Type 2	21	11	6
IC600BF921	5 v TTL output	3	•	
IC600BF923	10 to 50 V dc Sink Output	3		
IC600BF924	120 **V dc** Output	5		
IC600BF929	10 to 50 V dc Source output	3		
IC600BF930	115 **V** ac Protected Output	8	•	
IC600BF941	0 to 10 V dc Analog Output	29		

Table 3. Summary of Units of Load for I/O Modules - Continued

Catalog Number	Module Description	Units of Load (1)		
		+5 V	+12 V	-12 V
IC6OOBF942	10 V dc Analog Output	29		-
IC6OOBF943	4 to 20 mA Analog Output	29		-
IC6OOBF944	ASCII/BASIC Module (12K)	20	12	-
IC6OOBF949	ASCII/BASIC Module (28K)	20	12	-
IC6OOBF946	Loop Management Module	20	12	-
IC6OOBF947	I/O Link Local	20	12	-
IC6OOBF948	I/O CCM	20	12	-
IC6OOBF950	I/O CCM4	20	12	-
IC66OCBB900	Genius Bus Controller	20	2	
IC66OCB902	Genius Bus Controller w/Diag.	20	2	
IC660CBB901	Genius Bus Controller	20	2	
IC66OCB903	Genius Bus Controll wo/Diag.	20	2	

(I) For +5 V dc, 1 unit of load equals 60 mA (300 mw of power). For +12 and -12 V dc, 1 unit of load equals 25 mA (300 mw of power).

(2) +12 V and -12 V current is less than 1 unit of load if RS-232 mode is not used.

Table 4, Specifications

- Dimensions:	Rack-Mount: 19.0 x 14.0 x 10.3 (inches) 483 x 356 x 261 (mm) Panel-Mount: 20.0 x 14.0 x10.3 (inches) 508 x 356 x 261 (mm)
- Weight (Empty):	30 pounds (15Kg)
- Power Supply Input @ 47Hz-63Hz:	High Capacity: 95 to 260 **Vac, 250 VA** (max.) Standard: 95-130 Vac 190-260 Vac 80 VA (maximum)
- Noise Immunity:	Meets requirements of NEMA ICS 2-230 and ANSI C37,90A.
- Power Supply Output:	High Capacity: +5 Vdc, 16.5 A max +12 Vdc, 1.5 A max. -12 Vdc, 1.0 A max. Total power is limited to 3 90 watts. Standard: +5 **Vdc, 6.1** A max.
- Allowable Power Interruptions:	33 ms minimum at 115 Vac line.
- Module Capacity:	Ten Addressable card slots, plus one non-addressable slot for an I/O Receiver module.
- Operating Temperature:	0 -60° C (outside of the rack)
- Storage Temperature:	-20C - +80C
- Humidity:	5%-95 % (non-condensing)

Table 5. Ordering Information

Standard I/O Rack	High-Capacity I/O Rack
IC600YR501B	IC600YR511A

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83517C

2 feet to 500 feet lengths

I/O CABLE

GENERAL DESCRIPTION

The Input/Output (I/O) cable, consisting of 16, twisted-pair wires and two connectors, provides electrical continuity for the parallel I/O Bus as it extends from rack to rack within a Local, Central Processor Unit (CPU) or Remote I/O station; it can also connect a Local station to another Local station, or to a CPU station. Refer to Table 1 for I/O Cable features and benefits.

The cable is shielded and individual twisted-pair wires are color-coded. (Refer to Figure 3, next page). The cable is available in lengths ranging from 2 ft. (.6m) to 500 ft. (152.5 meters).

Refer to Figure 1 (below) for I/O Cable specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Available in lengths from 2 feet to 500 feet.	Provides flexibility in Series Six setup.
Color-coded twisted-pairs.	Simplifies troubleshooting.

- Cable Outside-Diameter:
  0.465 $\pm$ 0.020 (inches)
  11.8 $\pm$ 0.5 (mm)
- Cable Length: 2 feet (0.6m) to 500 feet (152.4m) in standard lengths (determined by part number).
- Conductor Size: No. 22 AWG (each wire)
- Jacket: PVC material, 300V insulation
  Temperature: -20^{o}C to +80^{o}C
- Internal Arrangement: 16 twisted pair with overall shield
- Connectors: 37-Pin D-Type Connector. One male, one female connector per cable

FIGURE 1. SPECIFICATIONS

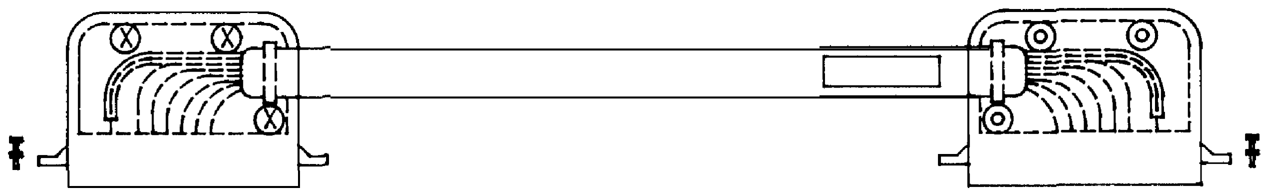


FIGURE 2. I/O CABLE

INSTALLATION

Note that the cable has one connector with male terminals and one with female terminals. As a general rule, the male connector on the cable connects to the upstream module, and the female connector to the downstream module. The specific modules which use this cable are: the I/O Control module, the Auxiliary I/O module, the I/O Receiver module, the I/O Transmitter module, and the downstream port of the Remote I/O Receiver module. All connectors should be secured using the furnished screws. Upstream is defined as toward CPU, downstream is away from CPU,

The shell of one of the connectors can be temporarily removed by loosening its screws, so that that end of the cable can be more easily slid into, and through, a section of conduit.

NOTE

The following constraints should be observed when using this cable to interconnect various parts of the Series Six I/O system:

1. The total cable length connecting the racks within an I/O station (the party-line bus) should be no more than 50 feet (15.2m). (Without transmitters.)

2. The cable length between a Local I/O station and the CPU station or another Local station should be no more than 500 feet (152.4m). (With transmitters.)

3. The parallel I/O bus between any Local I/O station and the CPU rack should interface through no more than four I/O Transmitter modules. (Up to four transmitters between CPU and furtherest I/O rack.)

Connector Terminal	Wire Color	Connector Terminal	Wire Color
# 1	NO CONNECTION	20	GRAY-RED
2	BLUE-WHITE	21	RED-GRAY
3	WHITE-BLUE	22	BLUE-BLACK
4	ORANGE-WHITE	23	BLACK-BLUE
5	WHITE-ORANGE	24	ORANGE-BLACK
6	GREEN-WHITE	25	BLACK-ORANGE
7	WHITE-GREEN	26	GREEN-BLACK
8	BROWN-WHITE	27	BLACK-GREEN
9	WHITE-BROWN	28	BROWN-BLACK
10	GRAY-WHITE	29	BLACK-BROWN
11	WHITE-GRAY	30	GRAY-BLACK
12	BLUE-RED	31	BLACK-GRAY
13	RED-BLUE	32	BLUE-YELLOW
14	ORANGE-RED	33	YELLOW-BLUE
15	RED-ORANGE	34	NOT USED
16	GREEN-RED	35	NOT USED
17	RED-GREEN	36	NOT USED
18	BROWN-RED	37	SHIELD
19	RED-BROWN		

NOTE

Same terminals at either end.

FIGURE 3. TWISTED-PAIR COLOR CODES

ORDERING INFORMATION

Part Number		
IC600WD002A	2-foot Cable with Connectors	0.6 Meters
IC600WD005A	5-foot Cable with Connectors	1.5 Meters
IC600WD010A	10-foot Cable with Connectors	3.0 Meters
IC600WD025A	25-foot Cable with Connectors	7.5 Meters
IC600WD050A	50-foot Cable with Connectors	15.0 Meters
IC600WD100A	100-foot Cable with Connectors	30.0 Meters
IC600WD200A	200-foot Cable with Connectors	60.0 Meters
IC600WD500A	500-foot Cable with Connectors	150.0 Meters

CATALOG NUMBER REVISION SUFFIX

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This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

JANUARY, 1984

Series Six™ PLC
Programmable Controllers

DC Output Modules

GEK-83521B
July, 1989

General Description

The discrete (OFF/ON), 8-point DC Output module can be utilized in an I/O rack, or in any of the I/O slots in a Model 60 Central Processor Unit (CPU), to provide an optically isolated interface between the backplane I/O bus and user output devices. The first four outputs are grouped to share a common power source, as are the second four outputs. The module for each output-voltage range is available in either a source or a sink version. The DC Output modules' features and benefits are summarized in Table 1.

When using a sink module, current must flow through the load into the output terminal of the module. When using a source module, current is provided by the module and the current flows out of the module to the load.

Each of the eight output drivers uses a Darlington amplifier as a switching device. The circuit board also contains comparator circuitry that determines if the module is being addressed and a buffer where the output data is stored and presented to the output drivers.

Provision is made to automatically disable the entire group of output drivers in the event of an I/O-chain, or CPU, failure. Light-Emitting Diode (LED) indicators display the state (ON/OFF) of each output, and the condition of the individual output-circuit fuses.

Refer to Table 2 for DC Output module specifications.

Table 1. Features and Benefits

Features	Benefits
Three switching ranges available: 20 Vdc. 40 Vdc. 55 Vdc. Each available in Source or Sink configuration.	Useful in a variety of applications. Provides output capability with existing user power supplies and devices.
Eight Output points per module.	Efficient use of I/O rack space.
Optically-coupled Output drivers.	Provides electrical isolation between user field devices and the Series Six Controller.
Applications	
- High-speed switching: - Solenoid valves. - Battery-powered I/O systems.	Annunciators. Indicators. Relays.

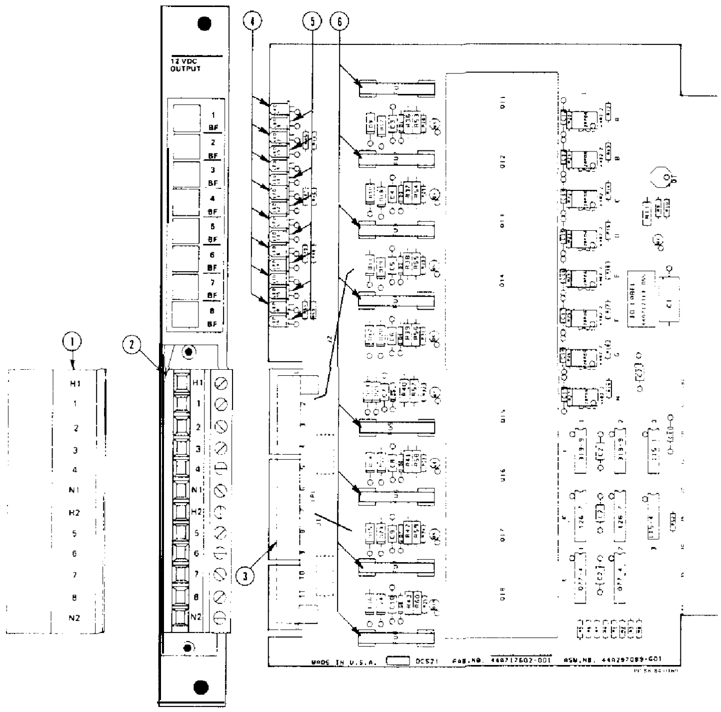


Figure 1, User ltems

1. Terminal Cover

2. User Terminal Block:
   Accepts connections from user output devices and the DC power source(s). (Refer to Figure 2, Typical User Connections.)

3. Circuit-Board Terminal Block:
   Mates with the user terminal block.

4. Output LED 1 → 8
   On: Corresponding output is in the ON state.
   Off: Corresponding output is in the OFF state.

5. BF (Blown Fuse) LED 1 → 8
   On: The fuse for corresponding output is open (blown).
   Off: The fuse for corresponding output is OK.

6. Output-Circuit Fuses: 3 A, normal blow (AGC 3)

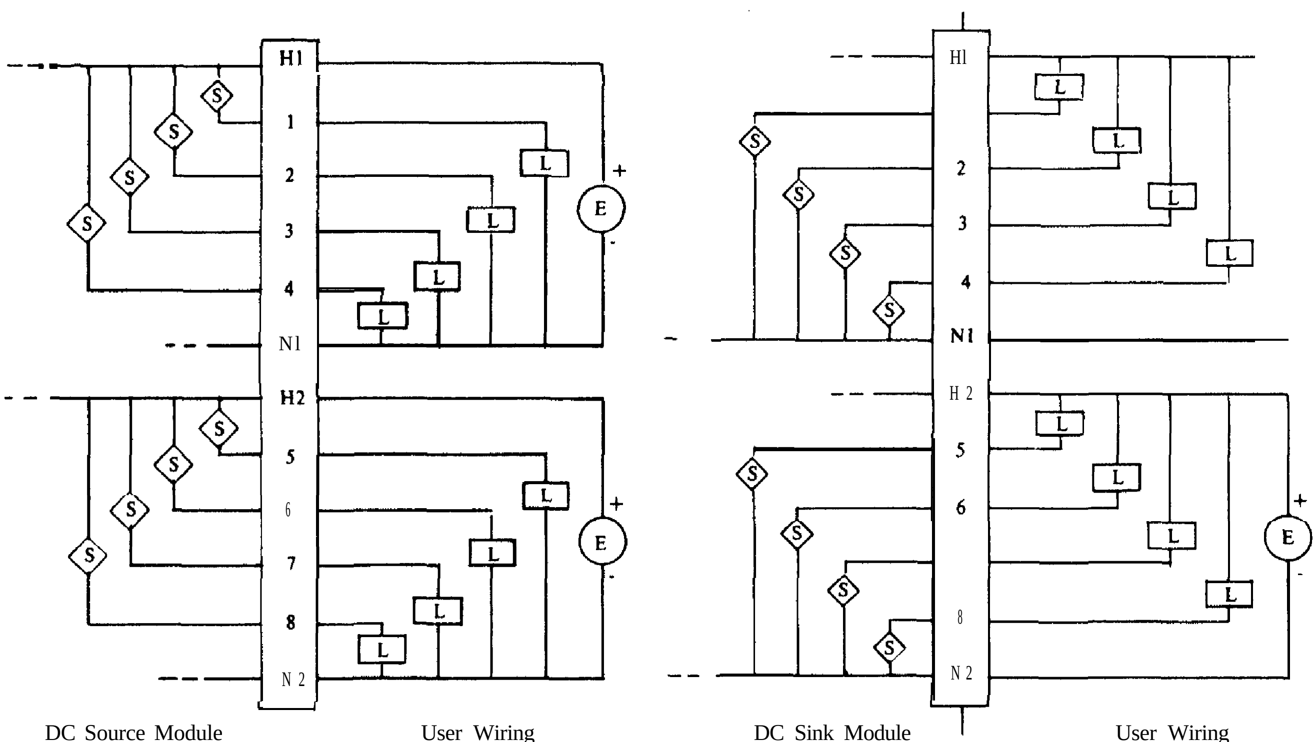
Installation

The DC Output module can be installed in an I/O rack or in a model 60 CPU rack. Before installing the module, set the Dual-In-Line-Package (DIP) switches directly behind the card slot on the rack backplane to establish the proper correspondence between the output terminals on this module and a group of eight consecutive output numbers in the program. To determine the proper switch settings, refer to the table in the Installation section of the Series Six Installation and Maintenance Manual, GEK-25361.

We recommend that he extraction/insertion tool furnished with the CPU be used to remove or install the circuit board. With the board in place in the rack, the faceplate should be slipped over the circuit board so that the terminals near the bottom of each are mated. The faceplate can then be secured to the rack using the thumbscrews at top and bottom.

Refer to Figure 2 for typical user connections to the DC Output module. One side of each load controlled by this module should be connected to the appropriate output terminal (1 through 8). The other side of each load connected to terminals 1 through 4 should be returned to a common line connected to the Neutral No.1 (N1) terminal for a source module, or to the High No.1 (Hl) terminal for a sink module. The other side of each load connected to terminals 5 through 8 should be returned to a common line connected to the Neutral No.2 (N2) terminal for a source module, or to the High No.2 (H2) terminal for a sink module. A user DC power source must be connected between the H1 (+) and the N1 (-) terminals; a power source must also be connected between the H2 (+) and the N2 (-) terminals. Each terminal can accommodate one No.12 AWG wire or two No.14 AWG wires. The terminal cover should be installed by guiding both of its edges onto the top of the terminal block and sliding it downward over the terminals.

Note that a markable area is provided on the plastic lens beside each pair of indicators for noting the function or destination of each output. The faceplates are color coded (blue) to allow you to easily distinguish the DC Output modules from other types of I/O modules.



LEGEND
S: Output Switching Device
L: User Load
E: User Power Source (DC)

Figure 2. Typical User Connections

Table 2. Specifications

- Dimensions:	Circuit Board: 8.15 x 11.0 x 1.20 (inches) 208 x 280 x 31 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)
- Power Requirements:	5 Vdc, 400 mA (maximum) Supplied by I/O-rack power supply. Module — User-Supplied Voltage 12 Vdc — 9 + 20 Vdc 24 Vdc — 19 + 40 Vdc 48 Vdc — 38 → 55 Vdc
- Number of Outputs:	Eight (8), in two groups of 4 outputs with common high and neutral connections.
- Leakage (OFF):	5 mA @ 60°C (maximum)
- Steady State Current:	2 A (maximum)
- Inrush Current:	7 A (maximum)
- Total ON-State Current per Module:	Maximum: 16 A @ 0-40C, 8 A @ 60°C Minimum: 0 A
- ON-State Voltage Drop:	2.25 V (maximum)
- Response Time:	1 ms (maximum)
- Operating Temperature:	0 - 60°C (at the outside of the rack) -20 to +80C
- Humidity:	5 - 95% (non-condensing)

Table 3, Ordering Information

Module	Circuit Board & Faceplate	Circuit Board	Faceplate
12 Vdc Output (Source)	IC600BF907B	IC600YB907B	IC600FP907B
24 **Vdc** Output (Source)	IC600BF908B	IC600YB908B	IC600FP908B
48 Vdc Output (Source)	IC600BF909B	IC600YB909B	IC600FP909B
12 Vdc Output (Sink)	IC600BF906B	IC600YB906B	IC600FP906B
24 Vdc Output (Sink)	IC600BF902B	IC600YB902B	IC600FP902B
48 Vdc Output (Sink)	IC600BF903B	IC600YB903B	IC600FP903B

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83523

ISOLATED 115V AC/DC INPUT MODULE

GENERAL DESCRIPTION

The Isolated 115V AC/DC Input module detects bipolar AC and DC voltages supplied by, and controlled by, the user. The features and benefits of this module are summarized in Table 1.

A module contains six inputs, each with its own neutral circuit. Each input circuit is isolated from every other input circuit and from the Series Six CPU circuitry.

An input circuit contains a rectifier, a noise filter to reduce common mode transients, an opto-isolator, and a Schmitt Trigger (one-shot), which fires to indicate that a voltage (AC or DC) in a specified range has been detected. An active input circuit is indicated by a Light-Emitting Diode (LED), visible through a lens on the faceplate.

Refer to Figure 1 for the Isolated AC/DC Input specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
LED for each input. Color-coded faceplates.	Allows visual inspection of I/O operations.
Optically-coupled inputs.	Provides electrical isolation between user power supplies and Series Six Programmable Controller.
Complete isolation of each input from the other input circuit (hot and neutral input connections).	Allows the mixing of up to six inputs on the same module that are powered by up to six different independent AC or DC voltage sources.
APPLICATIONS (Monitor The Inputs From:)	
- Power Protective Relays	- Limit Switches
- Motor Controls	- Toggle Switches
- Relays/Contactors	- Cam Switches

- Dimensions:

  Circuit Board:
  8.15 x 11.0 (inches)
  208 x 280 (mm)

  Faceplate:
  12.46 x 1.175 (inches)
  317 x 30 (mm)

- Power Requirements: 5 Vdc, 104 mA maximum
  Supplied by I/O power supply.
  (2 units of load)
  The user must supply power for the input devices.

- Number of Inputs:
  Six (6) independently isolated from each other and the Series Six common. Each input has its own neutral connection.

- Humidity: 5 to 95% (non-condensing)

- Operating Temperature: 0 to 60C
  (At the outside of rack)

- Storage Temperature: -20° to + 80°C

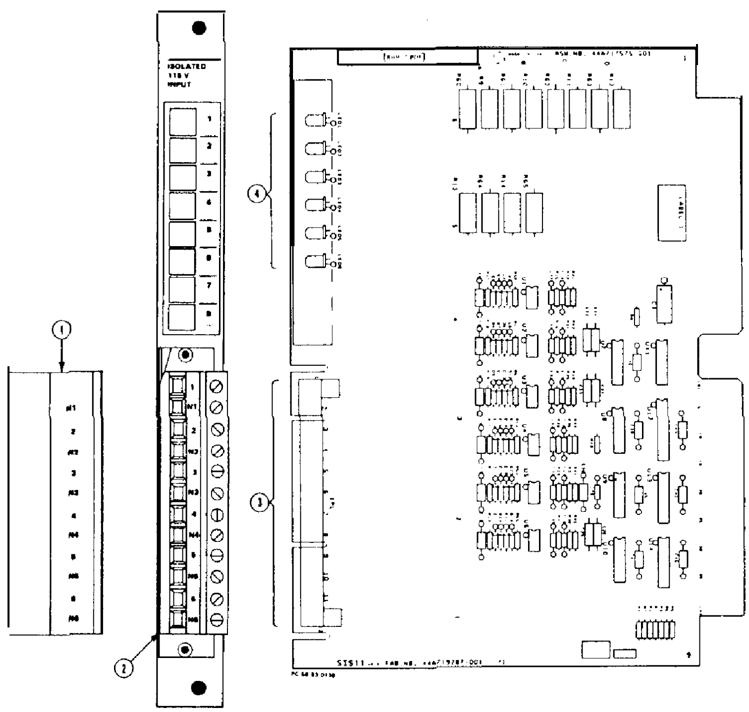
- Isolation:
  Series Six common to user common:
  Tested at 1500 volts AC 50/60 Hz for 1 min.
  Rated at 240 volts AC 50/60 Hz continuous.
  One input circuit to any other:
  Rated at 240 Vac 50/60 Hz continuous.

- Input Requirements:
  On Range 90 to 130 Vac/dc
  Off Range 0 to 30 Vac/dc

  Input loading: 20K Ω (5.5 mA at 115V)

- Delay Times:
  OFF to ON 6-20 msec
  ON to OFF 20-50 msec

FIGURE 1. SPECIFICATIONS



① Terminal Cover

② User Terminal Block: Accepts connections from user input devices, See the "Installation" section and Figure 3 of this Data Sheet.

③ Circuit Board Terminal Block: Mates with the user terminal block.

④ Input Lights: 1 through 6
ON: The associated input is in the ON state.
OFF: The associated input is in the OFF state.

FIGURE 2. USER ITEMS

INSTALLATION

The Isolated AC/DC Input module can be installed in an I/O rack or the I/O rack section of the Model 60 Central Processor Unit (CPU). Follow these steps:

1. Set the Dual-In-Line-Package (DIP) switches directly behind the card slot on the rack backplane to establish the correct correspondence between the input terminals on this module and a group of six consecutive input numbers in the user program. For further information on I/O DIP-switch settings, refer to the Installation Section of the Series -Six Installation and Maintenance Manual (GEK-25361).

NOTE

No inputs are assigned to the last two **reference numbers.**

2. Use the extraction/insertion tool furnished with the Series Six CPU to insert (or remove) this module in the card slot.

3. Guide the faceplate over the circuit board so that the terminals near the bottom of each are mated; secure the faceplate to the rack using the thumb-screws at the top and bottom.

4. Refer to Figure 3. Connect one side of the user circuit to the appropriate input terminal (1 through 6). Connect the other side of each user circuit to the appropriate neutral terminal (Nl through N6). Each input terminal can accommodate one No. 12 AWG wire or two No. 14 AWG wires.

5. Guide the terminal cover onto the top of the terminal block, then slide it downward over the terminals.

A markable area is provided on the plastic lens beside each LED for noting the function or source of each input. The faceplates are color coded:

- Orange: 115v

WARNING

Voltages from user field devices may be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

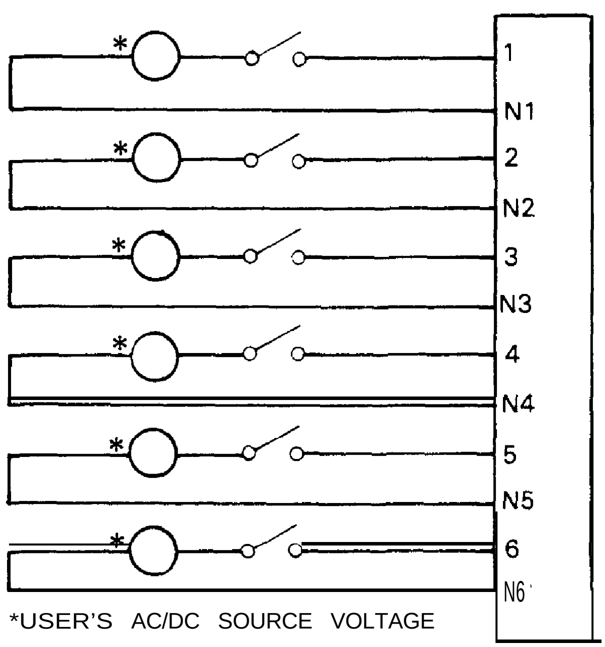


FIGURE 3. TYPICAL USER INPUT CONNECTIONS

ORDERING INFORMATION

Module	Circuit Board & Faceplate	Circuit Board	Faceplate
Isolated 115V AC/DC Input Module	IC600BF810A	IC600YB810A	IC600FP810A

For further information, contact your local GE Fanuc sales office.

CATALOG NUMBER REVISION SUFFIX

The equipment listed above with catalog numbers as shown or with a higher alpha suffix in the last position is designed for UL applications as auxiliary control devices. This equipment is a direct replacement for equipment with a prior alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment ,)

GE **Fanuc Automation North America, Inc., Charlottesville, Virginia**

DECEMBER, 1983

SERIES SIX

PROGRAMMABLE CONTROLLERS

INTERRUPT INPUT MODULE

GEK-83524A

INPUTS
INTERRUPT

GENERAL DESCRIPTION

The Interrupt Input module allows the user to initiate the execution of a subroutine by activating an input. (A subroutine can also be initiated by a user-program function.) By Series Six convention, a subroutine is a sequence of functions separate from the main program that is solved, only when required, by the Programmable Controller.

The Interrupt Input module can be utilized in a CPU I/O station or a Local I/O station. A Model 60 CPU or Model 600 CPU can support one Interrupt Input module, whereas a Model 6000 CPU can support two modules: one in a primary I/O chain, another in an auxiliary I/O chain. The Interrupt Input module features and benefits are summarized in Table 1.

Each module provides eight inputs. The inputs are organized into four groups of two, with an isolated neutral for each group. In series with each input is an LED that indicates current flow through the input circuit.

The inputs can respond to rising-edge transitions or falling-edge transitions. The edge response of an individual input is jumper-selectable by the user .

In a primary I/O chain, the module inputs, Nos.l-8 (I/O points I1001-Il008), correspond to subroutines, Nosl-8, resident in the user program. However, in an auxiliary I/O chain (which can only be connected to a Model 6000 CPU), the module inputs, Nos.l-8 (I/O points 11009-11016), correspond to subroutines, Nos.9-16, in the user program.

Interrupts are serviced by the CPU on a first-come, first-serve basis. When two or more interrupts occur simultaneously, the lowest-numbered interrupt is serviced first.

Refer to Figure 1 (next page) for Interrupt Input module specifications.

TABLE 1. FEATURES AND BENEFITS

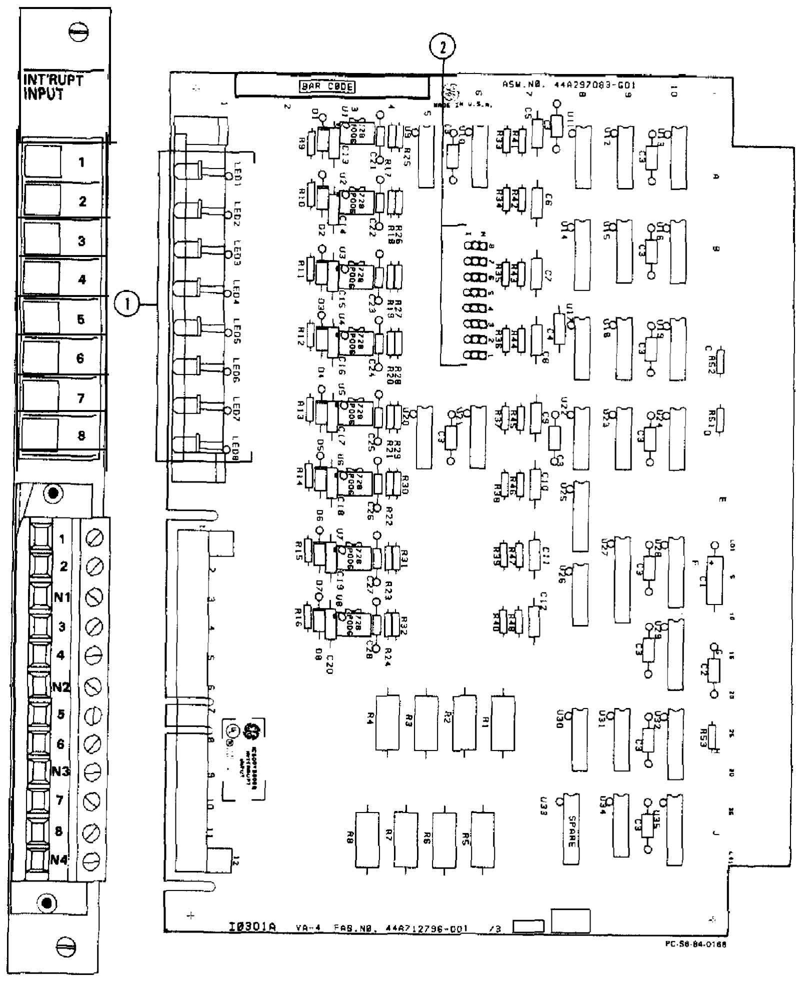
FEATURES	BENEFITS
300 usec Input Filtering.	Rapid response for high-speed input processing.
Four Isolated sets of two inputs.	Can use a different power source for every 2 inputs.
Jumper-selectable response to user device.	Responds to off-to-on transitions or on-to-off transitions.

APPLICATIONS

- Position Control
- Emergency Stops
- High-Speed Packaging

- Dimensions:
  - Circuit Board:
    - 8.15 x 11.0 x 1.20 (inches)
    - 208 x 280 x 31 (mm)
  - Faceplate:
    - 12.46 x 1.175 (inches)
    - 317 x 30 (mm)
- Power Requirements:
  - 5V DC, 225 mA (Max.)
  - (Supplied by I/O Rack Power Supply)
- Storage Temperature: 0 - 70°C
- Operating Temperature: 0 - 60°C
- Humidity: 5% - 95% (non-condensing)
- Card Filtering:
  - Off-On Delay: 300u s (max.)
  - On-Off Delay: 8 ms (min.)
    - 10 ms (typ.)
    - 12 ms (max.)
- User Power Source: 10-30V DC
  - Interrupt "OFF" Condition: 3V DC
  - Interrupt "ON" Condition: 10V DC

FIGURE 1. SPECIFICATIONS



① LED 1 → LED 8: LED numbers correspond to interrupt-input numbers. Active LED (ON) indicates current flow through the input circuit.

② Jumper 1 – Jumper 8: Jumper numbers correspond to interrupt-input numbers. Jumper at "N" terminal causes corresponding interrupt input to respond to rising edge. Jumper at "I" terminal causes corresponding interrupt-input to respond to falling edge.

FIGURE 2. USER ITEMS

INSTALLATION

The Interrupt Input module can be installed in any position of an I/O rack in a CPU I/O station or Local I/O station. (A Model 60 CPU-based system contains I/O slots within the CPU rack.) The module address is hardwired on the circuit board to equal 125, decimal (FD, hexadecimal). Consequently, the values of the DIP switches on the rack backplane adjacent to the I/O slot are ignored by the CPU.

Before inserting the module in the I/O rack, the user should inspect the placement of the eight, blue-plastic jumpers on the circuit board (Refer to Figure 2, User Item No. 2). These jumpers allow the user to select the edge responses of the eight inputs. The module is shipped from the factory with the eight inputs set to respond to rising-edge transitions. (The jumpers are inserted between middle terminals and the N terminals.) The user can direct any given input to respond to a falling-edge transition by inserting the associated jumper between the middle terminal and the I terminal.

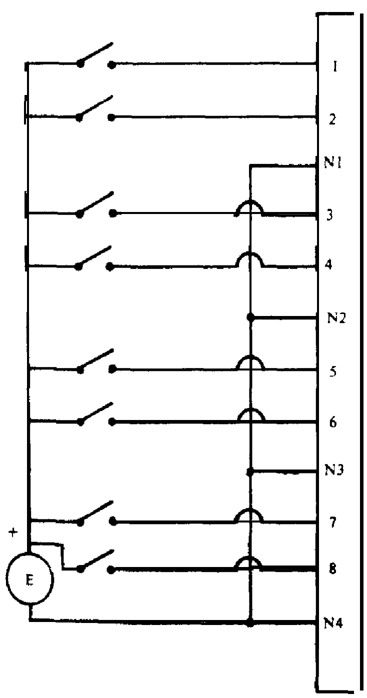
We recommend that you use the extraction/insertion tool furnished with your CPU to remove or install the circuit board. With the board in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that proper contact is made. You can then secure the faceplate to the rack using the thumbscrews at the bottom and top.

Refer to Figure 3, Typical User Connections. The Interrupt Input module inputs are connected to user-provided 10 – 30V DC power supplies. The switching device that activates an input must be in series with the power supply. In this scheme, one side of the switching device is connected to the input, the other side is connected to the positive terminal of the 10 → 30V DC supply; the negative terminal of the power supply is connected to the neutral terminal associated with the input.

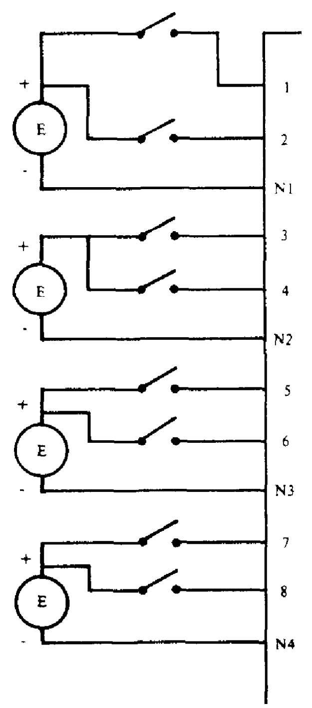
For the purpose of electrical isolation, as few as two inputs can be connected to a single 10 → 30V DC supply. Otherwise, up to eight inputs can be connected to a single 10 → 30V DC supply.

NOTE

We recommend that you power-down your Series Six Programmable Controller before installing or removing the Interrupt Input module. A parity error could result at any address in the I/O structure if you do not power-down as recommended.



NOTE
No Isolation: All inputs on one 10 – 30V DC supply



NOTE
Maximum Isolation: Two inputs on each 10 → 30V DC supply

FIGURE 3. TYPICAL USER CONNECTIONS

ORDERING INFORMATION

Circuit Board & Faceplate	Circuit Board	Faceplate
IC600BF808B	IC600YB808B	IC600FP808A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARIOTTESVItLE, VIRGINIA

APRIL, 1984

Series SIX
Programmable Controllers

GEK-83525E

October 1988

Analog Input Module

General Description

The Analog Input module is available in three versions: unipolar, bipolar and current. The unipolar module covers the voltage range, 0 to +10 V. The bipolar module covers the voltage range, - 10 to +1 0 V. The current module accepts currents in the range, 4 to 20mA; with a simple change of front panel connections it reads voltages in the range, +1 to +5 V. The Analog Input module features and benefits are summarized in Table 1.

Each of these modules functions as an analog-to-digital (A/D) converter for signals on each of its eight input channels. The sampled value of the input level is converted to a 12-bit binary number. This number is sent, along with binary information giving various operating conditions and the number of the channel being read, to the Input Status Table in the CPU.

Each module contains an eight-to-one analog multiplexer, A/D circuitry, and an opto-isolator, along with an address decoder and data-bus drivers. There is also detection circuitry for open-wire, high-limit, and low-limit conditions, as well as an LED indicator that displays module status.

Refer to Table 2 (next page) for Analog Input Module specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
Three Ranges Available: 0 to 10v -10 to +lO v 4 to 20 mA (+l to +5 V)	Useful in a Variety of Applications
Eight Input Channels per Module	Efficient Use of I/O-Rack Space
Conversion to 12 Data Bits	Provides Resolution of 1 Part in 4096
Differential Inputs	Good Noise Immunity (CMRR > 60 dB to 1 kHz) High Input Impedance (Typically 100 M Ω)
Optically-Coupled Data Path	Provides Electrical Isolation between User Field Devices and the Series Six Controller
Status Information Sent to CPU	Detects Overrange, Underrange, Open-Wire Conditions, and Module Status
Sequential or Repetitive Channel **Access**	Allows Normal Reading of All Channels, or High-Speed Sampling of Data from a Single Channel

APPLICATIONS	
Process Signal Measurement	Data Logging
Motor Speed Monitoring	Alarm Level Sensing
Energy Usage Monitoring	Position Sensing

Table 2. Specifications

Dimensions:	
Circuit Board:	8.15 x 11.0 x 1.20 (inches), 208 x 280 x 31 (mm)
Faceplate:	12.46 x 1.175 (inches), 317 x 30 (mm)
Operating Temperature:	0 to 60°C (at the outside of the rack)
Storage Temperature:	**-20** to **40°C**
Humidity:	**5** % - 95% (non-condensing)
Accuracy:	Voltage Input + 0.025% of full scale at 25°C typical + 0.050% of full scale at 25°C maximum Current Input (4-20 mA) + 0.075% of full scale at 25°C typical (see note below) + 0.125% of full scale at 25°C maximum

NOTE

Any one input can be calibrated to within 0.025% of full scale at 25°C.

	Current Input (10-50 mA) with external 100 ohm shunt voltage input function (1-5 V) being used. Therefore:+ 0.025% of full scale at 25°C typical PLUS tolerance of 100 ohm shunt, ± 0.050% of full scale at 25°C maximum PLUS tolerance of 100 ohm shunt.
Temperature Coefflcieut:	
Linearity	< 6ppm* of Full Scale per degree C
Gain	< 18ppm of Full Scale per degree C
offset	< 10ppm of Full Scale per degree C *ppm = parts per million Example: 10 ppm = 10 / 1 million = .001%
Power Requirements:	5 V dc, 1.5 A, Supplied by I/O-rack power supply. The user must supply analog input voltage or current levels.
Input Overvoltage:	Differential or common mode transients up to 30 V will not cause damage.
Input Bias Currents:	< 200 pA at +25 degrees C maximum < 8 nA at +70 degrees C maximum
Input Impedance:	< 100 M Ω Typical
Common Mode Voltage Operating Range:	+ 11 V maximum from inputs to SHD
Common Mode Rejection (Noise Immunity):	>60dB, DC to 1kHz
Cross Talk:	>74dB at 1kHz
Resolution:	**12** Binary Bits (1 part in 4096)
Input Filter:	Time Constant (nominal) is 1 milli-second

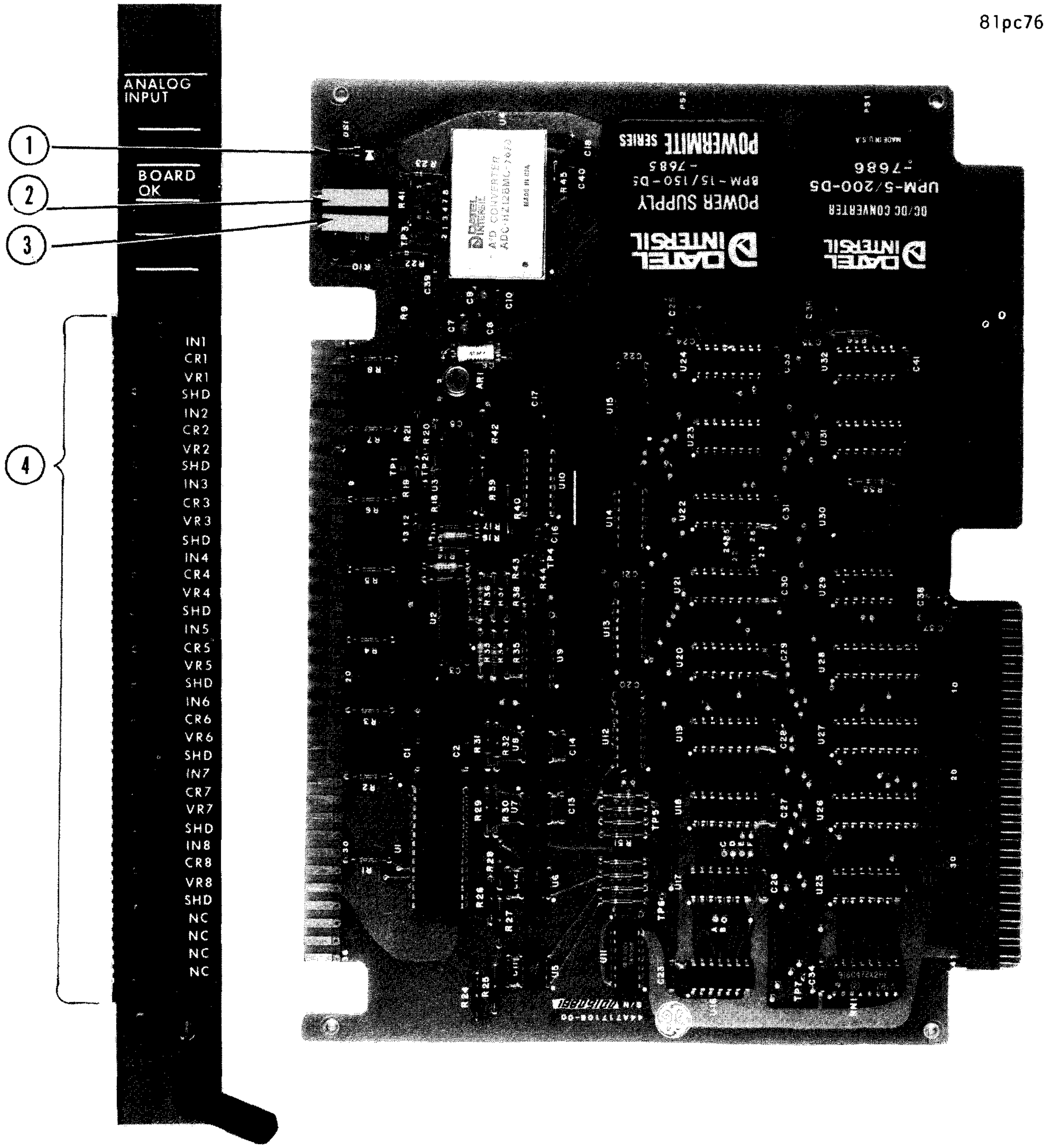


Figure 1. User Items

1. BOARD OK Light:
   The LED is OFF if there is an A/D converter malfunction, an I/O-rack power supply problem, or the CPU is in the Stop or the Run Disabled mode. It is also Off if the module has not been read since one of these conditions existed, or since power has been applied.
2. R12: Offset Potentiometer, (All Channels)
3. R11: Gain Potentiometer, (All Channels)
4. User Connector Block

Installation

The Analog Input module can be installed in an I/O rack, a Model 60 CPU rack, or a Series Six Plus CPU rack. Before installing the Analog Input module, the dual-in-line-package (DIP) switches immediately behind the card slot on the rack backplane should be set to reserve a group of 32 consecutive bits in the appropriate Input Status Table of the CPU. For specific DIP switch settings, see below.

Use the extraction/insertion tool furnished with the CPU to remove or install the circuit board. With the board in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that proper contact is made, then secure the faceplate to the rack using the thumbscrews at the top and bottom. Both the Input terminal (IN) and the Return terminal of any unused input channels should be connected to the shield terminal.

Input Number	Dip Switch Position				
	7	6	5	4	3
1 - 32					
33 - 64					X
65 - 96				X	
97 - 128				X	X
129 - 160			X		
161 - 192			X		X
193 - 224			X	X	
225 -256			X	X	X
257 - 288		X			
289 - 320		X			X
321 - 352		X		X	

Input Number	Dip Switch Position				
	7	6	5	4	3
353 - 384		X		X	X
395 - 416		X	X		
417 - 448		X	X		X
449 - 480		X	X	X	
481 - 512		X	X	X	X
513 - 544	X				
545 - 576	X				X
577 - 608	X			X	
609 - 640	X			X	X
641 - 672	X		X		
673 - 704	X		X		X

Input Number	Dip Switch Position				
	7	6	5	4	3
705 - 736	X		X	X	
737 - 768	X		X	X	X
769 - 800	X	X			
801 - 832	X	X			X
833 - 864	X	X		X	
865 - 896	X	X		X	X
897 - 928	X	X	X		
929 - 960	X	X	X		X
961 - 992	X	X	X	X	
993 -1024	X	X	X	X	X

(NOT USED)

X = Switch in OPEN Position (Depressed to the Left)

Switches No. 1 and 2 should be in CLOSED Position

Notes

A group of 32 consecutive I/O points are required to be selected for this module to communicate to and from the Input Table. Each of the eight input channels will utilize these same 32 I/O points. Each time a total I/O scan is executed, one of the input channels of this module will be scanned, converted, and sent to the Input Table. The next time a total I/O scan is executed the channel number is incremented by one and the next channel is scanned, converted, and sent to the Input Table on the same 32 consecutive I/O points. This process is repeated each time a total I/O scan is executed until all of the input channels are converted and sent to the Input Table. At this time the process repeats, one per total I/O scan, until all the channels are scanned. It is the responsibility of the user to program a store in a register of these data bits during the solution cycle and use the registers for reference inputs as the Input Table will reflect only one input channel at a time and the register will contain all eight channels.

Using, the CPU extended functions, the user can elect to read repeatedly the same channel or scan up to all eight channels in sequence at a much faster rate than the normal I/O scan rate. This is accomplished by programming a "DO I/O" function during the normal user program. Refer to the Application Guide Manual, GEK-25365, for more detailed instructions.

Electrical Installation

The Analog Input modules can be driven and wired to in many ways. A symbolic Analog Input module circuit is shown in Figure 2. For typical user input connections when using a 0 to 10V or -10 to +10V analog signal transmitter refer to Figure 3.

When using a +1 to +5V, 4 to 20 ma, or 10 to 50 ma analog signal transmitter refer to Figure 4 for typical user input connections. For other types of analog transmitters such as Type 2, Type 3, or Type 4, refer to Instrument Society of America Standard, ISA-S50.1, for guidance. A Type 2 transmitter is shown for reference only in Figure 5.

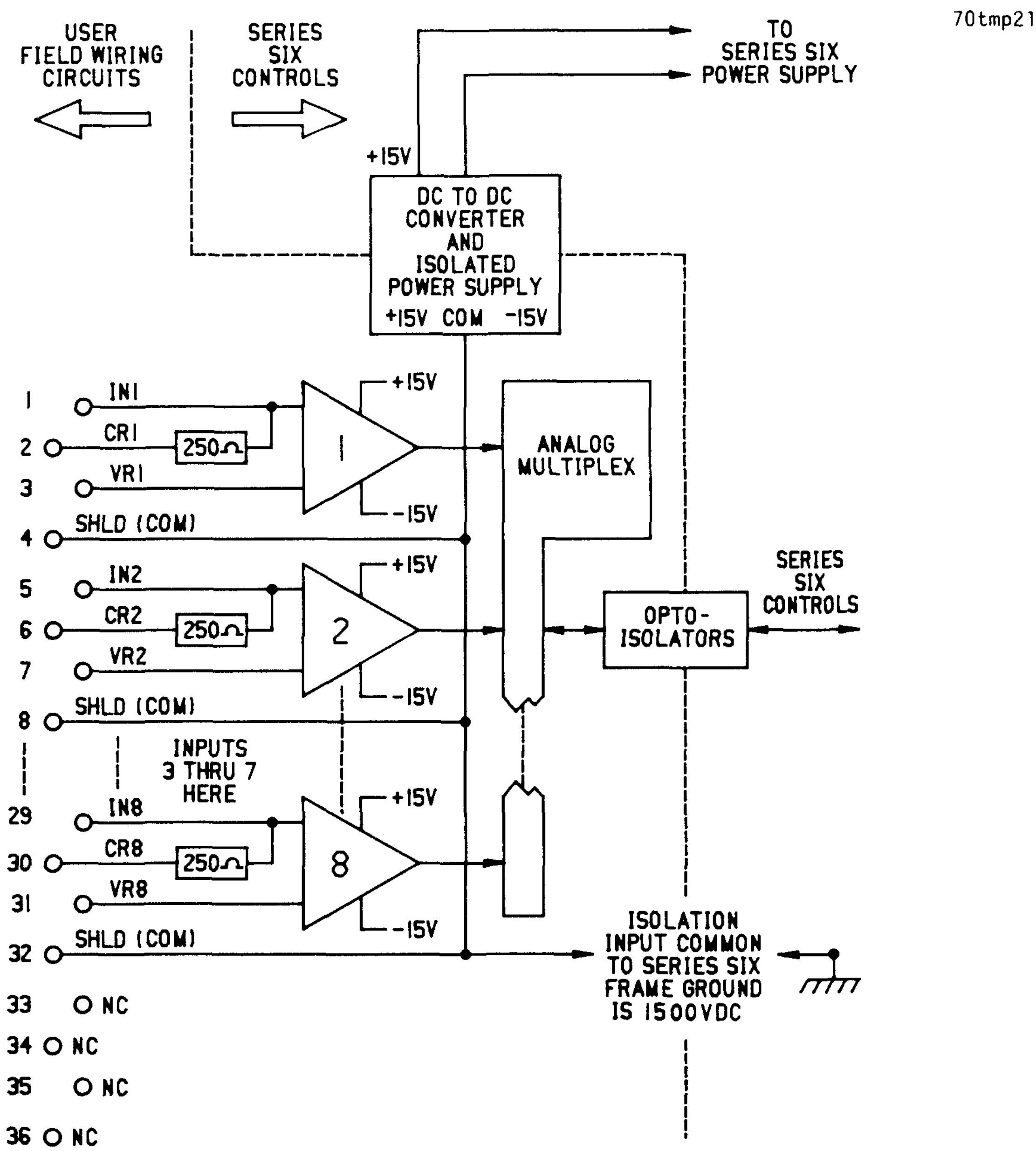


Figure 2. Symbolic Analog Input Module Circuit

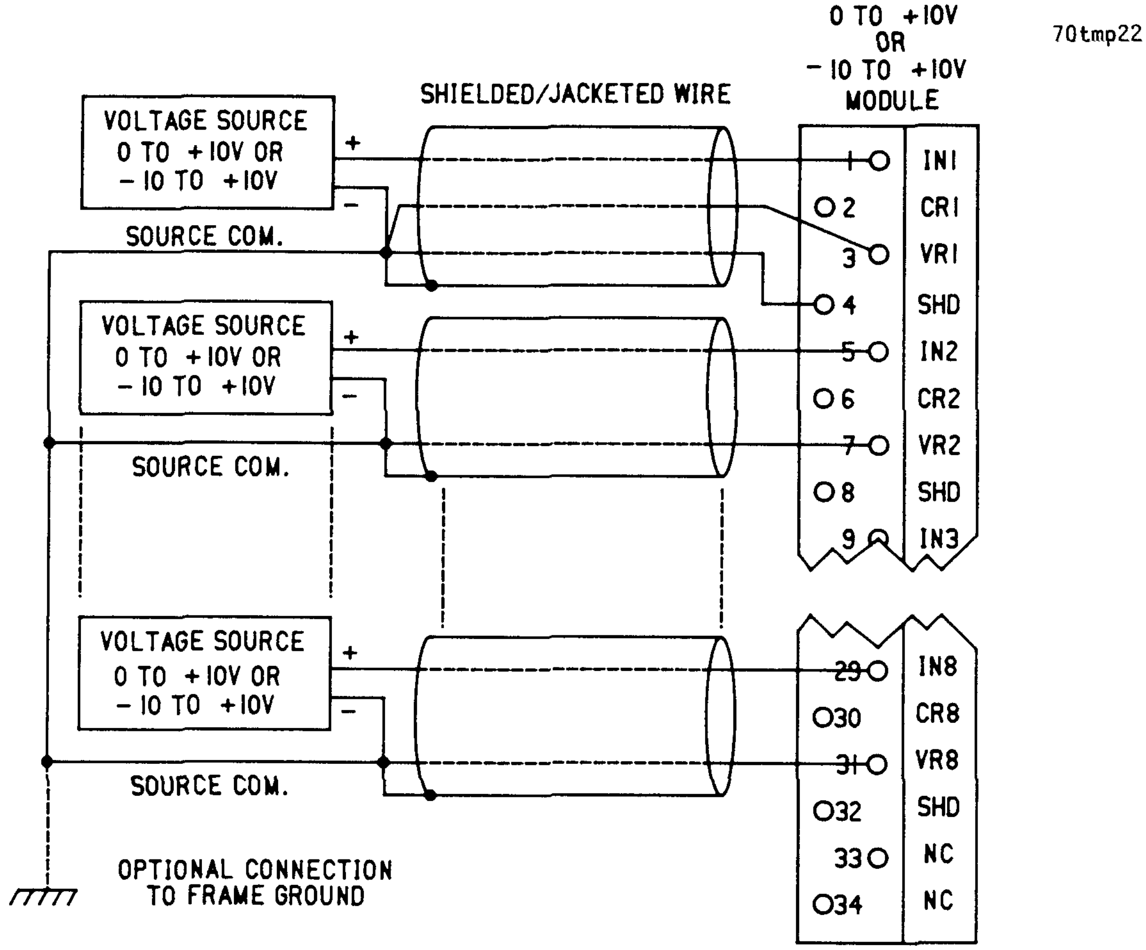


Figure 3. Typical User Input Connections (0 to +10 V or -10 to +10 V)

CAUTION

The signal lines (such as wires that connect to an IN- or VR- terminal) must be no more than ± 11V from the common (SHD) terminal at any time or damage may result to the module.

Notes

For an unbalanced source, the ground shield should be connected to the source common or ground as shown in the connection for input 2 above. If all of the source inputs to this module come from the same location and are referenced to the same common, a connection is made as shown in Input 1 to the SHD/common input to the module.

If the inputs to any one analog input module come from multiple sources, care must be taken to connect each of the source common points together and then connect to the Analog Input module at only one terminal, such as Terminal 4 above. This will eliminate multiple grounding or ground loops which can cause false input data.

All terminals marked SHD/common are internally connected together with 1500 V DC isolation to chassis. An optional way to connect the shields is to connect only one end and connect all shields at the module. Source commons should all be connected together and connected back to the module at only one place such as Input 1 above.

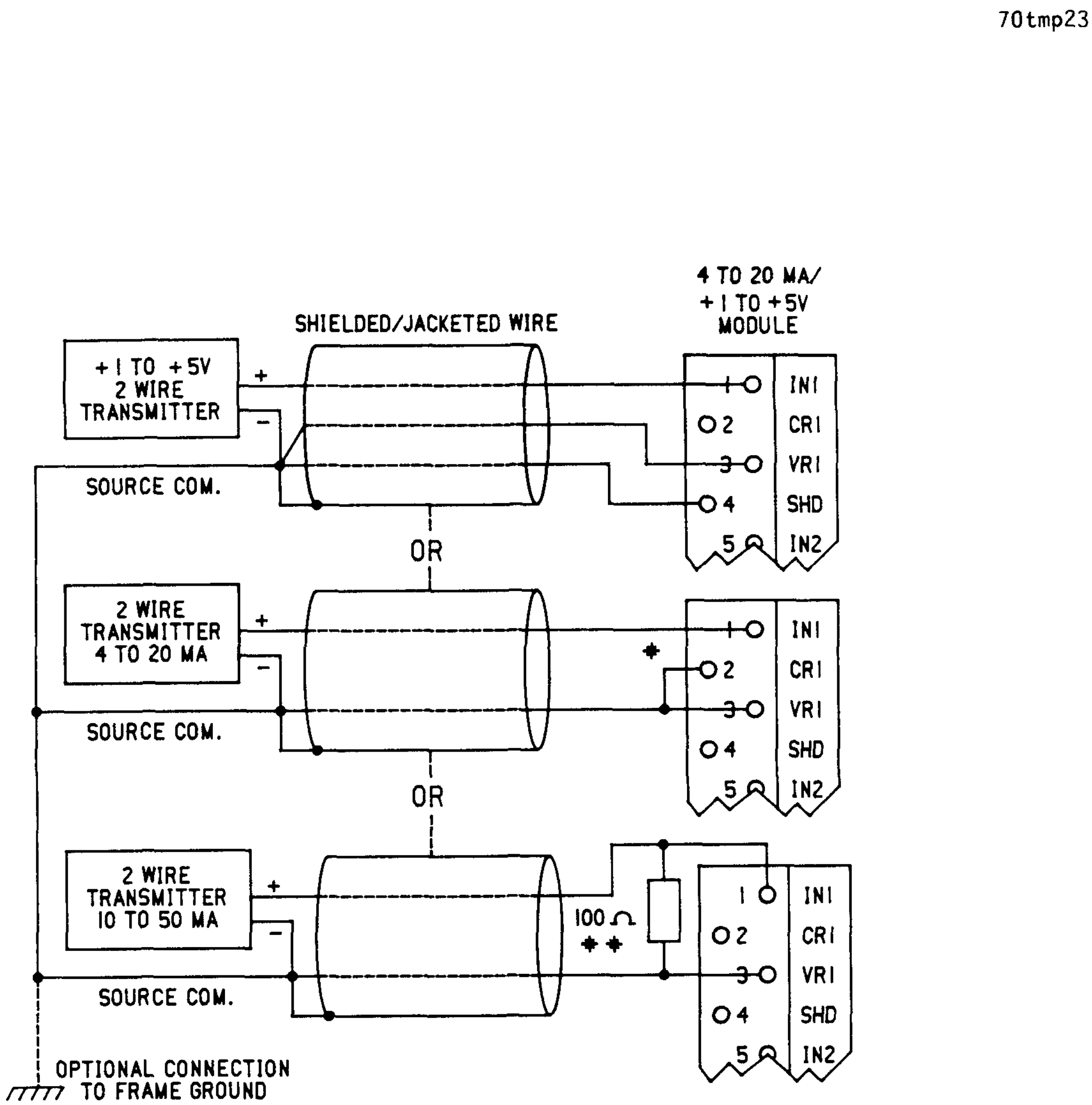


Figure 4. Typical User Input Connections (4 to 20 mA)

Notes

Reference the notes shown pertaining to Figure 3. These same notes apply to Figure 4, plus the following:

* 250 Ω shunt resistor provided internally (by GE Fanuc - NA) for 4 to 20 ma input use only.

** User may connect a 100 Ω shunt resistor if input is 10 to 50 ma.

Reference Figure 5 for a typical Type 2 current transmitter wiring hookup.

70tmp24

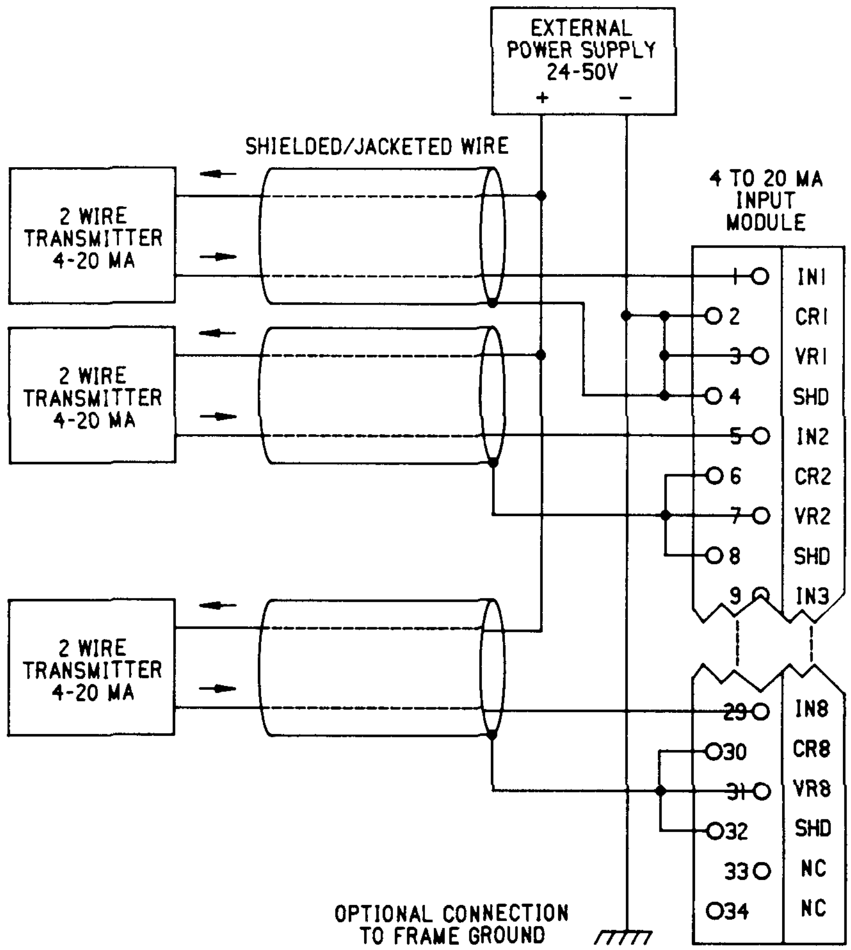


Figure 5. Typical Wiring for Type 2 Transmitters Requiring an External Power Supply (4 to 20 mA)

Notes

This configuration represents only one of many possible wiring hookups to the 4 to 20 ma input module and is shown for reference only. Using the symbolic Analog Input module circuit Figure 2, this Figure (5), and the Instrument Society of America Standard ISA-S50.1 publication most wiring hookups will be readily apparent.

The signal lines (such as inputs to IN-, CR-, or VR- terminals) must be no more than 11 volts from the common (SHD) terminal at any time or damage may result to the module.

Digital Data Format

Bit 1 corresponds to the lowest input number in the group of 32 inputs reserved for the module; Bit 32 corresponds to the highest input number in this group.

Bits 1-8: Channel Number: 8-bit binary number giving the number of the channel (1 to 8) being read. It consists of three significant bits (bits 1-3) and five zeroes (bits 4-8).

Bits 9-16: Status Byte:

Bit 13: Board OK: High if both +5 V and +15 V power-supply levels are OK; LOW otherwise.

Bit 14: Underrange: HIGH if input level is at or below the low end of the module range; LOW otherwise.

Bit 9: Valid Data: HIGH if the Board OK Light is On; LOW if the light is OFF. (Refer to Figure 2.)

Bit 10: (Unused)

Bit 11: Open Wire: HIGH if input circuit is open (< 0.4 V) on channel being read, with the 4 to 20 mA/+1 to 5 V module; LOW otherwise. Should be ignored with the 0 to +10 V and -10 to +10 V modules.

Bit 12: Sign: HIGH with negative input to the -10 to +10 V module; LOW with positive input. Always LOW with the other modules.

Bit 15: Overrange: HIGH if input level is at or above the high end of the module range; LOW otherwise.

Bit 16: Heartbeat: Changes state when the reading of a channel is complete.

Bits 17-24: Data: Eight least significant of the 12 bits of data. Bit No. 17 is the least significant bit (LSB).

Bits 25-32: Data: Four most significant of the twelve bits of data (bits 25-28), plus four bits of sign extension (bits 29-32). Bit No. 28 is the most significant bit (MSB). The sign-extension bits all have the same value as the Sign bit (bit No. 12).

The 12 bits of data and the sign extension make up a 16-bit binary number which is in straight binary form for positive data, or 2's - complement form for negative data. For the bipolar (-10 to +10 V) module, bit No. 28 functions as a sign bit.

Table 3. Input Status Table

Sign				Extension												Status								Channel Number Code								
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
Sign Extension Bits. Bits 29 through 32 will have the same value as Bit 28.				DATA BIT 12 MSB	DATA BIT 11 -	DATA BIT 10 -	DATA BIT 9 -	DATA BIT 8 -	DATA BIT 7 -	DATA BIT 6 -	DATA BIT 5 -	DATA BIT 4 -	DATA BIT 3 -	DATA BIT 2 -	DATA BIT 1 LSB	HEARTBEAT	OVERRANGE	UNDERRANGE	BOARD OK	SIGN BIT	OPEN WIRE	NOT USED	VALID DATA	ZERO	ZERO	ZERO	ZERO	ZERO	CHANNEL 0 0 0 0 1 1 1 1 MSB	CHANNEL 0 0 1 1 0 0 1 1	CHANNEL 0 1 0 1 0 1 0 1 LSB	CHANNEL NO. 1 2 3 4 5 6 7 8

Calibration Procedure

Required equipment:

Voltmeter - 5 digit
(Voltage Source - Resolution to 0.1 MV)
Calibration Connector (IC600MA508A)

Calibration of the Analog Input module should be performed every 90 days. For maximum accuracy the board should be calibrated at the normal ambient temperature which occurs in operation.

1. SET UP: Loosen the thumbscrews and remove the faceplate, taking care not to disturb the field wiring. Take the calibration connector, voltage source, and the voltmeter wired as shown in Figure 6 and connect it to the module in place of the faceplate.
Program the CPU to move the converted digital data from this channel to a convenient register location, where its value can be observed using the Program Development Terminal (PDT).
This can be done by using the following program:

```
     IWWWW       IXXXX       IYYYY       IZZZZ    RAAAA

 + - -/ - - + - - / - - + - - / - - + I/O     TO REG +    (  )

 where:

 IWWWW:  Lowest of the 32 consecutive input numbers used by
         this Analog Input module.

 IXXXX:  Next input number:  XXXX = WWWW + 1

 IYYYY:  Next input number:  YYYY = WWWW + 2

 IZZZZ:  Input number corresponding to the LSB of digital
         input data:  ZZZZ = WWWW + 16.

 RAAAA:  Register to display digital input data.
```

2. LOW END: Set the voltage source as close as possible to the value shown in Table 3.
Adjust R12 (Refer to Figure 1) until the digital output agrees with the value in Table 3.
There will be a slight delay for the register output value to update to reflect an adjustment as eight (8) I/O total scans may be required to read and convert the data for channel 1.
3. HIGH END: Set the voltage source as close as possible to the value in Table 3.
Adjust R11 (Refer to Figure 1) until the digital output matches the value in Table 3.
4. FINE ADJUSTMENT: Repeat steps No. 2 and No. 3 until the module is in calibration at both ends of its range simultaneously.

Table 4. Module Calibration

MODULE	LOW END		HIGH END	
	Source Voltage	**Digital Output***	**Source Voltage**	**Digital Output***
0 to +10 V	+0.0024 V	00001	+9.9951 V	OFFE
+1 to + 5 V (4 to 20 mA)	+1.0010 V	00001	+4.9980 V	OFFE
-10 to +10 V	-9.9951 V	F801	+9.9902 V	07FE

*In Hexadecimal Format

a42788

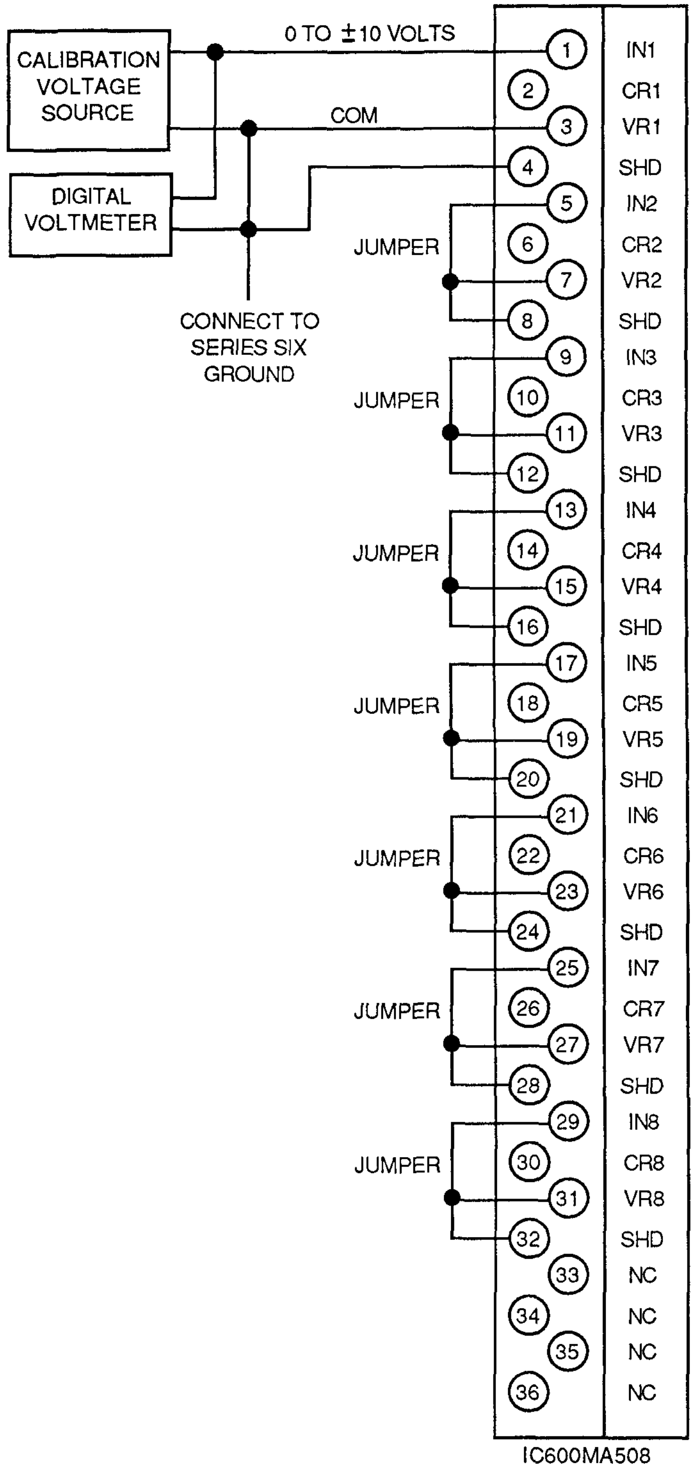


Figure 6. Wiring for Calibration of Analog Input Board

Module Reconfiguration

The Analog Input module can be reconfigured to function in any of three input ranges: 0 to +10V, -10 to +10V or 4 to 20 mA (1 to +5V). The user should note that all eight input channels, on any given module, provide a common input range.

INPUT RANGE	**JUMPER POSITIONS**
0V to +10V (unipolar)	1-2, 7-10, 8-9, 6-11, 13-14, 21-22, 24-25
-10V to +10V (bipolar)	1-3, 4-7, 8-9, 6-11, 13-14, 22-23, 25-26
4 to 20 mA (+1V to 5V)	1-2, 3-4, 5-6, 7-8, 12-13, 21-22, 24-25

Table 5. Ordering Information

Module	**Circuit Board & Faceplate**	**Faceplate**
0 to +10 V	IC600BF841	IC600FP841
-10 to +10 V	IC600BF842	IC600FP841
4 to 20 mA (+1 to +5 V)	IC600BF843	IC600FP843

Calibration Connector IC600MM08

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

NOTE

The Analog Input module will function properly only when used with Series Six Plus CPUs and Models 60, 600 and 6000 CPUs with the following serial numbers:

Model 60 CPU: Cl88 -8135 -0130, and higher.

Model 600 CPU: Cl88 -8138 -0100, and higher.

Model 6000 CPU: Cl88 -8138 -6000, and higher.

If your CPU has a serial number lower than that listed, contact the PLC Product Service Specialist at (804)978 -5624 for assistance.

FANUC

SERIES SIX

PROGRAMMABLE CONTROLLERS

ANALOG OUTPUT MODULES

GEK-83526D

OUTPUTS
0 to +10v
-10 to +10v
4to20mA

GENERAL DESCRIPTION

The Analog Output module is available in three versions: unipolar, bipolar and current. The unipolar **module** delivers output voltages in the range, 0 to + 10V. The bipolar module provides output voltages of either polarity, -10 to +10V. The current module delivers output currents in the range, 4 to 20mA. The Analog Output module features and benefits are summarized in Table 1.

In operation, these modules receive from the CPU twelve bits of binary output data as well as a binary number indicating which channel is to be accessed. The module functions as a digital-to-analog (D/A) converter, delivering the proper output voltage or current to the designated channel. This output level is maintained until the channel is accessed again.

Each module contains an address decoder and an opto-isolator, along with D/A and output amplifier circuitry. On the two voltage-output modules, an internal power converter delivers output levels that are isolated from the I/O bus. On the current-output module, the user can derive output power from this converter, or choose to provide an external power source, reducing the load on the power supply in the I/O rack. An LED indicator displays the status of the module.

Individual channels can be reassigned (with on-board jumpers) to function as unipolar, bipolar or current outputs.

Refer to Figure 1 (next page) for Analog Output module specifications.

NOTE

The Analog Output modules, IC600BF941A, 942A, and 943A should be utilized only in local I/O **applications. However, models IC600BF941B, 942B and 9438 can be utilized in both local and remote I/O applications.**

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Three Ranges Available: • 0 to 10 V • -10 to +10 V • 4 to 20 mA	Useful in a Variety of Applications
Four Output Channels per Module	Efficient Use of I/O-Rack Space
Conversion from 12 Data Bits	Provides Resolution of 1 Part in 4096
Optically-Coupled Data Path	Provides Electrical Isolation between User Field Devices and the Series Six Controller

APPLICATIONS

* Process Control	* Motor Speed Reference

- Dimensions:

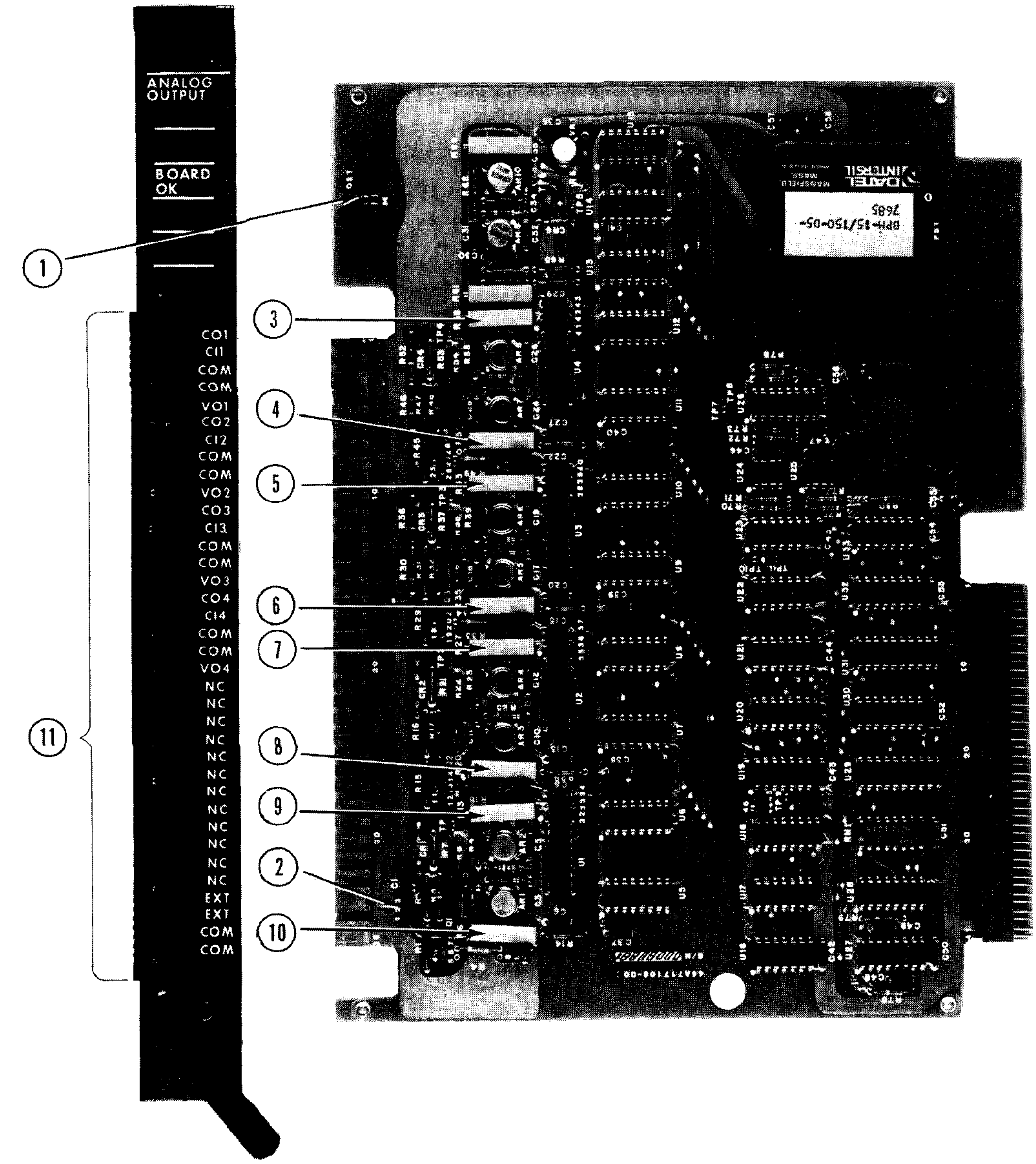
  Circuit Board: 8.15 x 11.0 x 1.20 (inches)
  208 x 280 x 31 (mm)

  Faceplate: 12.46 x 1.175 (inches)
  317 x 30 (mm)

- Operating Temperature: 0^{o} to 60^{o}C (at the outside of the rack)
- Storage Temperature: -20^{o} to $+80^{o}$C
- Humidity: 5% - 95% (non-condensing)
- Noise (Current Loop): < 1 uA rms, DC to 10 kHz
- Total Output Drift @ 0 Volts Out: < 10 ppm of Full Scale per ^{o}C, Typical
  < 30 ppm of Full Scale per ^{o}C, Maximum
- Total Output Drift @ Full Scale: < 20 ppm* of Full Scale per ^{o}C, Typical
  * ppm = parts per million

  Example: 10 ppm = 10 ÷ 1 million = .001%.

- Power Requirements: 5V DC, 1.5 A, Supplied by I/O-rack power supply.
- Optional Power Requirements: User supplied (4 to 20 mA modules only)
  +23V to +42.4V regulated.
  The current requirements and power supply must be adequate for the devices being driven by the Output module. Reference: ISA specification ISA-S50.1.
- Output Current (voltage range modules): ± 5 mA
- All outputs will sustain continuous short circuit.
- Output Load Capacitance: 750 pF maximum
- Cross Talk: Offset of channel change from plus Full Scale to minus (-) Full Scale is < 0.005%
- Accuracy: Resolution 12 Binary Bits (1 part in 4096)
  Linearity ± 0.012% of Full Scale



① BOARD OK Light:
The LED is OFF if there is a board malfunction, an I/O-rack power supply problem, or the CPU is in the Stop or the Run Disabled mode. It is also Off if the module has not been accessed since one of these conditions existed, or since power has been applied.

② Jumper to Select Internal Loop Supply/Common External Source.

③ R59: Gain Potentiometer, Channel No. 1

④ R51: Offset Potentiometer, Channel No. 1

⑤ R43: Gain Potentiometer, Channel No. 2

⑥ R35: Offset Potentiometer, Channel No. 2

⑦ R27: Gain Potentiometer, Channel No. 3

⑧ R20: Offset Potentiometer, Channel No. 3

⑨ R13: Gain Potentiometer, Channel No. 4

⑩ R6: Offset Potentiometer, Channel No. 4

⑪ User Connector Block

FIGURE 2. USER ITEMS

INSTALLATION

The Analog Output modules can be installed in an I/O rack or in a Model 60 CPU rack. Before installing the Analog Output module, the dual-in-line-package (DIP) switches immediately behind the card slot on the rack backplane should be set to reserve a group of 16 consecutive bits in the appropriate Output Status Table of the CPU. For specific DIP switch settings, refer to Figure 3.

Use the extraction/insertion tool furnished with the CPU to remove or install the circuit board. With the board in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that proper contact is made. Then, secure the faceplate to the rack using the thumbscrews at the top and bottom.

OUTPUT NUMBER	DIP SWITCH POSITION						OUTPUT NUMBER	DIP SWITCH POSITION						OUTPUT NUMBER	DIP SWITCH POSITION					
	7	6	5	4	3	2		7	6	5	4	3	2		7	6	5	4	3	2
1- 16							353-368		X		X	X		705-720	X		X	X		
17- 32						X	369-385		X		X	X	X	721-736	X		X	X		X
33- 48					X		385-400		X	X				737-752	X		X	X	X	
49- 64					X	X	401-416		X	X			X	753-768	X		X	X	X	X
65- 80				X			417-432		X	X		X		769-784	X	X				
81- 96				X		X	433-448		X	X		X	X	785-800	X	X				X
97-112				X	X		449-464		X	X	X			801-816	X	X			X	
113-128				X	X	X	465-480		X	X	X		X	817-832	X	X			X	X
129-144			X				481-496		X	X	X	X		833-848	X	X		X		
145-160			X			X	497-512		X	X	X	X	X	849-864	X	X		X		X
161-176			X		X		513-528	X						865-880	X	X		X	X	
177-192			X		X	X	529-544	X					X	881-896	X	X		X	X	X
193-208			X	X			545-560	X				X		897-912	X	X	X			
209-224			X	X		X	561-576	X				X	X	913-928	X	X	X			X
225-240			X	X	X		577-592	X			X			929-944	X	X	X		X	
241-256			X	X	X	X	593-608	X			X		X	945-960	X	X	X		X	X
257-272		X					609-624	X			X	X		961-976	X	X	X	X		
273-288		X				X	625-640	X			X	X	X	977-992	X	X	X	X		X
289-304		X			X		641-656	X		X				993-1008	X	X	X	X	X	
305-320		X			X	X	657-672	X		X			X	1009-1024	X	X	X	X	X	X
321-336		X		X			673-688	X		X		X			(NOT USED)					
337-352		X		X		X	689-704	X		X		X	X							

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left)

Switches No. 1 and No. 2 should be in CLOSED Position

FIGURE 3. DIP SWITCH SETTINGS

NOTES

1. A group of 16 consecutive I/O points are required for this module to communicate with the Output Status Table. Each of the four output channels in this module uses these same 16 I/O points for the loading of data. Each of the output channels has its own memory contained within the module. All channels being used will have a constant output whether it is updated every scan or every 10 scans. Each time a total I/O scan is executed the output programmed by the user logic program will be updated. Refer to the Programming Manual, GEK-25362, for more detailed instructions.

2. Using the CPU Extended Functions, the user can elect to output repeatedly the same channel or scan up to all four channels in sequence at a much faster rate than the normal I/O scan rate or output up to all four channels in sequence at a much faster rate than the normal I/O scan rate. This is accomplished by programming a "DO I/O" function or functions during the normal user program. Refer to the Application Guide, GEK-25365, for more detailed instructions.

3. It is the responsibility of the user to program a store in a register of the data that has been or is going to be output to the various output channels. These registers will be the data used in the logic program as the output table will have data about only one of the output channels in it.

ELECTRICAL INSTALLATION

The Analog Output modules can be used and wired to in many different ways. A symbolic Analog Output circuit is shown in Figure 4. Typical user output connections when using a 0 to +10V or -10V to +10V Analog Signal receiver refer to Figure 5.

For the 4 to 20 mA Analog Output module, the channels can be connected for internal or external common source operation depending on the setting of the circuit board jumper. Alternatively, any one or more individual channels can be connected with its own external source.

Be aware that all common (COMM) terminals are connected together inside the module. To minimize capacitive loading of the the outputs, twisted-pair cables should be used for output connections wherever possible.

Refer to Figure 6 for typical user output connections. For other types of Analog receivers refer to Instrument Society of America Standard ISA-S50.1 for guidance.

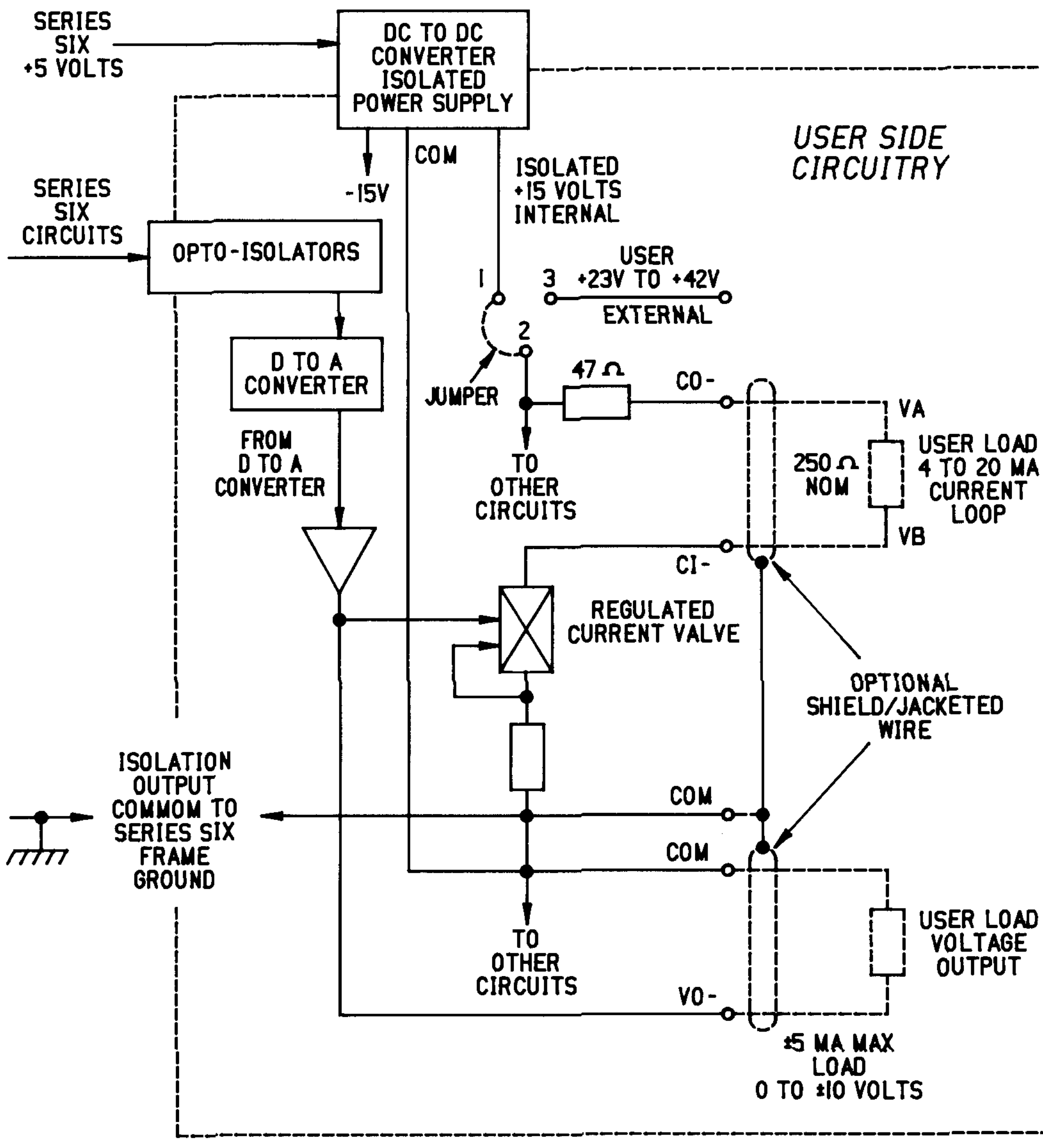


FIGURE 4. SYMBOLIC ANALOG OUTPUT MODULE CIRCUITRY

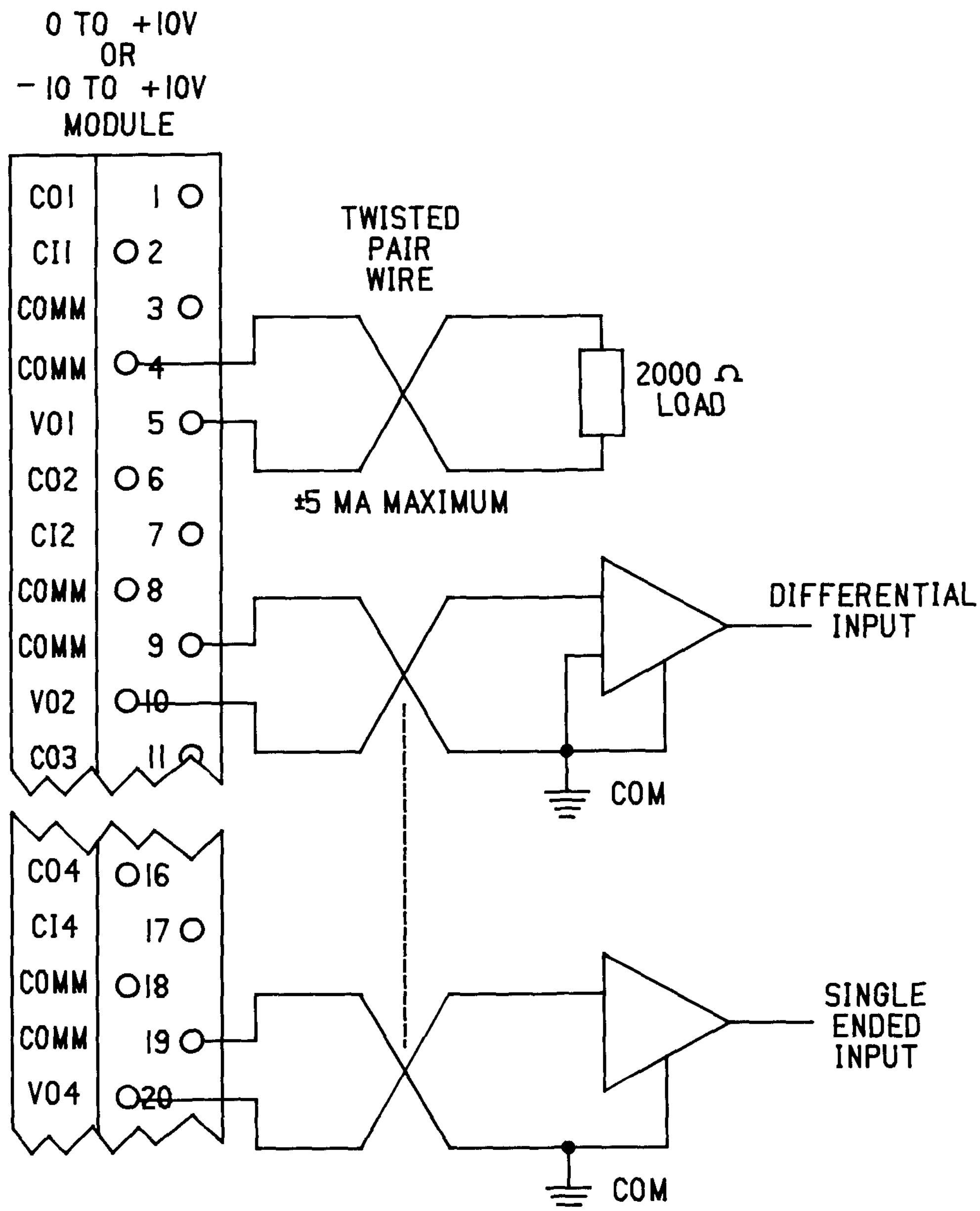


FIGURE 5. TYPICAL VOLTAGE OUTPUT CONNECTIONS

NOTES

1. **Maximum Loading is ± 5 mA for full voltage output.**

2. **All four outputs on this module are single ended and must be referred to the same user side common which is isolated from Series Six ground.**

3. **All COMM terminals are connected together internally to the module.**

4. **If multiple destinations are connected to the same output module their reference points (common) must be connected together and be at the same voltage.**

5. **Twisted-pair cable should be used whenever possible. Twisted pair and shield is preferred.**

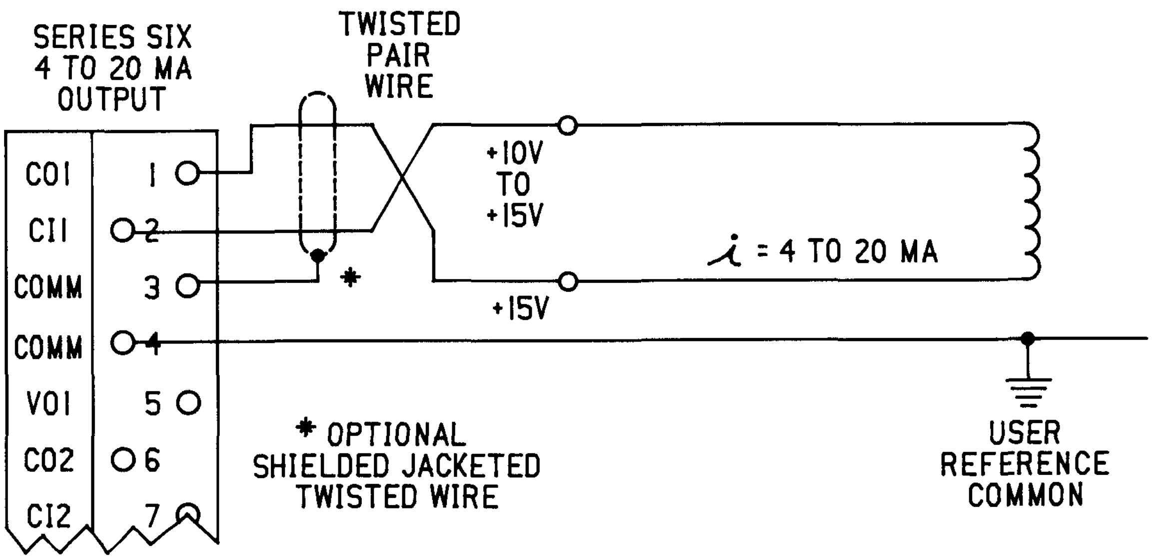


FIGURE 6A. SYMBOLIC FLOATING USER INPUT CIRCUIT
SERIES SIX - 4 to 20 mA OUTPUT MODULE INTERNAL LOOP POWER SUPPLY

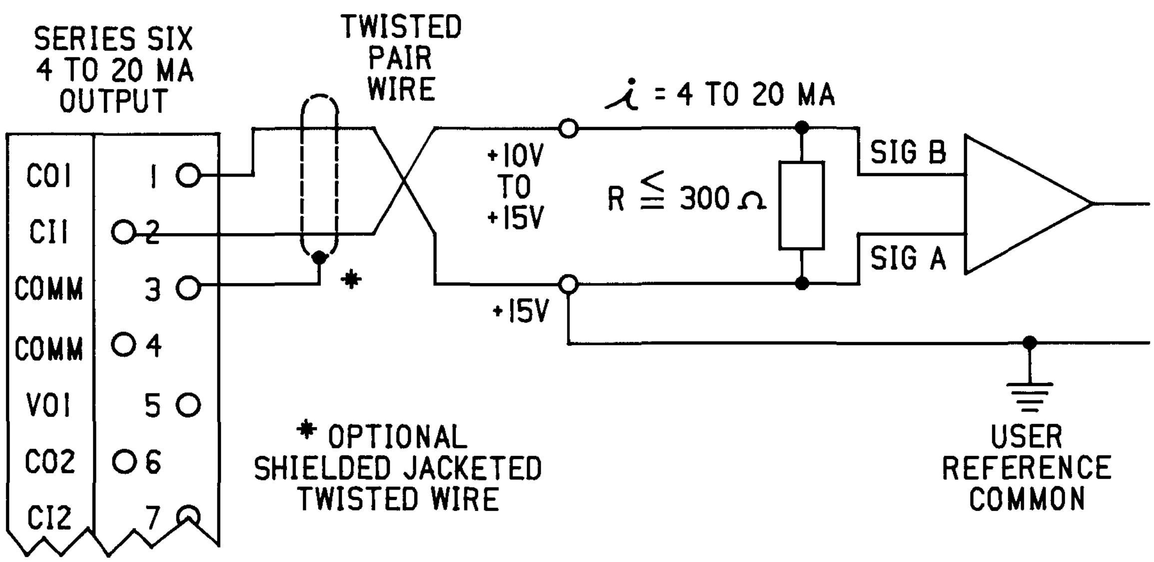


FIGURE 6B. SYMBOLIC NON-FLOATING USER INPUT CIRCUIT OR
SERIES SIX ANALOG INPUT MODULE

NOTES

1. **If damage can be caused to user input circuity when Signal A or Signal B are more than 10V above user common then user common must be connected as shown in Figure 6B to the Series Six +15V point. Because of this connection user common should never be connected to Series Six common.**

2. **The loading of the 4 to 20 mA module should be in accordance with ISA-S50.1 Transmitter Standard Class 2L when the module is using the internal loop power supply as shown.**

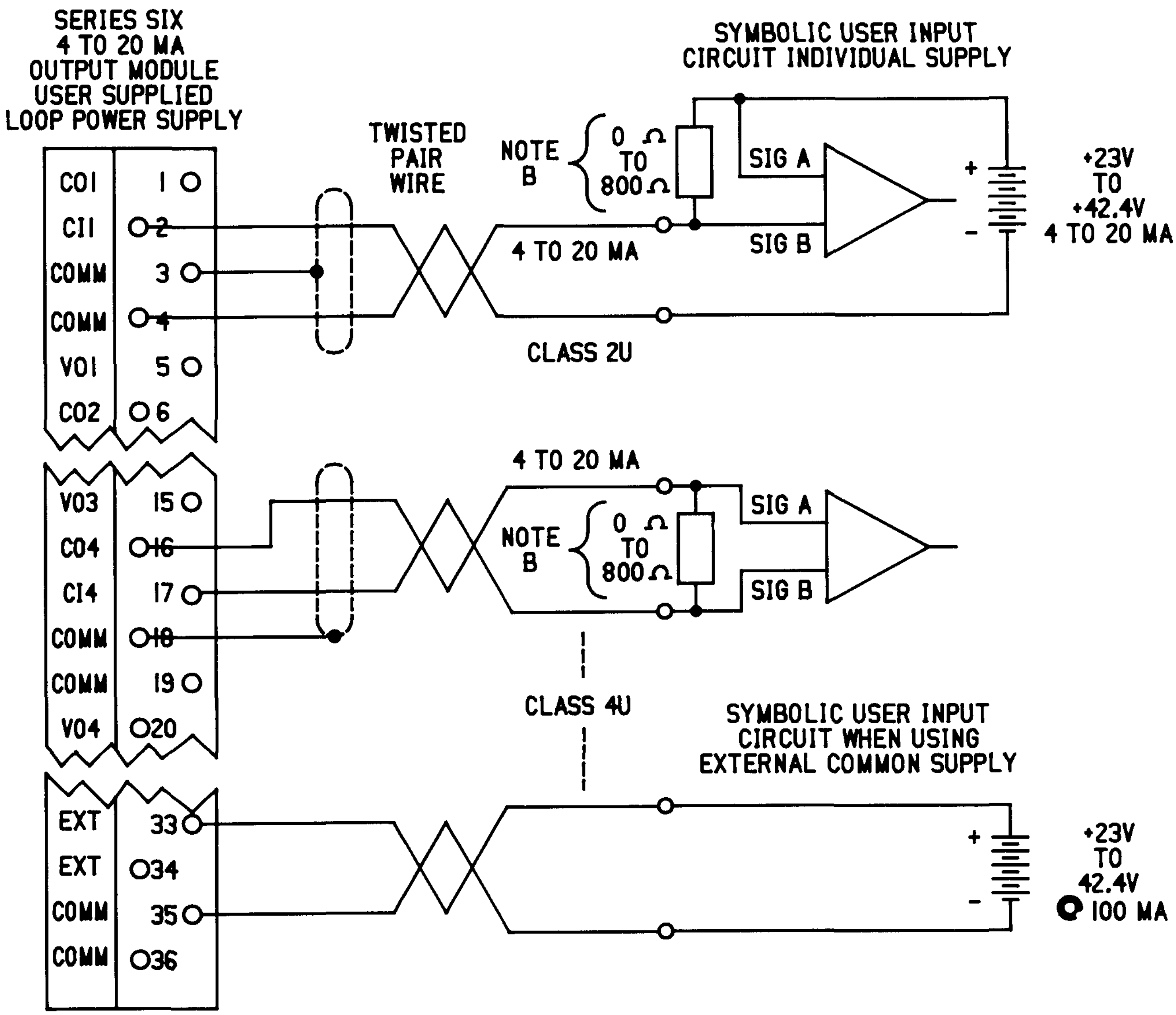


FIGURE 7. TYPICAL OUTPUT CONNECTIONS FOR 4 TO 20 mA OUTPUT USING EXTERNAL POWER SUPPLY

NOTES

4 TO 20 mA CURRENT OUTPUT TO FLOATING USER INPUTS ONLY

A. If damage could be caused to user input circuits because Signal A and Signal B inputs are from +23V to 42V above common (depending on the external supply), then the user must select other truly floating input receivers that can withstand this voltage differential.

B. The loading of the 4 to 20 mA module when using an external power supply should be in accordance with ISA-S50.1 Transmitter Class 2U or 4U data. This module is in compliance with or exceeds this specification.

C. Individual external supplies or common external supplies may be used on the same output module if the commons of the two supplies are at the same potential and may be connected together.

D. All points marked "COMM" on the output module are tied together internally. Caution must be used when connecting user commons to the same output module.

DIGITAL DATA FORMAT

Bit 1 corresponds to the lowest output number in the group of 16 outputs reserved for the module; Bit 16 corresponds to the highest output number in this group.

Bits 1-8: Data: Eight least significant of the twelve bits of data. Bit 1 is the least significant bit (LSB).

Bits 9-12: Data: Four most significant of the twelve bits of data. Bit 12 is the most significant bit. For the bipolar (-10 to +10 V) module, Bit 12 functions as a sign bit.

Bits 13-14: Channel Number: 2-bit binary number which determines the number of the channel (1 to 4) being accessed. Bit 14 is the MSB.

Bits 15-16: Not used: (May be in either a HIGH or LOW state.)

The twelve bits of data should be in straight binary form for positive output values, or in 2's-complement form for negative values. For the Bipolar (-10 V to +10 V) module, bit no. 12 functions as a sign bit.

OUTPUT STATUS TABLE DISPLAY

Two consecutive I/O addresses are required to write all 16 bits of information associated with each channel. A single channel is normally accessed during each sweep. The channel number is determined by the CPU, under control of the user program.

	CHANNEL NUMBER CODE				DATA											
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
CHANNEL NO.	UNUSED	UNUSED	CHANNEL	CHANNEL	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT	DATA BIT
1			0	0												
2			0	1	MSB *											LSB
3			1	0												
4			1	1												

* For Bipolar bit No. 12 functions as Sign bit.

CALIBRATION PROCEDURE

Required equipment: Voltmeter - 5 digit
250 ohm Precision Resistor
Calibration Connector (IC600MA508A)
Small screwdriver with approximately 3 inch insulated shaft.

Calibration of the Analog Output module should be performed every 90 days. For maximum accuracy the module should be calibrated at the normal ambient temperature which occurs in operation.

1. SET UP:
   Loosen the thumbscrews, remove the faceplate, taking care that the field wiring is not disturbed. Place the calibration connector on the front edge of the module. For the 0 to + 10 V or the -10 V to + 10 V module connect a Digital Voltmeter (DVM) between the terminals of the calibration connector as listed in the "V' column for the first channel in Table 2. For the 4 to 20 mA module, connect a 250 ohm precision resistor in parallel with the DVM, using the terminal numbers in the "I" column of Table 2. Be sure that the circuit-module jumper is set for the internal loop supply.

   Display the Ouput Status Table on the screen of the Program Development Terminal (PDT), with the cursor on the lowest output number assigned to this module by the DIP switches. Shift the display to hex format, obtaining a display of four hexadecimal digits corresponding to the 16 Output Status bits used by this module.

2. LOW END:
   Using the PDT keyboard, enter the four hex digits shown in the LOW END column of the Calibration Table into the Output Status Table. Note that the first digit assigns the channel number (1 to 4).
   Adjust the Offset Pot (Refer to Figure 2) for this channel until the DVM reads the voltage shown in Table 3.

3. HIGH END:
   Using the PDT keyboard, enter the four hex digits shown in the HIGH END column of Table 3 into the Output Status Table.
   Adjust the Gain Pot (Refer to Figure 2) for this channel until the DVM reads the voltage shown in Table 3 .

4. FINE ADJUST:
   Repeat steps No.2 and No.3 until no further change in either pot setting is required.

5. OTHER CHANNELS:
   Change the connections according to Table 2, and repeat steps No.2, No.3, and No.4 for channels 2, 3 and 4.

TABLE 2. CHANNEL ADJUSTMENT

	TERMINALS		CHANNEL NUMBER (*X)	OFFSET POT	GAIN POT
	V	I			
First Channel	5,4	1,2	1	R51	R59
Second Channel	10, 9	6, 7	2	R35	R43
Third Channel	15,14	11,12	3	R20	R27
Fourth Channel	20,19	16,17	4	R6	R13

TABLE 3. MODULE CALIBRATION

MODULE	LOW END		HIGH END	
	Digital Input	Output Voltage	Digital Input	Output Voltage
0 to +10V	*X000	0.0000 v	*XFFF	9.9976 V
-10 to +10 to	*X800	-10.0000 v	*X7FF	9.9951 v
4 to 20mA	*X000	1.0000 v	'XFFF	4.9990 v

*X = Channel number minus one in hexadecimal format. See channel number code under bits 13 and 14 of "Output Status Table Display" sheet 9.

OUTPUT RANGE SELECTION

Each channel on the module can be set independently for an output range of 0 to + 10 V, -10 to + 10 V, or 4 to 20 mA, by configuring the on board jumpers in the positions indicated in Table 4.

Note that whenever the range of a channel is changed, the channel should be recalibrated.

TABLE 4. JUMPERS ON MODULE

OUTPUT RANGE	FIRST CHANNEL	SECOND CHANNEL	THIRD CHANNEL	FOURTH CHANNEL
0 to +10v	30-31 27-28 41-42	23-24 20-21 38-39	16-17 13-14 35-36	9-10 6-7 32-33
-10 to +10v	29-30 25-27 42-43	22-23 18-20 39-40	15-16 11-13 36-37	8-9 4-6 33-34
4 to 20mA	30-31 26-27 41-42	23-24 19-20 38-39	16-17 12-13 35-36	9-10 5-6 32-33
4 to 20 mA output range only: For Common External Source, connect 2-3 For Internal Loop Supply, connect l-2				

ORDERING INFORMATION

(For Local and Remote I/O applications)

Module	Circuit Board & Faceplate	Circuit Board	Faceplate
0 to +10v	IC600BF941B	IC600YB941B	IC600FP941A
-10 to +10v	IC600BF942B	IC600YB942B	IC600FP941A
4 to 20mA	IC600BF943B	IC600YB943B	IC600FP941A

Calibration Connector

IC600MA508A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE **Fanuc** sales office.

NOTE

The Analog Output module will function properly only when used with CPUs with the following serial numbers:

Model 60 CPU: C186-81350130, and higher.

Model 600 CPU: C188-8138-0100, and higher.

Model 6000 CPU: Cl88-8138-6000, and higher.

If your CPU has a serial number lower than that listed, contact the PC Product Service Specialist at (804) -978-5624 for assistance.

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

Series Six™
Programmable Controllers

GEK-83527B
September 1988

Redundant Processor Unit DMA Cable

General Description

The Redundant Processor Unit (RPU) DMA cable is used internal to the RPU to interconnect the Data Control module bottom connector in slot 8 to the bottom connector in slot 6.

The cable consists of a male 37-pin D-type connector on each end. The cable is made up of 16 twisted pair (22 AWG) with an overall shield and a PVC jacket for a total of 32 wires plus shield.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Available in several lengths	Provides flexibility for Series Six hookup
Color coded twisted pairs	Simplifies troubleshooting

Table 2. SPECIFICATIONS

Cable Outside Diameter:	± 0.020 inches 11.81 ± 0.5 mm
Cable Length:	One or two feet (30.5 or 61 cm)
Conductor Size:	No. 22 AWG (each wire)
Jacket:	PVC material 300 V insulation Temperature: -20°C to +80°C
Internal Arrangement:	16 twisted pair (32 wires) with overall shield and jacket
Connectors:	37-pinD-type male connectors each end

PC-S6-N-0083

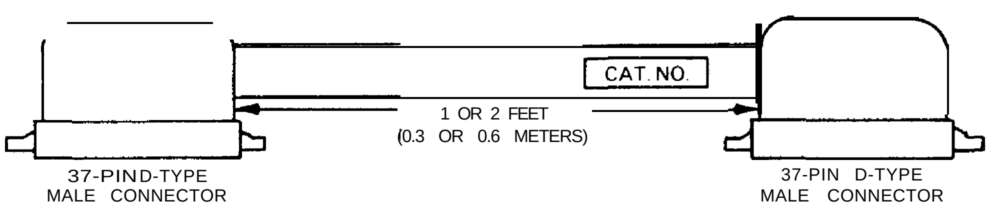
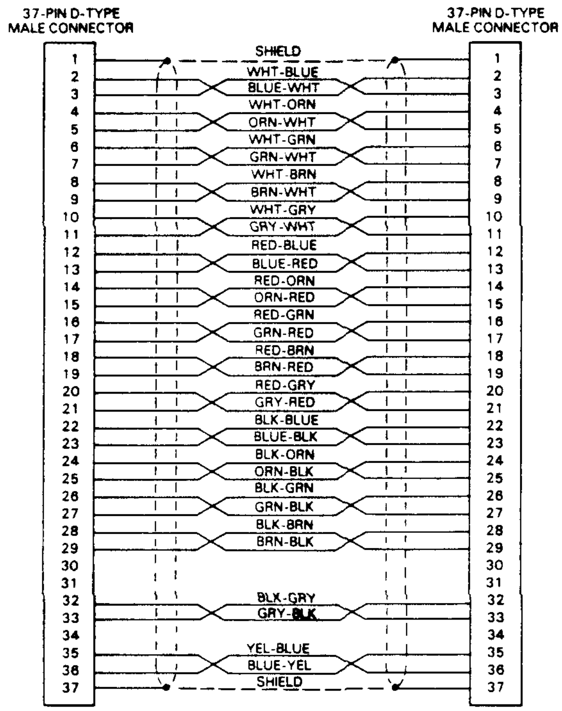


Figure 1. MECHANICAL ASSEMBLY

Installation

Either end of this cable may be connected to the bottom connector of the Data Control module in slot 8 of the RPU.

The other end should be connected to the bottom connector of the CPU Switch module in slot 6.



PC-S6-83-0084

Figure 2. WIRING DIAGRAM OF CABLE

Table 3. ORDERING INFORMATION

DESCRIPTION	CATALOG NUMBER
1 Foot (.3 Meters) cable with connectors each end	IC600WJ001A

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

SERIES SIX

PROGRAMMABLE CONTROLLERS

REMOTE I/O MODULES

GEK-83537C

240 I/O References
496 I/O References

GENERAL DESCRIPTION

The Remote I/O Modules, which include Driver and Receiver circuit boards, provide a serial, long-distance, communications interface between local and remote I/O locations. The Remote I/O Modules features and benefits are summarized in Table 1.

The Remote I/O modules support two types of serial communications interfaces: 2-twisted pair and RS-232-C (modem). The twisted pair interface consists of two unidirectional data lines (Transmit Data and Receive Data) through which data and control signals can be transferred 10,000 feet (3 km) at rates up to 57.6K baud.

The RS-232-C (modem) interface allows a Remote I/O Station to be located at a distance (from a Central Processing Unit (CPU), or Local I/O Station) limited only by the specifications of the modem employed and I/O response time requirements. Signal definitions are as described by the EIA RS-232C standard; six baud rates are selectable by the user, ranging from 110 to 57.6K baud.

The modules can support blocks of 128 or 256 I/O references; the block sizes are jumper-selectable on the Driver module. However, the user must reserve 8 of these I/O references for Series Six status information, leaving blocks of 240 or 496 I/O references, respectively, for general purpose inputs and outputs.

Another user option allows the Remote output points to hold their last state in the event of a CPU or communications link failure, and/or to allow the CPU to continue running during a fault or a parity error in the Remote station, or a link failure between the Driver and Receiver.

These module also contain diagnostic circuitry and Light-Emitting Diodes (LED's) that indicate a failure has occurred in the Remote I/O Driver, the serial communicaitions link, or the Remote station (including the Remote I/O Receiver). These LED's operate only when the module is installed in a properly powered I/O rack.

NOTE

Remote I/O Driver and Receiver modules, having model numbers IC600BF801A and IC600BF901A are not compatible with their successors, BF801B and 901B. Consequently, a model A module cannot be utilized in the same remote I/O configuration with a model B module.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Long-distance communications between CPU and I/O.	Reduces I/O wiring costs.
Dual-mode communication capability: ✍ twisted-pair ✍ modem	Useful in a variety of applications: ✍ high-speed over direct wires ✍ **iong** distances over other media
120 I-l 20 0 or 248 I-248 0 References per module.	Expandability.
Error detection lights.	Simplifies troubleshooting.
Jumper-selectable modes of operation.	Flexibility in applications.

APPLICATIONS

* Remote Sewage Aeration Lagoons
* Large Conveyor Systems
* Electric Sub-station Monitors
* Operator Consoles
* Tank Farm Monitor
* Pumping Stations
* Mining
* Moving Cranes
* Distributed Machine Lines

MODULE SPECIFICATIONS

- Dimensions:
  Circuit Board: 8.15 x 11.0 (inches)
  208 x 280 (mm)
  Faceplate: 12.46 x 1.175 (inches)
  317 x 30 (mm)
- Humidity: 5% - 95% (non-condensing)
- Storage Temperature: 0^{o} to 70^{o}C
- Power Requirements:

  Twisted-Pair Interface +5 Vdc, 2A
  (supplied by Standard I/O Rack P.S.)

  Modem Interface, +5 Vdc, +12 Vdc, -12 Vdc
  (supplied by High-Capacity I/O Rack P.S.)
- Operating Temperature: 0^{o} to 60^{o}C (outside rack)

TWISTED-PAIR CABLE SPECIFICATIONS

- Length, Maximum - 10,000 feet (3 kilometers)
- Two Individual Shielded, Twisted Pairs
- 22 AWG, Minimum
- 15 pf/foot, Maximum

  } Maximum signal loss of 20 db (total) at 100 KHz.
- Cable Type - National Electric Cable Co. 22P1SLCBT or equivalent
- Connector (Driver and Receiver End) - D-Subminiature Type, Cannon DBC25P with 207908-7 Hood or Equivalent (Standard RS-232C Connector)

RS-232C (MODEM) CABLE SPECIFICATIONS

- Length, Maximum - 50 feet (15 meters)
- Overall Shield
- 24 AWG, Minimum
- Connector, Driver or Receiver End - D-Subminiature Type, Cannon DBC25P with 207908-7 Hood or Equivalent (Standard RS-232C Connector)
- Connector, Modem - User Selected

NOTE ON MODEM SELECTION

When selecting a modem, be sure to specify one that is compatible with the Series Six Remote I/O.

Modems must be truly asynchronous at the desired baud rate. (Some modems are claimed to be asynchronous but in actuality place restrictions on data flow.)

The following RS-232-C signals are used:

PIN	SIGNAL
1	Chassis Ground (modem side only)
2	Tx Data
3	Rx Data
7	Signal Ground

In order to utilize auto-synchronization, some modems need to be configured according to the data format used. With Remote I/O, transmission can be in any of the following formats (user-selectable):

110 Baud, 12 bits/char. with either parity
110 Baud, 12 bits/char. with no parity*
300
1200
2400
9600
19.2K
57.6K
} Baud, { 11 bits/char. with either parity
11 bits/char. with no parity

(Factory setting is 57.6K baud, 11 bits/char. ODD parity.)

*When no parity is selected, verticle checksum error-checking is still in place.

At 1200 baud, Racal-Vadic 3450 Series modems work well when configured for 11 bit characters.

Modems which require at least one character time delay between messages (not truly asynchronous operation) may not function in Remote I/O systems.

FIGURE 1. SPECIFICATIONS

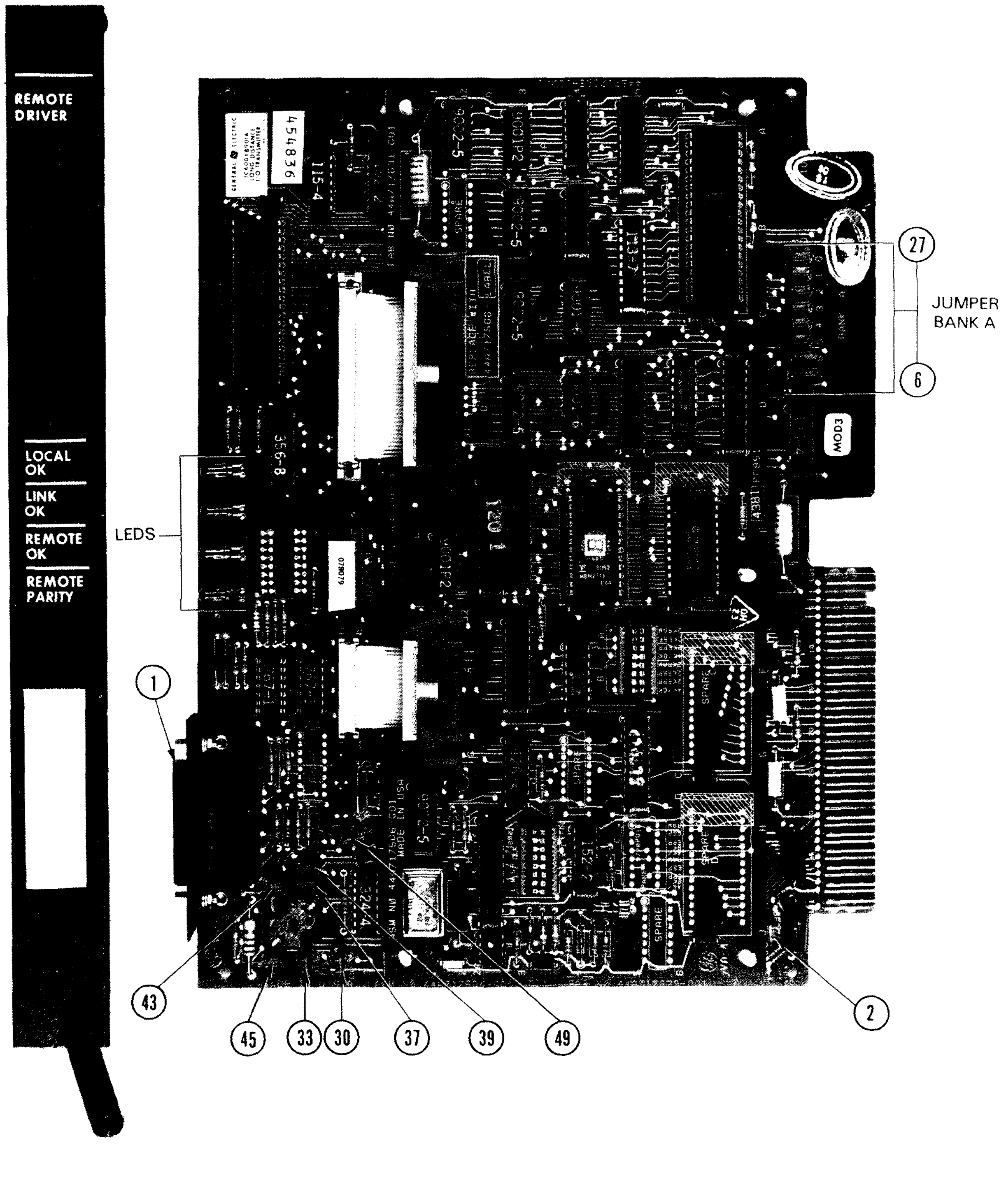


FIGURE 2. REMOTE I/O DRIVER USER ITEMS (Part 1 of 2)

① J3 Connector: Communications interface cable connector (For link to Remote I/O Receiver or Modem).

JUMPER		FUNCTION	FACTORY SETTING		ALTERNATE SETTING	
	②	Quantity of I/O	1-2	(120)	2-4	(248)
BANK A	⑥	Remote Parity Error Effect[1]	6-7	(Halt)	5-6	(Run)
BANK A	⑨	Comm. Failure Effect[1]	9-10	(Halt)	8-9	(Run)
BANK A	⑫	Odd/Even	12-13	(Odd)	11-12	(Even)
BANK A	⑮	Parity	15-16	(Yes)	14-15	(No)
BANK A	⑱	Factory Set	18-19		None	
BANK A	㉑	Baud Rate	21-22	(MSB)	20-21	
BANK A	㉔	Baud Rate	24-25		23-24	
BANK A	㉗	Baud Rate	27-28	(LSB)	26-27	
	㉚	Carrier Detect	30-50	(No)	29-30	(Yes)
	㉝	Clear-To-Send	33-51	(No)	32-33	(Yes)
	㊲	Output Mode	36-37	(Tw. Pair)	35-37	(RS-232C)
	㊴	Output Mode	38-39	(Tw. Pair)	39-40	(RS-232C)
	㊸	Input Mode	42-43	(Tw. Pair)	41-43	(RS-232C)
	㊺	Input Mode	44-45	(Tw. Pair)	45-46	(RS-232C)
	㊾	Sensitivity	48-49	(Med)	47-49	(Min)

LED INDICATORS

LED	DESCRIPTION
LOCAL OK	ON - Remote I/O Driver module operating normally. OFF - Fault in Remote I/O Driver.
LINK OK	ON - Communications link between this module and Remote Receiver good. OFF - Communications error between this module and Remote Receiver.
REMOTE OK	ON - Remote system is operating normally. OFF - Fault exists in Remote I/O system. (Power supply failure, cable loose, module not seated properly, etc.).
REMOTE PARITY	ON - Remote system has no parity errors, operation normal. OFF - Parity error detected in Remote I/O system, CPU will stop unless option jumper on this module set for CPU to RUN when error detected.

FIGURE 2. REMOTE I/O DRIVER (Part 2 of 2)

1. The Hold Last State and the Remote Parity Error Effect or Communications Failure Effect functions are available with Remote Driver/Remote Receiver modules revision C (P/N IC600BF901C/IC600BF801C or IC600YB901C/IC600YB801C, respectively). These functions do not operate properly with earlier revisions. If you require use of these functions on earlier modules, please contact the GE Fanuc Field Service Group at 804-978-5624 for assistance.

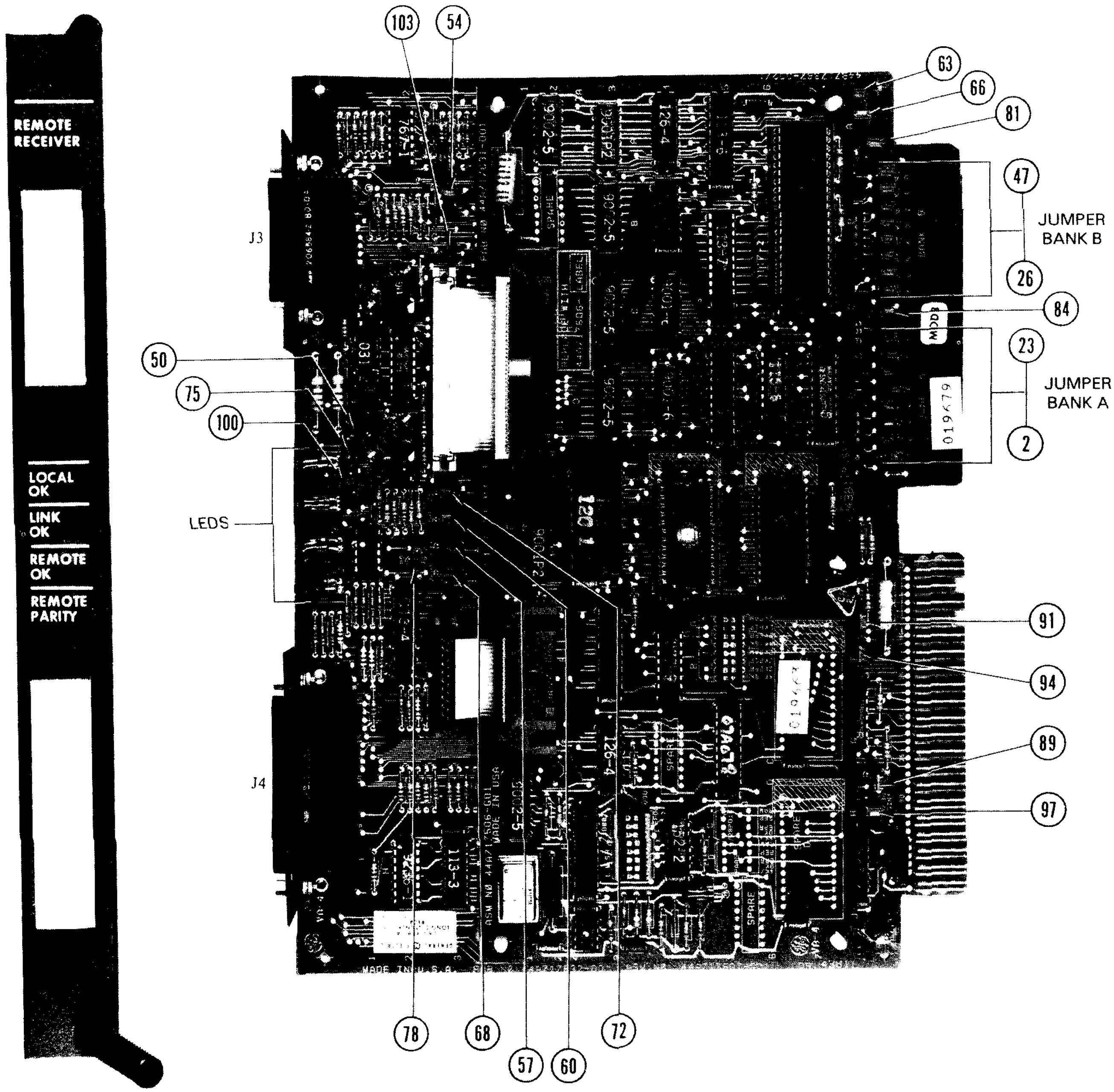


FIGURE 3. REMOTE I/O RECEIVER USER ITEMS (Part 1 of 3)

① J3 Connector: Communications interface cable connector (For link to Remote I/O Receiver or Modem).

③ J4 Connector: Connector for cable link to other I/O racks in Remote I/O station.

	JUMPER		FUNCTION	FACTORY SETTING		ALTERNATE SETTING	
BANK A	2		Factory Set	1-2		None	
BANK A	5		Comm. Failure Effect[1]	4-5	(Out.OFF)	5-6	(Out.Hold)
BANK A	8		Odd/Even	7-8	(Odd)	8-9	(Even)
BANK A	11		Parity	10-11	(Yes)	11-12	(No)
BANK A	14		Factory Set	13-14		None	
BANK A	17		Baud Rate	16-17	(MSB)	17-18	
BANK A	20		Baud Rate	19-20		20-21	
BANK A	23		Baud Rate	22-23	(LSB)	23-24	
BANK B	26		Factory Set	25-26		None	
BANK B	29		Factory Set	28-29		None	
BANK B	32		Factory Set	31-32		None	
BANK B	35		Factory Set	34-35		None	
BANK B	38		Factory Set	37-38		None	
BANK B	41		Factory Set	40-41		None	
BANK B	44		Factory Set	43-44		None	
BANK B	47		Factory Set	46-47		None	
	54		Sensitivity	53-54	(Med.)	52-54	(Min.)
	57		Carrier Detect	57-0V	(No)	56-57	(Yes)
	60		Clear-To-Send	60-0V	(No)	59-60	(Yes)
	63		Output Mode	63-64	(Tw. Pair)	62-63	(RS-232C)
	66		Output Mode	65-66	(Tw. Pair)	66-67	(RS-232C)
	50		Input Mode	49-50	(Tw. Pair)	50-51	(RS-232C)
	103		Input Mode	102-103	(Tw. Pair)	103-104	(RS-232C)
	68		Factory Set	68-0V		None	
	72		Factory Set	72-0V		None	
	75		Factory Set	74-75		None	
	78		Factory Set	78-79		None	
	89	SET THESE THREE	Second Rack Present	88-89	(Yes)	87-89	(No)
	91	SET THESE THREE	Second Rack Present	91-92	(Yes)	90-91	(No)
	94	SET THESE THREE	Second Rack Present	94-95	(Yes)	93-94	(No)
	81		Factory Set	81-82		None	
	100		Factory Set	99-100		None	
	97		Factory Set	96-97		None	

1. The Hold Last State and the Remote Parity Error Effect or Communications Failure Effect functions are available with Remote Driver/Remote Receiver modules revision C (P/N IC600BF901C/IC600BF801C or IC600YB901C/IC600YB801C, respectively). These functions do not operate properly with earlier revisions. If you require use of these functions on earlier modules, please contact the GE Fanuc Field Service Group at 804-978-5624 for assistance.

FIGURE 3. REMOTE I/O RECEIVER USER ITEMS (Part 2 of 3)

LED INDICATORS

LED	DESCRIPTION
LOCAL OK	ON - Remote I/O Receiver module operating normally. OFF - Communications failure due to timeout or successive transmission errors.
LINK OK	ON - Communications link between this module and Remote I/O Driver established and valid. OFF - Communications error between this module and Remote I/O Driver.
REMOTE OK	ON Remote system is operating normally. OFF - Fault in Remote I/O system (illegal address block, loose connection, power supply failure).
REMOTE PARITY	ON - Remote system operating normally with no parity errors. OFF - Parity error detected in Remote I/O system.

FIGURE 3. REMOTE I/O RECEIVER (Part 3 of 3)

INSTALLATION

Before installing the Remote I/O modules, review Table 2 to determine if the factory-set configurations are suitable for the Remote I/O application. Optional configurations are also indicated in Table 2. Step-by-step considerations are described in this section.

Modems being used must be compatible with Remote I/O, see specifications (pages 2 and 3).

TABLE 2. THINGS TO CONSIDER BEFORE INSTALLING MODULES

STEP	CONSIDERATION	FACTORY CONFIGURATION	OPTIONAL CONFIGURATION
1	Block Size	120 Inputs/120 Outputs	248 Inputs/248 Outputs
2	Block Address Switches	8 Blocks of 240 I/O References to choose from	4 Blocks of 496 I/O References to choose from
3	Number of I/O Racks in Remote I/O Station	2 or more I/O Racks in Remote Station	1 I/O Rack (Containing Receiver) in Remote Station
4	Communications Interface	Twisted-Pair up to 10,000 ft (3 km)	RS-232 (Modem) as link (Requires High-Capacity I/O Rack)
5	Communications Failure: CPU Status	STOP CPU	Allow CPU to Run
6	Communications Failure: Remote I/O Status	Turn all outputs OFF	Hold all outputs at last state
7	Remote I/O Parity Error	STOP CPU	Allow CPU to Run

Step 1 - Block Size

To obtain the Remote I/O modules for a block size of 496 inputs/outputs, set jumper 2 on the Driver module to position 2-4 (Refer to Figure 2, User Item 2)

Step 2 - Address Switches

If the block size equals 240, the user can select one of eight blocks of I/O References; the selection is made at the I/O Rack where the Driver is to be installed. Adjacent to the module slot on the rack backplane where the Driver is to be installed is a DIP-switch package whose possible block address settings are described in Figure 4.

The Driver DIP-switches, 1-4, are used to select which of 16 possible addresses in the block is to be reserved for the remote I/O status information. (If 1-4 were depressed to the left, the last address of I/O references would be selected e.g. 0121 - 0128).

If the block size is to equal 496, the user can select one of four blocks of I/O references; (the DIP-switch rockers 1-5, in this case, select one of 32 possible addresses for status) the selection is made at the I/O Rack where the Driver is to be installed. Refer to Figure 5 for possible selections.

I/O References In Remote Location	User I/O Quantity	Rack Address Switches 5	6	(7 =Bottom) 7
0001-0128	120/120	R	R	R
0129-0256	120/120	L	R	R
0257-0384	120/120	R	L	R
0385-0512	120/120	L	L	R
0513-0640	120/120	R	R	L
0641-0768	120/120	L	R	L
0769-0896	120/120	R	L	L
0897-1000	96/96	L	L	L

Note: L = Depressed to Left (Open)
R = Depressed to Right (Closed)

FIGURE 4. I/O RACK DIP-SWITCH SETTINGS FOR 240 I/O BLOCKS

I/O References	User I/O	Rack Address Switches 7	6
0001-0256	248/248	R	R
0257-0512	248/248	R	L
0513-0768	248/248	L	R
0769-1000	224/224	L	L

Note: L = Depressed to Left (Open)
R = Depressed to Right (Closed)

FIGURE 5. I/O RACK DIP-SWITCH SETTINGS FOR 496 I/O BLOCKS

NOTE

All I/O modules in the remote end must utilize addresses within the range established by the Driver. Inputs not used at the remote end can be used elsewhere in the system (local or remote locations). Outputs can be duplicated if needed.

Step 3 - Number of I/O Racks

At the Receiver, if there are no other racks in the Remote I/O Station containing the receiver, reposition the jumpers to the right to properly terminate the I/O communications:

At Receiver - For Single Rack Operation	
Jumper 89	87 - 89
Jumper 91	90 - 91
Jumper 94	93 - 94

Step 4 - Communications Interface

If the twisted-pair interface (differential) is to be utilized, verify the jumper settings indicated below for both the Driver and Receiver modules.

TWISTED PAIR (DIFFERENTIAL) JUMPERS

At Driver		Setting	Function
Jumper 27	Bank A	27-28	57.6Kb
Jumper 24	Bank A	24-25	
Jumper 21	Bank A	21-22	
Jumper 15	Bank A	15-16	
Jumper 12	Bank A	12-13	Odd Parity
Jumper 30		30-50	Carrier Detect
Jumper 33		33-51	Clear to Send
Jumper 37		36-37	Differential Mode
39		38-39	
43		42-43	
45		44-45	
Jumper 49		48-49	Sensitivity

At Receiver		Setting	Function
Jumper 23	Bank A	22-23	57.6Kb
Jumper 20	Bank A	19-20	
Jumper 17	Bank A	16-17	
Jumper 14	Bank A	13-14	
Jumper 11	Bank A	10-11	Odd Parity
Jumper 63		63-64	Differential Mode
66		65-66	
50		49-50	
103		102-103	
Jumper 54		53-54	Sensitivity
Jumper 57		57-0V	Carrier Detect
Jumper 60		60-0V	Clear to Send

Step 4 - Communications Interface (continued)

If the Modem, RS-232, option is selected, the following jumpers must be reset, (all jumpers must be changed to have a functional system).

NOTE

Both the Remote Driver and the Remote Receiver must be placed in high capacity I/O racks to operate with RS-232 devices; any I/O rack will function when using twisted pair.

RS-232C JUMPERS

At Driver	Settings			Function
Bank A Select Desired Baud Rate	21-22	24-25	27-28	57.6K
	21-22	24-25	26-27	19.2K
	21-22	23-24	27-28	9.6K
	21-22	23-24	26-27	2.4K
	20-21	24-25	27-28	1.2K
	20-21	24-25	26-27	300
	21-22	23-24	27-28	110
Jumper 15		15-16		Parity
		14-15		No Parity
Jumper 12		12-13		Odd Parity
		11-12		Even Parity
Jumper 37		35-37		RS-232C Mode
39		39-40		
43		41-43		
45		45-46		
Jumper 49		47-49		Sensitivity

At Receiver	Settings			Function
Bank A Select Desired Baud Rate (Same as Driver)	16-17	19-20	22-23	57.6K
	16-17	19-20	23-24	19.2K
	16-17	20-21	22-23	9.6K
	16-17	20-21	23-24	2.4K
	17-18	19-20	22-23	1.2K
	17-18	19-20	23-24	300
	17-18	20-21	22-23	110
Jumper 11		10-11		Parity
		11-12		No Parity
Jumper 8		7-8		Odd Parity
		8-9		Even Parity
Jumper 63		62-63		RS-232C Mode
66		66-67		
50		50-51		
103		103-104		
Jumper 54		54-55		Sensitivity

Step 5 - Communications Failure - CPU Status[1]

If an error is detected between the Driver and Receiver, what should the CPU do?

	(Factory Setting) Halt CPU	(Optional Setting) CPU RUN
At Driver Jumper 9	9-10	8-9

Step 6 - Communications Failure Remote I/O Status[1]

If an error is detected between the Driver and Receiver, what should the Remote I/O do?

	(Factory Setting) Turn All Outputs OFF	(Optional Setting) Hold LAST STATE
At Receiver Jumper 5	4-5	5-6

Step 7 - Remote I/O Error

If an error is detected in the parity checking at the Remote Station within its I/O modules and/or racks, what should the CPU do?

	(Factory Setting) Halt CPU	(Optional Setting) CPU RUN
At Driver Jumper 6	6-7	5-6

1. The Hold Last State and the Remote Parity Error Effect or Communications Failure Effect functions are available with Remote Driver: Remote Receiver modules revision C (P/N IC6OOBF901C, IC600BF801C, or IC600YB901C, IC600YB801C, respectively). These functions do not operate properly with earlier revisions. If you require use of these functions On earlier modules, please contact the GE Fanuc Field Service Group at 804-978-5624 for assistance.

WIRE CONNECTIONS

Use the insertion/extraction tool packaged with the Series Six CPU to insert the Remote I/O Driver and Receiver modules into their respective I/O racks. Position the faceplates over the cable connector(s) on the circuit boards; then secure the faceplate to the rack using the thumbscrews at the top and bottom.

If wiring the twisted-pair interface, refer to Figure 6. Use National Electric Cable, 22P15LCBT, or equivalent; the Receiver module can be located up to 10,000 feet (3 Km) from the Driver. The twisted-pair cable specifications are described in Figure 1.

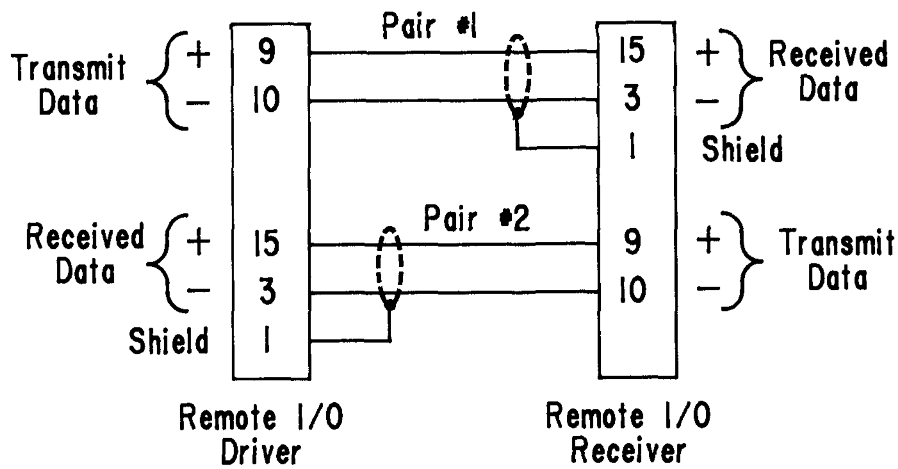


FIGURE 6. TWISTED-PAIR WIRE CONNECTIONS

If wiring the RS-232-C interface for communications through a modem, refer to Figure 7. The modem can be located up to 50 feet (15 meters) from the associated Driver or Receiver module. The RS-232-C cable specifications are described in Figure 1.

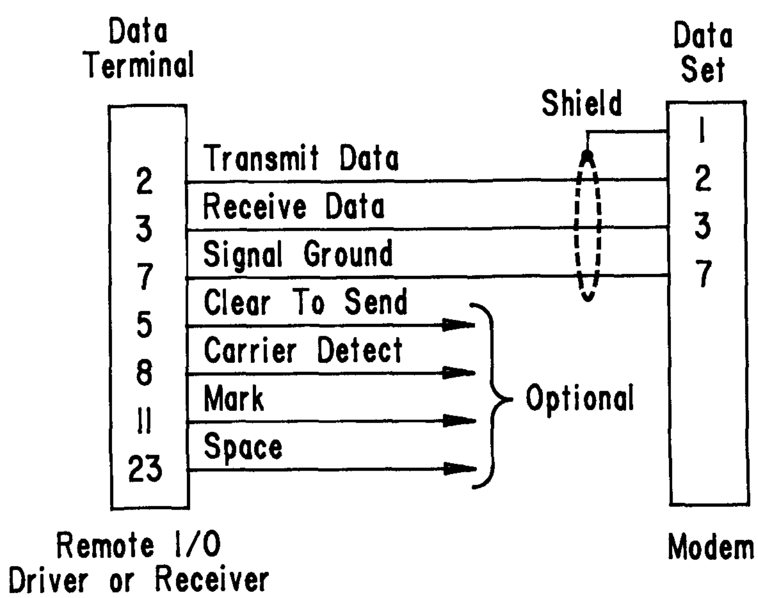


FIGURE 7. MODEM WIRE CONNECTIONS

SYSTEM DELAY TIMES

The following may be used to calculate worst-case delay times for an output to reach the Remote I/O in the absence of noise (link failure) (all results are in milliseconds).

PULSE WIDTHS:
Minimum pulse duration to assure output gets to the Remote I/O and/or inputs gets to CPU:

$$\text{Minimum Pulse Width:} \quad = \quad 2.5 + \left[\frac{600}{\text{K Baud Rate}}\right] + 1 \text{ Sweep (for 120 I/O)}$$

$$= \quad 5.0 + \left[\frac{1188}{\text{K Baud Rate}}\right] + 1 \text{ Sweep (for 248 I/O)}$$

OUTPUT DELAY:
Worst case time for CPU to affect a remote output compared to if it were in a local I/O chain:

$$\text{Maximum Delay Time:} \quad = \quad 5.0 + \left[\frac{902}{\text{K Baud Rate}}\right] + 1 \text{ Sweep (for 120 I/O)}$$

$$= \quad 10.0 + \left[\frac{1606}{\text{K Baud Rate}}\right] + 1 \text{ Sweep (for 248 I/O)}$$

INPUT DELAY:
Worst case time for input at remote station to reach CPU (not including input filters on boards):

$$\text{Maximum Delay Time:} \quad = \quad 5.0 + \left[\frac{1078}{\text{K Baud Rate}}\right] + 3 \text{ Sweeps* (for 120 I/O)}$$

$$= \quad 10.0 + \left[\frac{1958}{\text{K Baud Rate}}\right] + 3 \text{ Sweeps* (for 248 I/O)}$$

* 3 Sweeps can be reduced to 2 Sweeps if DO I/O instruction is used before logic using Remote I/O.

NOTES

1. For 110 baud with parity 12-bit characters are used, so multiply number in brackets by 1.09.
2. If NO PARITY is selected (user option) 10-bit characters are used, multiply number in brackets by 0.91 (except for 110 baud, multiply by 1.0).
3. To take into account the allowance to a transmission error (which does not cause system to halt) add the bracketed amount again.

EXAMPLES:

1. Factory Settings:
   (57.6K baud, ODD parity), 120 I/O: with 10 millisecond CPU Sweep:

   a. Minimum Detectable Pulse Width:

$$= \quad 2.5 \quad + \quad \left[\frac{660}{57.6}\right] \quad + \quad 10$$

$$= \quad 24 \text{ milliseconds}$$

EXAMPLES (Continued):

b. Worst case delay time from CPU to Remote Output:

$$= 5.0 + \left[\frac{902}{57.6}\right] + 10 = 15 + [15.7]$$
$$= 31 \text{ milliseconds}$$

c. Worst case delay time for input to reach CPU with DO I/O instruction:

$$= 5.0 + \left[\frac{1078}{57.6}\right] + 10(2) = 25 + [18.7]$$
$$= 44 \text{ milliseconds}$$

d. Worst case input delay including one bad message:

$$= 44 + [18.7]$$
$$= 63 \text{ milliseconds}$$

2. 1200 Baud Modem operation, no parity, 120 I/O. with 10 millisecond sweep:

a. Minimum Detectable Pulse Width:

$$= 2.5 + \left[\frac{660}{1.2} \times 0.91\right] + 10$$

No Parity = 10 bit frame

$$= 12.5 + [500.5]$$
$$= 513 \text{ milliseconds}$$

b. Worst Case Output Delay:

$$= 5.0 + \left[\frac{902}{1.2} \times 0.91\right] + 10$$
$$= 15 + [684]$$
$$= 699 \text{ milliseconds}$$

c. Worst Case Input Delay (without DO I/O instruction):

$$= 5.0 + \left[\frac{1078}{1.2} \times 0.91\right] + 10(3)$$
$$= 35 + [817]$$
$$= 852 \text{ milliseconds}$$

d. Worst Case Output Delay allowing a transmission error:

$$= 699 + [684]$$
$$= 1383 \text{ milliseconds}$$
$$= 1.4 \text{ seconds}$$

e. Worst Case Input Delay allowing a transmission error:

$$= 852 + [817]$$
$$= 1649 \text{ milliseconds}$$
$$= 1.7 \text{ seconds}$$

REMOTE I/O STATUS BYTE

The Remote Driver utilizes 8 input references and 8 output references as selected by the I/O rack address switches (refer to step 2). The outputs are reserved for future use; the inputs provide the user with information as summarized below. The example references assume the Driver is using references, 0121 - 0128 (DIP switches 1-4 set to left, 5-7 set to right).

Input Number	Example	Function
1	10121	Data Hand Shake
2	10122	Reserved
3	IO123	Reserved
4	IO124	Remote Parity
5	10125	Remote OK
6	IO126	Link OK
7	10127	Local OK
8	10128	Heartbeat

Input No.

Input 1 toggles to indicate occurance of data handshake between Driver and Receiver.

2-3 Reserved.

4. If a parity error is detected in the communications between the Remote Receiver and other Remote racks, the 4th input is a zero (OFF). Otherwise, it is a one (ON).

5, If any fault is found with the Remote I/O such as power supply failure or parity error, the 5th input is a zero (OFF) ; otherwise, it is a one (ON).

6. If any error is detected in the communications system between the Driver and the Receiver the, 6th input is a zero (OFF), Errors include failure of LRC, parity error, broken cable, faulty modem, etc. Otherwise, it is a one (ON).

7. If any fault is found with the driver installed in the Local I/O, the 7th input is a zero (OFF); otherwise, it is a one (ON).

8. The 8th input cycles, OFF/ON/OFF/ON/OFF, one change each scan, indicating that the remote I/O system is properly functioning. If any of the four inputs (4-7) are set to zero, this input stops cycling and will hold an OFF or ON state, whichever was the last valid data.

ORDERING INFORMATION

	Circuit Board & Faceplate	Circuit Board	Faceplate
I/O Remote Receiver	IC600BF80lC	IC600YB801C	IC600FP801A
I/O Remote Driver	IC600BF901C	IC600YB901C	IC600FP901A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic, Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE FANUC AUTOMATION NORTH AMERICA, INC. CHARLOTTESVILLE, VIRGINIA

PRINTED IN U.S.A

SERIES SIX

PROGRAMMABLE CONTROLLERS

REED RELAY OUTPUT MODULE

GEK-83540

OUTPUT
0 - 250 V AC/DC
0- 100VA

GENERAL DESCRIPTION

The Reed Relay Output module can be utilized in either an I/O Rack or a Model 60 CPU to provide a compact, electrically-isolated, relay contact interface between user power supplies and discrete loads. The Reed Relay Output module features and benefits are summarized in Table I,

The module includes six, Form C, mercury-wetted relays; each output circuit is separately fused and contains an LED that indicates when the circuit coil is energized. All six outputs are updated by the Series Six CPU during an I/O scan.

The de-energized state of each relay is jumper-selectable by the user; either normally-open (N.O.) or normally-closed (N.C.) contacts can be selected on a circuit-by-circuit basis.

The user also has the option to exclude the RC protection circuit provided for each output; this jumper-selectable option provides for low-level analog and instrumentation signals.

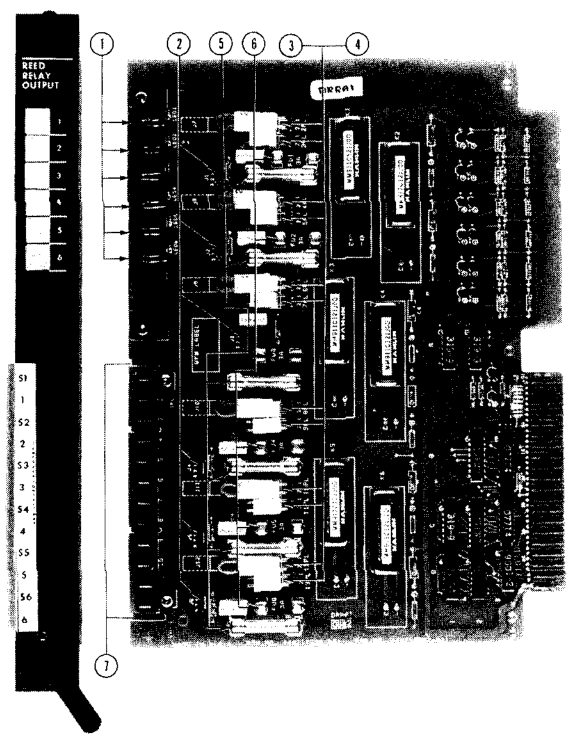
Refer to Figure 1 (next page) for Reed Relay Output module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Normally Open/Normally Closed contact selection.	Useful in a variety of applications
6 relay outputs per module.	Low cost per output point
Individual fuses and status indicators	Protection and monitoring aids
250 V AC/DC (100 Volt-Amps max)	Can be used with wide range of AC or DC loads
High-voltage isolation capabilities	Provides Electrical Isolation (750 Volts max) between user field devices and the Series Six Controller

- Dimensions:
  - Circuit Board:
    - 8.15 x 11.0 (inches)
    - 200 x 260 (mm)
  - Faceplate:
    - 12.46 x 1.175 (inches)
    - 317 x 30 (mm)
- Power Requirements: +5V DC, 750 mA maximum
  Supplied by I/O Rack power supply.
- Operating Temperature: 0^{o} - 60^{o}C
  (at the outside of the rack)
- Storage Temperature: -20^{o} to + 80^{o}C
- Humidity: 5% - 95% (non-condensing)
- Contact Rating
  - Type: Form C, N.O. or N.C.; Jumper selectable
  - Power: 100 VA (max)
  - Voltage: 250 V AC/DC (Max)
    4 V drop at 2 amp
  - Current: 2 amp continuous
    2 amp inrush
  - Contact Resistance: .050 OHM (max)
  - On Delay: 2 msec
  - Off Delay: 3 msec
- Longevity: 10^8 operations with proper contact protection
- Contact Protection: 68 OHM and .012 uf RC network Jumper Selectable

FIGURE 1. SPECIFICATIONS



① LED 1-6:
Active (lit) LED's indicate energized coils for circuits 1 through 6, respectively.

② Jumpers J1 - J6:
Select RC protection circuits when in positions, "1-2", for circuits 1 throuth 6, respectively. Positions "2-3" are the optional settings.

③ Plugs 2, 4, 6, 8, 10 and 12:
Select the normally-open contacts for circuits 1 through 6, respectively. (Factory Settings)

④ Plugs 3, 5, 7, 9, 11, and 13:
Select the normally-closed contacts for circuits 1 through 6, respectively. (Optional Settings)

⑤ Type AGC 3 Fuses, 1-6:
3 amp fuses for circuits 1 through 6, respectively.

⑥ International 5 x 20 mm fuses, 1-6:
3 amp fuses for circuits 1 through 6, respectively

⑦ User Terminal Block

FIGURE 2. USER ITEMS

INSTALLATION

Before installing the Reed Relay module in an I/O Rack (or Model 60 CPU rack), determine if the factory configuration of the module is suitable for the application. The factory configuration includes normally-open contacts (refer to Figure 2, User Item 3) and RC protection circuits (Figure 2, User Item 2) for each of the six output circuits.

Also, establish the proper correspondence between the output terminals on this module and a group of six consecutive output numbers in the user program by setting the dual-in-line-package (DIP) switch on the rack backplane adjacent to the card slot. (Refer to table in the Installation section of Installation And Maintenance Manual, GEK-25361.

NOTE

Install the Reed Relay module in a vertically-oriented position. (That is, in a rack positioned right-side up.) Otherwise, the module will not function properly.

Use the extraction/inserting tool furnished with the Series Six CPU to install the module in the rack. With the board in place in the rack, slip the faceplate over the circuit board so that the terminals near the bottom of each are mated; then, secure the faceplate to the rack using the thumbscrews at the top and bottom.

Refer to Figure 3 for typical user output connections. (Figure 3 includes a schematic representation of Reed Relay output circuit, No. 1. The RC protection circuit jumper (J1), the N.O. plug (2 PL), the N.C. plug (3PL), the energized-coil light (LED1), and fuse (FU1) are shown.) Connect one side of the load to be controlled by this module to the appropriate output terminal, (1 through 6). The other side of the load is connected through the user-supplied power source to terminals, S1 through S6, respectively. Each terminal can accommodate one No. 12 AWG or two No. 14 AWG wires. The terminal cover should be installed by guiding both its edges onto the top of the terminal block and sliding it downward over the terminals.

A markable area is provided on the plastic lens beside each indicator for noting the function or destination of each output.

WARNING

Voltages from user field devices could be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of the module or any wires connected to it.

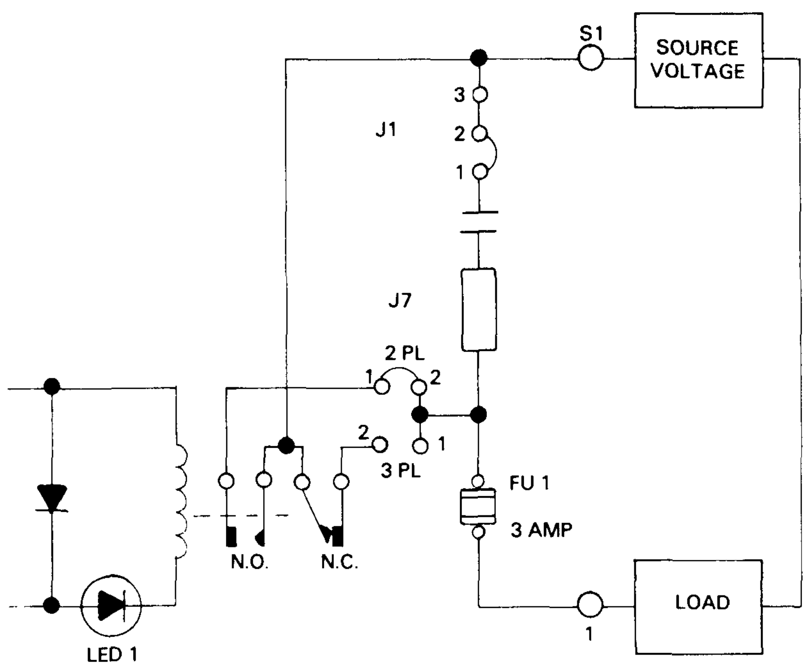


FIGURE 3. TYPICAL USER CONNECTIONS

ORDERING INFORMATION

REED RELAY MODULE

Circuit Board & Faceplate	Circuit Board Only	Faceplate Only
IC600BF914A	IC600YB914A	IC600FP914A

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83541A

OUTPUT
115 Vac
230 Vac

ISOLATED AC OUTPUT MODULES

GENERAL DESCRIPTION

The Isolated AC Output modules, utilized in either an I/O Rack or Model 60 CPU to provide switching capabilities between user AC power supplies and user loads, are available in two versions: 115V AC and 230V AC. The Isolated AC Output module features and benefits are summarized in Table 1.

The modules include six optically-isolated outputs; each output circuit employs a TRIAC as a switching device to connect the corresponding output terminal to the high-side of the user power supply when the output is in the ON state. All six outputs are updated by the CPU during an I/O scan.

A pair of indicators, visible through module faceplate, are associated with each output: one displays the status of the circuit fuse; the other iights when the circuit coil is energized.

Refer to Figure 1 (next page) for Isolated AC Output module specifications.

TABLE 1: FEATURES AND BENEFITS

FEATURES	BENEFITS
Available in two versions: 115VAC 230VAC	Useful in a variety of applications
Isolated output circuit	Allows each output circuit to use a separate power source
Individual circuit indicators	Protection and monitoring aids
3 ampere output circuits	Large loads can be controlled without interposing relays
Optically-coupled data path	Provides electrical isolation between user field devices and the Series Six Controller
APPLICATIONS	
* Interface to motor control centers	* Interface to solenoids

- Dimensions:
  - Circuit Board:
    - 8.15 x 11.0 (inches)
    - 200 x 260 (mm)
  - Faceplate:
    - 12.46 x 1.175 (inches)
    - 317 x 30 (mm)
- Power Requirements: +5V DC, 460 mA maximum
  Supplied by I/O Rack power supply.

MODULE	USER-SUPPLIED VOLTAGE	LEAKAGE (OFF)
115V AC	90-130V AC	4 ma
230V AC	180-260V AC	4 ma

- ON-State Current:
  - Maximum: 3A (see below for derating)
  - Minimum: 10 ma (exception: 230V AC supplying inductive load with power factor at less than .95, requires 30 ma)
- Inrush Current: 20A for 33 ms (maximum)
- ON Delay: less than 1/2 cycle
- OFF Delay: no greater than 1/2 cycle
- Output Voltage Drop:
  - 1.2 V typical
  - 2.2 V maximum
- Number of Outputs:
  Six (6), each with a separate source and output connection
- Operating Temperature: 0^{o} - 60^{o}C
  (at the outside of the rack)
- Storage Temperature: -20^{o} to $+80^{o}$C
- Humidity: 5% - 95% (non-condensing)

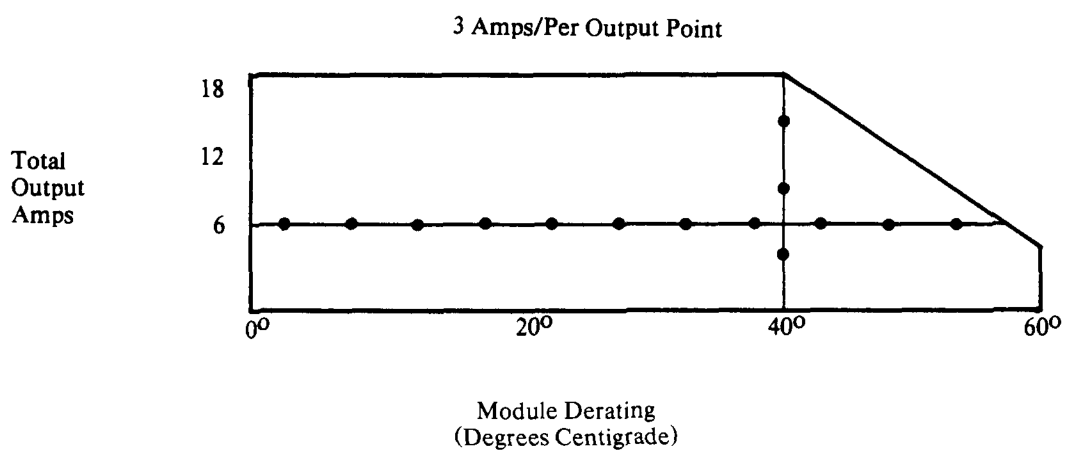
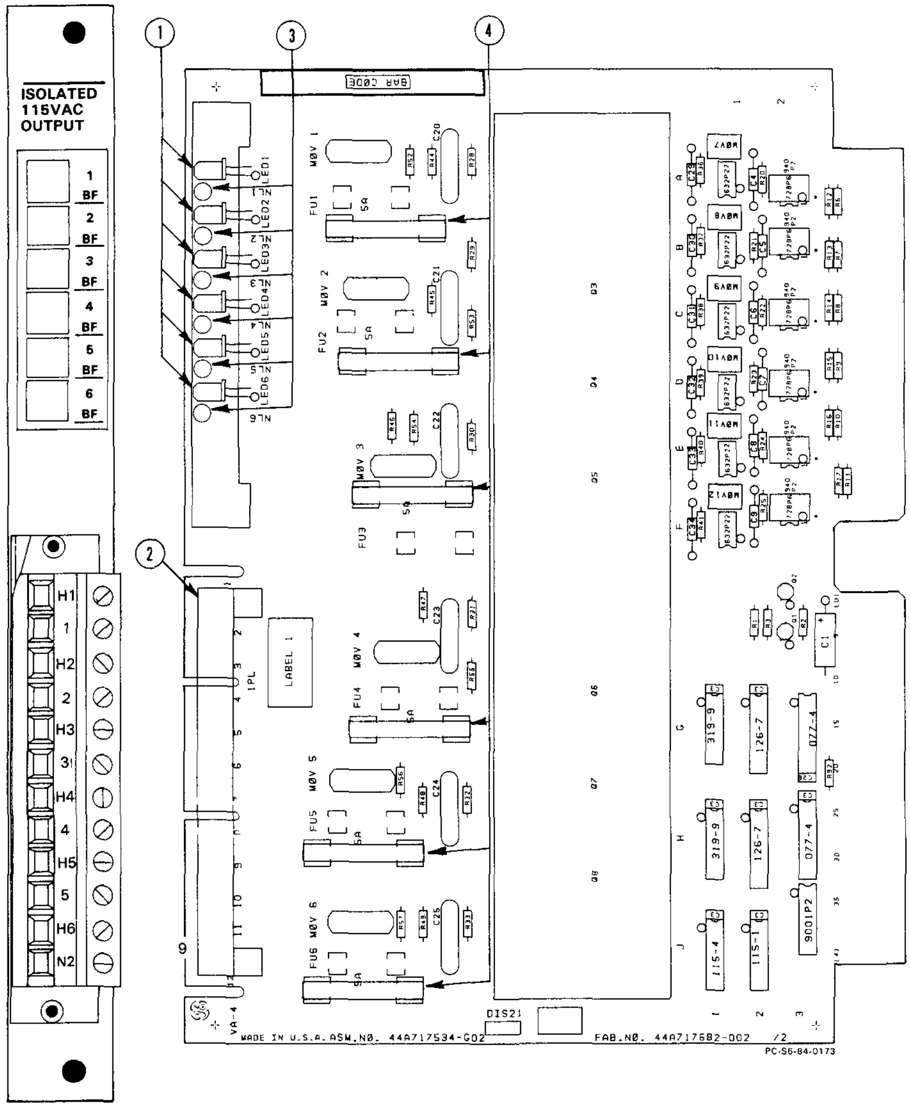


FIGURE 1. SPECIFICATIONS



① LED 1-6:
Lighted LED's indicate active coils in output circuits 1 through 6, respectively.

② User Terminal Block

③ BF Neon Lamps 1-6:
ON= Fuses for outputs 1 through 6, respectively, are blown.
OFF= Fuses for outputs 1 through 6, respectively, are OK.

④ Type AGC 5 fuses, 1-6
5 amp fuses to circuits 1 through 6 respectively.

FIGURE 2. USER ITEMS

INSTALLATION

Before installing the Isolated Output module in an I/O Rack (or Model 60 CPU rack) establish the proper correspondence between the output terminals on this module and a group of six consecutive output numbers in the user program by setting the dual-in-line-package (DIP) switch on the rack backplane adjacent to the card slot. (Refer to table in Installation section of Installation And Maintenance Manual, GEK-25361.)

Use the extraction/insertion tool furnished with the Series Six CPU to install the module in the rack. With the board in place in the rack, slip the faceplate over the circuit board so that the terminals near the bottom of each are mated; finally, secure the faceplate to the rack using the thumbscrews at the top and bottom.

Refer to Figure 3 for typical user connections. Connect the high side of the voltage source to the appropriate H (High) terminal (1-6) on the Isolated AC Output module; connect the load to appropriate O (output) terminal (1-6) on the module. Each terminal can accommodate one No. 12 AWG, or two No. 14 AWG, wires.

Guide the terminal cover edges onto the top of the terminal block and slide it downward over the terminals. A markable area is provided on the plastic lens beside each indicator for noting the function or destination of each output.

WARNING

Voltages from user field devices could be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

LEGEND

S: Output Switching Device
L: User Load
E: User Power Source

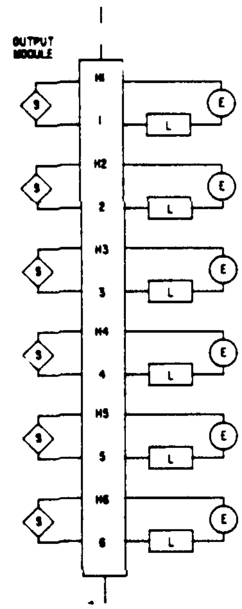


FIGURE 3. TYPICAL USER CONNECTIONS

ORDERING INFORMATION

Module	Circuit Board and Faceplate	Circuit Board	Faceplate
115 Vac	IC600BF910B	IC600YB910B	IC600FP910B
230 Vac	IC600BF912B	IC600YB912B	IC600FP912B

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

SERIES SIX

PROGRAMMABLE CONTROLLERS

AXIS POSITIONING MODULE (TYPE 1)

GENERAL DESCRIPTION

The Axis Positioning Module (APM) is an intelligent, programmable, single-axis positioning controller integrated into the Series Six Programmable Controller (PC) system. The APM provides a real time interface between the Series Six PC and a servo-controlled axis. The user can monitor and control the APM from a Program Development Terminal (PDT) while the APM performs the complex calculations required to control a precision servo system. Due to the complete integration of the APM into the PC system, the Series Six provides a predictable, yet flexible, axis control capability. The features and benefits of the APM are summarized in Table 1.

The Axis Positioning Module resides in a Series Six I/O rack where it is serviced by the Series Six Central Processing Unit (CPU) in the course of a normal CPU scan. (Figure 1 provides a view of the module circuit board and faceplate.) The CPU communicates with the APM via the Series Six I/O Bus using the standard Series Six protocol. The APM translates the positioning commands it receives from the CPU into a position versus time profile, determines the current position of the axis using the input from an absolute position feedback device (a resolver), and compares it with the commanded position indicated by the profile. This process generates a +/-10 V dc (maximum) velocity command output to a drive which moves the axis.

A complete command set (containing over 70 commands) and single or multiple resolver feedback capabilities allow the APM to be utilized in numerous applications. Typical position ranges are 140 feet with a resolution of .0001 inch, or 1400 feet with .001 inch resolution. Typical velocities are 600 ipm with .0001 inch resolution, or 6000 ipm with -001 inch resolution.

Up to 10 stored programs (canned cycles) can be downloaded from the CPU to an APM; collectively, the canned cycles can contain up to 492 move commands. A canned cycle is "called," or commanded to execute, from relay ladder logic.

The APM interface specifications are provided in Table 2; the resolver specifications are provided in Table 3. Refer to the APM Manual, GEK-25363, and the APM Commands, Return Data and Error Chart, GEJ-6041, for further information.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Directly interfaces with Series Six PC.	Reduces wiring costs.
Programmable acceleration and deceleration ramps.	Maximizes drive capabilities and improves system performance.
Multiple resolver/absolute positioning capabilities.	Enables APM to determine absolute axis position at power-up without home position routine.
Absolute and incremental positioning modes.	Provides flexibility in programming.
Programmable position loop gain.	Allows user to set gain without adjusting potentiometer/Greater stability with time and temperature changes.
Programmable Velocity Feedforward.	Enhances servo performance by allowing operation with reduced following error.
Simple, single velocity moves or complex velocity/time profiles.	Enables APM to be used as velocity-only controller as well as position controller,
Canned cycles.	Eliminates repetitious programming.
Precise coordination of multiple axis systems.	Extends applications capabilities.
Axis status and system error indications to Series Six CPU.	Provides user with complete range of input data.
On-board diagnostics and indicator lights.	Simplifies troubleshooting.
Analog Input.	Provides general purpose analog input capabilities and programmable alarm setpoints.
Programmable Position, Velocity and Acceleration limits.	Provides complete control over the motion profile.
Programmable dwells.	Allows accurate dwell times not dependent on CPU scan time.

TABLE 2. SPECIFICATIONS

INTERFACE	IN/OUT	CHARACTERISTICS
Drive Enable (optional connection)	output	Normally open relay contact; Contact Rating: 24 V ac/dc, 1 amp maximum; (resistive load only); (power supplied by user).
Loop Contactor (optional connection)	output	Same as Drive Enable.
Negative (Left) Overtravel Switch (optional connection)	Input	Requirements: ON state = 24 V dc +/-10%; OFF state < 3 V dc; input current = 10 mA at 24 V; Input impendance = 2000 ohms. Interpretation: OFF = overtravel. A jumper (JP3) is provided to disable the Overtravel Switch function.
Positive (Right) Overtravel Switch (optional connection)	Input	Same as Negative Overtravel.
Home Switch	Input	Requirements: Same as Negative Overtravel. Interpretation: ON = Negative side of Home Position; OFF = Positive side of Home Position;
Drive OK (optional connection1	Input	Requirements: ON state = 24 Vdc +/-10%; OFF state < 3 V dc; Input current = 10 mA at 24 V; Input impendance = 2000 ohms. Interpretation: ON = Drive OK; OFF = Drive not OK. A jumper (JP4) is provided to disable the DRIVE OK input.
Velocity Command	output	Differential output of D/A converter with following characteristics: Resolution: 13 bits including sign Linearity: .012% of Full Scale Output Offset voltage at zero output: +/-500 microvolts max. Maximum output voltage: +/-10v +/-.3 v Minimum output load resistance: 2000 ohms.
Analog Input (optional connection)	Input	A/D converter input with the following characteristics: Input range: 0 to +10.0Vdc Gain factor: + 10.0 V dc input produces an output value of 100 to the CPU Input impedance: Greater than 10K ohms
Synchronized Start (optional connection)		Output on Master APM; Input on Slave APM. Jumpers JPl, JP2 and JP5 configure the APM for Normal or Master/Slave operation.
Power Supply		A High-Capacity I/O power supply or Model 60 CPU is required to provide backplane power to the APM.

TABLE 3. RESOLVER SPECIFICATIONS

Transformation ratio: 50 + /- 0.1	DC stator resistance: 30 to 225 ohms
Stator input impedance (rotor open) : 1700 to 9000 ohms at 2.5 KHz	Rotor output voltage: 4.0 V RMS min with 20K load
	DC rotor resistance: 15 to 4000 ohms

Resolver Cable Specifications

Maximum Length:	300 feet (each cable)
Excitation Cable:	Two individually shielded twisted pairs, Belden type 8723 or equivalent
Feedback Cable:	One shielded twisted pair, Belden type 8762 or equivalent.

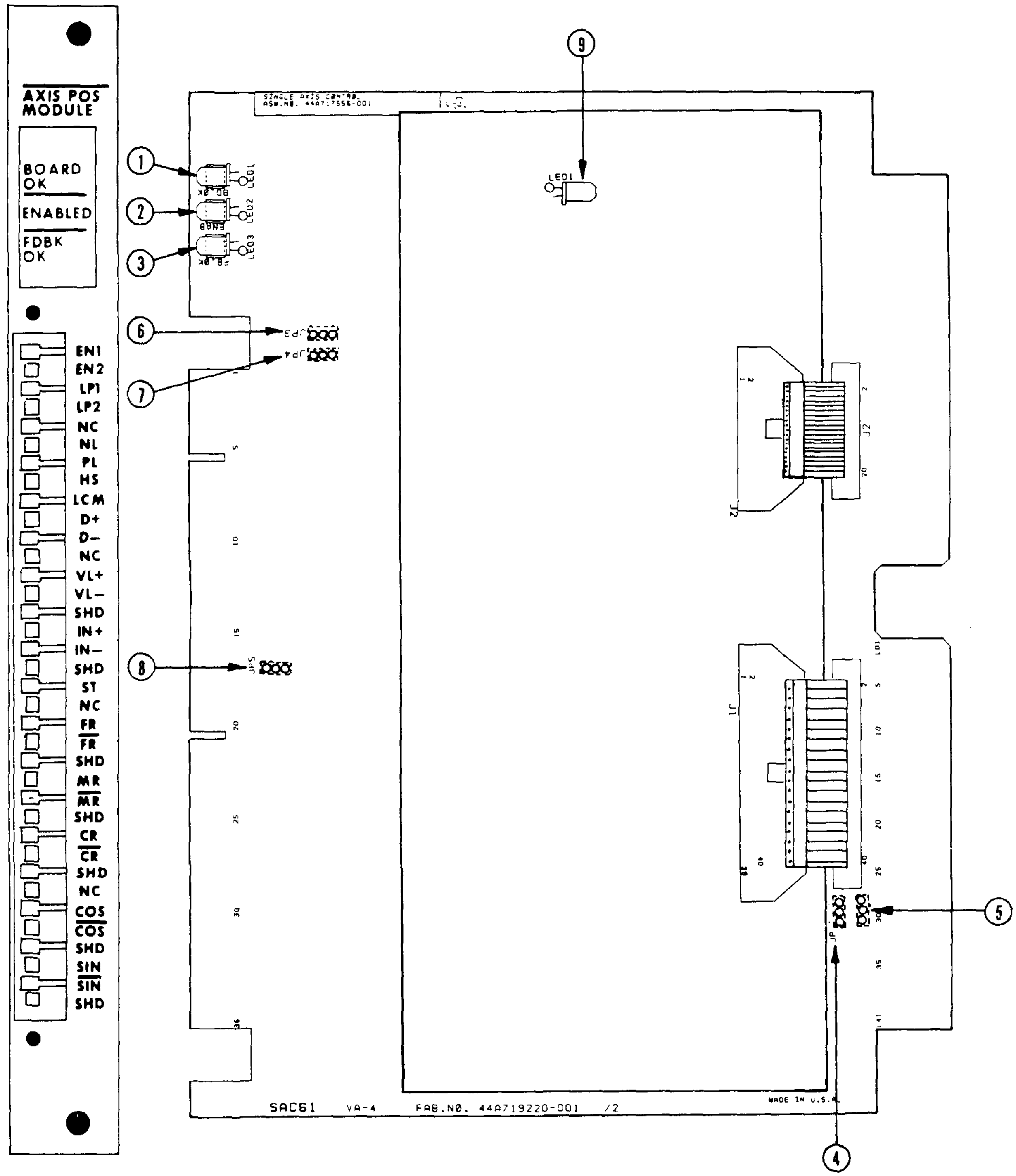


FIGURE 1. USER ITEMS (Part 1 of 2)

① BOARD OK LED
- ON: APM has passed self-diagnostic tests. These tests are performed when the I/O rack is turned on and whenever an error condition occurs.
- OFF: APM hardware failure. APM not in High Capacity I/O rack or a Model 60 CPU I/O slot.

② ENABLED LED
- ON: APM is capable of controlling position. Turned on by discrete command, ENABLE APM.
- OFF: Turned off by any error condition or REMOTE STOP Command.

③ FEEDBACK OK LED
- ON: Resolver feedback is present.
- FLASHING: Resolver feedback is not present.

④ Jumper JP1
- Functions: Normal Operation (1-2); Master Clock (2-3).
- Factory-Set: Normal Operation (1-2).

⑤ Jumper JP2
- Functions: Normal Operation (1-2); Slave Clock (2-3).
- Factory-Set: Normal Operation (1-2).

⑥ Jumper JP3
- Functions: Overtravel Limit Switch Enable (1-2); Overtravel Limit Switch Disable (2-3).
- Factory-Set: Overtravel Limit Switch Enable (1-2).

⑦ Jumper JP4
- Functions: Drive OK Input Enable (1-2); Drive OK Input Disable (2-3).
- Factory-Set: Drive OK Input Enable (1-2).

⑧ Jumper JP5
- Functions: Master Start Output (1-2); Slave Start Input (2-3).
- Factory-Set: Master Start Output (1-2).

⑨ Factory Test LED

FIGURE 1. USER ITEMS (Part 2 of 2)

INSTALLATION

Figure 2 provides a representation of possible user connections to the APM. The module faceplate is shown. Refer to the APM Manual, GEK-25363, for detailed connection information.

WARNING

Voltages from user field devices could be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

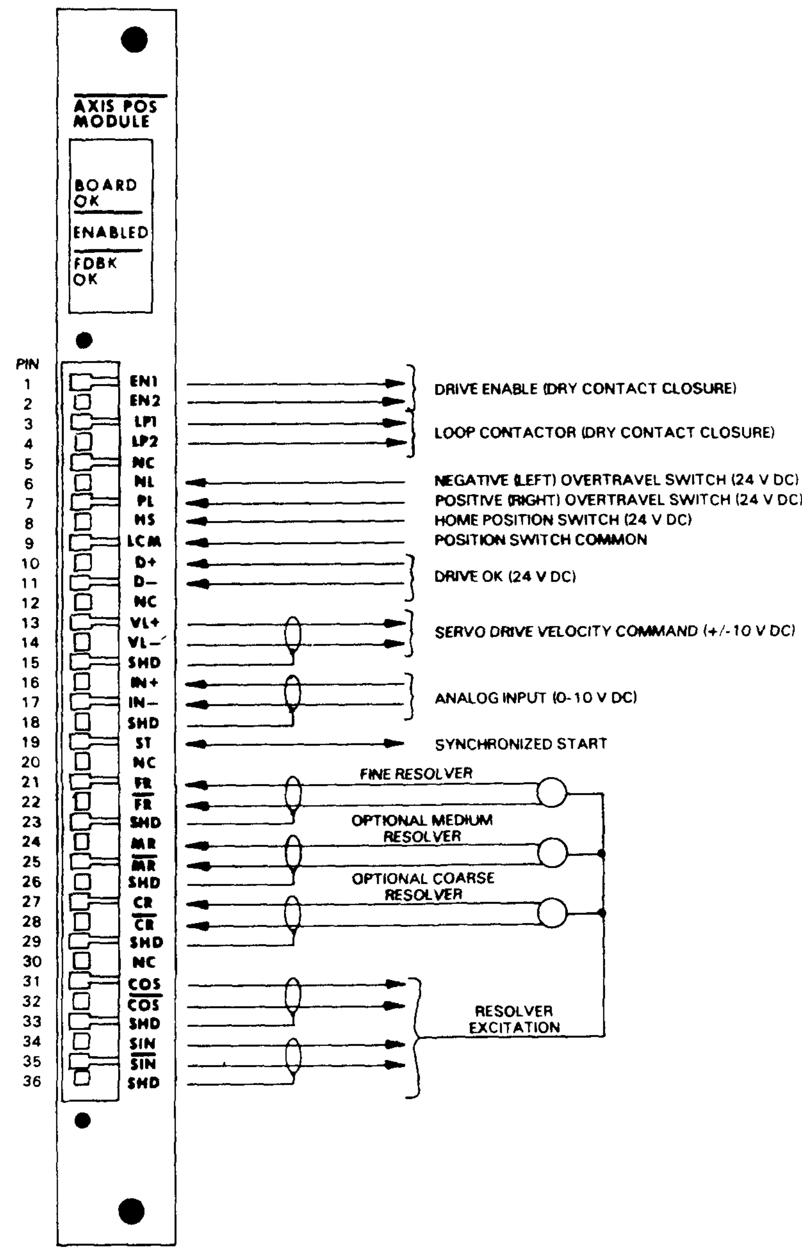


FIGURE 2. USER CONNECTIONS

I/O ADDRESSING

Figure 3 shows the allowable I/O address and corresponding Dual In-line Package (DIP) switch settings.

INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1- 32						353-384		X		X	X	705-736	X		X	X	
33- 64					X	385-416		X	X			737-768	X		X	X	X
65- 96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024	X	X	X	X	X
321-352		X		X		673-704	X		X		X		(NOT USED)				

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left)

Switches No. 1 and No. 2 should be in CLOSED Position

FIGURE 3. DIP SWITCH SETTINGS

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
IC600BF915C	IC600YB915C	IC600FP915A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

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SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83545

HIGH SPEED COUNTER

GENERAL DESCRIPTION

The High Speed Counter is an intelligent I/O module and can be utilized in an I/O rack, or in any of the I/O slots in a Mode1 60 CPU, to solve a wide variety of position and velocity measurement/control applications where the frequency of incoming pulses is too high to be handled directly by the Series Six CPU. Features and Benefits for this module are summarized in Table 1.

This microprocessor based counter is capable of receiving count pulses from quadrature encoders, digital tachometers, and mechanical or transistor switches Input voltage levels are jumper configurable to accept TTL Single Ended, TTL Differential, or 10-30 VDC signals. Four open-collector transistor outputs are provided for real time response independent of CPU scan time. Each output can sink up to 250 ma at voltages up to 30V. Individual pull-up resistors are also provided. The module can accept pulse rates of 50 KHz per channel. The accumulated count is stored as a 24 bit 2's complement number giving a counting range of -8,388,607 to + 8,388,607.

A total of 12 software preset registers are supported by the High Speed Counter module. Four of these presets control the four real time outputs while the remaining eight can be used in CPU relay logic. Each preset value can be individually set by the CPU. It is then continuously compared to the accumulated count by the modules microprocessor. The user can determine the sense of the comparison, selecting between having the output turn on when the accumulated count is less than (<) or greater than or equal to ≥ the preset value. User logic in the CPU can individually set the four real time outputs to be enabled/disabled, and/or latched/unlatched. Additional capabilities allow the user to enable/disable counting, select count direction, reset the accumulated count to a predetermined value, or dynamically change any of the I2 software preset registers.

Since this intelligent I/O module resides in the Series Six I/O structure, multiple counter modules can be utilized. Each counter will use 32 Input and 32 Output addresses by which the CPU downloads preset and mode select data and by which position and status data is received.

TABLE 1, FEATURES AND BENEFITS

FEATURES	BENEFITS
Accepts many types of counting input Quadrature encoder Digital tachometer Transistor/photo switch Mechanical contacts	Provides direct and isolated inputs for multiple types of field devices
Counting rate to 5OKHz Xl, X2, X4 count input for quadrature input to 200KHz Maximum count: -8,388,608 to + 8,388,607	Provide high speed pulse input over wide count range, no need to cascade counters
Four external outputs Individual preset comparisons can be <, or ≥ to accumulated count Individual enable/latch functions ,500 micro-second response time • Sink 250ma, TTL to 30VDC	Control multiple field devices, for fast, high speed application
Eight internal presets for CPU use Individual preset comparisons can be <, or ≥ to accumulated count	Functions as programmable limit switch whose bits can be read by the CPU and used to control logic based on accumulated count.
Internal/External Signals for Count enable Count direction Count reset Marker Home position	Added dimensions for flexible, real world applications
Calculate the number of counts occurring during a user-defined time period.	Returns counts/timebase (velocity) value for use in digital speed regulation programs
Continued operation of counter if CPU is placed off-line or fails	Maintain accurate position count and control of connected loads
Built-in diagnostics, indicators and CPU status information	Detects system faults and alerts CPU logic and operator

TABLE 2. SPECIFICATIONS

Dimensions:

Circuit Board
8.15 x 11.0 x 1.20 (inches)
208 x 280 x 31 (mm)l5.0V

Faceplate
12.46 x 1.175 (inches)0.2V
317 x 30 (mm)

Power requirements
5 VDC, 1.1A maximum
Supplied by I/O rack power supply
Units of Load = 19
User Supplied

	TTL	1 o-3ov
Voltage	5V + 0.20 VDC	10-30V ± .5 VDC
Ripple	100mv	Iv
Current	400ma	400ma

Timing Characteristics
Input Pulse Rate: DC to 5OKHz (square wave)
Input Pulse Rate with filter selected: DC to 100Hz (square wave)
Marker Pulse Width: 5 usec (minimum)
Response time for outputs l-4 to incoming pulses: 500 usec (typ)

TTL Single Ended Sink Input Characteristics
Maximum Input Voltage: 5.5V
Minimum Turn-On Voltage: 2.0V
Minimum Input Voltage: -1.5V
Maximum Turn-Off Voltage: 0.8V
Input Impedance: 1000 ohms (TYP)
Minimum Low Level Input Current: -6.0ma (sinking)

5 Volt Differential Input Characteristics
Inputs are RS422 compatible
Maximum Input Voltage: ± 15.0V
Common Mode Voltage Range: ± 7.0V
Threshold Sensitivity: ± 0.2V
Input Impedance: 115 ohms (TYP.)
Minimum Input Current: ± 3.0ma

- l0-30V single ended source input characteristics.

  Maximum Input Voltage: 33V
  Minimum Turn-On Voltage: 9V
  Minimum Input Voltage: -20V
  Maximum Turn-off Voltage: 2V
  Input Impedance: 3800 ohms (TYP)

- Output Characteristics
  Outputs are open collector with a common clamp diode (CLP) provided for optional connection to positive source.

  Pull-up resistors provided for outputs.
  PUl = 1100 ohm.
  PU2, PU3, outputs. PU4 = 4700 ohm

  Maximum Supply Voltage: 30 VDC

  Maximum On-State Voltage Drop:
  0.4V for: I 50ma
  0.70 for: 1250ma

  Maximum Output Current:
  250ma continuous
  500ma peak for 1 second

- Operating Temperature:
  0-60°C (at outside of rack)

- Storage Temperature: -20° to + 80°C

- Humidity: 5-95% (non-condensing)

- Altitude: Up to 10,000 feet above sea level

INSTALLATION

The High Speed Counter module can be installed in an I/O rack or in a Model 60 CPU rack. Before installing the module, the dual-in-line-package (DIP) switches immediately behind the card slot on the rack backplane should be set to reserve a group of 32 consecutive bits in the appropriate Input AND Output Status Tables of the CPU. For specific DIP switch settings, refer to Figure 1.

You should also set the circuit board jumpers and dip switch to configure the module for your particular application. Refer to Figure 2 for description of all user settings.

We recommend that you use the extraction/insertion tool furnished with your CPU to remove or install the circuit board. With the board in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that proper contact is made. You can then secure the faceplate to the rack using the thumbscrews at the top and bottom.

Refer to Figure 3 and 4 for typical user output connections to this module. Figure 7 shows the general internal design for the four output circuits, while Figures 5 and 6 contains the general internal design for the input circuits.

WARNING

Voltages from user field devices could be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

OUTPUT NUMBER	DIP SWITCH POSITION					OUTPUT NUMBER	DIP SWITCH POSITION					OUTPUT NUMBER	DIP SWITCH POSITION				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1- 32						353-384		X		X	X	705-736	X		X	X	
33- 64					X	385-416		X	X			737-768	X		X	X	X
65- 96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024 (NOT USED)	X	X	X	X	X
321-352		X		X		673-704	X		X		X						

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left)

Switches No. 1 and No. 2 should be in CLOSED Position

FIGURE 1. DIP SWITCH SETTINGS FOR I/O RACK

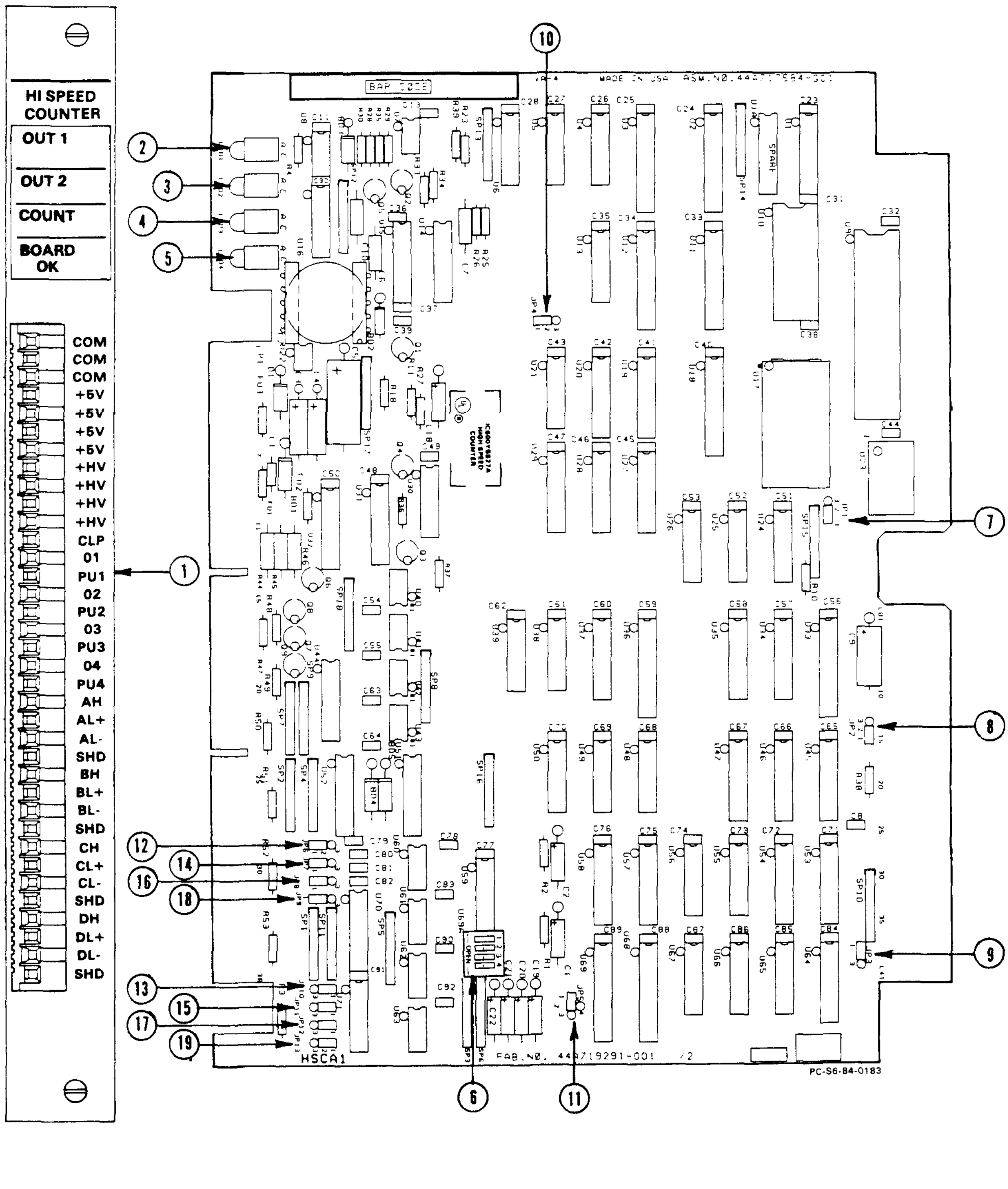


Figure 2. CONFIGURABLE USER SETTINGS (Part 1 of 3)

ITEM	FUNCTION FOR USER SETTINGS
1	Faceplate with lens and 36-point connector.
2	LED for OUT 1; when ON, indicates output 1 is energized.
3	LED for OUT 2; when ON, indicates output 2 is energized.
4	LED for count; when blinking, indicates pulses are being received.
5	LED for Board OK; when ON, Board passed diagnostic test.

ITEM	DIP SWITCH	FUNCTION	
6	SW1 Open*	Input A Filter	Switch Open: 100 Hz Filter Disabled
	SW2 Open*	Input B Filter	Switch Closed: 100 Hz Filter Enabled
	SW3 Open*	Input C Filter	
	SW4 Closed	Input D Filter	
		Set to Closed position if input is connected to a device using dry contacts, or other non-solid state device.	

ITEM	JUMPERS	FUNCTION FOR USER SETTINGS
7	JP1	
	1-2*	Run - Normal Use
	2-3	Factory Test
8	JP2	
	1-2*	If the CPU RESET signal is high, the counter will continue to function, except outputs 1 thru 4 will be forced off regardless of their previous state. When the CPU once again becomes operational, the four outputs will return to their conditional state as determined by the enable/disable and latch/unlatch bits and the preset comparison state.
	2-3	If the CPU RESET signal is high, the counter will continue to function, and will retain full control over its four outputs.
9	JP3	
	1-2*	Not Used
	2-3	Not Used

* Factory Setting

FIGURE 2. CONFIGURABLE USER SETTINGS (PART 2 OF 3)

ITEM	DIP SWITCH	FUNCTION
(10)	JP4	
	1-2*	Encoder mode - Quadrature Encoder with optional marker
	2-3	Counter mode - Square wave pulse input
(11)	JP5	
	1-2*	X1 for quadrature encoder input
	2-4	X2 for quadrature encoder input
	2-3	X4 for quadrature encoder input
		Must be set to X1 when in counter mode
(12)(13)	JP6 JP10	
	1-2* 1-2*	Input A - 5V differential
	1-2 2-3	Input A - TTL single ended
	2-3 2-3	Input A - 10-30V single ended
(14)(15)	JP7 JP11	
	1-2* 1-2*	Input B - 5V differential
	1-2 2-3	Input B - TTL single ended
	2-3 2-3	Input B - 10-30V single ended
(16)(17)	JP8 JP12	
	1-2* 1-2*	Input C - 5V differential
	1-2 2-3	Input C - TTL single ended
	2-3 2-3	Input C - 10-30V single ended
(18)(19)	JP9 JP13	
	1-2 1-2	Input D - 5V differential
	1-2 2-3	Input D - TTL single ended
	2-3 2-3	Input D - 10-30V single ended

* Factory Setting

FIGURE 2. CONFIGURABLE USER SETTINGS (PART 3 OF 3)

TYPICAL JUMPER SETTINGS	
JP 1 : 1-2	JP 10 : 1-2
JP 2 : 1-2	JP 11 : 1-2
JP 3 : 1-2	JP 12 : 1-2
JP 4 : 1-2	JP 13 : 2-3
JP 5 : 1-2	SW 1 : OPEN
JP 6 : 1-2	SW 2 : OPEN
JP 7 : 1-2	SW 3 : OPEN
JP 8 : 1-2	SW 4 : CLOSED
JP 9 : 2-3	

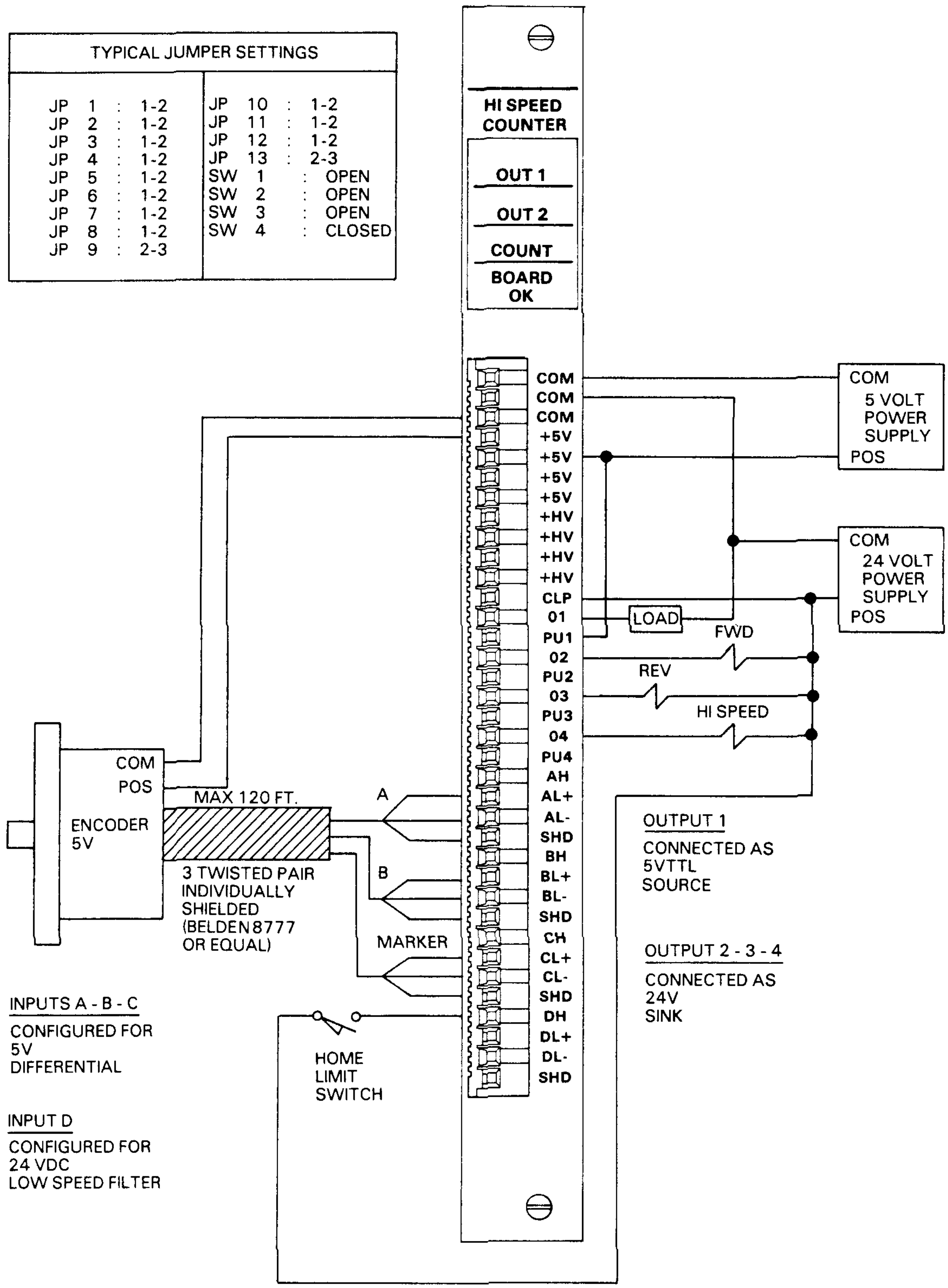


Figure 3. HIGH SPEED COUNTER - ENCODER MODE APPLIED TO CARRIAGE POSITION CONTROL

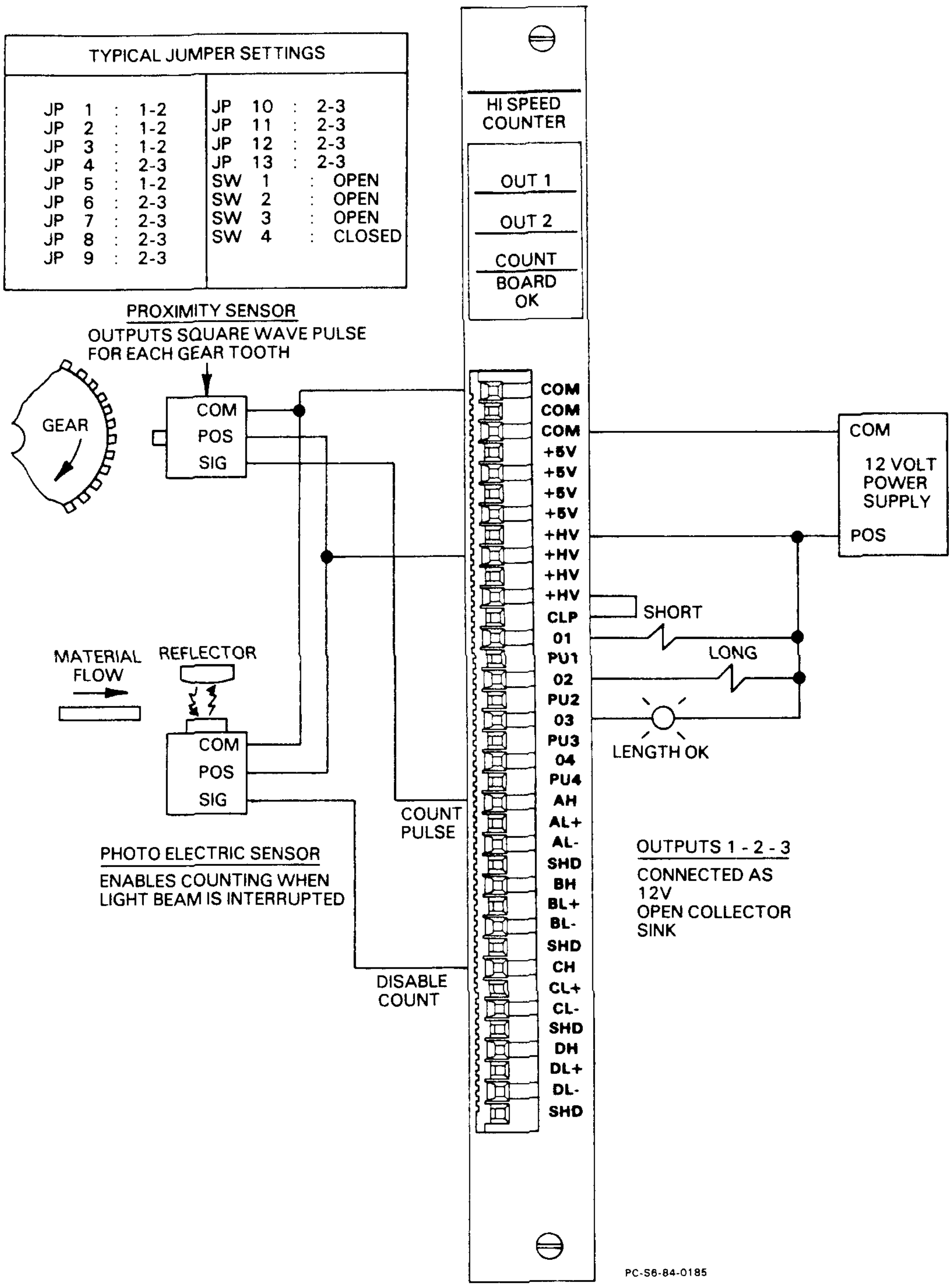
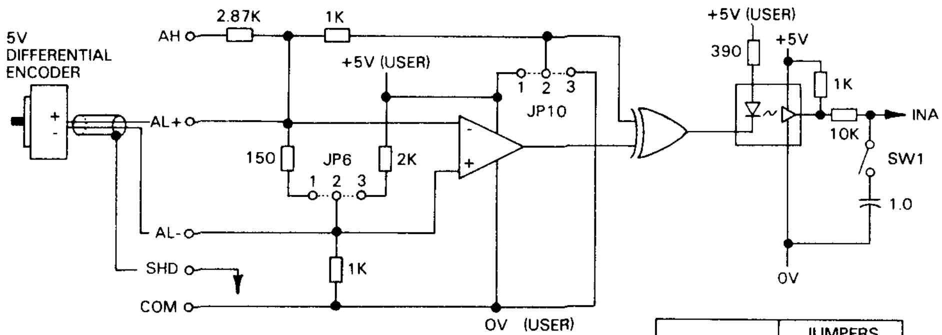
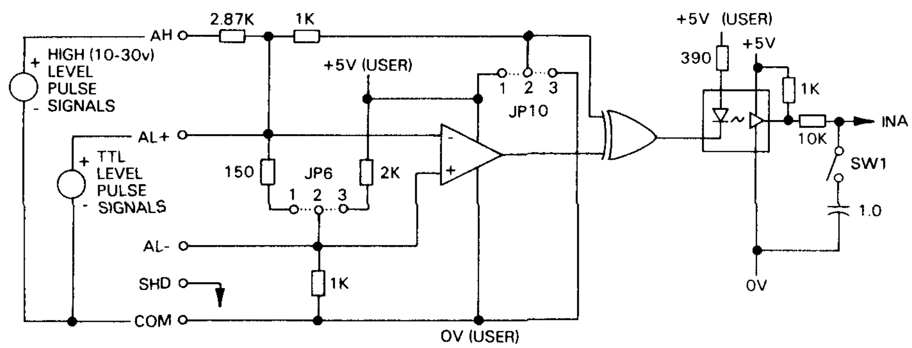


Figure 4. HIGH SPEED COUNTER - COUNTER MODE APPLIED TO LENGTH MEASUREMENT CONTROL



INPUT A	JUMPERS JP6	JUMPERS JP10
DIFFERENTIAL	1-2	1-2
TTL	1-2	2-3
10-30 VDC	2-3	2-3

Figure 5. TYPICAL DIFFERENTIAL INPUT LOGIC DIAGRAM



INPUT A	JUMPERS JP6	JUMPERS JP10
DIFFERENTIAL	1-2	1-2
TTL	1-2	2-3
10-30 VDC	2-3	2-3

Figure 6. TYPICAL PULSE INPUT LOGIC DIAGRAM

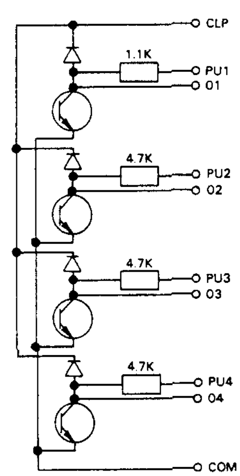


Figure 7. OUTPUT LOGIC DIAGRAM

HARDWARE INTERFACE

All external wiring connections to the High Speed counter module are made via the 36point terminal connector on the module faceplate. Table 3 details the function of each terminal point. Please note that all terminals with the same name (i.e. COM, + 5V, +HV, SHD) are internally connected when the terminal strip is connected to the printed circuit board, If shielded cable is used, system earth ground is provided via faceplate to chassis connection and the grounding of the chassis enclosure. For typical wiring diagrams refer to Figure 3 and 4.

TABLE 3. TERMINAL WIRING DESCRIPTION

TERMINAL NUMBER	NAME	FUNCTION
1,2,3	COM	Common ground connection.
4,5,6,7	+5v	User power supply positive connection for 5V operation.
8, 9, 10, 11	+HV	User power supply positive connection for 10-30V operation.
12	CLP	Clamp diode connection. Protects outputs from inductive kick-back from the load. The CLP terminal should be jumpered to the positive side of the output power supply.
13 14	01 PU1	Open collector sink output. TTL compatible up to 50ma. Outputs can sink 250 ma. continuous, 500 ma. peak. The maximum supply voltage is 30V. If the PU1 terminal is connected to the positive terminal of the output supply, the output will be pulled up through a 1100 ohm resistor. This output can drive the Series Six interrupt input board using a 24-30V power supply.
15 16	02 PU2	Open collector sink output. TTL compatible up to 50ma. Outputs can sink 250 ma. continuous, 500 ma. peak. The maximum supply voltage is 30 V. If the PU2 terminal is connected to the positive terminal of the output supply, the output will be pulled up through a 4700 ohm pull-up resistor.
17 18	03 PU3	Open collector sink output. TTL compatible up to 50 ma. Outputs can sink 250 ma. continuous, 500 ma. peak. The maximum supply voltage is 30V. If the PU3 terminal is connected to the positive terminal of the output supply, the output will be pulled up through a 4700 ohm pull-up resistor.
19 20	04 PU4	Open collector sink output. TTL compatible up to 50 ma. Outputs can sink 250 ma, continuous, 500 ma. peak. The maximum supply voltage is 30V. If the PU4 terminal is connected to the positive terminal of the output supply, the output will be pulled up through a 4700 ohm pull-up resistor.
21 22 23 24	AH AL+ AL- SHD	These terminals form the IN A input. The settings of JP6 and JP10 determine the input type (see Figure 2). In the COUNTER mode IN A is used for the incoming square wave pulses. In the ENCODER mode this input is used for quad A of the encoder.

TABLE 3. TERMINAL WIRING DESCRIPTION (CONTINUED)

TERMINAL NUMBER	NAME	FUNCTION
25 26 27 28	BH BL+ BL- SHD	These terminals form the IN B input. The settings of JP7 and JPl 1 determine the input type (see Figure 2). In the COUNTER mode these terminals are used for the count direction control. With no signal applied the count direction is UP. If the direction is to be controlled via software, the input should be disabled, or not connected. Up.Down is controlled in software by bit 10 of the Discrete command (see Figure 9). In the ENCODER mode this input is used for quad B of the shaft encoder.
29 30 31 32	CH CL+ CL- SHD	These terminals form the IN C input. The settings of JP8 and JP12 determine the input type (see Figure 2). In the COUNTER mode these terminals are used as a counter enable control. With no signal applied the counter is ENABLED. If the counter enable is to be controlled by software command, IN C should be disabled, or not connected. Enable/Disable is controlled in software by Bit 9 of the Discrete Command (see Figure 9). In the ENCODER mode this input is used for the marker pulse of the shaft encoder. If there is no marker present then no connection should be made to this input
33 34 35 36	DH DL+ DL- SHD	These terminals form the IN D input. The settings of JP9 and JP13 determine the input type (see Figure 2). In the COUNTER mode the IN D input is used to reset the counter. The reset function forces the accumulated count to the Lower Count Limit. The reset condition will exist as long as the IN D signal is asserted. With no signal applied the counter is NOT RESET. The count can also be reset by software command. IN D should be disabled or not connected if software control is used. Reset is controlled in software by Bit 19 of the Discrete Command (see Figure 9). In the ENCODER mode the IN D input is used to establish home position. When the HOME command is active and the IN D limit switch is asserted, the next marker pulse will cause the accumulated count to be set to the home position value. After the marker occurs, incoming pulses will be counted, and will represent an offset from HOME position.

GENERAL DESCRIPTION OF OPERATION

The intelligent High Speed Counter module receives command data from the Series Six CPU logic program and returns count and status data to the CPU. These data transfers requires 32 input and 32 output points. There are also four input circuits and four output circuits for connection to field devices. Refer to Table 3 for a full description of each.

The High Speed Counter card has two basic modes of operation (counter or encoder) which are selectable by means of a jumper. The functions of the inputs depends on the mode of operation selected.

In the Counter mode the inputs are defined as follows:

- INA Pulse Input: connected to the pulses to be counted.
- INB Direction Input: controls the direction of counting.
- INC Enable/Disable Input: used to enable or disable counting.
- IND Reset Input: sets the Accumulate register to the Lower Count Limit and inhibits counting while active.

In the Encoder mode the inputs have the following meanings:

- INA Quad A Input: connected to channel A of the quadrature encoder.
- INB Quad B Input: connected to channel B of the quadrature encoder.
- INC Marker Input: connected to the marker channel of the encoder.
- IND Limit Switch Input: used to establish True Home Position.

Each input is provided with a selectable filtering network. When the filter is selected, the frequency response of the input is limited to 100Hz (square wave). The filter is normally used for debouncing mechanical contacts.

When the ENCODER mode is selected, one of three counting rates: Xl, X2, or X4 can be jumper selected by the user. When the COUNTER mode is selected, the jumper must be placed in the Xl position. Figure 8 shows the effect of this jumper selection for when quadrature encoders are used.

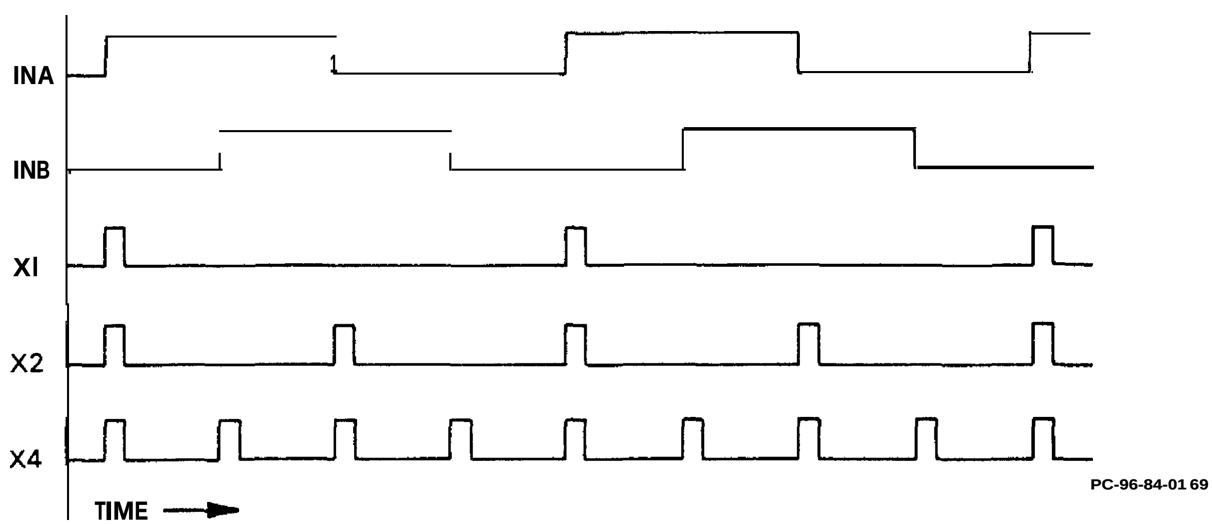


FIGURE 8. QUADRATURE PULSE COUNTING

The module contains an 8 bit counter which is read by the counter software and used to maintain a 24 bit Accumulate register. The counting range of this register is -8,388,608 to +8,388,607. Negative values are kept as 2's complement. The user can define the upper and lower counting limits anywhere within this range (the Upper Count Limit minus the Lower Count Limit must be greater than 128). When counting up, the Accumulate register will be set to the Lower Count Limit after reaching the Upper Count Limit plus one. When counting down, the Accumulate register will be set to the Upper Count Limit when reaching the Lower Count Limit minus one.

The four outputs are open collector transistors which can provide TTL compatible levels. Individual pull-up resistors are provided to allow outputs to drive TTL or CMOS logic without the use of external resistors. When used in the open collector configuration, the outputs can sink 250 ma. of current and can accept up to 3OV. The output circuitry is optically isolated and detailed in Figure 7.

The state of each of the four outputs is determined by a combination of five factors:

1. Preset/Accumulate Relationship (< , ⩾)
2. Comparison Sense (Command # 35)
3. Disable/ Enable (Discrete Command)
4. Unlatch/Latch (Discrete Command)
5. Previous State of Output

How these factors control an output is shown in Table 4.

NOTE

Once an output has been turned on through the conditions described in Table 4, it can be latched on using discrete commands 15-18 (Refer to Figure 9). Once an output is latched on it will remain on regardless of changes in the Disable/Enable or Preset Comparison function. The output will not be turned off until it is unlatched, and the conditions in Table 4 are appropriate.

TABLE 4. OUTPUT STATE TABLE

Accumulate <, ⩾ Preset	Comparison Sense (CMMD # 35)	Preset* Comparison Function	Disable/ Enable	output State
<	0	0	0	0
⩾	0	1	0	0
<	0	0	1	0
⩾	0	1	1	1
<	1	1	0	0
⩾	1	0	0	0
<	1	1	1	1
⩾	1	0	1	0

Result of Preset Comparison is determined by the comparison sense (Command # 35), and the Preset/Accumulate relationship (<, ⩾).

When configured for open collector operation, outputs can be paralleled. In conjunction with the preset compare and enable/disable functions, custom ON/OFF switching patterns can be established. It should be noted that the counter does not monitor the state of the outputs. Therefore, if a failure in that circuitry should occur, the CPU delete "system" will not be aware of it.

In addition to the four outputs, the counter module provides eight programmable Internal Preset registers. CPU logic can download preset limits which are then compared to the accumulated count with the resultant state (true or false) returned to the CPU.

Because the counter is an intelligent module, it is capable of continued operation regardless of the operating state of the CPU. This feature is selectable via a jumper and is conditioned upon the module being previously downloaded with preset data from the CPU and the I/O rack and external power supplies being operational.

An external user-furnished power supply is required to support the delete "field" isolated Input and Output logic. The power supply may be 5 VDC or 10-30 VDC. If this, or the rack power supply should lose power, the module must be reloaded from the CPU. An appropriate status bit will be set.

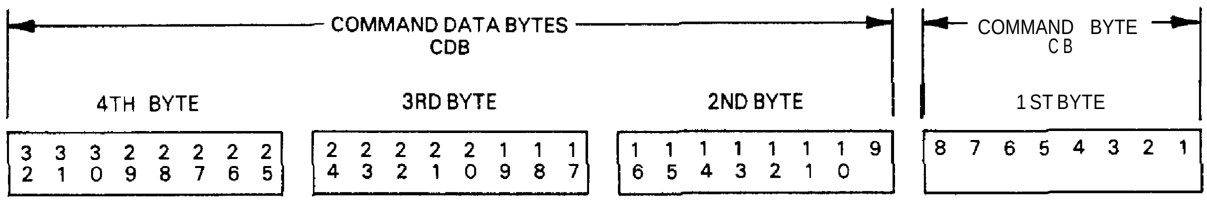
CPU INTERFACE

Communications between the High Speed Counter module and the Central Processor Unit (CPU) is accomplished via 32 consecutive input and output bits. (I/O address selection is discussed under Installation.) Command and preset data is transferred from the CPU to the counter module, while board status, output status, accumulated count, or counts/time-base is returned from the counter to the CPU. A two way data transfer will occur with every CPU I/O scan.

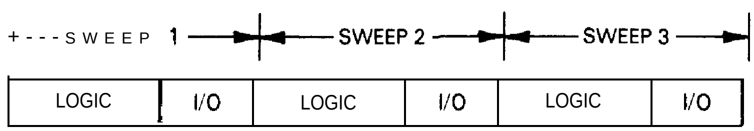
Since data is only transferred between the CPU and the counter in the I/O scan, the user needs to consider carefully the use of the Suspend I/O instruction. The counter will continue operation without communication to the CPU when the I/O is suspended, but it will not be able to apprise the CPU of its status. In similar context, use of the DO I/O instruction, which could poll the counter too frequently, would tend to cause the module to respond slowly to the degree that it may miss a pulse. To prevent this, a minimum of 6 msec should elapse between I/O scans that use the I/O addresses of the counter.

DATA SENT FROM SERIES SIX CPU

The first 8 bits or the first byte of data transferred from the CPU to the counter is referred to as the Command Byte (CB), while the remaining 24 bits or 3 bytes are referred to as the Command Data Bytes. This data uses 32 bits of the CPU output table.



Information contained in the Command Data Bytes is interpreted by the counter based upon the Command Number contained in the Command Byte.



- If the CPU issues a command in Sweep 1 that requires a specific type of data to be returned, that data will be returned in Sweep 2, and be available for logic solutions in Sweep 3.
- If a command is issued that does not request return data, the previously requested data will continue to be returned.
- If a command generates an error, that Error Code will be returned in the next I/O sweep. Subsequent sweeps will return data that was previously requested.

- A CPU SUSPEND I/O function will stop all communications to the counter module while allowing it to continue in full operation.
- A CPU DO I/O function, which addresses a specific counter, can be used to download system parameters. However, communications with the counter must not occur more often than every 6 milliseconds.

COMMAND BYTE (CB)

The Command Byte contains a Command Number that is used to set up the operational characteristics of the High Speed Counter. CPU logic selects the Command Number to be executed in the counter module and places that number in the Command Byte. One command is executed per I/O scan. Once card set up is complete, the Command Number is usually set to zero. The Command Data Bytes contain the information necessary to complete the execution of the command specified. Table 5 contains a list of all the commands along with a detailed description.

TABLE 5, COMMAND NUMBER

COMMAND NUMBER DECIMAL VALUE	COMMAND NUMBER HEX VALUE	DEFINITION OF COMMAND
0	00	DISCRETE COMMANDS - Interpret data bits (9-32) as discrete commands as detailed in Figure 9.
1	01	RESET CARD - Accumulated count and preset register are set to zero; outputs are turned off and board returned to initial default conditions, diagnostic tests are run, if tests are passed, the heartbeat will toggle and the Power-Up Bit of the Status Byte will be set; all commands except the Reset Card command will be ignored until this Power-Up Bit is cleared by Command 6. If the diagnostic tests fail an error code will be returned on the next I/O scan and the Board OK LED is turned off.
2	02	CONTINUE - This is a null command and the counter will continue to operate in the previously commanded mode. When used, this command improves counter processing time.
3	03	RETURN DISCRETE COMMAND - Return data bits (9-32) of Last Discrete Command (CB =0) sent as detailed in Figure 11.
4	04	HOME POSITION - Used only in encoder mode. (Refer to Figure 13.) Data bytes will contain value of Home Position location, all outputs are disabled and unlatched, the Home Position Bit in the returned Status Byte is cleared and incoming count pulses are ignored, On first Marker Pulse (Input C) after Home Limit Switch signal (Input D) is received: Home Position value is loaded into accumulate register, incoming pulses will ADD/SUBTRACT from accumulate register to track offset from Home Position, Home Position bit (SB=5) is set, and outputs remain disabled. If, in Encoder Mode, Home Position Value is outside the Upper or Lower Count Limit, or if another command is issued while the Home Command Bit is set, an error code will be returned. This command is active until Home Position is found or Abort Home Position (CB=5) or Reset Card (CB= 1) is issued.
5	05	ABORT HOME POSITION COMMAND - Used only in Encoder Mode; cancels Command 4; count pulses are again accepted while outputs are held disabled. Outputs must be re-enabled via the Discrete Command (CB =O). Since Home Position was not established and counting was disabled, the Accumulate Register value should be used with caution. If not in the Counter Mode or if the Home Position (Command 4) is not active, an error code will be returned.
6	06	CLEAR POWER-UP BIT - Sets Bit 2 of Status Byte to zero; this bit must equal zero for the counter module to accept any command other than Reset Card (CB= 1); bit will be set on power-up, external power supply failure, or after Reset Card command is issued.
7 thru 15	07 thru OF	Reserved for future use.

TABLE 5. COMMAND NUMBER (CONTINUED)

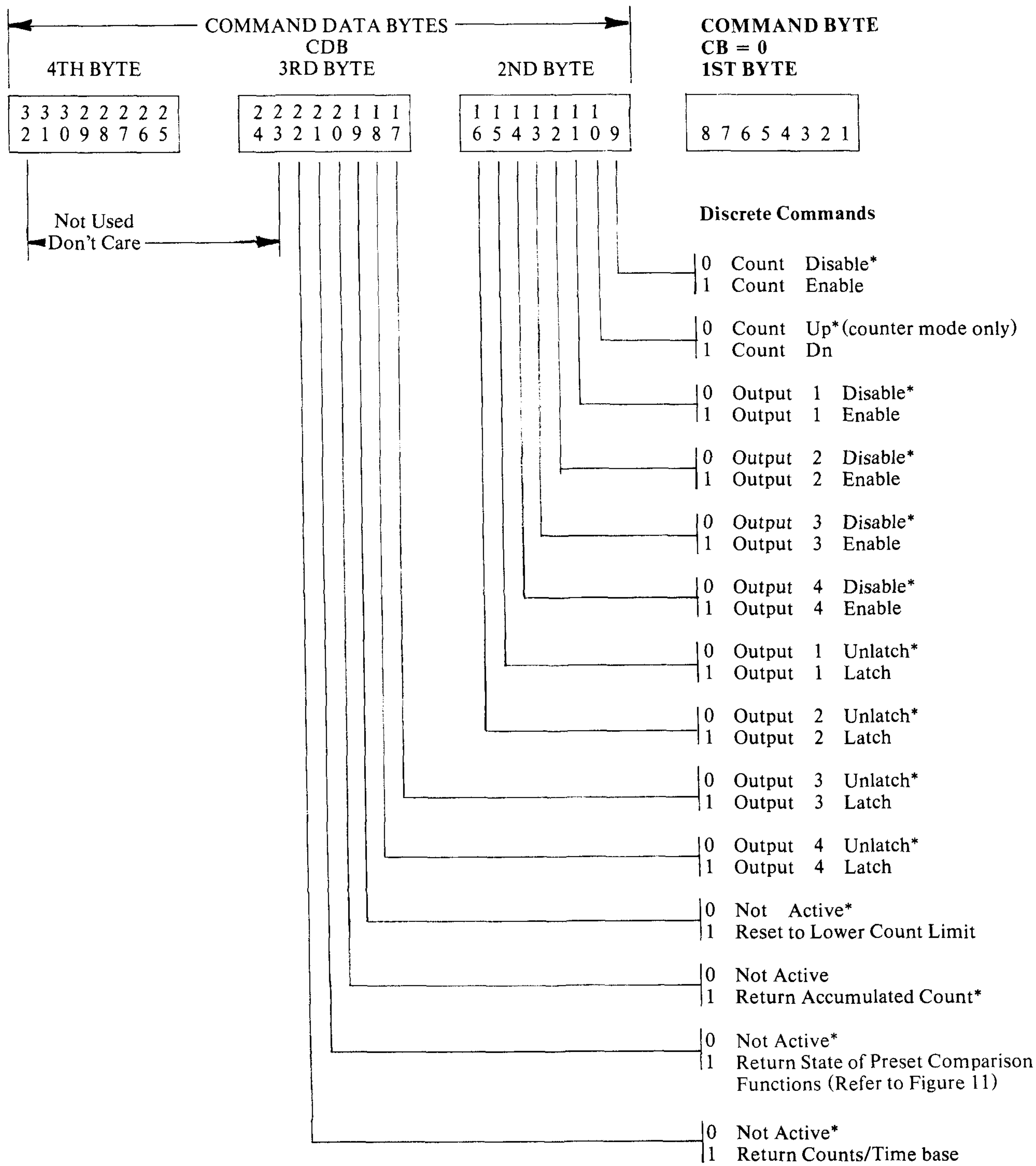
COMMAND NUMBER DECIMAL VALUE	COMMAND NUMBER HEX VALUE	DEFINITION OF COMMAND
16	10	LOAD OUTPUT 1 PRESET REGISTER from Command Data Bytes
17	11	LOAD OUTPUT 2 PRESET REGISTER from Command Data Bytes
18	12	LOAD OUTPUT 3 PRESET REGISTER from Command Data Bytes
19	13	LOAD OUTPUT 4 PRESET REGISTER from Command Data Bytes
20	14	LOAD INTERNAL PRESET REGISTER 1 from Command Data Bytes
21	15	LOAD INTERNAL PRESET REGISTER 2 from Command Data Bytes
22	16	LOAD INTERNAL PRESET REGISTER 3 from Command Data Bytes
23	17	LOAD INTERNAL PRESET REGISTER 4 from Command Data Bytes
24	18	LOAD INTERNAL PRESET REGISTER 5 from Command Data Bytes
25	19	LOAD INTERNAL PRESET REGISTER 6 from Command Data Bytes
26	1A	LOAD INTERNAL PRESET REGISTER 7 from Command Data Bytes
27	1B	LOAD INTERNAL PRESET REGISTER 8 from Command Data Bytes
		If Preset Value is above the Upper Count Limit or below the Lower Count Limit, an error code will be returned and, the command will not be executed. Counter operation remains unchanged. Default value upon power-up is zero.

TABLE 5. COMMAND NUMBERS (CONTINUED)

COMMAND NUMBER		
DECIMAL VALUE	HEX VALUE	DEFINITION OF COMMAND
28 thru 31	1C thru 1F	Reserved for future use.
32	20	LOAD ACCUMULATE REGISTER from Command Data Bytes-If new Accumulate Value is above the Upper Count Limit or below the Lower Count Limit, an error code will be returned and, the command will not be executed. Counter operation remains unchanged, Default value upon power-up is zero.
33	21	LOAD UPPER COUNT LIMIT from Command Data Bytes-If Upper Count Limit minus the Lower Count Limit is less than 128, an error code will be returned and, the command will not be executed. Counter operation remains unchanged. Default value upon power-up is 8,388,607 or 7FFFFF(HEX).
34	22	LOAD LOWER COUNT LIMIT from Command Data Bytes-If Upper Count Limit minus the Lower Count Limit is less than 128, an error code will be returned and, the command will not be executed. Counter operation remains unchanged. Default value upon power-up is zero. Lower count limit is -8,388,608 or 800000 (HEX).
35	23	LOAD PRESET COMPARISON SENSE - Interpret Command Data Bytes (bits 9-32) as detailed in Figure 10.
36	24	LOAD TIME BASE from Command Data Bytes- Sets time base in milliseconds for measurement of count pulses/ time base for use in velocity feedback. If time base is set outside of range 1 to 65,535 (milliseconds), an error code will be returned and, the command will not be executed. Counter operation remains unchanged.
37 thru 47	25 thru 2F	Reserved for future use.

TABLE 5. COMMAND NUMBERS (CONTINUED)

COMMAND NUMBER		
DECIMAL VALUE	HEX VALUE	DEFINITION OF COMMAND
48	30	RETURN OUTPUT 1 PRESET REGISTER
49	31	RETURN OUTPUT 2 PRESET REGISTER
50	32	RETURN OUTPUT 3 PRESET REGISTER
51	33	RETURN OUTPUT 4 PRESET REGISTER
52	34	RETURN INTERNAL PRESET REGISTER 1
53	35	RETURN INTERNAL PRESET REGISTER 2
54	36	RETURN INTERNAL PRESET REGISTER 3
55	37	RETURN INTERNAL PRESET REGISTER 4
56	38	RETURN INTERNAL PRESET REGISTER 5
57	39	RETURN INTERNAL PRESET REGISTER 6
58	3A	RETURN INTERNAL PRESET REGISTER 7
59	3B	RETURN INTERNAL PRESET REGISTER 8
60 thru 63	3c thru 3F	Reserved for Future Use
64	40	RETURN ACCUMULATE REGISTER (CB = 32)
65	41	RETURN UPPER COUNT LIMIT (CB=33)
66	42	RETURN LOWER COUNT LIMIT (CB=34)
67	43	RETURN PRESET COMPARISON SENSE (CB=35)
68	44	RETURN TIME BASE (CB=36)
69 thru 255	45 thru 7F	Reserved for future use

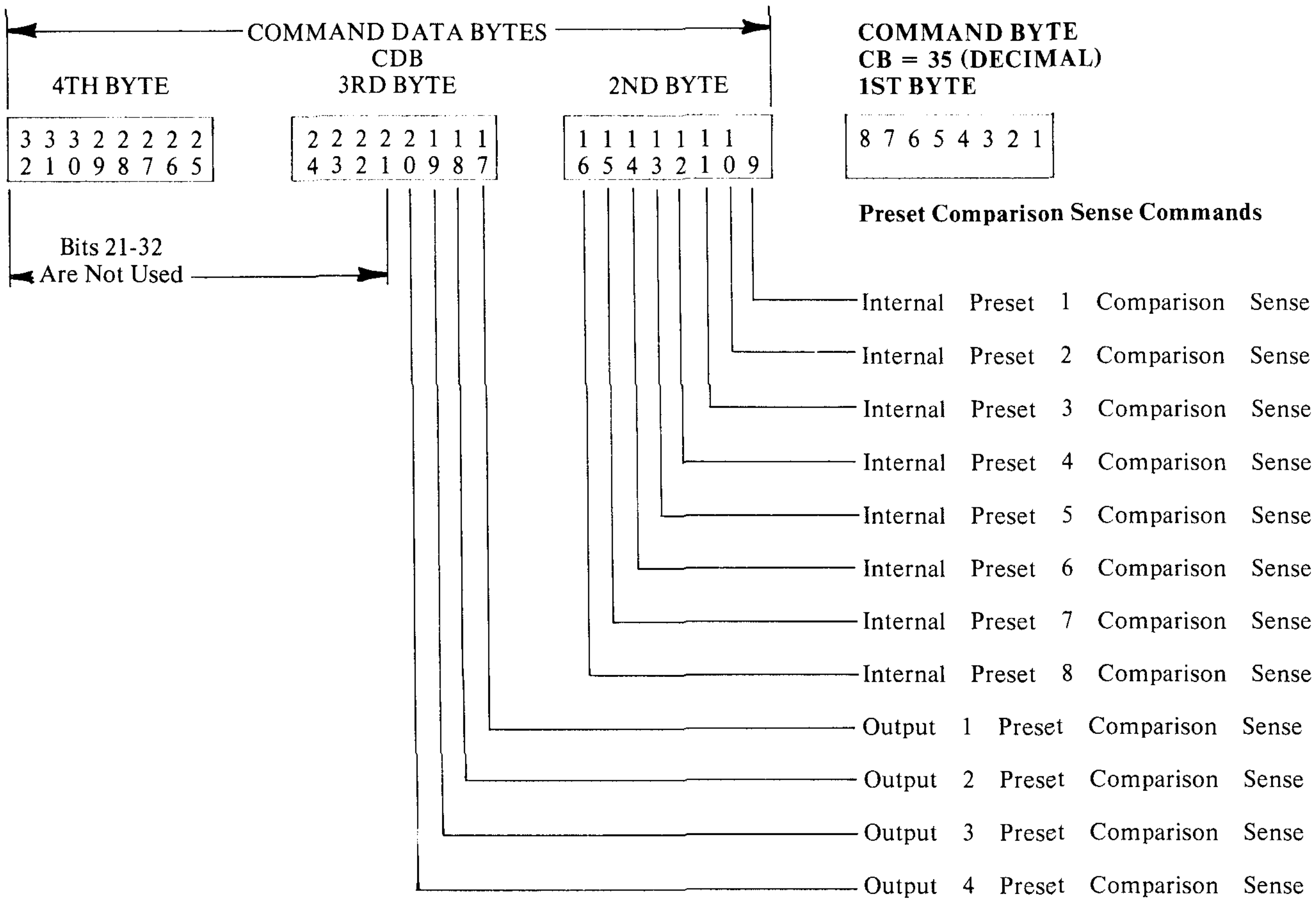


* Default conditions on power-up

NOTE

The High Speed Counter will interrupt and act upon each bit every time this data set is received from the CPU. The module will execute, for function bits 20, 21, 22 only, the lowest bit number function if more than one bit is set.

Figure 9. DISCRETE COMMAND FORMAT
COMMAND BYTE EQUALS ZERO (CB=0)



NOTE

The Load Preset Comparison Sense command (CB = 35) establishes the True. False (1/0) comparison sense between the accumulate and the twelve presents in the counter module. Output # 9 through # 20 set the sense for the eight internal and four output presets. If the output is off (0), the respective preset comparison function will be true (1) when the accumulated count is greater than or equal (≥) to the preset. If the output is on (1), the preset comparison function will be true when the accumulated count is less than (<) the preset. The following chart illustrates this concept.

Figure 10. PRESET COMPARISON SENSE

ACCUMULATED COUNT <, ⩾ PRESET	COMPARISON SENSE	PRESET COMPARISON FUNCTION
<	OFF (0)	FALSE (0)
⩾	OFF (0)	TRUE (1)
<	ON (1)	TRUE (1)
3	ON (1)	FALSE (0)

NOTE (Continued)

In the case of outputs, the output will be turned on when the Preset Comparison function is true if it has been enabled (Refer to Table 4, and Figure 9). When the Preset Comparison function is no longer true, the output will be turned off, unless it has been latched (Refer to Figure 9).

The state of all Preset Comparison functions (FALSE = 0, TRUE = 1), can be returned to CPU User Logic by giving the module discrete command # 21, return state of Preset Comparison functions (Refer to Figures 9, and 11).

Figure 10. PRESET COMPARISON SENSE (Continued)

DATA RETURNED TO SERIES SIX CPU

The first 8 bits, or the first byte of data, transferred to the CPU from the counter is referred to as the Status Byte, while the remaining 24 bits or 3 bytes are referred to as the Returned Data Bytes. This data uses 32 bits of the CPU Input Table.

RETURN DATA BYTES RDB			STATUS BYTE SB
4TH BYTE	3RD BYTE	2ND BYTE	1ST BYTE
32 31 30 29 28 27 26 25	24 23 22 21 20 19 18 17	16 15 14 13 12 11 10 9	8 7 6 5 4 3 2 1

Information contained in the Returned Data Bytes is that data which was requested via the Command Number contained in the Command Byte issued during the previous I/O scan. The previously requested data type will be returned every I/O scan unless a new type of return data is requested. Default returned data on power-up is the accumulated count value.

STATUS BYTE

8	7	6	5	4	3	2	1

1st BYTE

The Status Byte (SB) contains information pertaining to the current operating status of the High Speed Counter. This byte is updated and returned to the CPU every I/O scan. Definition of the Status Byte bits is as follows.

Bit 1 - HEARTBEAT: This bit indicates if the board is functional. It is toggled every time an I/O scan occurs except during power-up diagnostics, Any failures **of** counter diagnostics will stop the heartbeat.

Bit 2 - POWER-UP: This bit is set by the module to a one (1) whenever rack or external power is applied, either for the first time or following a power dip. On power-up, the counter will run its diagnostic tests and reset all internal data registers to their default values.

A Reset Card Command (CB= 1) from the CPU will also cause diagnostics to be executed and the Power-Up bit to be set.

All commands (except Reset Card) will be ignored until this bit is reset to zero (0) by the Clear Power-up Bit Command (CB = 6).

Bit 3 - EXTERNAL POWER SUPPLY STATUS: This bit is set to a one (1) whenever the external (user) power supply is below 4.5V. When external power fails, the Power-Up bit is set and the counter will run its diagnostic tests and reset all data registers to their default values.

All commands (except Reset Card) will be ignored until the Power-Up bit is reset to a zero (0) by the Clear Power-up Bit Command (CB = 6).

Bit 4 - COUNTING ENABLED: This bit, when set to a one (1) by the counter module, indicates that the counter is enabled. The Count Enable command (CB=0, bit 9) must be set to one (1) to enable counting. To Disable counting, set bit 9 to zero (0), or in the Count Mode, apply a signal to Input C.

Bit 5 - HOME/DIRECTION: In the Encoder Mode this bit indicates that Home Position has been established, and is set to a one (1) when any of the following events occur:

a. After the Home Command (CB=4) is issued, and the first Marker Pulse is received after the Home Limit Switch is reached. Refer to Figure 14.

b. A load Accumulate command (CB=32) is issued.

c. A Reset Accumulate to Lower Count Limit (CB=O, bit 19) is issued.

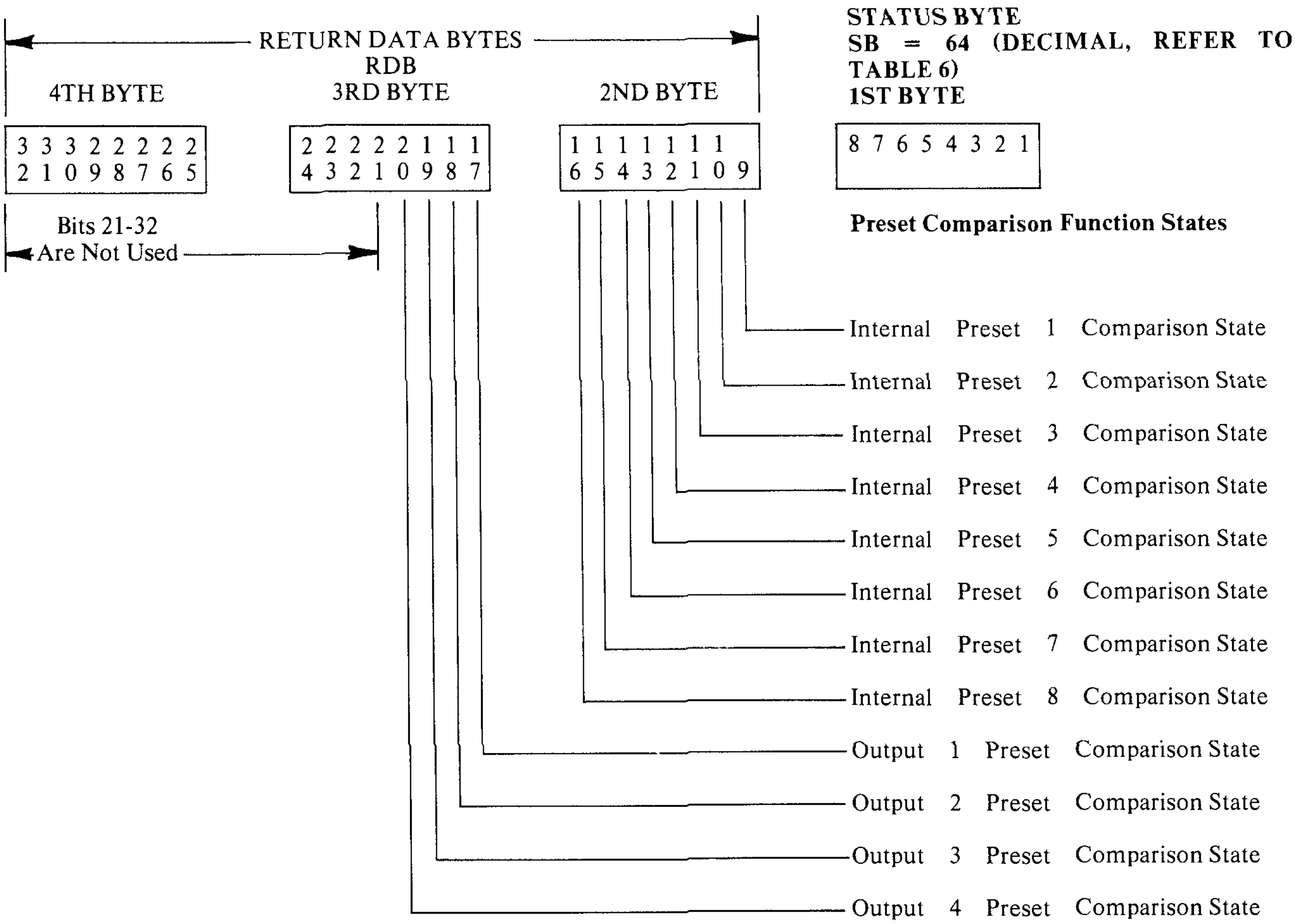
This bit is reset to zero (0) on Power-up, Reset Command (CB-O), or Home Command (CB=4).

In the Counter Mode this bit indicates the direction of count (0 = up, (1 = down). Direction is a function of Input B or the Up/Down Count command (CB=0, bit 10). Count direction is Up unless a signal is applied to Input B or CB=0, bit 10 is set to a one (1).

Bits 6, 7, 8 - Returned Data Type: Interpretation of these bits indicates the type of data being returned to the CPU in the Return Data Bytes 2, 3, and 4. If an error code is returned, the command that caused the error is ignored, and count operation remains unchanged. (Refer to Table 6)

TABLE 6. RETURNED DATA TYPE

Bit 8	Bit 7	Bit 6	Data Returned
0	0	0	Accumulated Count (default on power-up)
0	0	1	Counts/Time base
0	1	0	Comparison States for Presets (see Figure 12)
0	1	1	Returned Data as requested in previous I/O scan from commands 3,48-59, 65-68
1	0	0	Error Code (see Figure 13)
1	0	1	Future Use
1	1	0	Future Use
1	1	1	Future Use



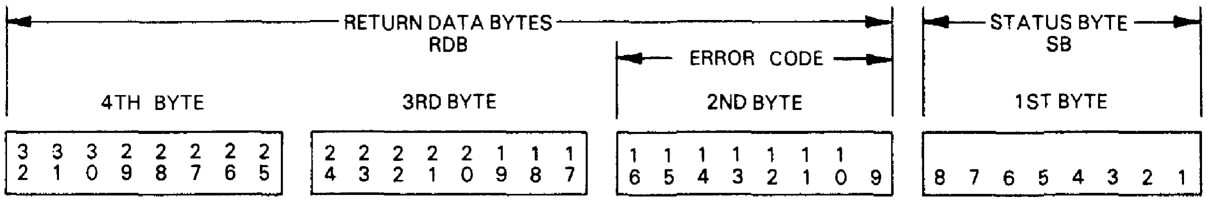
NOTE

This discrete data is returned to the CPU Input Table two sweeps after discrete command # 21 has been issued (Refer to Figure 9). Inputs 9 through 20 reflect the state of all Preset Comparison functions (Refer to Figure 10). If the Input is on (1), the Preset Comparison function is True. Conversely, if the Input is off (0), the Preset Comparison Function is False.

The state (ON/OFF) of each of the four outputs does not necessarily match the state of the Preset Comparison function. The Enable/Disable Latch/Unlatch, along with the Preset Comparison Function determine the ON/OFF status of each output (Refer to Table 4, and Figure 9).

Figure 11. COMPARISON STATES FOR PRESETS

ERROR CODES



When the Status Byte bits 6, 7, 8 indicate an error code is present (refer to Table 6), a binary number will be returned in the 2nd Byte indicating the particular Error Code. If a command generates an error, that command will be ignored and an Error Code will be present in the Return Data Bytes of the next I/O scan. Subsequent sweeps will return the previously requested data. Counter operation remains unchanged from its current operating mode whenever an error code is sensed. The data contained in the 3rd and 4th bytes is indeterminate. The Error Codes are as follows.

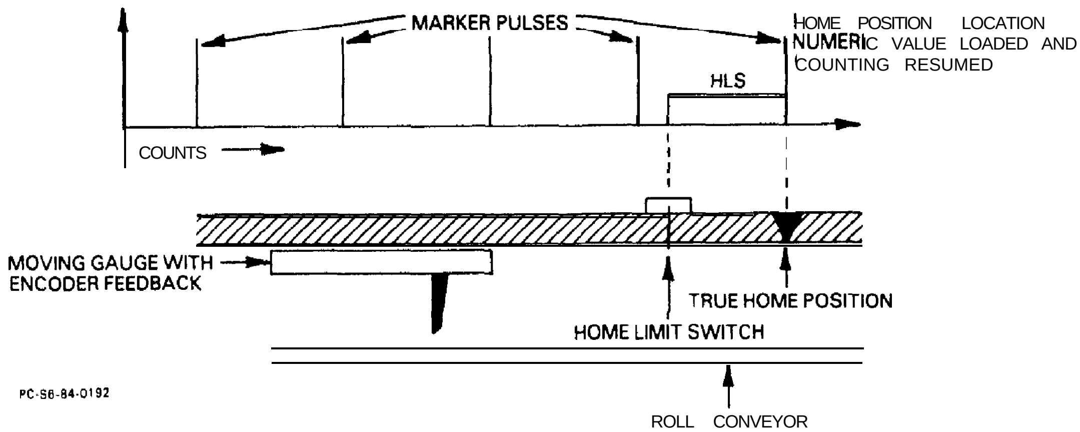
HIGH SPEED COUNTER ERROR CODES

DECIMAL VALUE	HEX VALUE	DESCRIPTION OF ERROR
1	1	Invalid Home Position value - The valid Home Position value should be: LCL < = Home Position < = UCL LCL = Lower Count Limit UCL = Upper Count Limit The command was not executed.
2	2	Invalid Home Command - While in Home Position mode no commands are accepted. This error code will be generated if another Home command is issued before Home position is achieved.
3	3	Invalid Home Command - Home command was issued while in counter mode.
4	4	Invalid Abort Home Command - Abort Home command was not executed because card is not in Home Position Mode, or Home position has already been established.
5	5	Invalid Abort Home Command - Abort Home command was issued while in counter mode.
6	6	Invalid Command Number - Command does not exist.
7- 10	I - A	Invalid Output (l-4) Preset Value - Valid preset values are: LCL < = Output (l-4) Preset < = UCL The command was not executed.

FIGURE 12. ERROR CODES

DECIMAL VALUE	HEX VALUE	DESCRIPTION OF ERROR
11-18	B-12	Invalid Internal Preset (l-8) Value - Internal Preset Value must lie between lower count limit and upper count limit, LCL ≤ Internal Preset ≤ UCL The command was not executed.
19	13	Invalid Accumulate Value - Valid Accumulate values are: LCL < = Accumulate < = UCL The command was not executed.
20	14	Invalid Upper Count Limit - Upper Count Limit minus Lower Count Limit should be greater than or equal to 128. The command was not executed.
21	15	Invalid Lower Count Limit - Upper Count Limit minus Lower Count Limit should be greater than or equal to 127. The command was not executed.
22	16	Invalid Time Base Value - Valid Time Base values are: 1< = Time Base < = 65535
23	17	Invalid Command; Power-up Bit Set - When the power-up bit (bit 2 of the Status Byte) is set, the only commands the card will respond to are the Clear Power-up Bit command and the Reset Card command. The command was not executed.
24	18	Diagnostic Failure* - Internal RAM test failed. After error is sent heartbeat will die. Cycle power to reset this bit,
25	19	Diagnostic Failure* - External RAM failed. After error is sent heartbeat will die. Cycle power to reset this bit.
26	1A	Diagnostic Failure* - EPROM test failed. After error is sent heartbeat will die. Must re-cycle power.
27	1B	External Power Supply Failure - External power supply has gone out of tolerance. Card will go through power-up sequence, and all default conditions will be restored.
		* If the High Speed Counter fails to pass its self-diagnostic tests, reseat the module in the I/O rack and check power supplies. If the module does not respond properly replace it and return the failed unit to G.E. for repairs or call our Service Number 804-978-5747.

FIGURE 12. ERROR CODES (CONTINUED)



1. Set counter in Home Position Mode (CB=4). The Data Bytes will contain the numeric value of the Home Position Location. Counter outputs are turned off and incoming count pulses are ignored.

2. Advance guage towards the home position.

3. When the Home Limit Switch is tripped, a signal is received at Input D.

The next Marker Pulse (Input C) from the Encoder C) nals the True Home Position.

4. The numeric value of the Home Position Location is now loaded into the Accumulate Register and counting resumed to track offset from the True Home Position. The outputs remain disabled and must be re-enabled by the CPU program.

FIGURE 13. HOME POSITION APPLICATION

DATA DOWNLOAD USING THE REGISTER TABLE

INTRODUCTION

Since the High Speed Counter Module is capable of counting high frequency input pulses it can be used in applications involving quadrature encoders and high speed digital tachometers and photosensors. The applications include cam switch simulations, velocity measurement applications, and position tracking applications. However, before the HSC can be utilized in any application the Series Six CPU must tell the counter via command data how and when to react to the incoming pulses.

The following pages will present a method of downloading command data to the High Speed Counter card through the 32 consecutive input and output points that the module occupies in a Series 6 system. The data download routine is imbedded in a Demonstration program that uses a Series 6 with an Extended Instruction Set, 1024 registers, and an I/O Simulator Unit with a BCD display, 16 toggle switch inputs and 16 LED outputs.

With the Demonstration Program the user can enter commands into a command table. The command table is set-up within the Register Table of the CPU. The user simply types the commands into the Register Table using a Program Development Terminal (PDT) or a WorkMaster. The program will step through the Register Table transferring the commands one by one from the table to the HSC.

In the Series Six system the I/O simulator uses input and output addresses 1 through 32. The High Speed Counter card is addressed at I/O points 33 through 64. Table 7 lists all of the Inputs, Outputs and Register address references that are used in the Demonstration Program.

OPERATION

The Demonstration Program is divided into two sections: the Main Body and a Subroutine. The Main Body contains the logic that performs the power up sequence required to enable the counter. The Subroutine does the actual loading of the Command Data to the HSC module. Figures 14 and 15 illustrate the operation of the Main Body and the Subroutine, respectively, in block diagram form. The function of each logic block with the corresponding rung numbers is described below.

TABLE 7. INPUT/OUTPUT AND REGISTER ALLOCATION CHART

Reference	Description
01 to 16	I/O Simulator
33 to 64	High Speed Counter Module
01 to016	I/O Simulator
033 to 064	High Speed Counter Module
0201	Clear Power Up Bit
0202	Initiate Register Download
0203	Register Download In Progress
0204	Register Download Complete
0205	Command Byte Equals Zero
0206 to 0230	Detects Zero Data Byte Commands
0231,0232	Detects End of Register Table
0233	Update Simulator LED Outputs
0234	Indicates CB = 0 For Single Command Load
R12toR14	Scratch Registers
R15, R16	Stores Counts Per Time Base
R17 to R20	Scratch Registers
R21	Stores Command Byte Data
R22	Scratch Register
R23	Storage For 3rd Data Byte
R24	Pointer For Commands In the Register Table
R25 to R64	Table of HSC Commands
R65	Command Byte For Single Command Load
R66, R67	Data Bytes For Single Command Load
R74, R75	Return Data Bytes

MAIN BODY OF PROGRAM
(Refer to Figure 14)

Clear Power Up: Bit	This block sends CB = 6 to the HSC. The counter will only accept Command 1 (Reset Module) and Command 6 (Clear Power Up Bit) while the Power Up Bit is set. Rung Numbers: 24,25
Load Discrete: Set Up Data	The HSC outputs (in the default state) after power up are disabled. Also after power up the counter is disabled; meaning the HSC will ignore any incoming pulses. Here the Command Byte is set to zero (Discrete Commands) to enable the outputs and the counter. Rung Numbers: 2 - 7
Initiate: Register Load	This block contains the logic that initializes the register pointer to rest at the first register in the Register Table. Also a latch is set up that controls the operation of the Subroutine. While Command Data is being downloaded the latch is energized: if the last register in the table has been loaded the latch de-energizes, which terminates Subroutine execution. Rung Numbers: 24,26, 28
Last Register: Loaded	Here a check is performed to determine if the last register in the table has been loaded. As long as the register pointer has not reached the end of the table commands are downloaded to the HSC. Rung Numbers: 27
HSC Count/Outputs: Enabled and Download Complete	If the above check is true all commands in the table have been downloaded and the counter module will be enabled. Rung Numbers: 28
Execute: Subroutine	The Subroutine is executed one time to download a single corn mand from Register Table to the High Speed card. Rung Numbers: 29,43 - 80

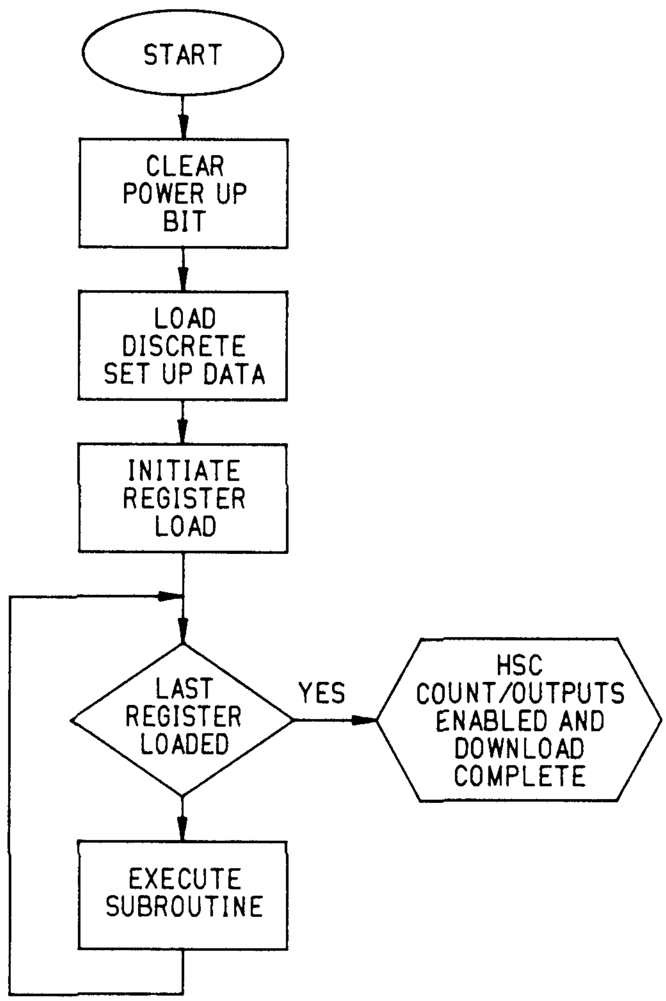


Figure 14. MAIN BODY OF PROGRAM

SUBROUTINE

(Refer to Figure 1.51

Read Command:	Read the Command Byte from the register in the Register Table upon which the register pointer resides. Store the Command Byte in a buffer register. (Increment the pointer.) Rung Numbers: 44
Last Register:	This block performs a check to determine if the previously read command resides in the last register in the Register Table. Rung Numbers: 44
'0' D.B.: Command Detected	Here a check is performed to determine whether or not the command requires Data Bytes. Rung Numbers: 45 - 68
'0' Register: Value	If the command does not require any Data Bytes, check the Command Byte for a value of zero (Discrete Commands or **no** commands). Rung Numbers: 69, 70
Clear 1st and: 2nd D.B.	If a zero Data Byte Command is detected clear the data byte buffer registers. Rung Numbers: 70
Clear 3rd D.B.	
Read 1st and: 2nd D.B.	If the command requires data read the 1st and 2nd Data Bytes from the Register Table and store them in a buffer register. (Increment pointer.) Rung Numbers: 71
Read 3rd D.B.:	Read the 3rd Data Byte and store it in a buffer register. (Increment Pointer.) Rung Numbers: 72
Load Command: Byte	Load the Command Byte from the storage register to the Output Table. Rung Numbers: 73
Load 1st and: 2nd D.B.	Move the 1st and 2nd Data Bytes from the buffer storage register to the Output Table. Rung Numbers: 73
Load 3rd D.B.:	Move the 3rd Data Byte from its buffer register to the Output Table. Rung Numbers: 73

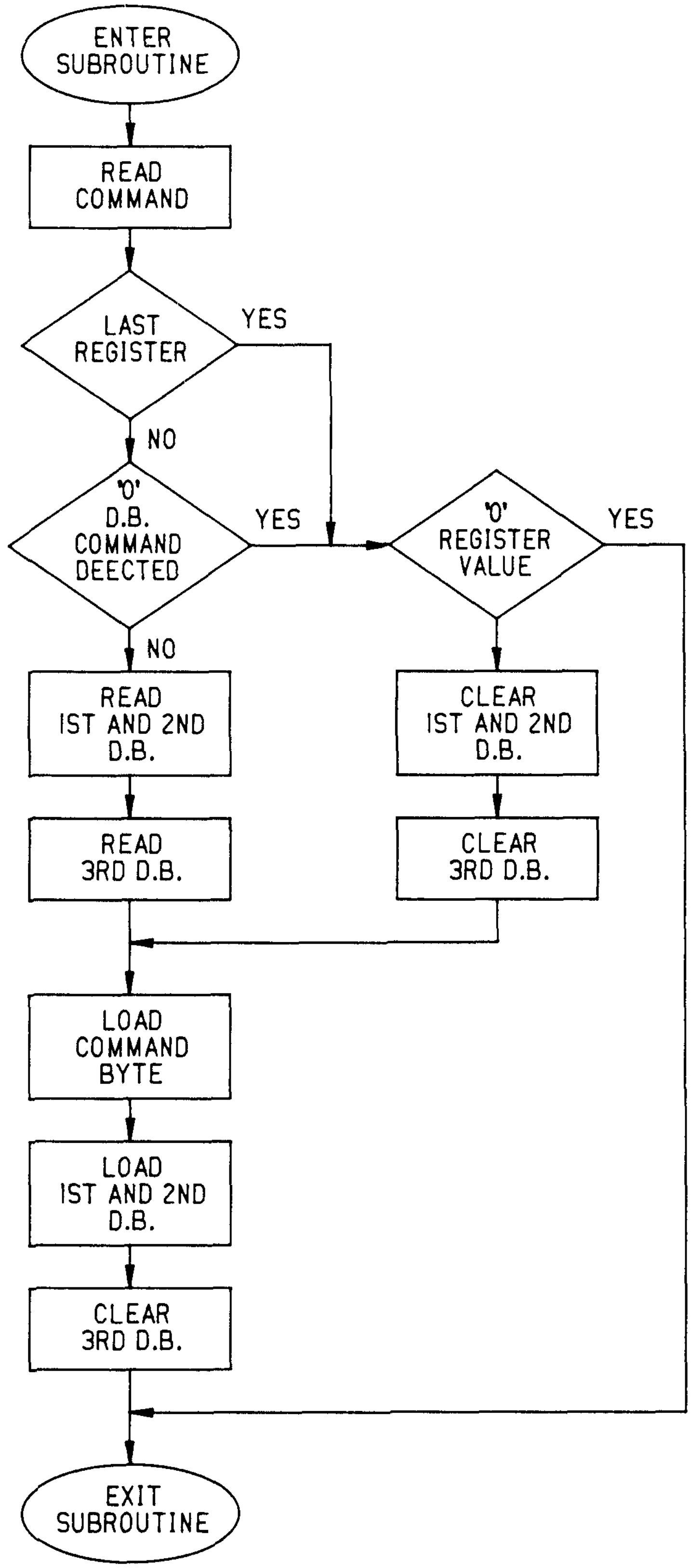


Figure 15. SUBROUTINE

ENTERING COMMAND DATA

The High Speed Counter commands are entered into a table that consists of a block of registers located in the CPU Register Table. In the Demonstration Program the first register in the table is R25 and the last register is R64. Each command will occupy either one or three registers depending upon the command. Commands that require no Data Bytes use one register: commands that require data use 3 registers.

For the Command Byte, the command number is entered as a single precision decimal number into the Register Table. The Data Bytes, if required, are entered as a double precision number into the next two registers in the table. The Figure 17 below illustrates how the commands would appear in the Register Table on a PDT.

TABLE 8. CPU REGISTER TABLE

REGISTER 0025

0024	00000	00000	00000	00000	00000	00000	00000	00000	0017
0032	00000	00000	0000009999		00034	+0000009999		00033	0025
0040	00000	00000	00000	00000	+0000001000		00036	00064	0033
0048	00000	00000	00000	00000	00000	00000	00000	00000	0042

The above illustration shows four commands. Command 33 (Load Upper Count Limit) resides in R25. Located in R26 and R27 are the Data Bytes (+ 9999) associated with CB = 33. R28 contains the command to "Load the Lower Count Limit" of the HSC (CB = 34). The data for this command is located in R29 and R30 (-9999). R33 contains a value of 64. CB = 64 (Return Accumulate Register) does not require any Data Bytes, so the next command in the table is located in R34.

NOTE

Command 64 could also have been entered into R31, and CB = 36 could have been placed in R32. If Command 36 had been placed in R32 the Data Bytes would be entered into R33 and R34.

I/O SIMULATOR

The I/O Simulator is used to activate the inputs that download the data to the HSC, latch the HSC outputs, load a single command and reset the counter module. The Series 6 CPU uses outputs on the simulator to display the count or error codes, and provide diagnostic information with the LED indicator lights. Figure 16 and Tables 7 and 8 give the simulator I/O functions.

The BCD display will display the accumulate count value of the High Speed Counter by default. If the HSC module generates an error code, the error code will be displayed.

TABLE 9. SIMULATOR INPUTS

Toggle Switch #	Function
11	Reset the High Speed Counter Module. Send CB = 1.
12	Clear the Power Up Bit and Download the Command Table to the HSC.
13	Abort the Home Search, Send CB = 5.
14	Reset the Accumulate Count Register to its Lower Limit.
15 through 18	Latch/Unlatch HSC outputs 1 through 4.
19	Return Preset Comparison States.
110	Return the Counts per Time Base and Store the number of counts in R15 and 16.
111	Load the single command located in R65, R66, and R67. (R65 contains the Command Byte and R66 and R67 contains the Data Bytes.

SIMULATOR OUTPUTS

TABLE 10 SIMULATOR OUTPUTS

LED Light #	Function
01	Counting is Enabled
02	The Power Up Bit has been cleared and the commands have been downloaded.
03	Energized when the external power supply is out of tolerance.
04	Turns on when an error condition exists.
05 through 08	Indicates the HSC Preset Comparison States when switch 19 is “on“.
08	Energized when number on BCD display is negative.
113 through 016	Reflects the HSC Outputs Preset Comparison Senses as determined by CB = 35.
017 through 032	Simulator LED Display.

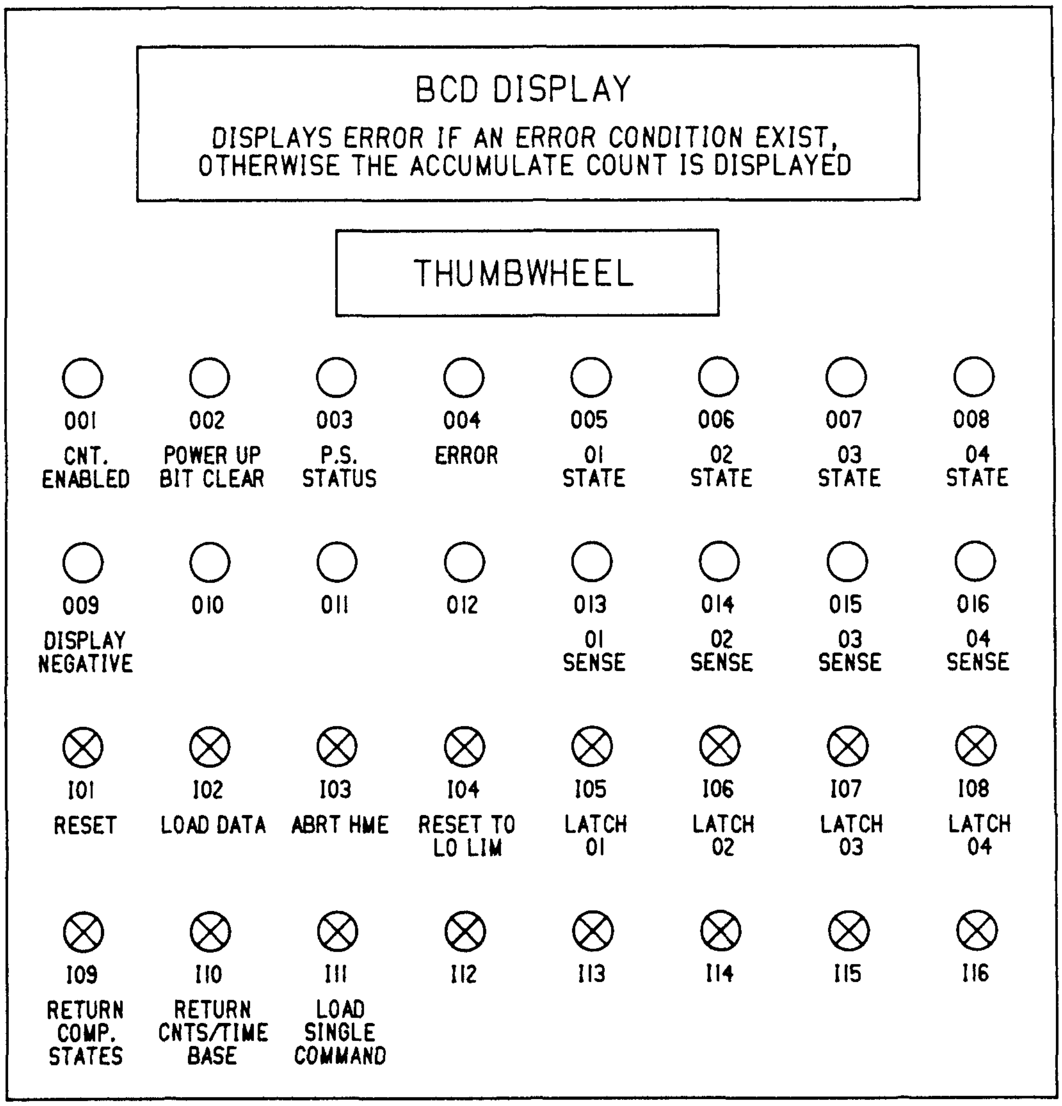


Figure 16. I/O SIMULATOR

GE SERIES SIX DOCUMENTATION
SERIES SIX HIGH SPEED COUNTER DATA DOWNLOAD PROGRAM
REGISTER TABLE METHOD

```
  GGGGGG     EEEEEEEE
 GGGGGGGG    EEEEEEEE
GG           EE
GG           EE
GG   GGGGG   EEEEEE
GG      GG   EE
GG      GG   EE
 GGGGGGGG    EEEEEEEE
  GGGGGG     EEEEEEEE
```

```
 SSSSSS    EEEEEEEE   RRRRRRR     II   EEEEEEEE    SSSSSS
SSSSSSSS   EEEEEEEE   RRRRRRRR    II   EEEEEEEE   SSSSSSSS
SS         EE         RR     RR   II   EE         SS
SS         EE         RR     RR   II   EE         SS
 SSSSSS    EEEEEE     RRRRRRR     II   EEEEEE      SSSSSS
      SS   EE         RR  RR      II   EE               SS
      SS   EE         RR   RR     II   EE               SS
SSSSSSSS   EEEEEEEE   RR    RR    II   EEEEEEEE   SSSSSSSS
 SSSSSS    EEEEEEEE   RR     RR   II   EEEEEEEE    SSSSSS
```

```
 SSSSSS    II   XX        XX
SSSSSSSS   II    XX      XX
SS         II     XX    XX
SS         II      XX  XX
 SSSSSS    II       XXX
      SS   II      XX  XX
      SS   II     XX    XX
SSSSSSSS   II    XX      XX
 SSSSSS    II   XX        XX
```

```
***************************************************************************
*                                                                         *
*       INSTRUCTION SET: EXTENDED                                         *
*                 CPU ID:    2                                            *
*        CPU MEMORY SIZE:  4096                                           *
*    PROGRAM MEMORY SIZE:   434                                           *
*   REGISTER MEMORY SIZE:  1024                                           *
*                                                                         *
***************************************************************************
```

```
|
| << RUNG     0 >>
|
| ***************************************************************************
| *                                                                         *
| *      The logic in this Demonstration Program is divided and            *
| *      prioritized to avoid the interlocking that would have             *
| *      been necessary otherwise. In the program the Reset                *
| *      Command (CB = 1), activated by I1, is given the highest           *
| *      priority and the single command load, activated by I11,           *
| *      is given the lowest priority.                                     *
| *                                                                         *
| *                                                                         *
| ***************************************************************************
|
|
|
+[   Start of Program   ]-
|
|
| << RUNG     1 >>
|
|
|
+[NO OP]-                                                              (   )
|
|
| << RUNG     2 >>
|
| ***************************************************************************
| *                                                                         *
| *      The program is initially set up to send the Discrete Command      *
| *      set to the High Speed Counter Module. (If the outputs associated  *
| *      with the HSC are not cleared the last command downloaded will be  *
| *      sent to the module repeatedly.) Also this allows specific commands *
| *      to be activated by the toggle switch inputs on the I/O Simulator. *
| *                                                                         *
| *      033      CmdByte      HSC Command Byte                             *
| *      049      DatByt2      HSC 2nd Data Byte                            *
| *                                                                         *
| *                                                                         *
| ***************************************************************************
|
|                 CmdByte                       DatByt2
| Const            00033    Const                00049
+[   A      MOVE       B ]-[   A      MOVE        B ]-                  (   )
|+00000                  +00000
```

```
|
| << RUNG     3 >>
|
| ****************************************************************************
| *                                                                          *
| *      By default after power up the HSC counter is disabled (ignores      *
| *      incoming pulses).  The following five rungs will enable the         *
| *      counter and the HSC outputs using the Discrete Command Set.         *
| *                                                                          *
| *      041    DatByt1    HSC 1st Data Byte/Discrete Bit 9_Enable count     *
| *      043    Dsct_11    Discrete Data_HSC Output Bit 11/Output 1 Enable   *
| *      044    Dsct_12    Discrete Data_HSC Output Bit 12/Output 2 Enable   *
| *      045    Dsct_13    Discrete Data_HSC Output Bit 13/Output 3 Enable   *
| *      046    Dsct_14    Discrete Data_HSC Output Bit 14/Output 4 Enable   *
| *                                                                          *
| *                                                                          *
| ****************************************************************************
|
|                                                                      DatByt1
|                                                                       00041
+[NO OP]----------------------------------------------------------------(   )
|
|
| << RUNG     4 >>
|
|                                                                      Dsct_11
|                                                                       00043
+[NO OP]----------------------------------------------------------------(   )
|
|
| << RUNG     5 >>
|
|                                                                      Dsct_12
|                                                                       00044
+[NO OP]----------------------------------------------------------------(   )
|
|
| << RUNG     6 >>
|
|                                                                      Dsct_13
|                                                                       00045
+[NO OP]----------------------------------------------------------------(   )
|
|
| << RUNG     7 >>
|
|                                                                      Dsct_14
|                                                                       00046
+[NO OP]----------------------------------------------------------------(   )
|
```

```
|
| << RUNG    8 >>
|
| ******************************************************************************
| *                                                                            *
| *      Input 11 allows a single command (excluding Discrete Commands)        *
| *      to be downloaded to the HSC card using R65 as Command Byte data       *
| *      and R66 and R67 for the Data Bytes.                                   *
| *                                                                            *
| *      I11      Ld_Cmd      Load Single Command                              *
| *      O33      CmdByte     HSC Command Byte                                 *
| *      O41      DatByt1     HSC 1st Data Byte/and 2nd Byte                   *
| *      O57      DatByt3     HSC 3rd Data Byte                                *
| *      O234     NoSngle     If CB=0 Do Not Execute Single Command            *
| *      R12      Srtch_1     Scratch Register                                 *
| *      R13      Srtch_2     Scratch Register                                 *
| *      R65      SglLdCB     Command Byte For Single Command Load             *
| *      R66      SglLd12     1st and 2nd Data Bytes Single Cmd Load           *
| *      R67      SglLd3      3rd Data Byte Single Command Load                *
| *                                                                            *
| ******************************************************************************
|
|Ld_Cmd                    Srtch_2 SglLdCB         Srtch_1 Srtch_2 Srtch_1 NoSngle
| I0011   Const             R0013   R0065           R0012   R0013   R0012   O0234
+--] [---[   A      MOVE     B ]-[  MOVE RIGHT 8 BITS  ]-[   A   :    B ]---(   )
|       +00000
|
| << RUNG    9 >>
|
|Ld_Cmd  NoSngle SglLdCB CmdByte SglLd12 DatByt1 SglLd3             DatByt3
| I0011   O0234   R0065   O0033   R0066   O0041   R0067              O0057
+--] [------]/[---[ REG  TO I/O ]-[ REG  TO I/O ]-[  MOVE RIGHT 8 BITS  ]-  (   )
|
|
| << RUNG   10 >>
|
| ******************************************************************************
| *                                                                            *
| *      When Input 10 is activated the Discrete Command "Return               *
| *      Counts per Time Base" (Bit 22) is issued. The number of               *
| *      counts per programmed time base are stored in R15 and R16.            *
| *                                                                            *
| *      I10      Rt_C/TB      Return Counts per Time Base                     *
| *      I41      1stRtDB      HSC 1st Return Data Byte/and 2nd Byte           *
| *      I57      3rdRtDB      HSC 3rd Return Data Byte                        *
| *      O54      Dsct_22      Discrete Data_HSC Ouput Bit 22                  *
| *      R15      C/TB_12      1st and 2nd Data Bytes_Counts/Time Base         *
| *      R16      C/TB_3       3rd Data Byte_Counts/Time Base                  *
| *                                                                            *
| ******************************************************************************
|
|Rt_C/TB                                                                  Dsct_22
| I0010                                                                    O0054
+--] [-------------------------------------------------------------------(   )
|
```

```
|
| << RUNG    11 >>
|
|Rt_C/TB 1stRtDB            C/TB_12 3rdRtDB          C/TB_3
| I0010    I0041             R0015    I0057            R0016
+--] [---[    A       MOVE        B ]-[  MOVE RIGHT 8 BITS  ]-                   (   )
|
|
| << RUNG    12 >>
|
| ***************************************************************************************
| *                                                                                     *
| *       Input 9 uses the "Return Comparison States" to allow the S6                  *
| *       CPU to energize outputs (Simulator LED Outputs 5 to 8).                       *
| *                                                                                     *
| *       I9        Rt_CpSt      Return Preset Comparison States                        *
| *       I49       2ndRtDB      HSC 2nd Return Data Byte                               *
| *       I50       Rtrn_18      HSC Return Data_Input Bit 18                           *
| *       I51       Rtrn_19      HSC Return Data_Input Bit 19                           *
| *       I52       Rtrn_20      HSC Return Data_Input Bit 20                           *
| *       O5        O1CmpSt      HSC Output 1 Preset Comparison State                   *
| *       O6        O2CmpSt      HSC Output 2 Preset Comparison State                   *
| *       O7        O3CmpSt      HSC Output 3 Preset Comparison State                   *
| *       O8        O4CmpSt      HSC Output 4 Preset Comparison State                   *
| *       O53       Dsct_21      Discrete Data_HSC Output Bit 21                        *
| *                                                                                     *
| ***************************************************************************************
|
|Rt_CpSt                                                                          Dsct_21
| I0009                                                                            O0053
+--] [----------------------------------------------------------------------------(   )
|
|
| << RUNG    13 >>
|
|Rt_CpSt 2__RtDB                                                                  O1CmpSt
| I0009    I0049                                                                   O0005
+--] [-----] [-------------------------------------------------------[LATCH]---( L )
|                                                                                 (   )
|Rt_CpSt 2__RtDB                                                                  (   )
| I0009    I0049                                                                  (   )
+--] [-----] [--------------------------------------------------------------------(UL)
|
|
| << RUNG    14 >>
|
|Rt_CpSt Rtrn_18                                                                  O2CmpSt
| I0009    I0050                                                                   O0006
+--] [-----] [-------------------------------------------------------[LATCH]---( L )
|                                                                                 (   )
|Rt_CpSt Rtrn_18                                                                  (   )
| I0009    I0050                                                                  (   )
+--] [-----]/[--------------------------------------------------------------------(UL)
|
```

```
|
| << RUNG    15 >>
|
|Rt_CpSt Rtrn_19                                                         03CmpSt
| I0009    I0051                                                          O0007
+--] [-----] [----------------------------------------------------[LATCH]---( L)
|                                                                          (  )
|Rt_CpSt Rtrn_19                                                           (  )
| I0009    I0051                                                           (  )
+--] [-----]/[-------------------------------------------------------------(UL)
|
|
| << RUNG    16 >>
|
|Rt_CpSt Rtrn_20                                                         04CmpSt
| I0009    I0052                                                          O0008
+--] [-----] [----------------------------------------------------[LATCH]---( L)
|                                                                          (  )
|Rt_CpSt Rtrn_20                                                           (  )
| I0009    I0052                                                           (  )
+--] [-----]/[-------------------------------------------------------------(UL)
|
|
| << RUNG    17 >>
|
| ******************************************************************************
| *                                                                            *
| *      This rung sets the default Return Data type to be the                 *
| *      accumulate count register of the High Speed Counter.                  *
| *                                                                            *
| *      I9       Rt_CpSt     Return Preset Comparison States                  *
| *      I10      Rt_C/TB     Return Counts per Time Base                      *
| *      O52      Dsct_20     Discrete Data_HSC Output Bit 20                  *
| *                                                                            *
| ******************************************************************************
|
|Rt_CpSt Rt_C/TB                                                          Dsct_20
| I0009    I0010                                                           O0052
+--]/[-----]/[-------------------------------------------------------------(  )
|
```

```
:
: << RUNG    18 >>
:
: ****************************************************************************
: *                                                                          *
: *                                                                          *
: *       Inputs 8,7,6, and 5 utilize the Discrete Commands to latch         *
: *       and unlatch the Preset Comparison States of the four HSC           *
: *       Outputs.                                                           *
: *                                                                          *
: *       I5      Latch_1      Latch HSC Ouput 1                             *
: *       I6      Latch_2      Latch HSC Ouput 2                             *
: *       I7      Latch_3      Latch HSC Ouput 3                             *
: *       I8      Latch_4      Latch HSC Ouput 4                             *
: *       047     Dsct_15      Discrete Data__HSC Output Bit 15              *
: *       048     Dsct_16      Discrete Data__HSC Output Bit 16              *
: *       049     Dsct_17      Discrete Data__HSC Output Bit 17              *
: *       050     Dsct_18      Discrete Data__HSC Output Bit 18              *
: *                                                                          *
: *                                                                          *
: ****************************************************************************
:
:Latch_4                                                                Dsct_18
: I0008                                                                  O0050
+--] [-------------------------------------------------------------------(   )
:
:
: << RUNG    19 >>
:
:Latch_3                                                                DatByt2
: I0007                                                                  O0049
+--] [-------------------------------------------------------------------(   )
:
:
: << RUNG    20 >>
:
:Latch_2                                                                Dsct_16
: I0006                                                                  O0048
+--] [-------------------------------------------------------------------(   )
:
:
: << RUNG    21 >>
:
:Latch_1                                                                Dsct_15
: I0005                                                                  O0047
+--] [-------------------------------------------------------------------(   )
:
```

```
|
| << RUNG    22 >>
|
| ******************************************************************************
| *                                                                            *
| *       Input 4 will reset the accumulate count register in the HSC          *
| *       to its lower limit.                                                  *
| *                                                                            *
| *       I4      RstLoLm      Rst Accumulate Register To Lower Limit          *
| *       051     Dsct_19      Discrete Data__HSC Output Bit 19                *
| *                                                                            *
| ******************************************************************************
|
|RstLoLm                                                                  Dsct_19
| I0004                                                                    O0051
+--] [------------------------------------------------------------------------( )
|
|
| << RUNG    23 >>
|
| ******************************************************************************
| *                                                                            *
| *       Input 3 sends Command 5 (Abort Home Command) to the HSC.             *
| *                                                                            *
| *       I3      AbrtHme      Abort Home Search                               *
| *       033     CmdByte      HSC Command Byte                                *
| *       049     DatByt2      HSC 2nd Data Byte/and 3rd Data Byte             *
| *                                                                            *
| *                                                                            *
| ******************************************************************************
|
|AbrtHme                   CmdByte                    DatByt2
| I0003    Const            O0033    Const             O0049
+--] [---[  A      MOVE      B ]-[    A      MOVE       B ]-                 ( )
|         +00005                   +00000
```

```
:
: << RUNG    24 >>
:
: ******************************************************************************
: *                                                                            *
: *      When Input 2 is on it performs multiple functions. In the             *
: *      1st Scan after the input is actived Command 6 is issued to            *
: *      clear the Power-Up Bit. In the 2nd Scan the Subroutine is             *
: *      activated which downloads the commands stored in the                  *
: *      Register Table.                                                       *
: *                                                                            *
: *      I2      Ld_Cmds     Clear Power Up Bit/Download Data to HSC           *
: *      O33     CmdByte     HSC Command Byte                                  *
: *      O201    ClPwrBt     One Shot To Clear Power Up Bit                    *
: *      O202    InitDld     One Shot To Initiate Register Download            *
: *                                                                            *
: *                                                                            *
: ******************************************************************************
:
:Ld_Cmds                                                                ClPwrBt
: I0002                                                                  O0201
+--] [-----------------------------------------------------------------------(OS)
:
:
: << RUNG    25 >>
:
:ClPwrBt                       CmdByte
: O0201    Const                O0033
+--] [---[   A      MOVE       B ]-                                      (   )
:         +00006
:
: << RUNG    26 >>
:
:ClPwrBt                                                                InitDld
: O0201                                                                  O0202
+--]/[-----------------------------------------------------------------------(OS)
:
```

```
|
| << RUNG    27 >>
|
| ******************************************************************************
| *                                                                            *
| *       0232 and 0231 are flags that are turned on when the last            *
| *       register in the Register Table has been downloaded to the           *
| *       HSC. When 0232 and 0231 are on the Subroutine ceases operation.     *
| *                                                                            *
| *       0202     InitDld     One Shot To Initiate Register Download         *
| *       0203     Dld_On      Register Download In Progress                  *
| *       0204     Dld_Off     Register Table Download Complete               *
| *       0231     EOTble1     Flag 1_End Of Register Table                   *
| *       0232     EOTble2     Flag 2_End Of Register Table                   *
| *       R14      Srtch_3     Scratch Register                               *
| *       R24      Reg_Ptr     Pointer For Register Table                     *
| *                                                                            *
| ******************************************************************************
|
|EOTble2                                                                 Dld_Off
| 00232                                                                   00204
+--] [--+-----------------------------------------------------------------(OS)
|       |
|EOTble1|
| 00231 |
+--] [--+
|
|
| << RUNG    28 >>
|
|InitDld                    Reg_Ptr                                      Dld_On
| 00202    Const             R0024                                        00203
+--] [---[   A      MOVE       B ]------------------------------[LATCH]---( L)
|         +00000                                                         (  )
|Dld_Off                                                                 (  )
| 00204                                                                  (  )
+--] [--------------------------------------------------------------------(UL)
|
|
| << RUNG    29 >>
|
|Dld_On                     Srtch_3                        Srtch_3
| 00203    Const             R0014                Const     R0014
+--] [---[   A      MOVE       B ]-[ DO SUB         N     REPS ]-             (  )
|         +00001                                 001
```

```
 :
 : << RUNG    30 >>
 :
 : ******************************************************************************
 : *                                                                            *
 : *       Toggle Switch Input 1 resets the Preset Registers, the               *
 : *       Discrete Commands, and the HSC Outputs. (The Power-Up                *
 : *       Bit is also set when Command 1 is sent.)                             *
 : *                                                                            *
 : *       I1     Reset     Reset the High Speed Counter Module                 *
 : *       O33    CmdByte   HSC Command Byte                                    *
 : *                                                                            *
 : *                                                                            *
 : ******************************************************************************
 :
 : Reset                          CmdByte
 : I0001    Const                  O0033
 +---] [---[    A       MOVE        B ]-                                   (    )
 :         +00001
 :
 : << RUNG    31 >>
 :
 :
 :
 +[NO OP]-                                                                 (    )
 :
 :
 : << RUNG    32 >>
 :
 : ******************************************************************************
 : *                                                                            *
 : *       Input 36 (Status Byte Bit 4) energizes O1 (Simulator LED             *
 : *       Ouput 1) whenever the HSC count is enabled.                          *
 : *                                                                            *
 : *       I36       EnblBit      Status Byte Bit 4                             *
 : *       O1        CntEnbl      Counting Is Enabled                           *
 : *                                                                            *
 : ******************************************************************************
 :
 :EnblBit                                                                  CntEnbl
 : I0036                                                                    O0001
 +--] [--------------------------------------------------------------------(    )
 :
```

```
|
| << RUNG   33 >>
|
| ****************************************************************************
| *                                                                          *
| *      After the Register Table is downloaded to the HSC and              *
| *      the Power-Up Bit has been cleared Simulator LED Ouput 2            *
| *      is energized.                                                      *
| *                                                                          *
| *      I34      PwrUpBt      Status Byte Bit 2_Power Up Bit               *
| *      O2       DldCmpt      Power Up Bit Clear & Download Complete       *
| *      O203     Dld_On       Register Download Complete                   *
| *                                                                          *
| ****************************************************************************
|
|PwrUpBt  Dld_On                                                      DldCmpt
| I0034    O0203                                                        O0002
+--]/[-----]/[-------------------------------------------------------------(  )
|
|
| << RUNG   34 >>
|
| ****************************************************************************
| *                                                                          *
| *      This rung will turn off Simulator LED Ouput 3 whenever             *
| *      the External Power Supply is out of tolerance.                     *
| *                                                                          *
| *      I35      PS_Stat      Status Byte Bit 3_Power Supply Status        *
| *      O3       Ext_PS       External Power Supply Status Indicator       *
| *                                                                          *
| ****************************************************************************
|
|PS_Stat                                                               Ext_PS
| I0035                                                                 O0003
+--]/[---------------------------------------------------------------------(  )
|
```

```
:
: << RUNG   35 >>
:
: ****************************************************************************
: *                                                                          *
: *      When the "Return Data Type" input points indicate an error          *
: *      condition Simulator LED Output 4 turns on and the Simulator         *
: *      displays the error code.                                            *
: *                                                                          *
: *      I38      DatTyp1      Status Byte Bit 6_Return Data Type            *
: *      I39      DatTyp2      Status Byte Bit 7_Return Data Type            *
: *      I40      DatTyp3      Status Byte Bit 8_Return Data Type            *
: *      I41      1stRtDB      HSC 1st Return Data Byte                      *
: *      O4       Error        Error Condition Exists                        *
: *      O17      SimDply      Simulator BCD Display                         *
: *      R74      RtDta12      1st & 2nd Data Bytes HSC Return Data          *
: *                                                                          *
: ****************************************************************************
:
:DatTyp1 DatTyp2 DatTyp3                  RtDta12                      Error
: I0038   I0039   I0040   Const            R0074                       O0004
+--]/[-----]/[-----] [---[   A      MOVE      B ]-------------------------( )
:                         +00000
:
: << RUNG   36 >>
:
:DatTyp1 DatTyp2 DatTyp3 1stRtDB          RtDta12 RtDta12 SimDply
: I0038   I0039   I0040   I0041            R0074   R0074   O0017
+--]/[-----]/[-----] [---[  MOVE RIGHT 8 BITS  ]-[ BIN  TO BCD ]-        ( )
:
:
: << RUNG   37 >>
:
: ****************************************************************************
: *                                                                          *
: *      This rung will energize Simulator LED Ouput 9 whenever              *
: *      a negative accumulate count value is returned to the S6             *
: *      CPU.                                                                *
: *                                                                          *
: *      I64      NumSign      HSC Return Data_Input Bit 32/Sign Bit         *
: *      O9       Neg_Num      Number on Simulator Display is Negative       *
: *      R17      Srtch_4      Scratch Register                              *
: *                                                                          *
: ****************************************************************************
:
:NumSign                   Srtch_4 Srtch_4 Srtch_4                     Neg_Num
: I0064   Const             R0017   R0017   R0017   Const              O0009
+--] [---[   A      MOVE      B ]-[   A INV   B      LEN ]-----------------( )
:        +00000                                      001
```

```
|
| << RUNG   38 >>
|
| ****************************************************************************************
| *                                                                                      *
| *      After the "Invert" Instruction is executed on R17 this                          *
| *      rung performs a sign extension on R75 to convert the 3 bytes                    *
| *      of HSC Return Data into 4 bytes of S6 Double Precision Data                     *
| *      (R74 and R75). The value in R74 is then converted to a positive                 *
| *      4 digit BCD number to be displayed on the I/O Simulator.                        *
| *                                                                                      *
| *      I38      DatTyp1      Status Byte Bit 6_Return Data Type                        *
| *      I39      DatTyp2      Status Byte Bit 7_Return Data Type                        *
| *      I40      DatTyp3      Status Byte Bit 8_Return Data Type                        *
| *      I41      1stRtDB      HSC 1st Return Data Byte                                  *
| *      I64      NumSign      HSC Return Data_Input Bit 32/Sign Bit                     *
| *      O17      SimDply      Simulator BCD Display                                     *
| *      R17      Srtch_4      Scratch Register                                          *
| *      R18      Srtch_5      Scratch Register                                          *
| *      R74      RtDta12      1st & 2nd Data Bytes HSC Return Data                      *
| *      R75      RtDta3       3rd Data Byte HSC Return Data                             *
| *                                                                                      *
| ****************************************************************************************
|
|1stRtDB RtDta12 3rdRtDB          RtDta3  NumSign Srtch_4          RtDta3
| I0041   R0074   I0057            R0075   I0064   R0017            R0075
+[ I/O  TO REG ]-[    A      MOVE       B ]---] [---[  MOVE LEFT  8 BITS  ]-   (   )
|
|
| << RUNG   39 >>
|
|NumSign          1stRtDB Srtch_5
| I0064   Const   I0041   R0018
+--] [---[    A SUBX  B  =    C ]-                                              (   )
|        +00000
|
| << RUNG   40 >>
|
|NumSign 1stRtDB          Srtch_5
| I0064   I0041            R0018
+--]/[---[    A      MOVE      B ]-                                             (   )
|
|
| << RUNG   41 >>
|
|DatTyp1 DatTyp2 DatTyp3 Srtch_5 SimDply
| I0038   I0039   I0040   R0018   O0017
+--]/[-----]/[-----]/[---[ BIN  TO BCD ]-                                       (   )
|
|
| << RUNG   42 >>
|
|
|
+[NO OP]-                                                                       (   )
|
```

```
|
| << RUNG   43 >>
|
| ***************************************************************************
| *                                                                         *
| *                                                                         *
| *              >>>>>>>>>>     BEGIN SUBROUTINE     <<<<<<<<<<             *
| *                                                                         *
| *                                                                         *
| *      The remainder of the program is the subrouitine which performs    *
| *      the actual loading of the HSC with the Command Data that is       *
| *      stored in the Register Table.                                      *
| *                                                                         *
| ***************************************************************************
|
|
|
+[ENDSW]-
|
|
| << RUNG   44 >>
|
| ***************************************************************************
| *                                                                         *
| *      The "Table To Destination" Instruction in this rung moves          *
| *      the Command Byte pointed to by the pointer (R24) into R21.         *
| *      A check is performed by the instruction which energizes 0231       *
| *      when the register pointer reaches the end of the Register          *
| *      Table. If 0231 is on subroutine execution ends.                    *
| *                                                                         *
| *      0231    EOTble1     Flag 1_End Of Register Table                   *
| *      R21     Stor_CB     Storage For Command Byte                       *
| *      R24     Reg_Ptr     Pointer For Register Table                     *
| *                                                                         *
| ***************************************************************************
|
|Reg_Ptr Stor_CB                                                     EOTble1
| R0024   R0021   Const                                               00231
+[TABLE-TO-DEST    LEN]-------------------------------------------------(   )
|                  040
```

```
:
: << RUNG    45 >>
:
: ****************************************************************************
: *                                                                          *
: *       The next 26 rungs of logic check for commands that do not          *
: *       require any Data Bytes.                                            *
: *                                                                          *
: *       0205      0_Dtcd      Zero Value In Register Detected              *
: *       0206      Cm01Dtd     Command 1 Detected                           *
: *       0207      Cm02Dtd     Command 2 Detected                           *
: *       0208      Cm04Dtd     Command 4 Detected                           *
: *       0209      Cm05Dtd     Command 5 Detected                           *
: *       0210      Cm06Dtd     Command 6 Detected                           *
: *       0211      Cm48Dtd     Command 48 Detected                          *
: *       0212      Cm49Dtd     Command 49 Detected                          *
: *       0213      Cm50Dtd     Command 50 Detected                          *
: *       0214      Cm51Dtd     Command 51 Detected                          *
: *       0215      Cm52Dtd     Command 52 Detected                          *
: *       0216      Cm53Dtd     Command 53 Detected                          *
: *       0217      Cm54Dtd     Command 54 Detected                          *
: *       0218      Cm55Dtd     Command 55 Detected                          *
: *       0219      Cm56Dtd     Command 56 Detected                          *
: *       0220      Cm57Dtd     Command 57 Detected                          *
: *       0221      Cm58Dtd     Command 58 Detected                          *
: *       0222      Cm59Dtd     Command 59 Detected                          *
: *       0223      Cm64Dtd     Command 64 Detected                          *
: *       0224      Cm65Dtd     Command 65 Detected                          *
: *       0225      Cm66Dtd     Command 66 Detected                          *
: *       0226      Cm67Dtd     Command 67 Detected                          *
: *       0227      Cm68Dtd     Command 68 Detected                          *
: *       R21       Stor_CB     Storage For Command Byte                     *
: *       R22       Srtch_7     Scratch Register                             *
: *                                                                          *
: ****************************************************************************
:
:                    Srtch_7 Srtch_7 Stor_CB                           0_Dtcd
: Const               R0022   R0022   R0021                             00205
+[    A      MOVE       B ]-[    A   :     B ]--------------------------------( )
:+00000
:
: << RUNG    46 >>
:
:                    Srtch_7 Srtch_7 Stor_CB                          Cm01Dtd
: Const               R0022   R0022   R0021                             00206
+[    A      MOVE       B ]-[    A   :     B ]--------------------------------( )
:+00001
:
: << RUNG    47 >>
:
:                    Srtch_7 Srtch_7 Stor_CB                          Cm02Dtd
: Const               R0022   R0022   R0021                             00207
+[    A      MOVE       B ]-[    A   :     B ]--------------------------------( )
:+00002
```

```
|
| << RUNG   48 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm04Dtd
| Const               R0022   R0022   R0021                                          00208
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00004
|
| << RUNG   49 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm05Dtd
| Const               R0022   R0022   R0021                                          00209
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00005
|
| << RUNG   50 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm06Dtd
| Const               R0022   R0022   R0021                                          00210
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00006
|
| << RUNG   51 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm48Dtd
| Const               R0022   R0022   R0021                                          00211
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00048
|
| << RUNG   52 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm49Dtd
| Const               R0022   R0022   R0021                                          00212
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00049  .
|
| << RUNG   53 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm50Dtd
| Const               R0022   R0022   R0021                                          00213
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00050
|
| << RUNG   54 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm51Dtd
| Const               R0022   R0022   R0021                                          00214
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00051
|
| << RUNG   55 >>
|
|                    Srtch_7 Srtch_7 Stor_CB                                        Cm52Dtd
| Const               R0022   R0022   R0021                                          00215
+[    A      MOVE        B ]-[    A   :     B ]-------------------------------------(   )
|+00052
```

```
!
! << RUNG    56 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm53Dtd
! Const              R0022   R0022   R0021                                    00216
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00053
!
! << RUNG    57 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm54Dtd
! Const              R0022   R0022   R0021                                    00217
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00054
!
! << RUNG    58 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm55Dtd
! Const              R0022   R0022   R0021                                    00218
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00055
!
! << RUNG    59 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm56Dtd
! Const              R0022   R0022   R0021                                    00219
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00056
!
! << RUNG    60 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm57Dtd
! Const              R0022   R0022   R0021                                    00220
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00057
!
! << RUNG    61 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm58Dtd
! Const              R0022   R0022   R0021                                    00221
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00058
!
! << RUNG    62 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm59Dtd
! Const              R0022   R0022   R0021                                    00222
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00059
!
! << RUNG    63 >>
!
!                   Srtch_7 Srtch_7 Stor_CB                                  Cm64Dtd
! Const              R0022   R0022   R0021                                    00223
+[    A      MOVE       B ]-[    A   :     B ]-----------------------------------( )
!+00064
```

```
:
: << RUNG    64 >>
:
:                    Srtch_7 Srtch_7 Stor_CB                                      Cm65Dtd
: Const               R0022   R0022   R0021                                        O0224
+[    A      MOVE        B ]-[    A   :      B ]-------------------------------------(   )
:+00065
:
: << RUNG    65 >>
:
:                    Srtch_7 Srtch_7 Stor_CB                                      Cm66Dtd
: Const               R0022   R0022   R0021                                        O0225
+[    A      MOVE        B ]-[    A   :      B ]-------------------------------------(   )
:+00066
:
: << RUNG    66 >>
:
:                    Srtch_7 Srtch_7 Stor_CB                                      Cm67Dtd
: Const               R0022   R0022   R0021                                        O0226
+[    A      MOVE        B ]-[    A   :      B ]-------------------------------------(   )
:+00067
:
: << RUNG    67 >>
:
:                    Srtch_7 Srtch_7 Stor_CB                                      Cm68Dtd
: Const               R0022   R0022   R0021                                        O0227
+[    A      MOVE        B ]-[    A   :      B ]-------------------------------------(   )
:+00068
```

```
:
: << RUNG    68 >>
:
:O_Dtcd  Cm01Dtd                                                                    O_Dtcd1
: 00205   00206                                                                      00228
+--]/[--+--] [--+-------------------------------------------------------------------( )
:       :       :
:       :Cm02Dtd:
:       : 00207 :
+       +--] [--+
:       :       :
:       :Cm04Dtd:
:       : 00208 :
+       +--] [--+
:       :       :
:       :Cm05Dtd:
:       : 00209 :
+       +--] [--+
:       :       :
:       :Cm06Dtd:
:       : 00210 :
+       +--] [--+
:       :       :
:       :Cm48Dtd:
:       : 00211 :
+       +--] [--+
:       :       :
:       :Cm49Dtd:
:       : 00212 :
+       +--] [--+
:       :       :
:       :Cm50Dtd:
:       : 00213 :
+       +--] [--+
:
```

```
|
| << RUNG    69 >>
|
|O_Dtcd  Cm51Dtd                                                                   O_Dtcd2
| 00205   00214                                                                     00229
+--]/[--+--] [--+-------------------------------------------------------------------( )
|       |       |
|       |Cm52Dtd|
|       | 00215 |
+       +--] [--+
|       |       |
|       |Cm53Dtd|
|       | 00216 |
+       +--] [--+
|       |       |
|       |Cm54Dtd|
|       | 00217 |
+       +--] [--+
|       |       |
|       |Cm55Dtd|
|       | 00218 |
+       +--] [--+
|       |       |
|       |Cm56Dtd|
|       | 00219 |
+       +--] [--+
|       |       |
|       |Cm57Dtd|
|       | 00220 |
+       +--] [--+
|       |       |
|       |Cm58Dtd|
|       | 00221 |
+       +--] [--+
|
```

```
|
| << RUNG    70 >>
|
| ******************************************************************************
| *                                                                            *
| *      IF a Zero Data Byte Command is detected the Data Byte                 *
| *      storage registers (R22and R23) are cleared.                           *
| *                                                                            *
| *      0205     0_RgVal      Zero Value In Register Detected                 *
| *      0223     Cm64Dtd      Command 64 Detected                             *
| *      0224     Cm65Dtd      Command 65 Detected                             *
| *      0225     Cm66Dtd      Command 66 Detected                             *
| *      0226     Cm67Dtd      Command 67 Detected                             *
| *      0227     Cm68Dtd      Command 68 Detected                             *
| *      0228     0_Dtcd1      Flag 1_Zero Data Byte Detected                  *
| *      0229     0_Dtcd2      Flag 2_Zero Data Byte Detected                  *
| *      0230     0_Dtcd3      Flag 3_Zero Data Byte Detected                  *
| *      R22      Srtch_7      Scratch Register/1st and 2nd Data Bytes         *
| *      R23      3rd_DB       Storage For 3rd Data Byte                       *
| *                                                                            *
| ******************************************************************************
|
|0_Dtcd  Cm59Dtd                  Srtch_7                     3rd_DB         0_Dtcd3
| 00205   00222   Const           R0022    Const              R0023           00230
+--]/[--+--] [--+[    A      MOVE      B ]-[    A      MOVE     B ]------------(   )
|       |       |+00000                  +00000
|       |Cm64Dtd|
|       | 00223 |
+       +--] [--+
|       |       |
|       |Cm65Dtd|
|       | 00224 |
+       +--] [--+
|       |       |
|       |Cm66Dtd|
|       | 00225 |
+       +--] [--+
|       |       |
|       |Cm67Dtd|
|       | 00226 |
+       +--] [--+
|       |       |
|       |Cm68Dtd|
|       | 00227 |
+       +--] [--+
|       |       |
|       |0_Dtcd1|
|       | 00228 |
+       +--] [--+
|       |       |
|       |0_Dtcd2|
|       | 00229 |
+       +--] [--+
|
```

```
|
| << RUNG   71 >>
|
| ********************************************************************************
| *                                                                              *
| *      If the Command Byte is non-zero and is not a Zero Data Byte             *
| *      Command the following rung of logic moves the 1st and 2nd               *
| *      Data Bytes out of the Register Table and into Data Byte                 *
| *      Storage Register R22.                                                   *
| *                                                                              *
| *      0205      O_RgVal      Zero Value In Register Detected                  *
| *      0230      O_Dtcd3      Flag 3_Zero Data Byte Detected                   *
| *      R22       Srtch_7      Scratch Register/1st and 2nd Data Bytes          *
| *      R23       3rd_DB       Storage For 3rd Data                             *
| *                                                                              *
| ********************************************************************************
|
|O_Dtcd  O_Dtcd3 Reg_Ptr Srtch_7
| 00205   00230   R0024   R0022   Const
+--]/[-----]/[---[TABLE-TO-DEST    LEN]-                                  (   )
|                                  040
|
| << RUNG   72 >>
|
| ********************************************************************************
| *                                                                              *
| *      If the Command Byte is non-zero and is not a Zero Data Byte             *
| *      Command the 3rd Data Byte is transferred from the Register              *
| *      Table to R23. If the pointer (R24) rests at the last register           *
| *      in the table 0232 is energized which terminates the download            *
| *      subroutine.                                                             *
| *                                                                              *
| *      0205      O__RgVal     Zero Value In Register Detected                  *
| *      0230      O_Dtcd3      Flag 3_Zero Data Byte Detected                   *
| *      R23       3rd_DB       Storage For 3rd Data Byte                        *
| *      R24       Reg_Ptr      Pointer For Register Table                       *
| *                                                                              *
| ********************************************************************************
|
|O_Dtcd  O_Dtcd3 Reg_Ptr 3rd_DB                                          EOTble2
| 00205   00230   R0024   R0023   Const                                    00232
+--]/[-----]/[---[TABLE-TO-DEST    LEN]-----------------------------------(   )
|                                  040
```

```
|
| << RUNG   73 >>
|
| ************************************************************************
| *                                                                      *
| *      If the Command Byte is non-zero the Command located in          *
| *      R21 with data (R22 and R23) are downloaded to the HSC.          *
| *                                                                      *
| *      033      CmdByte       HSC Command Byte                         *
| *      041      DatByt1       HSC 1st Data Byte/and 2nd Data Byte      *
| *      057      DatByt3       HSC 3rd Data Byte                        *
| *      R21      Stor_CB       Storage For Command Byte                 *
| *      R22      Srtch_7       Scratch Register/1st and 2nd Data Bytes  *
| *                                                                      *
| ************************************************************************
|
|O_Dtcd  Stor_CB CmdByte Srtch_7 DatByt1 3rd_DB           DatByt3
| 00205   R0021   00033   R0022   00041   R0023            00057
+--]/[---[ REG  TO I/O ]-[ REG  TO I/O ]-[  MOVE RIGHT 8 BITS  ]-        (  )
|
|
| << RUNG   74 >>
|
|
|
+[NO OP]-                                                                (  )
|
|
| << RUNG   75 >>
|
| ************************************************************************
| *                                                                      *
| *      If CB = 35 Simulator LED Ouputs 013 to 016 are updated to       *
| *      reflect their corresponding Preset Comparison Senses.           *
| *                                                                      *
| *      013      01CmpSe       HSC Ouput 1 Preset Comparison Sense      *
| *      014      02CmpSe       HSC Ouput 2 Preset Comparison Sense      *
| *      015      03CmpSe       HSC Ouput 3 Preset Comparison Sense      *
| *      016      04CmpSe       HSC Ouput 4 Preset Comparison Sense      *
| *      049      DatByt2       HSC 2nd Data Byte/Bit 17                 *
| *      050      Dsct_18       Discrete Data_HSC Output Bit 18          *
| *      051      Dsct_19       Discrete Data_HSC Output Bit 19          *
| *      052      Dsct_20       Discrete Data_HSC Output Bit 20          *
| *      0205     O_RgVal       Zero Value In Register Detected          *
| *      0230     O_Dtcd3       Flag 3_Zero Data Byte Detected           *
| *      0233     UpDtOut       If CB=35 Update Corresponding Outputs    *
| *                                                                      *
| ************************************************************************
|
|O_Dtcd  O_Dtcd3                 Srtch_1 Srtch_1 Stor_CB            UpDtOut
| 00205   00230   Const           R0012   R0012   R0021              00233
+--]/[-----]/[---[   A     MOVE     B ]-[   A   :    B ]----------------(OS)
|                  +00035
```

```
|
| << RUNG    76 >>
|
|UpDtOut  DatByt2                                                         01CmpSe
| 00233    00049                                                           00013
+--] [-----] [--------------------------------------------------------[LATCH]---( L)
|                                                                           (  )
|UpDtOut  DatByt2                                                           (  )
| 00233    00049                                                            (  )
+--] [-----]/[--------------------------------------------------------------(UL)
|
|
| << RUNG    77 >>
|
|UpDtOut  Dsct_18                                                         02CmpSe
| 00233    00050                                                           00014
+--] [-----] [--------------------------------------------------------[LATCH]---( L)
|                                                                           (  )
|UpDtOut  Dsct_18                                                           (  )
| 00233    00050                                                            (  )
+--] [-----]/[--------------------------------------------------------------(UL)
|
|
| << RUNG    78 >>
|
|UpDtOut  Dsct_19                                                         03CmpSe
| 00233    00051                                                           00015
+--] [-----] [--------------------------------------------------------[LATCH]---( L)
|                                                                           (  )
|UpDtOut  Dsct_19                                                           (  )
| 00233    00051                                                            (  )
+--] [-----]/[--------------------------------------------------------------(UL)
|
|
| << RUNG    79 >>
|
|UpDtOut  Dsct_20                                                         04CmpSe
| 00233    00052                                                           00016
+--] [-----] [--------------------------------------------------------[LATCH]---( L)
|                                                                           (  )
|UpDtOut  Dsct_20                                                           (  )
| 00233    00052                                                            (  )
+--] [-----]/[--------------------------------------------------------------(UL)
|
|
| << RUNG    80 >>
|
|
|
+[    Return     ]-
|
```

```
 |
 | << RUNG    81 >>
 |
 |
 |
 +[ENDSW]-
 |
 |
 | << RUNG    82 >>
 |
 |
 |
 +[ENDSW]-
 |
```

ORDERING INFORMATION

Equipment	Catalog Number
Circuit Board without Faceplate	IC600YB827A
Faceplate	IC600FP827A
Circuit Board with Faceplate	IC600BF827A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

FEBRUARY, 1985

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83546C

HIGH-DENSITY INPUT MODULE
WITH STATUS INDICATORS

GENERAL DESCRIPTION

The High-Density Input module can be utilized in an I/O Rack, in any of the I/O slots in a Model 60 Central Processor Unit (CPU), or a Series Six Plus CPU to provide a compact, optically-isolated interface between the Series Six backplane I/O bus and Field Digital Circuitry (TTL mode) or input devices (10-50 V mode). The High-Density Input module features and benefits are summarized in Table 1.

This module provides 32 inputs divided into four groups of eight inputs each. All 32 inputs (four groups) are normally updated in the course of one I/O scan.

There is a common ground (or return) point provided for all 32 input points.

By placement of a jumper on the circuit board, the user can select the input data to be sink (active low) or source (active high). The placement of a second jumper allows the data being sent to the CPU to be inverted (complemented) or non-inverted. Two Light-Emitting Diode (LED) indicators identify the selected modes. A third jumper selects the voltage level of the user power supply: 5 volts or 10 to 50 volts. When operating in the TTL mode, the 5 V power supply must be used. Dual-In-line Package (DIP) switches on the circuit board allow the selection of 50 microsecond or 10 millisecond time delays on an individual basis for each input. Hysteresis of approximately 10% of supply voltage provides better noise immunity even with the filter switched off.

Refer to figure 1 for High-Density Input module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Three user-selectable input modes: TTL Levels 10-50 V dc (sink) 10-50 V dc (source)	Can be used with standard logic circuitry, or sense other DC levels.
32 input points per module	Low cost per input point. More efficient use of I/O-rack space.
Selectable on-delay and off-delay times of: • 50 microseconds • 10 milliseconds	Fast response for time-critical applications. Greater filtering for higher noise environments.
APPLICATIONS Interface to CPU from: Instruments with TTL outputs Current-sinking DC devices Current-sourcing DC devices Compact I/O system. Example: operator's devices where low cost inputs and high density is required.	

Dimensions:

Circuit Board: 8.15 x 11.0 (inches) 208 x 280 (mm)

Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)

Storage Temperature: -20C to +80C

Operating Temperature: 0C to + 60°C at outside of rack.

Humidity: 5% to 95% (non-condensing)

Altitude: Up to 10,000 feet above sea level (operating)

Isolation: Series Six common to user common
2000 V dc for one second (maximum)
240 V ac 50/60Hz continuous (maximum)
Rate of change (noise immunity) 500 V/microsecond (maximum)

Power Requirements:
Supplied by I/O rack or Series 60 rack:
+ 5 V dc, 200 mA maximum or 4 power units
Ref. Chapter 2, section 2, I/O module load, Installation and Maintenance Manual, GEK-25361A.

User supplied power:
TTL Mode: + 5 ± 0.25 V dc including ripple of 0.25 V
Power used by module - 1.5 Watts with LEDs

10-50 V Mode: 10 V dc to 50 V dc including ripple.
Ripple < ± 2 volts at 50/60 Hz.
Power used by module - 4.0 Watts with LEDs

Input Requirements:

Switching Thresholds:

	ON STATE	OFF STATE	HYSTERESIS
TTL Mode:	< 0.8 Volts	> 2.0 Volts	0.9 Volts
10-50V Sink Mode:	< 40% V supplied	> 70% V supplied	10% V supplied
10-50V Source Mode:	> 70% V supplied	< 40% V supplied	10% V supplied

Input Impedance: 15,000 ohms

Response Time:
50 microseconds (Filter out)
10 milliseconds (Filter in)

FIGURE 1. SPECIFICATIONS

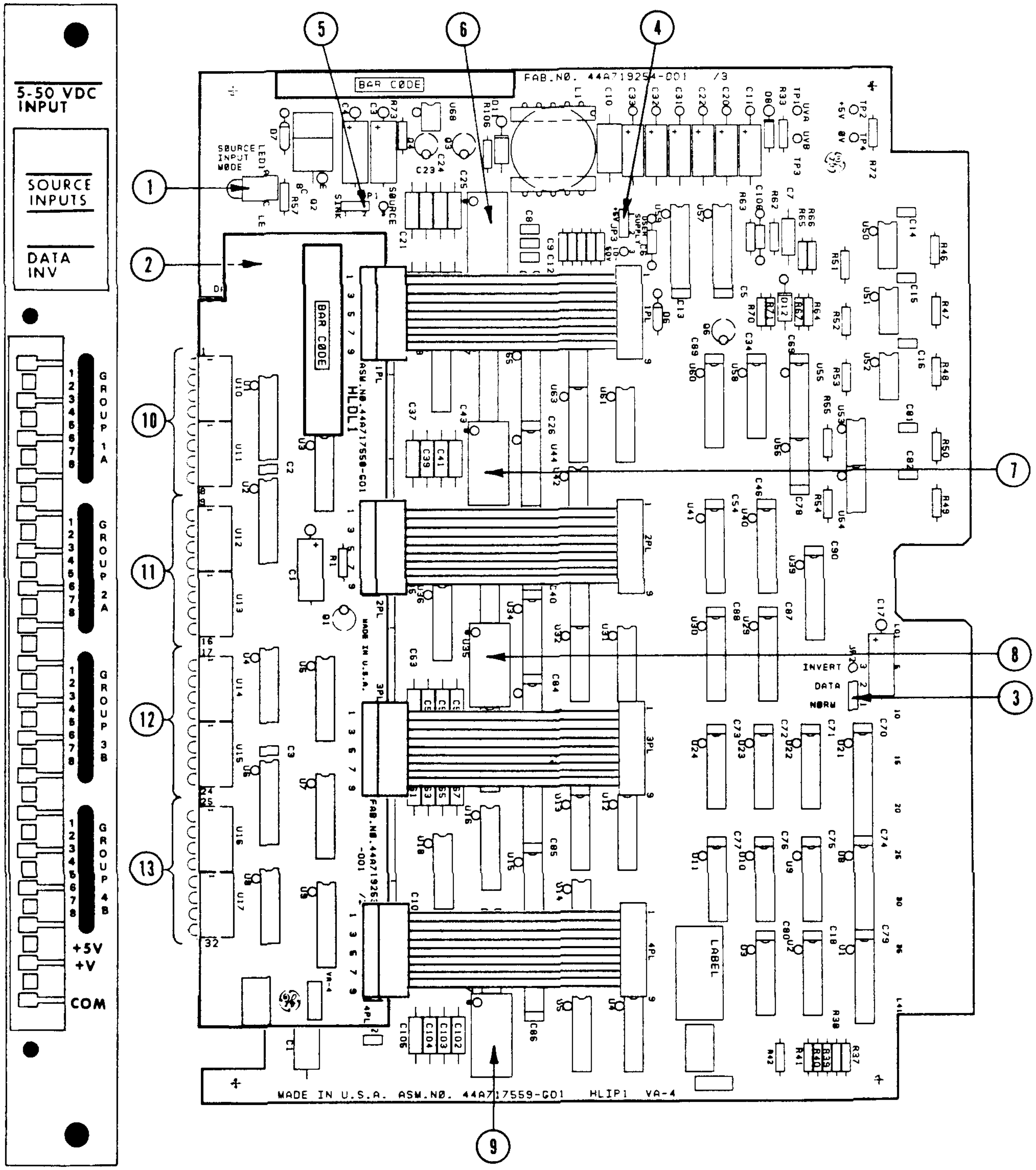


FIGURE 2A. USER ITEMS (Part 1 of 2)
High Density Input Module With Status Indicator Lights

(1) LED Indicator
ON: Source Input mode
OFF: Sink Input mode

(2) LED Indicator
ON: Input Data Inverted
OFF: Input Non-Inverted

(3) Jumper JP2 : 1-2 Position Data Normal
2-3 Position Data Invert

(4) Jumper JP3 : 1-2 Position 5V user supply
2-3 Position 10-50V user supply

(5) Jumper JP1 : 1-2 Position Sink Mode
2-3 Position Source Mode

Selectable Filter-DIP Switches

Switch OPEN: 50 microseconds delay on Input switch in OPEN position (depressed toward front of module).

Selectable Filter-DIP Switches (continued)

Switch CLOSED: 10 milliseconds delay on input.

KEY	GROUP	INPUTS	SWITCHES
(6)	1	1 through 8	1 through 8
(7)	2	1 through 8	1 through 8
(8)	3	1 through 8	1 through 8
(9)	4	1 through 8	1 through 8

LEDs - Illuminated when current flowing at input terminal.

KEY	GROUP	INPUTS	LEDs
(10)	1	1 through 8	1 through 8
(11)	2	1 through 8	9 through 16
(12)	3	1 through 8	17 through 24
(13)	4	1 through 8	25 through 32

FIGURE 2B. USER ITEMS (Part 2 of 2)

INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1- 32						353-384		X		X	X	705-736	X		X	X	
33- 64					X	385-416		X	X			737-768	X		X	X	X
65- 96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024 (NOT USED)	X	X	X	X	X
321-352		X		X		673-704	X		X		X						

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left)

Switches No. 1 and No. 2 should be in CLOSED Position

FIGURE 3. DIP SWITCH SETTINGS

INSTALLATION

The High-Density Input module can be installed in an I/O Rack in a Model 60 CPU Rack or in a Series Six Plus CPU Rack. Before installing the module, the Dual-In-Line Package (DIP) switches immediately behind the card slot on the rack backplane should be set to reserve 32 consecutive input points in the Input Status Table of the CPU. For specific DIP switch settings, refer to figure 3.

The circuit-board jumpers must also be set to configure the module to operate in the desired system configuration. For example: sink or source, invert or non-invert, TTL or lo-50 volt inputs. Refer to figure 2, User Items and appropriate figure 5, 6 or 7.

NOTE

Jumper JP3 must be set correctly for the voltage in use. See figures 5, 6, and 7. Failure to set JP3 to the correct position may prevent module from operating.

The ON state of an input *point,* as defined in figure 1, results in a “1” being loaded into the Input Status Table with the module in the non-inverting mode; an input in the OFF state results in a “0” being loaded into the Input Status Table.

If input connections for 10 to 5OV modes shown in figures 6 and 7 are used, a closed switch turns the input ON; an open switch turns the input OFF. In the absence of user power, all inputs will appear to be in the OFF state.

It is recommended that the extraction/insertion tool furnished with the CPU be used to remove or install the circuit boards. With the board in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that proper contact is made. The faceplate can then be secured to the rack using the thumbscrews at the top and bottom.

Refer to figures 4 for a typical symbolic input circuit.

Refer to figures 5, 6 and 7 for Typical User Input connections to this module. In the TTL mode of operation, the low (negative) side of each of the TTL inputs must be returned to the Module Common (COM) terminal Pin 34.

NOTE

Set Jumper JP3 correctly as follows:

VOLTAGE	TO PIN	SET JP3
5V	33 & 34	1-2
1o-5ov	34 ONLY	2-3

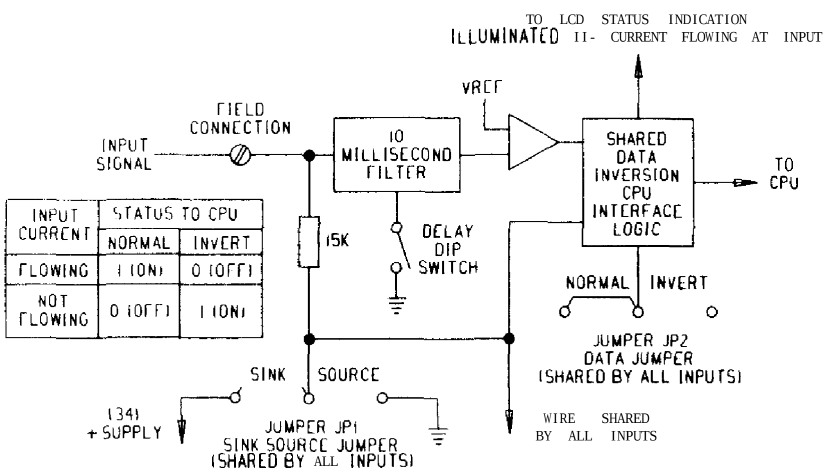
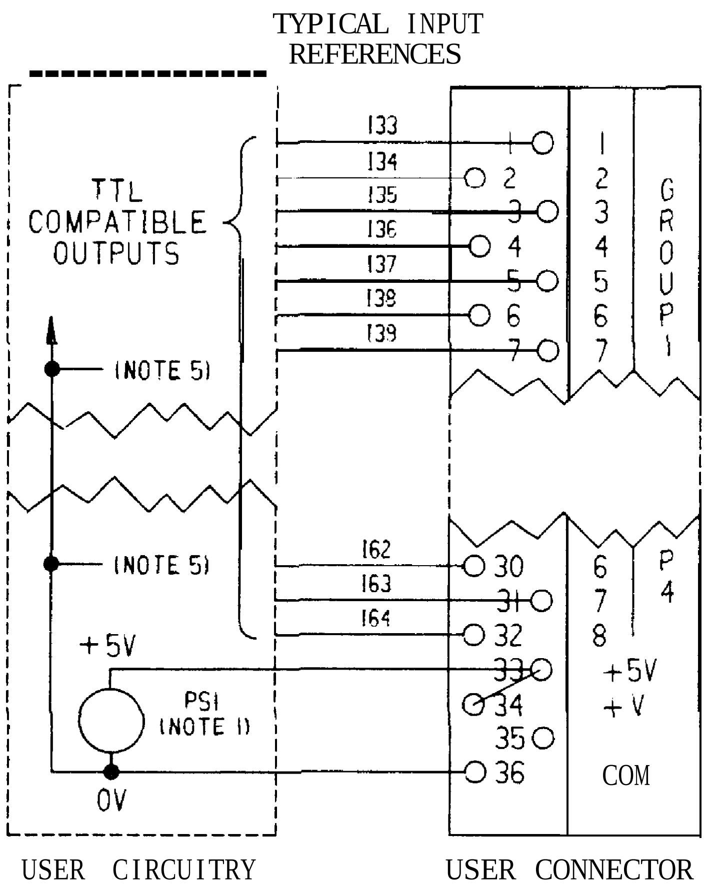


FIGURE 4. TYPICAL SYMBOLIC INPUT CIRCUIT; 1 OF 32

CAUTION

Do not apply more than +5 volts to the 5 volt terminal nor jumper the 5 volt (Pin 33) terminal to the SO volt terminal (Pin 34) when using this module in the 10-50V mode. Failure to observe this caution will damage the module due to excessive voltage on the logic circuitry.



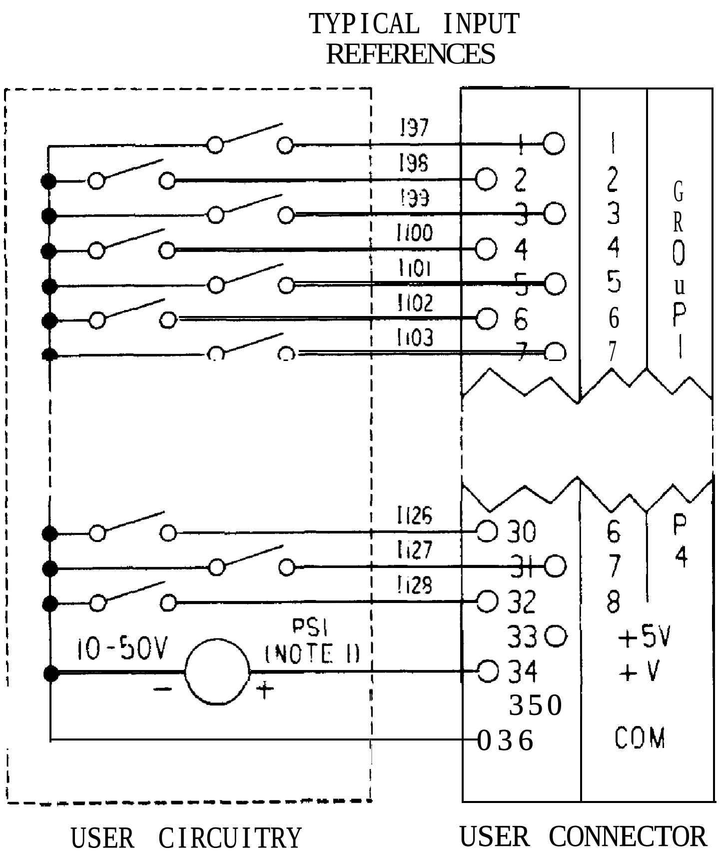
NOTE

1. PS1 is a 5 volt power supply supplied by user and wired as shown.
2. Jumper JP3 must be in the l-2 position when using this type power.
3. Jumper JP1 must be set to the l-2 (SINK) position for TTL current loads.
4. Module can be wired and setup for only 1 mode of operation at a time.
5. The low (negative) of each of the users TTL input circuits must be returned to the module common (COM) terminal, Pin 36.
6. See figures 2 and 3 for other switch and jumper settings.
7. Jumper Pins 33 and 34 together on user connector.

FIGURE 5. RECOMMENDED USER INPUT CONNECTIONS FOR TTL MODE OPERATION

CAUTION

Do not apply more than +5 volts to the 5 volt terminal nor jumper the 5 volt (Pin 33) terminal to the 50 volt terminal (Pin 34) when using this module in the 10-50V mode. Failure to observe this caution will damage the module due to excessive voltage on the logic circuitry.



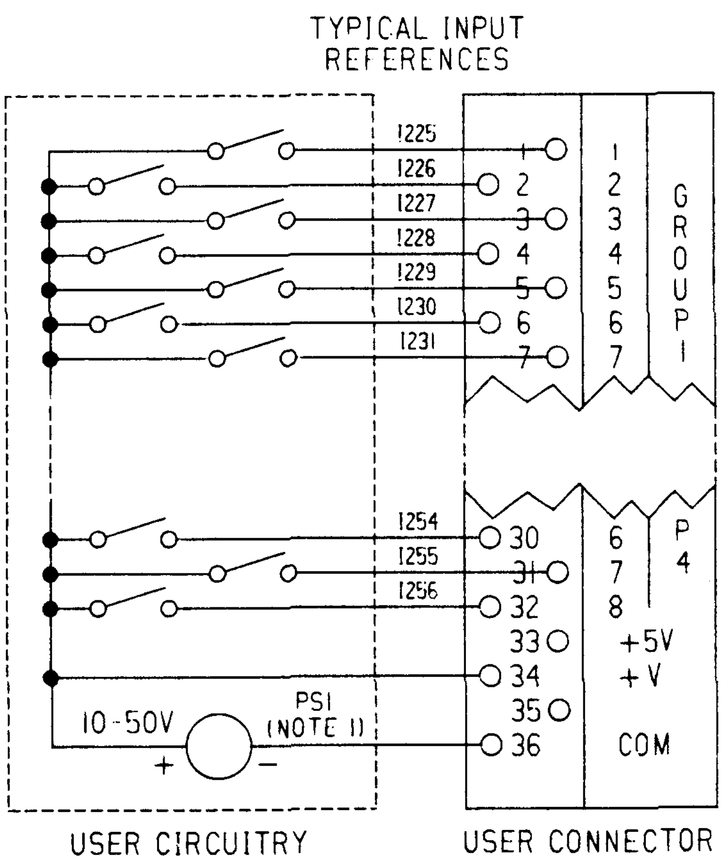
NOTE

1. PSI is a 10-50 volt power supply supplied by user and wired as shown.
2. Jumper JP3 must be in the 2-3 position when using this type power.
3. Jumper JP1 must be set to the 1-2 (SINK) position.
4. Module can be wired and setup for only 1 mode of operation at a time.
5. See figures 2 and 3 for other switch and jumper settings.
6. Do not jumper Pin 33 to 34 on user connector.

FIGURE 6. RECOMMENDED USER INPUT CONNECTIONS FOR 10-50 VOLT SINK MODE OPERATION

CAUTION

Do not apply more than +5 volts to the 5 volt terminal nor jumper the 5 volt (Pin 33) terminal to the 50 volt terminal (Pin 34) when using this module in the 10-50V mode. Failure to observe this caution will damage the module due to excessive voltage on the logic circuitry.



NOTE

1. **PS1 is a 10-50 volt power supply supplied by user and wired as shown.**
2. **Jumper JP3 must be in the 2-3 position when using this type power.**
3. **Jumper JP1 must be set to the 2-3 (SOURCE) position.**
4. **Module can be wired for only 1 mode of operation at a time.**
5. **See figures 2 and 3 for other switch and jumper settings.**
6. **Do not jumper Pin 33 to 34 on user connector.**

FIGURE 7. RECOMMENDED USER INPUT CONNECTIONS FOR 10-50 VOLT SOURCE MODE OPERATION

ORDERING INFORMATION

Module	Circuit Board and Faceplate	Circuit Board Only	Facealate Onlv
5 to 50 V dc Input With Indicators	IC600BF83 1	IC600YB831	IC600FP831

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

JULY, 1986

FANUC

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-83549A

OPERATOR INTERFACE UNIT CABLE

GENERAL DESCRIPTION

The Operator Interface Unit (OIU) cable, consisting of 4 twisted pair wires, an overall shield, and two connectors, provides electrical connection between a Series Six Central Processor Unit (CPU) and an OIU. Refer to Table 1 for features and benefits.

The cable is shielded, has an overall PVC **jacket,** and the individual twisted pair wires are color-coded. Refer to Figure 3. The cable is available in a 10 foot length. Refer to Figure 1 for cable specifications. Refer to Figure 2 for mechanical assembly.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Available in a 10 foot length	Provides flexibility for Series Six hookup
Color-coded twisted pairs	Simplifies troubleshooting

Cable Outside Diameter: 0.310 ± 0.020 inches 7.87 ± 0.5 mm	Jacket: PVC material 300 V insulation Temperature: -20°C to +80°C
Cable Length: 10 feet + 3 inches minus 0 inches (30.5 or 61 cm)	Internal Arrangement: 4 twisted pair with overall shield and jacket
Conductor Size: No. 22 AWG (each wire)	Connectors: 25pin D-type connector one male on each end. One end marked CPU the other OIU.

FIGURE 1. SPECIFICATIONS

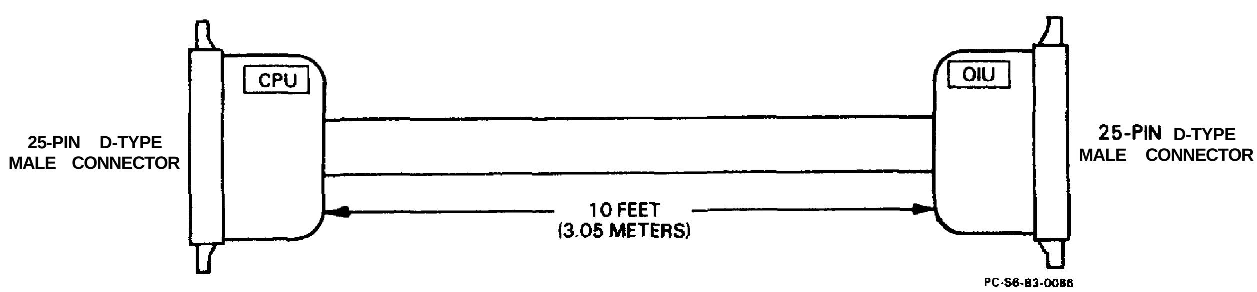


FIGURE 2. MECHANICAL ASSEMBLY

INSTALLATION

Each end of the cable has the same type of male 25-pin D-type connector. Care must be taken when plugging the cable into the CPU-CCM2 module or the OIU to match the CPU marked connector with the CPU-CCM2 module and the connector marked OIU should only be plugged into the OIU.

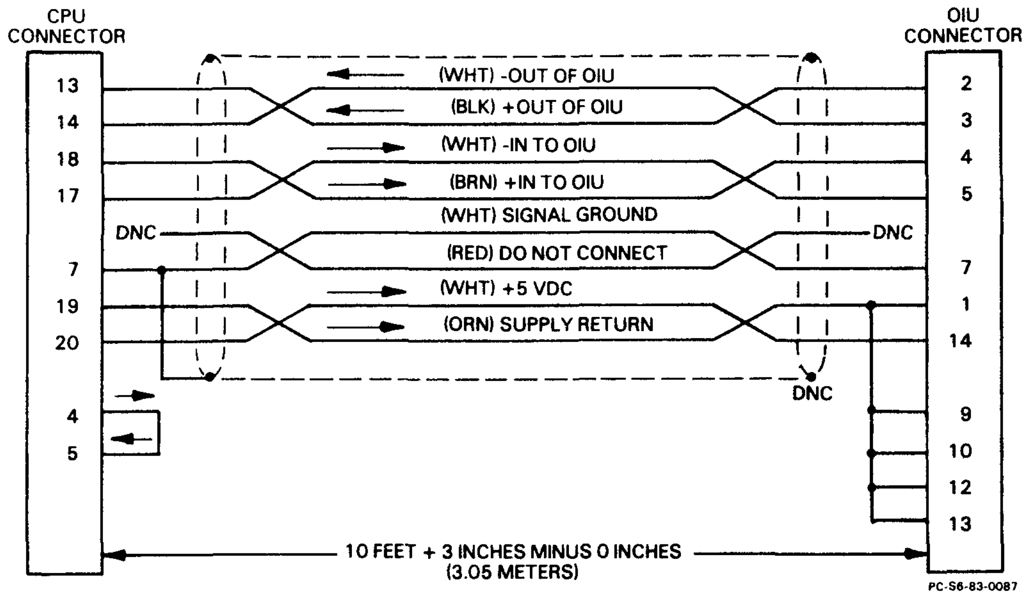


FIGURE 3. WIRING DIAGRAM OF CABLE

ORDERING INFORMATION

Part Number	Description
IC600WK010A	10 foot (3.05 meters) cable with connectors each end

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

Series Six™ PLC
Programmable Controllers

GEK-84857B

July, 1989

High Density TTL Output Module

General Description

The High-Density Transistor Transistor Logic (TTL) Output module, with indicating Light-Emitting Diodes (LEDs, can be utilized in an I/O rack, or in any of the 1/O slots in a Series Six Plus Central Processor Unit (CPU), to provide a compact, optically-isolated interface between the backplane I/O bus and field digital circuitry (TTL).

Each module provides 32 active low outputs divided into 4 groups, each containing 8 outputs. All 32 outputs (4 groups) are normally updated in the course of one I/O scan. A common return point connects the 32 loads on the High-Density TTL Output module.

The placement of a jumper allows the selection of disabling all outputs during a reset condition or the holding of the last state presented to the outputs even if a reset or failure should occur.

By placement of a second jumper on the module the user can select whether the data received from the CPU is inverted (complemented) or non-inverted before controlling the outputs. Two LED indicators identify the selected modes of operation.

The module is supplied in one version with 32 LEDs (one for each output) indicating the state of each output individually. A particular LED will be illuminated whenever its corresponding output is on.

The High-Density TTL Output module features and benefits are summarized in Table 1. Refer to Table 3 for module specifications.

Table 1, Features and Benefits

Features	Benefits
32 TTL (Logic Level) output points per module.	Low cost per output point. Efficient use of I/O rack space.
Output Indicating lights.	Visual indication at the module of the OFF/ON state of the outputs.
Programmable hold last commanded state of outputs.	The last commanded output states are retained throughout a Series Six power-down or system fault so long as the user power is uninterrupted.
Applications	
Interface from CPU to: Devices having TTL or CMOS inputs Other low voltage Low current loads	Compact I/O System

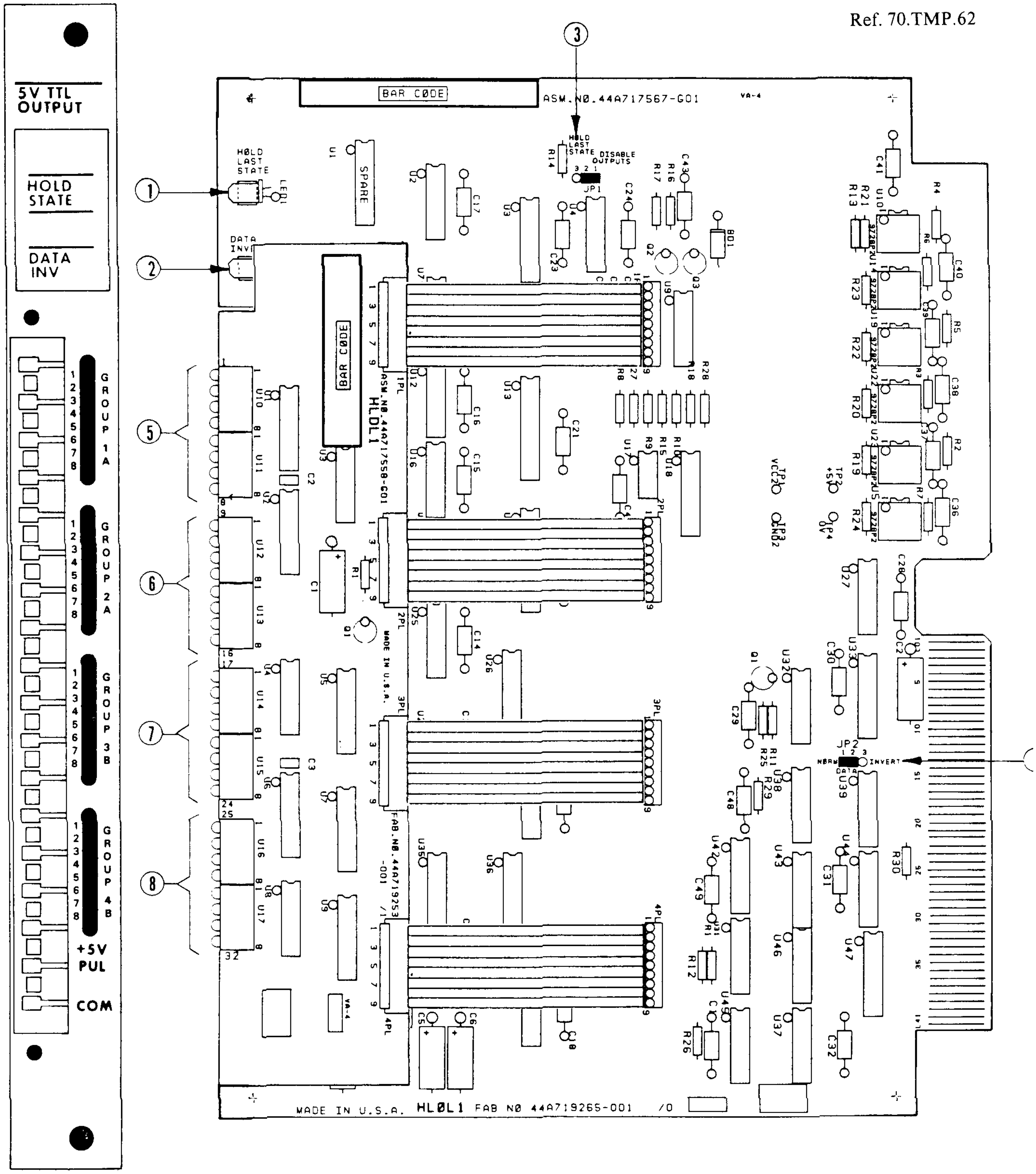


Figure 1. User Items (Part 1 of 2) High Density TTL Output, with Status Indicator Lights

1. LED Indicator
   ON: Hold Last State
   OFF: Disable Outputs

2. LED Indicator
   ON: Output Data Inverted (0 = Low)
   OFF: Output Data Non-Inverted (1 = Low)

3. Jumper JP1: 1-2 Position, Disable Outputs
   2-3 Position, Hold Last State

4. Jumper JP2: 1-2 Position, Normal
   2-3 Position, Data Inverted

LEDs - Illuminated when corresponding output is turned ON (low).

Key	Group	Outputs	LED
5.	1	1 through 8	1 through 8
6.	2	1 through 8	9 through 16
7.	3	1 through 8	17 through 24
8.	4	1 through 8	25 through 32

Figure 1. User Items (Part 2 of 2) Cont'd

Table 2. Dip Switch Settings

Output Number	Dip Switch Position					Output Number	Dip Switch Position					Output Number	Dip Switch Position				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1- 32						353-384		X		X	X	705-736	X		X	X	
33- 64					X	385-416		X	X			737-768	X		X	X	X
65- 96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024 (NOT USED)	X	X	X	X	X
321-352		X		X		673-704	X		X		X						

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left)
Switches No. 1 and No. 2 should be in CLOSED Position

Installation

The High-Density TTL Output module can be installed in an I/O rack or in a Series Six Plus CPU rack. Before installing the module, the Dual-In-line-Package (DIP) switches immediately behind the card slot on the rack backplane should be set to reserve 32 consecutive bits in the appropriate output status table of the CPU. For specific DIP switch settings, refer to Table 2.

The circuit-board jumpers must be set to configure the module to operate in the desired system configuration. For example: invert or non-invert and disable outputs or hold last state. Refer to Figure 1, User Items.

The response to a power-down or Series Six system fault is defined by jumper 1 (JPl). Position l-2 (DISABLE OUTPUTS) turns all outputs OFF in such cases. Position 2-3 (HOLD LAST STATE) would maintain the last commanded state of the outputs until new valid data is presented or user power is removed. In either case all outputs are initialized OFF when user power is turned on.

Jumper 2 (JP2) determines what state commanded by the CPU is used to tum an output ON. In the Normal mode (non-inverting) the ON state (active low output) results when a logical 1 is in the Output Status Table. Conversely, an OFF state (output high) exists with a 0 in the Output Status Table. Just the opposite output state versus output status table exists if the module is placed in the Inverting mode.

When using a High-Density Output module to drive a High-Density Input module, both modules should be configured in the same mode (Inverting or Non-Inverting). Following this procedure ensures that the bit values sent from the Output Status Table to the Input Status Table are not inverted.

It is recommended that the extraction/insertion tool furnished with the CPU be used to remove or install the circuit boards. With the board in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that the proper contact is made. The faceplate can then be secured to the rack using the thumbscrews at the top and bottom.

Refer to Figure 2 for a typical symbolic output circuit.

Refer to Figure 3 for typical user connections to this module. If active-pullup outputs are desired with this TTL module, the PUL terminal should be connected to the positive terminal of the output supply (0 to 15 V dc). For open-collector operation, the PUL terminal should be left open (no connection).

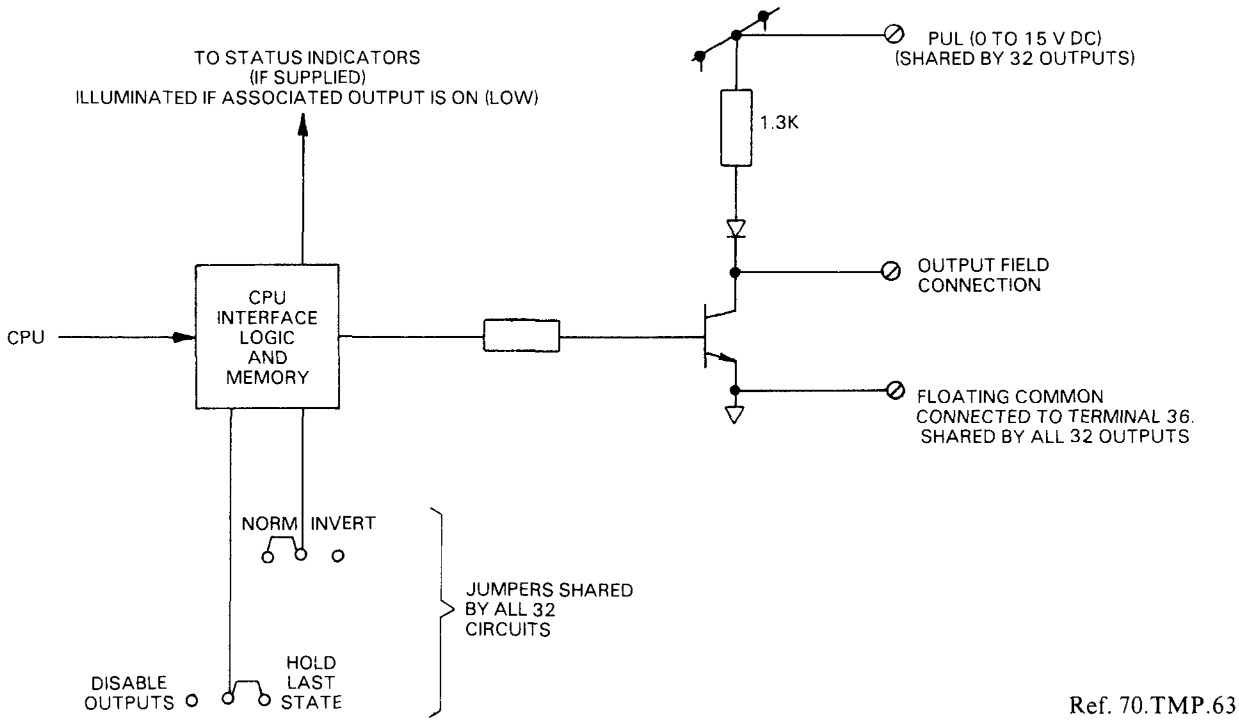
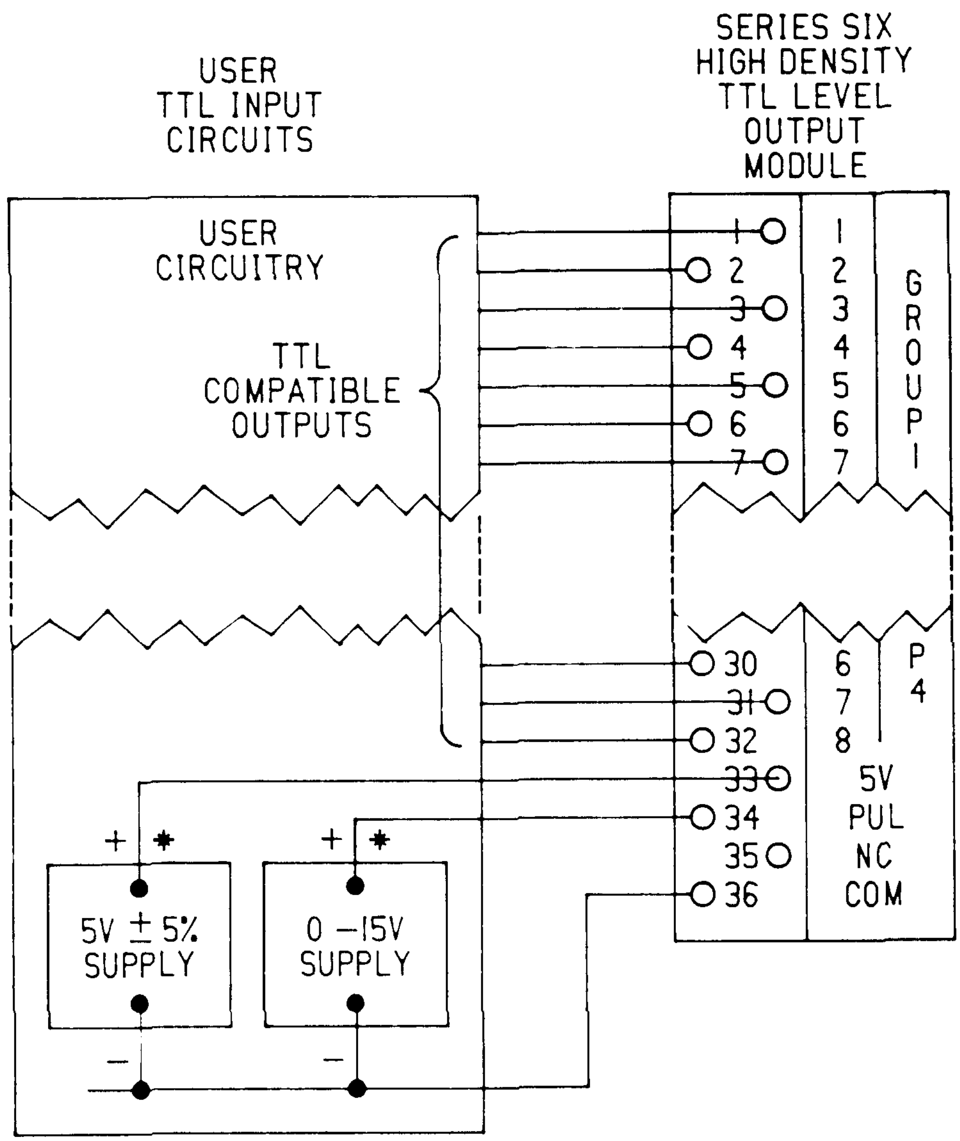


Figure 2. Simplified Symbolic Output Circuit

Ref. 70.TMP.64



* CAN BE THE SAME POWER SUPPLY IF IT IS 5V ± 5%.

Figure 3. Typical User Output Connections up to 32 Outputs

GEK-84857B

Table 3. Specifications

Dimensions:	Circuit Board: 8.15 x 11.0 (inches) 208 x 280 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)
Storage Temperature:	**-20” to +80°C**
Operating Temperature:	0° - 60 °C at the outside of rack.
Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 10,000 feet above sea level (operating),
Isolation:	Series Six common to user common. 2000 V dc for one second (maximum) 240 V ac 50/60Hz continuous (maximum). Rate of change (noise immunity) 500 V/microsecond (maximum).
Power **Requirements:**	Supplied by I/O rack or Series 60 rack: **+5** V dc, 180 mA **maximum** or **3** power units. Ref. Chapter 2 **section 2,** I/O module load, Installation and Maintenance Manual, GEK-25361.
User **Supplied Power:**	To user on module logic at terminal 33. Voltage including ripple 5 0.25 V dc Current: 550 mA (with status indicating LEDs) To user output pull up at terminal 34. Voltage including ripple 0 to 15 V dc Equivalent load resistance = 1.3K number of outputs used.
Output Capabilities:	ON state, output low Module acts as a current sink. 25 milliamps per output for TTL compatibility 0.5 V dc. 50 milliamps per output point maximum 1.0 V dc. OFF state, output high. Open collector operation if PUL (terminal **34)** is left open. Sources current as voltage source equal to terminal 34 voltage minus 0.6 volts in series with 1.3K resistor.
Response Time:	ON to OFF or OFF to ON, 40 microseconds maximum.

NOTE

For previous revisions of **5V** TI'L Output modules (911A and 911B) see GEK-83530.

Table 4. Ordering Information

Module	Circuit Board and Faceplate	Circuit Board Only	Faceplate Only
5V TTL Output With Status Indicators	IC6OOBF921A	IC600YB921A	IC600FP921A

Catalog Number Revision Suffix

The equipment iisted above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

Series Six PLC

GEK-84858B
June,1989

High Density 10 to 50 V DC Source Output Module

General Description

The High-Density Source Output module - with indicating Light-Emitting Diodes (LEDs) can be utilized in an I/O rack, or in any of the I/O slots in a Series Six Plus Central Processor Unit (CPU), to provide a compact, optically-isolated interface between the backplane I/O bus and user circuitry.

Each module provides 32 active high outputs divided into 4 groups, each containing 8 outputs, all 32 outputs (4 groups) are normally updated in the course of one I/O scan.

A common return point connects the 32 loads on the High-Density Source Output module. However, provisions are made for connecting user voltage +VA (10 to 50 volts) as a common source voltage for 16 of the outputs (groups 1 and 2), and user voltage +VB (10 to 50 volts) as a common source voltage for the other 16 outputs (groups 3 and 4). These may be the same or different voltages. Part of the internal module electronics is powered from the user +VA terminal.

The placement of a jumpers allows the selection of disabling all outputs during a reset condition or the holding of the last state presented to the outputs even if a reset or failure should occur. By placement of a second jumper on the circuit board the user can select whether the data received from the CPU is inverted (complemented) or non-inverted before controlling the outputs. Two LED indicators identify the selected modes of operation.

The module is supplied in one version having 32 LEDs (one for each output) indicating the state of each output individually. A particular LED will be illuminated whenever it's corresponding output is ON.

The High-Density Source Output module features and benefits are summarized in Table 1. Refer to Table 3. for module specifications.

Table 1. **Features and Benefits**

Features	Benefits
32 source output points per module.	Low cost per output point. Efficient use of I/O rack space.
Indicating lights.	Visual indication at the module of the OFF/ON state of the outputs.
Programmable hold last commanded state of outputs.	The last commanded output states are retained throughout a Series Six power-down or system fault so long as the user power is uninterrupted.
Applications	
Interface from CPU to: Pilot lights Small solenoids Other DC loads (current source)	Compact I/O Systems

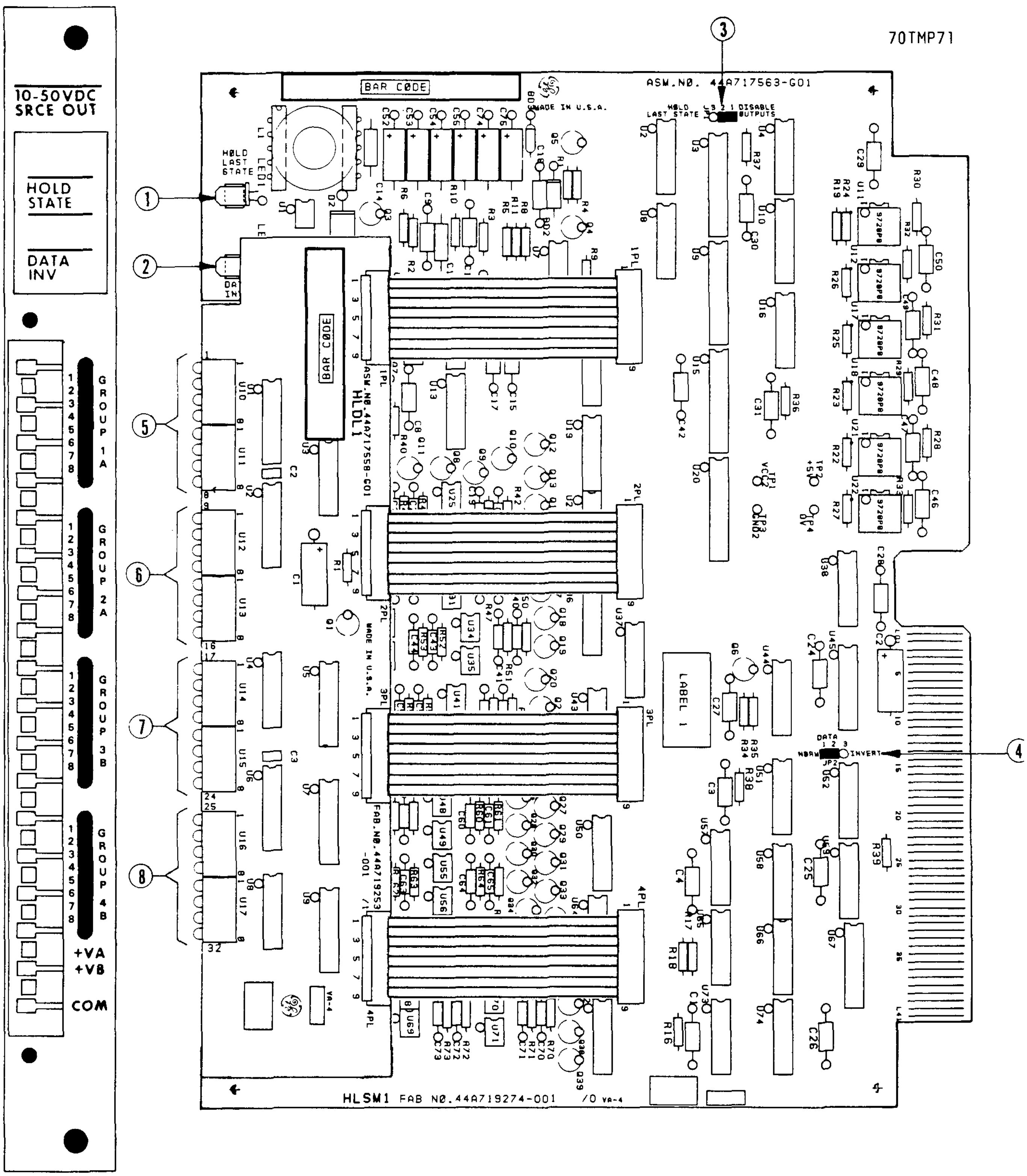


Figure 1. User Items (Part 1 of 2) High Density 10 to 50 V dc Source Output Module with Status Indicator Lights

1. LED Indicator
   ON: Hold Last State
   OFF: Disable Outputs when required

2. LED Indicator
   ON: Output Data Inverted
   OFF: Output Data Non-Inverted

3. Jumper JP1: 1-2 Position, Disable Outputs
   2-3 Position, Hold Last State

4. Jumper JP2: 1-2 Position, Normal
   2-3 Position, Data Inverted

LEDs - Illuminated when corresponding output is turned ON (low).

Key	Group	Outputs	LED
5.	1	1 through 8	1 through 8
6.	2	1 through 8	9 through 16
7.	3	1 through 8	17 through 24
8.	4	1 through 8	25 through 32

Figure 1. User Items (Part 2 of 2) Cont'd

Table 2. Dip Switch Settings

OUTPUT NUMBER	DIP SWITCH POSITION					OUTPUT NUMBER	DIP SWITCH POSITION					OUTPUT NUMBER	DIP SWITCH POSITION				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1- 32						353-384		X		X	X	705-736	X		X	X	
33- 64					X	385-416		X	X			737-768	X		X	X	X
65- 96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024 (NOT USED)	X	X	X	X	X
321-352		X		X		673-704	X		X		X						

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left)

Switches No. 1 and No. 2 should be in CLOSED Position

installation

The High-Density 10 volt to 50 volt Source Output module can be installed in an I/O rack or in a Series Six Plus CPU rack. Before installing the module, the Dual-In-line Package (DIP) switches immediately behind the card slot on the rack backplane should be set to reserve 32 consecutive bits in the appropriate output status table of the CPU. For specific DIP switch settings, refer to Table 2.

The circuit board jumpers must be set to configure the module to operate in the desired system configuration. For example: invert or non-invert, and disable outputs or hold last state. Refer to Figure 1, User Items.

The response to a power-down or Series Six system fault is defined by jumper 1 (JPl). Position l-2 (DISABLE OUTPUTS) turns all outputs OFF in such cases. Position 2-3 (HOLD LAST STATE) would maintain the last commanded state of the outputs until new valid data is presented or user power is removed. In either case all outputs are initialized OFF when user power is turned on.

Jumper 2 (JP2) determines what state commanded by the CPU is used to turn an output ON. In the Normal mode (non-inverting) the ON state (active high output) results when a logical 1 is in the Output Status Table. Conversely, an OFF state (output low) exists with a 0 in the Output Status Table. Just the opposite output state versus output status table exists if the module is placed in the Inverting mode.

When using a High-Density Output module to drive a High-Density Input module, both modules should be configured in the same mode (Inverting or Non-Inverting). Following this procedure ensures that the bit values sent from the Output Status Table to the Input Status Table are not inverted.

It is recommended that the extraction/insertion tool furnished with the CPU be used to remove or install the circuit boards. With the boards in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that the proper contact is made. The faceplace can then be secured to the rack using the thumbscrews at the top and bottom.

Refer to Figure 2 for a typical symbolic output circuit.

Refer to Figure 3 for typical user connections to this module. For inductive loads, clamps diodes are connected internally to common. Outputs groups 1 and 2, as well as some of the module circuitry, are provided with power from terminal 33 (+VA), output groups 3 and 4 are provided with power from terminal 34 (+VB). These may be different voltages but must both have common negative points which are tied together and then tied to common terminal 36.

A power supply or supplies must be connected to both +VA and +VB terminals to prevent alarms.

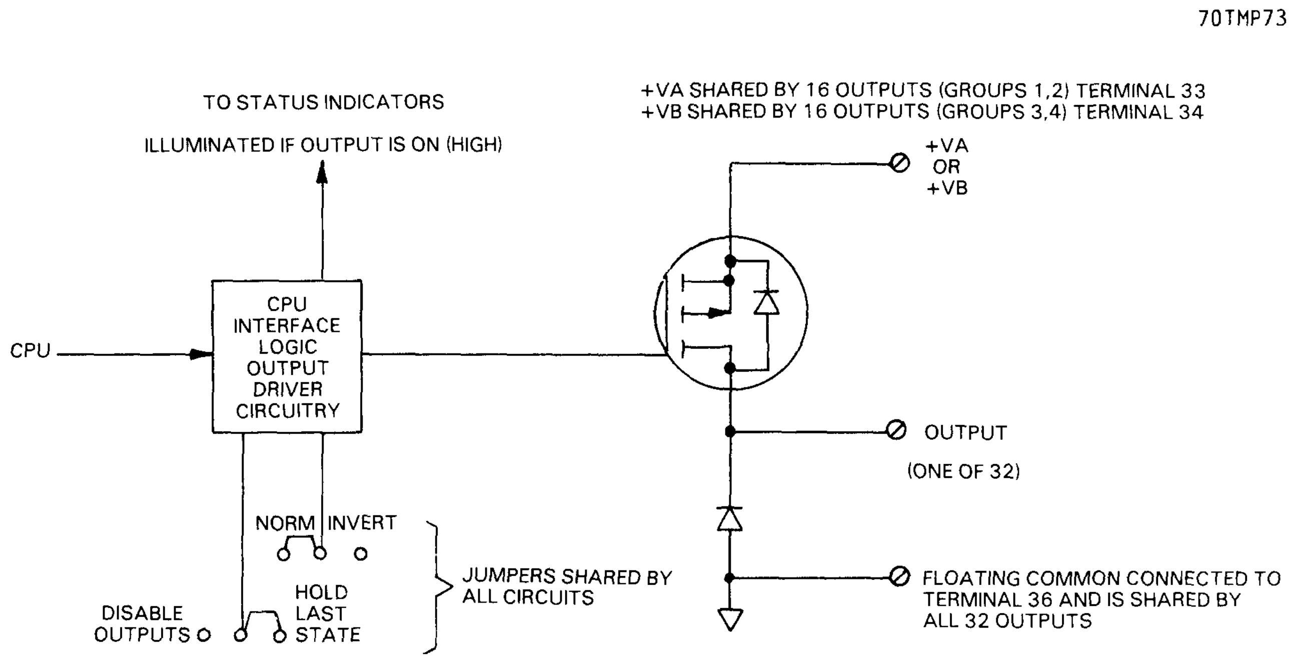


Figure 2. Simplified Symbolic 10 to 50 V DC Source Output Circuit

CAUTION

There are 4 groups of 8 outputs each in this module, Each of the 4 groups is updated at a different time in the I/O scan. The capability exists for connecting 2 or more outputs in parallel for increasing the current output for driving larger loads. Up to 8 outputs may be paralleled, for up to 4 amps output, if these 8 outputs are in the same group. Outputs from one group may not be connected in parallel with outputs from another group. Paralleling outputs from one group with outputs from another group can cause damage to the module during an I/O scan.

If multiple outputs are connected in parallel, care should be taken when using a Workmaster computer or an Operator Interface Unit (OIU) for troubleshooting. Changing, or overriding status bits in the Output Status Table, with outputs paralleled requires that all of the paralleled output status bits be turned off or turned on simultaneously. Otherwise all of the output current could be placed on as few as only one output. This condition could cause damage to the module. Damage can also be caused by improper programming of multiple paralleled outputs,

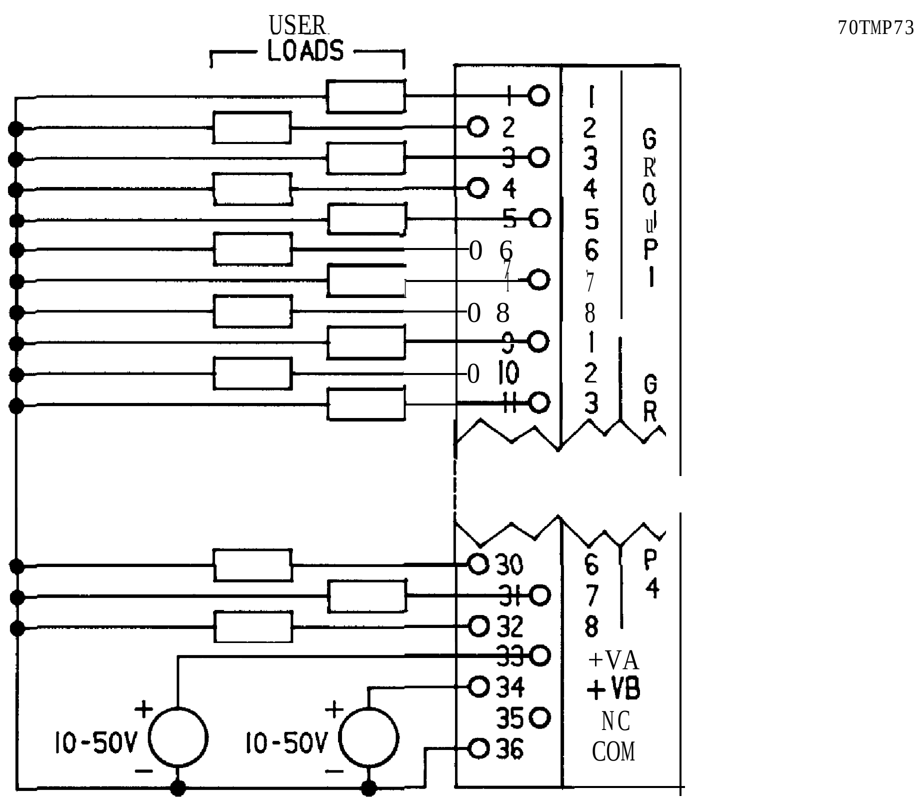


Figure 3. Typical User Output Connections

NOTE

A power supply must be connected **to both** +VA and +VB terminals.

Output groups 1 and 2 require user power of from +lO to +50 volts which must be connected to terminal 33 (+VA). Output groups 3 and 4 require user power of from +I0 to +50 volts which must be **connected** to terminal 34 (+VB). These 2 terminals may be connected to the same voltage or to different voltages that have a common negative return which is connected to terminal 36 (COM).

Table 3. Specifications

Dimensions:	Circuit Board: 8.15 x 11 .O (inches) 208 x 280 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)
Storage Temperature:	-20” to +80°C
Operating Temperature:	0” to 60°C at the outside of rack.
Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 10,000 feet above sea level (operating).
Isolation:	Series Six Plus common to user common. 2000 V dc for one second (maximum). 240 V ac 50/6OHz continuous (maximum). Rate of change (noise immunity) 500 V/microsecond (maximum).
Power Requirements:	Supplied by I/O rack or Series Six Plus rack: +5 V dc, 180 mA maximum or 3 power units. Ref. Chapter 3, I/O module load, Installation and Maintenance Manual, GEK-96602.
User Supplied Power:	To +VA terminal 33. Voltage including ripple: no less than 10 V dc to/or greater than 50 V dc including ripple of no more than ±2 V 50/60 Hz. Current at terminal 33 = 5 Watts plus load current. To +VB terminal 34. Voltage including ripple: no less than 10 V dc to/or greater than 50 V dc including ripple of no more than ±2 V 50/60 Hz. Current at terminal 34 = 2 Watts plus load current.
Output Capabilities:	ON state, output high Module acts as a current source. 500 milliamps per output. OFF state: Output low or output floats. Leakage: ml milliamp per output maximum. Paralleling Outputs: See discussion, page 6, Figure 3.
Response Time:	ON to OFF or OFF to ON, 40 microseconds maximum.

Table 4. Ordering Information

Module	Circuit Board and Faceplate	Circuit Board Only	Faceplate Only
High-Density Source Output With Status Indicators	IC600BF929A	IC600BF929A	IC600BF929A

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed **by** Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

Series Six™ PLC
Programmable Controllers

GEK-84859B

July, 1989

High Density 10 to 50 V DC Sink
Output Module

General Description

The High-Density Sink Output module, with indicating Light-Emitting Diodes (LEDs), can be used in an I/O rack, or in any of the I/O slots in a Series Six Plus Central Processor Unit (CPU), to provide a compact, optically-isolated interface between the backplane I/O bus and field digital circuitry (sink),

Each module provides 32 active low outputs divided into 4 groups, each containing 8 outputs. All 32 outputs (4 groups) are normally updated in the course of one I/O scan, A common return point connects the 32 loads on the High-Density Sink Output module.

The placement of a jumper allows the selection of disabling all outputs during a reset condition or the holding of the last state presented to the outputs even if a reset or failure should occur.

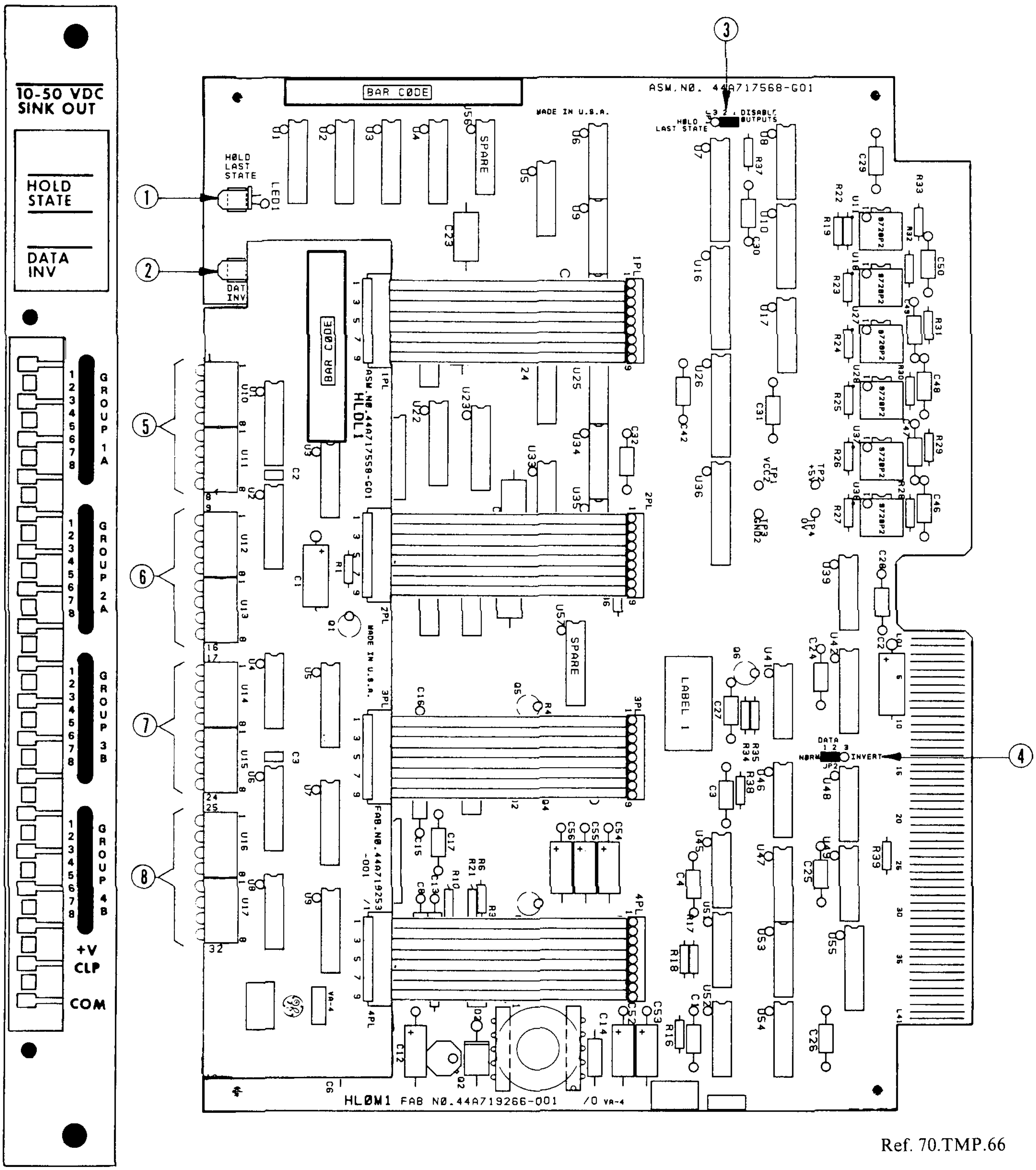
By placement of a second jumper on the module the user can select whether the data received from the CPU is inverted (complemented) or non-inverted before controlling the outputs. Two LED indicators identify the selected modes of operation.

The module is supplied in one form having 32 LED status indicators (one for each output) displaying the state of each output individually. A particular LED will be illuminated whenever it's corresponding output is on.

The High-Density Sink Output module feature's and benefits are summarized in Table 1. Refer to Table 3 for module specifications.

Table 1. Features and Benefits

Features	Benefits
32 source output points per module.	Low cost per output point. Efficient use of I/O rack space.
Output Indicating lights.	Visual indication at the module of the OFF/ON state of the outputs
Programmable hold last commanded state of outputs.	The last commanded output states are retained throughout a Series Six power-down or system fault so long as the user power is uninterrupted.
Applications	
Interface from CPU to: Lamp Drivers Small Coils Other DC loads (current sink)	Compact I/O Systems



Ref. 70.TMP.66

Figure 1. User Items (Part 1 of 2) High Density 10 to 50 V dc Sink Output Module with Status Indicator Lights

1. LED Indicator
   ON: Hold Last State
   OFF: Disable Outputs when required

2. LED Indicator
   ON: Output Data Inverted
   OFF: Output Data Non-Inverted

3. Jumper JP1: 1-2 Position, Disable Outputs
   2-3 Position, Hold Last State

4. Jumper JP2: 1-2 Position, Normal
   (1=LOW=ON)
   2-3 Position, Data Inverted
   (1=HIGH=OFF)

LEDs - Illuminated when corresponding output is turned ON (low).

Key	**Group**	**Outputs**	**LED**
5.	1	1 through 8	1 through 8
6.	2	1 through 8	9 through 16
7.	3	1 through 8	17 through 24
8.	4	1 through 8	25 through 32

Figure 1. User Items (Part 2 of 2) Cont'd

Table 2. Dip Switch Settings

Output Number	**Dip Switch Position**					**Output Number**	**Dip Switch Position**					**Output Number**	**Dip Switch Position**				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1- 32						353-384		X		X	X	705-736	X		X	X	
33- 64					X	385-416		X	X			737-768	X		X	X	X
65- 96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024	X	X	X	X	X
321-352		X		X		673-704	X		X		X	(NOT USED)					

[X] = Switch in OPEN Position (Depressed to the Left)
Switches No. 1 and No. 2 should be in CLOSED Position

Installation

The High-Density 10 to 50 volt Sink Output module can be installed in an I/O rack or in a Series Six Plus CPU rack. Before installing the module, the Dual-In-line Package (DIP) switches immediately behind the card slot on the rack backplane should be set to reserve 32 consecutive bits in the appropriate output status table of the CPU. For specific DIP switch settings, refer to Table 2.

The circuit board jumpers must be set to configure the module to operate in the desired system configuration. For example: invert or non-invert and disable outputs or hold last state. Refer to Figure 1 user items.

The response to a power-down or Series Six system fault is defined by jumper 1 (JPl). Position 1-2 (DISABLE OUTPUTS) turns all outputs OFF in such cases. Position 2-3 (HOLD LAST STATE) would maintain the last commanded state of the outputs until new valid data is presented or user power is removed. In either case all outputs are initialized OFF when user power is turned on.

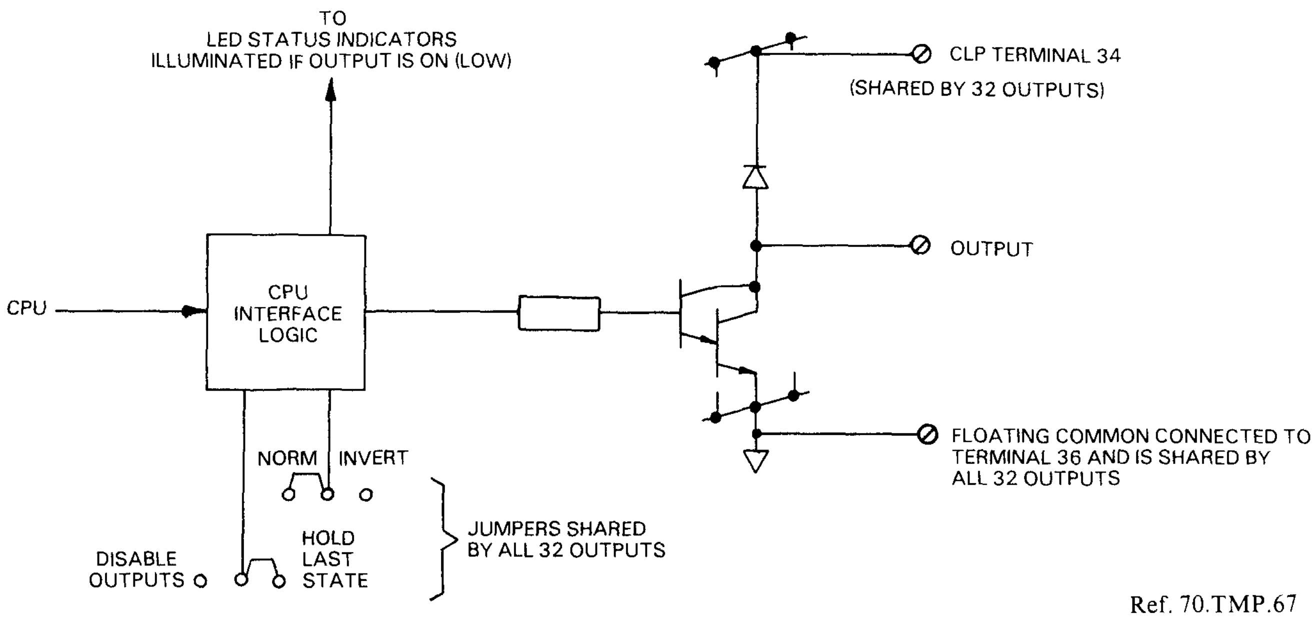
Jumper 2 (JP2) determines what state commanded by the CPU is used to turn an output ON. In the Normal mode (non-inverting) the ON state (active low output) results when a logical 1 is in the Output Status Table. Conversely, an OFF state (output high) exists with a 0 in the Output Status Table, Just the opposite output state versus output status table exists if the module is placed in the Inverting mode.

When using a High-Density Output module to drive a High-Density Input module, both modules should be configured in the same mode (Inverting or Non-Inverting). Following this procedure ensures that the bit values sent from the Output Status Table to the Input Status Table are not inverted.

It is recommended that the extraction/insertion tool furnished with the CPU be used to remove or install the circuit boards. With the boards in place in the rack, the edge connector on the faceplate should be slipped over the circuit board so that the proper contact is made. The faceplate can then be secured to the rack using the thumbscrews at the top and bottom.

Refer to Figure 2 for a typical symbolic output circuit.

Refer to Figure 3 for typical user connections to this module. If inductive loads are used, the CLP (clamp) terminal should be connected to the positive side of the highest voltage supply used with the loads. For example: if some loads are 12V, some are 24V, and some are 48V, connect CLP to the +48V, even if the 48V loads are only purely resistive.



Ref. 70.TMP.67

Figure 2. Simplified Symbolic Sink 10 to 50 V DC Output Circuit with Clamp

Ref. 70. TMP.68

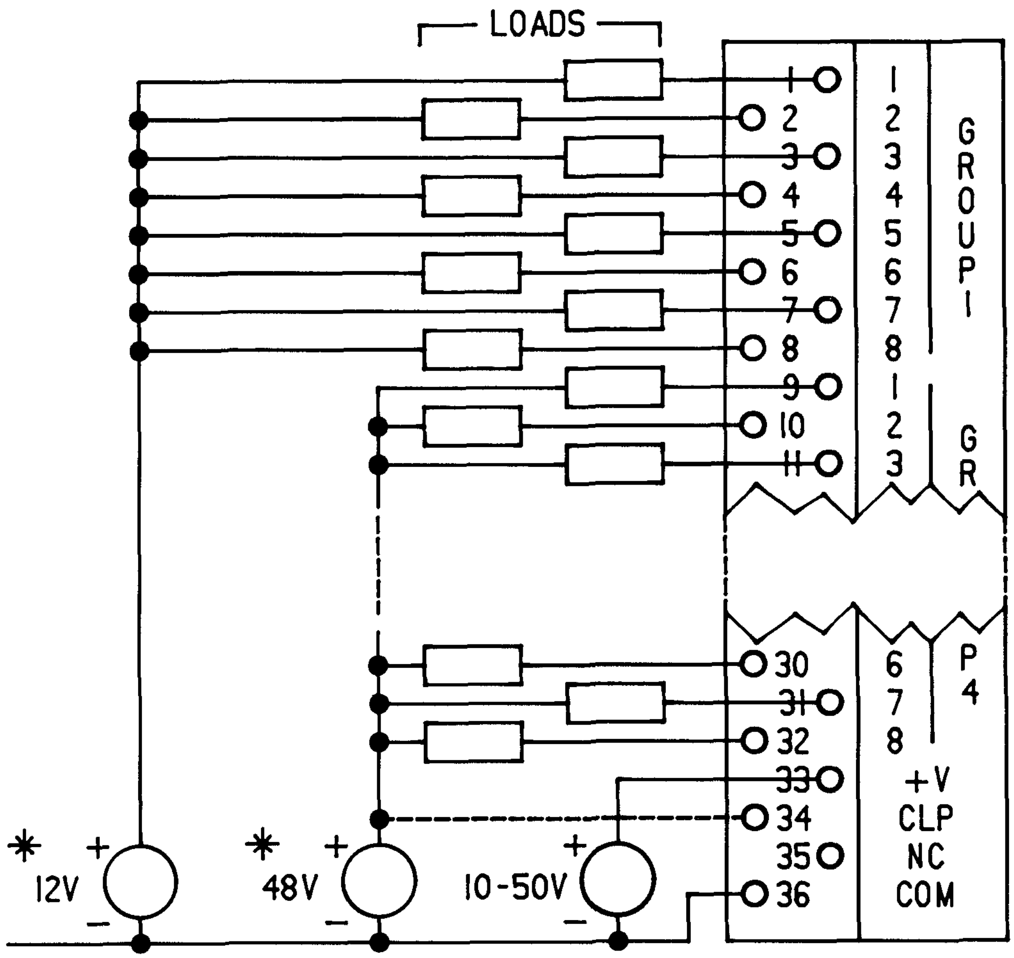


Figure 3. Typical User Output Connections

NOTE

The loads may be connected to any voltage from +10 volts to +50 volts so long as the power supplies share a common negative point. As shown above some loads are connected to +12 volts, and some are connected to +48 volts. Some could be connected to +24V as well or all could have been connected to the same voltage between +10V and +50 volts. For suppression purposes the highest voltage used should also be connected to CLP (terminal 34), as the +48V is shown connected above. Although up to +50 volts may be connected to the +V terminal 33, the lowest voltage present on the module should be connected to terminal 33.

NOTE

For previous revisions of Sink Output modules without indicators (913A and 913B) see GEK-83530.

Table 3. Specifications

Dimensions:	Circuit Board: 8.15 x 11.0 (inches) 208 x 280 (mm) Faceplate: 12.46 x 1.175 (inches) **317 x 30** (mm)
Storage Temperature:	**-20” to +80°C**
Operating Temperature:	0° to 60°C at the outside of rack.
Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 10,000 feet above sea level (operating).
Isolation:	Series Six Plus common to user common, 2000 V dc for one second (maximum). 240 V ac 50/60Hz continous (maximum). Rate of change (noise immunity) 500 V/microsecond (maximum).
Power Requirements:	Supplied by I/O rack or Series Six Plus rack: +5 V dc, 180 mA maximum or 3 power units. Ref. Chapter 2 section 2, I/O module load, Installation and Maintenance Manual, GEK-25361A.
User Supplied Power:	To user on module logic at terminal 33. Voltage including ripple: no less than 10 V dc to/or no greater than 50 V dc including ripple of no more than ±2 v 50/60 Hz. Power Required: 5 Watts with status indicator LEDs. To CLP terminal 34. See note on page 6, Figure 3.
Output Capabilities:	ON state, output low: **Module** acts as a current sink. 250 milliamps maximum 0” to 50°C or 200 milliamps maximum 51° to 60°C. 0.1 milliamps minimum OFF state: Output high: Output floats to load voltage. 1.0 milliamps maximum leakage current.
Response Time:	ON **to** OFF or OFF to ON, 40 microseconds maximum.

Table 4. Ordering Information

Module	Circuit Board and Faceplate	Circuit Board Only	Faceplate Only
10/50 Vdc Sink Output With Status Indicators	IC600BF923A	IC600BF923A	IC600BF923A

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc.(UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

Series Six™
Programmable Controllers

GEK-84860B

March 1989

Redundant Processor Unit

General Description

The Redundant Processor Unit (RPU) acts as a switch to transfer control from one Series Six Plus Central Processor Unit (CPU) or I/O chain to a standby upon failure of the first. To accomplish this, the RPU monitors the CPU and I/O chain for fault conditions, and when detected, conducts an orderly transfer of control to the standby CPU. A bumpless transfer, one without loss or interjection of data, is accomplished within a few milliseconds, while maintaining program and I/O continuity. Actual transfer time varies up to 2 CPU sweeps, depending upon where in the sweep cycle the fault occurs and the amount of data to be transferred.

The RPU includes a Data Control module, Data PROM and Storage modules, and CPU, I/O, and Device Switch modules, connected to a common power supply and backplane, all enclosed within a mountable rack. The RPU system is designed to directly interface with CPU Extended Software Revision 103 or above. Earlier releases can be upgraded to this level, The features and benefits of the RPU are summarized in Table 1, while Table 2 provides module specifications. Figure 1 illustrates the standard rack configuration and cable connections to CPUs and I/O chains.

The Data Control module, which contains an Intel 8086 microprocessor, is used to control parallel communications between the master and standby CPUs and their I/O chains. CPU synchronization is maintained by this module, as is transfer of I/O and register data between master and standby CPUs.

The DATA PROM module contains the executive program which controls the RPU, while memory contained on the Data Storage module is used as intermediate storage locations for input, output override, or register data read by the RPU. On every CPU scan, the RPU reads the requested data from the master CPU and transfers it to the standby processor. Transfer data is selected by hardware jumpers on the Device Switch module, or by the setting of I/O bits and registers in the master CPU.

Actual switching of the I/O data bus cable is accomplished through interaction of the CPU and I/O Switch modules.

The CPU Switch selects either the CPU1 or CPU2 I/O Bus, whichever is determined to be Master by the Data Control module, and connects this bus to the I/O Switch module through the backplane. The main function of the I/O Switch module is to select between I/0 chains 1 or 2 and connect the selected chain to the master CPU I/O bus. If Auxiliary I/O chains are being used, a second pair of CPU and I/O Switch modules are inserted in the RPU rack for connection to these devices. Each of these modules contain 37-pin, D-type connectors for termination of the standard multi-conductor I/O bus cables.

The Device Switch module contains logic for interfacing the various modules and provides system status information. Additionally, 12 form C relays, whose state is dependent upon which CPU is master, are mounted on this module. A 36 point terminal connector is provided for connection to external devices such as CRTs and printers. By use of these low level contacts, external devices can be switched between master CPUs.

The Main Power Supply provides the +5 and +12 volts required for proper RPU operation. It also contains a RUN/HOLD keyswitch for selecting the state of operation, and another keyswitch whose function is to select which CPU is to be master or allow the RPU to automatically select the master. Two form C relay contacts are also available for user connection. One contact (Alarm No. 2) will annunciate if there is a problem within the RPU, CPU, or I/O system which requires attention, although the total system is still operational. The other contact (Alarm No. 1) is used to annunciate a major fault which causes the total system to shut down.

For those applications that require maximum redundancy, an Auxiliary Power Supply is available for the RPU. This supply mounts in the RPU rack and will power the RPU system in the event of failure of the main power supply. Separate power sources can be connected to each RPU power supply to assure operation in the event of loss of one or the other power source.

Table 1. Features and Benefits

FEATURES	BENEFITS
Dual I/O chains	Additional Redundancy Capability
Dual RPU power supplies	Additional Reliability
Device Switch card	Permits Transfer of Peripheral Devices
Automatic update when CPU returned to on-line status	Increased Performance
No Special Programming Required	Easy Installation
RPU Fault Tolerant Operation	CPU System Operation Maintained for most RPU Failures
Digital Fault Annunciation	Simplifies Troubleshooting
Alarm contacts	Separate Annunciation for major or minor faults

Table 2. Specifications

Dimensions:	Rack Mount: 19.0 x 14.0 x 10.3 (Inches) 483 x 356 x 261 (mm) Panel Mount: 20.0 x 14.0 x 10.3 (Inches) 508 x 356 x 261 (mm)
Weight (with **modules):**	37 lbs (17Kg)
Storage Temperature:	-40° to +70° c
Operating Temperature:	0° to 55° C (at the outside of the rack)
Humidity:	5% - 95% (non-condensing)
Power Requirements:	95 V to 260 V ac, 125 V A maximum. Frequency: 47-63hz

INSTALLATION NOTES

Verify with the Workmaster™ Computer that each CPU is equipped with Extended Software Revision 103 or later. CPU I/O Control modules (IC600CB503) and Auxiliary I/O Control modules (IC600CB513) produced after January, 1984 (CPU Serial Number Cl888405-0000 and later), contain enhanced filter circuits. Because of the RPU's ability to monitor and sense externally induced disturbances, these enhanced modules should be in CPUs being used in conjunction with an RPU system to improve the reliability of the total system. Inspection of CPU systems used with an RPU system should be made to make sure the proper enhanced modules are contained within the CPUs used.

The appropriate modules are identified as follows: I/O Control module IC600CB503 should be labeled Assembly Version R07 or later. Looking at the component side of the module, oriented with the backplane pins to the right, the assembly version label is a white affixed label at the bottom right hand edge of the module. Auxiliary I/O Control module (IC600CB513) should be labeled Assembly Version R03 or later. Location of the Assembly Version label is approximately the same as the IC600CB503 module above.

Scan Time >15Oms, use ALU3 board or RPU Rev K kit, or > Rev G.

If any questions arise concerning the module assembly versions or the extended software version of the CPU, contact PC Product Service at (804) 978-5747.

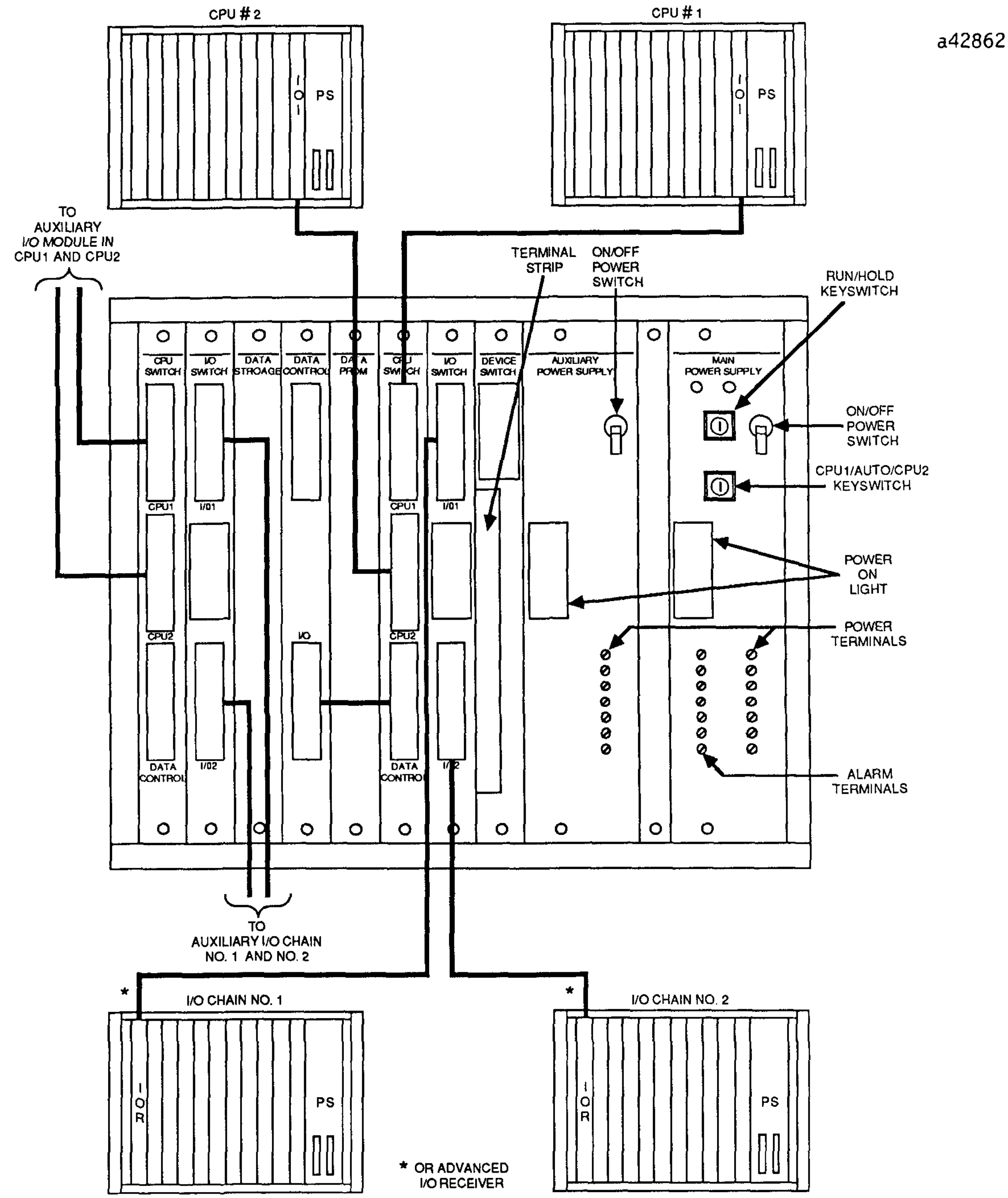


Figure 1. RPU Rack Configuration

Installation

This section provides a summary of the procedures described in the Installation section for the various RPU modules. Do not attempt to install the Redundant Processor Unit (RPU) without first reading this material.

1. The RPU can be rack, panel or wall mounted, depending on the orientation of the mounting brackets.
2. If Auxiliary I/O is to be used, insert the second pair of CPU and I/O Switch modules. Use the extraction/insertion tool supplied with the CPU to install these modules in the first and second (respectively) slots from the left.
3. Set jumper on I/O Switch modules for either single or dual I/O chains.
4. Set jumpers on Device Switch module for data to be transferred and other functions.

5. If the Auxiliary Power Supply is to be used, connect the appropriate cables and wires and insert the power supply into the slot adjacent to the Main Supply.
6. Connect the multi-conductor cables from CPU1 and CPU2 I/O Control modules to the appropriate 37-pin connectors on the CPU Switch module.
7. Connect the multi-conductor cable from the I/O Receiver (or Advanced I/O Receiver) module of the I/O chain to the 37 pin connector marked I/O1 on the I/O Switch module.
8. If Redundant I/O or Auxiliary I/O is used, make similar connections to I/O Chain 2 and Auxiliary I/O chains.
9. Connect the short multi-conductor cable supplied with the RPU between the bottom 37-pin connectors of the Data Control and CPU Switch modules.
10. If peripheral devices are to be switched between CPUs, make the appropriate connections to the 36 point terminal strip on the Device Switch module.
11. Make the following connections to the terminal blocks on the RPU Main and Auxiliary Power Supplies:
    - 3-wire (grounding) AC power cord.
    - Alarm-relay contacts (on Main Supply only).
12. Verify that the software version is correct as described in the Installation Notes on page 2.

Table 3. Ordering Information

Equipment	Catalog Number
RPU System	IC600RP551
* Rack and Power Supply	IC600RR551
* Data Control	IC6OORB753
* Data Storage	IC600RM715
* Data PROM	IC6OORM716
* I/O Switch	IC600RB750
* CPU Switch	IC600RB751
* Device Switch	IC600RB752
* Cable, Data Control to CPU Switch	IC6OOWJ001
**Cable 2 feet	IC600WH002
**Cable 5 feet	IC6OOWHOO5
**Cable 10 feet	IC600WH010
Main Power Supply	IC600PM507
Auxiliary Power Supply	IC600PM508

* Items marked are combined and sold as a basic RPU system under catalog number IC600RP551.

** These cables are used to connect the RPU to CPU No. 2 only. The RPU to CPU No. 1 cable is the standard I/O chain cable IC600WD002 (2 ft), IC600WD005 (5 ft) or IC600WD0l0 (10 ft). RPU to I/O chain cables are also standard I/O chain cables.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

GE FANUC

Series Six
Programmable Controllers

GEK-84861B

March 1989

Redundant Processor Unit
Main Power Supply Module

General Description

The Redundant Processor Unit (RPU) is designed to operate either with a single (Main) power supply module or with two power supply modules, the second being the Auxiliary Power Supply.

The AC Main Power Supply module accepts 115 Vac or 230 Vac and provides regulated +5V and +12 Vdc to the RPU backplane. AC power is connected to terminals on the front panel and routed through a line filter, switch and fuse to a switching power supply.

The DC Main Power Supply module accepts 24 Vdc and provides regulated +5V and +12 Vdc to the RPU backplane. DC power is also connected to terminals on the front panel and routed through a line filter, switch and fuse to a switching power supply.

Terminals on the front panel enable the user to access electromechanical relay contacts for connection to user indicators, or any device to be activated during an alarm condition.

A Light-Emitting Diode (LED), visible through a lens on the front panel, is an indicator of the status of the module. A keyswitch mounted on the front panel is used to select either the RUN or HOLD mode of the RPU. A second keyswitch allows the user to select Central Processor Unit (CPUl), CPU2 or AUTO. A full description of the alarm relay fault conditions as well as the RUN/HOLD switch and CPUl/AUTO/CPU2 switch operation is given in the RPU Manual, GEK-25366. Other features and benefits are listed in Table 1, while Table 2 shows module specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
Input Voltage Requirements: 95 - 260 Vac 47-63Hz or 24 Vdc	Compatible with a variety of power sources
Can be utilized along with an Auxiliary Power Supply module	Power Supply system redundancy
Provides access to electromechanical relay contacts	Activates user-supplied fault annunciators
Visible LED monitor	Displays status of output voltages of module

Table 2. AC - DC Specification

Input:	AC: 95 - 260 Vac, 250 Va maximum Frequency: 47-63 Hz DC: 25Vdc, V maximum Frequency: 47-63 Hz
Output:	+5 Vdc at 15.5 Amps maximum +I2 Vdc at 1.0 Amp maximum
Allowable Power Interruption:	33 ms minimum @ 115 Vac line
Noise Immunity:	Meets requirements of NEMA ICS 2-230 and ANSI C37.90A
Dimensions:	12.46 x 9.00 x 2.75 (inches) 317 x 119 x 70 (mm)
Operating Temperature:	0° to 60 °C (outside of rack)
Storage Temperature:	-40°C to 70°C
Humidity:	5% to 95 % (non-condensing)

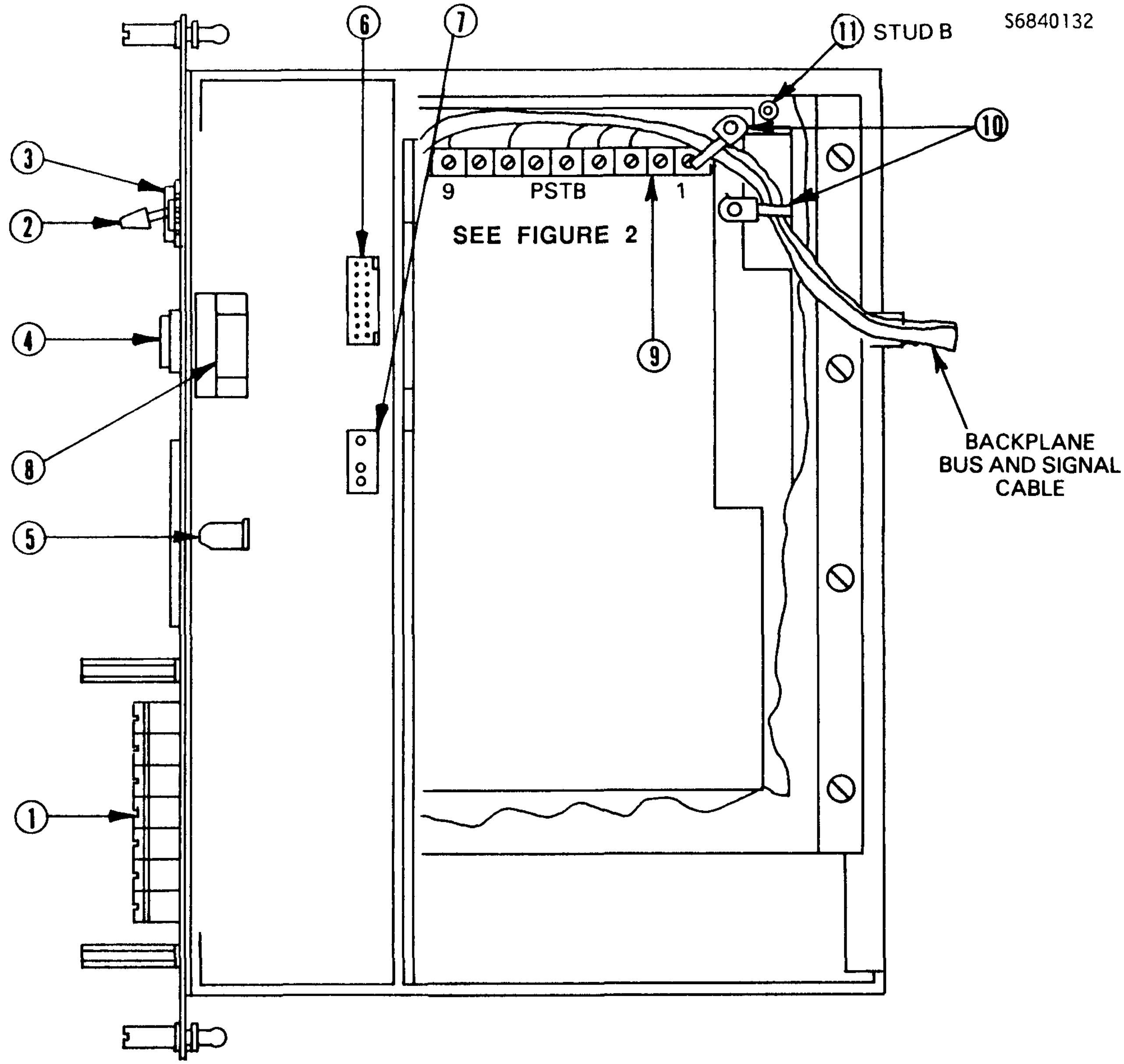


Figure 1. User Items

1. Front Panel Connector Block
2. Power Switch
3. RUN/HOLD Keyswitch
4. CPU1/CPU2/AUTO Keyswitch
5. Power-On LED

   On: The voltage levels of both DC outputs (+12V and +5V) are within tolerance.

   Off: At least one of these voltage levels is out of tolerance.

6. P1, 16-Pin Connector
7. P6, 3-Pin Connector
8. 2A Fuse
9. Power Supply Terminal Board
10. Cable Clamp
11. Chassis Ground Terminal

Installation

The RPU is designed to operate either with a single power supply module, or with two power supply modules. The removal and replacement guidelines of a power supply module in a dual supply system also apply to a single supply system.

When two power supply modules are used, the system offers power supply redundancy in such a way that:

- If both supply modules are functioning normally, one module has the load and the other is on standby.
- If one power supply module fails, the other either continues to carry the load or automatically assumes it without affecting the normal operation of the RPU system.
- A power supply module should be able to be removed or installed while the RPU system is up and running without interrupting the normal operation of the RPU system.
- However, because there may be live voltages on a power supply module, even after the switch to that module is turned off, the following removal and replacement guidelines should be observed.

Power Supply Module Replacement (RPU running)

1. Switch RUN/HOLD switch to HOLD.
2. Remove power to failed power supply by disconnecting AC source.
3. Disconnect wiring to AC and alarm terminals.
4. Remove partition faceplate between power supplies.
5. Release quarter-turn fasteners and slide power supply out to expose connectors located behind faceplate.
6. Disconnect the 4 wires from the supply chassis and 2 connectors from the monitor circuit board.
7. Remove the failed power supply.
8. Reverse the above procedure to install the replacement module.
9. After the replacement power module has been installed apply power to module and verify that the POWER-ON LED is on.
10. Switch RUN/HOLD switch to RUN.

CAUTION

Care should be taken to avoid shorting components or leads on the module being replaced. The free-hanging connectors from **this module should also be handled or positioned in such a way that they are not** brought **into** contact **with conductive surfaces.**

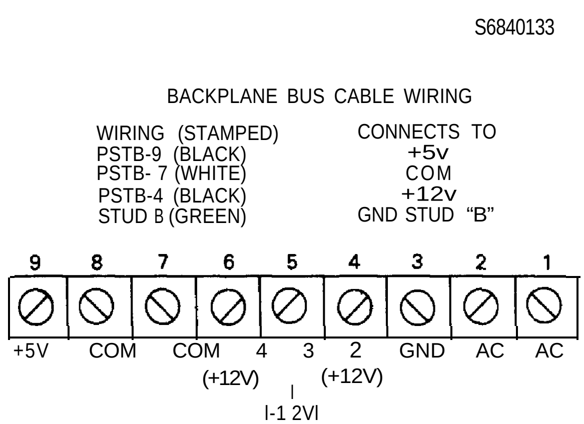


Figure 2. Power Supply Terminal Block

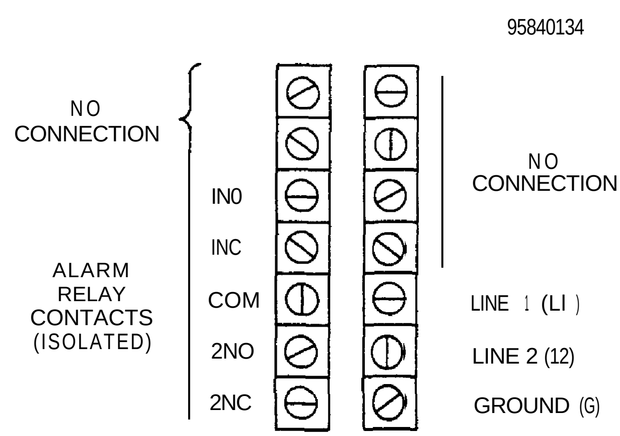


Figure **3.** Front **Panel Terminal Block**

CAUTION

The alarm contacts consist of two sets of Form C contacts. The terminals marked 1 NO and 1 NC are associated with Alarm Type No. 1; the terminals marked 2 NO and 2 NC with Alarm Type No. 2. Incorrectly wiring these alarms may cause damage to your equipment (see the RPU Manual, GEK-25366, for further information on Alarm Nos. 1 and 2.)

The user devices connected to each set of alarm terminals on this module should present a resistive load drawing no more than one ampere (1A) of current at no greater than 115 Vac/28 Vdc. Failing to observe this caution may result in damage to the module.

NOTE

During normal operation, the alarm relays are energized. During an alarm condition, when the relay becomes de-energized, the contacts marked 1 NO and 2 NO open, and those marked 1 NC and 2NC close.

NOTE

The two keystrokes (Run/Hold, Pwr/Auto/ CPU2) depend on the Main Power Supply for their circuits. If the Main Power Supply fails, the RPU firmware will behave as though the Run/Hold keyswitch has been switched to Hold, even if an Auxiliary Power Supply is present.

Table 3. Ordering Information

DESCRIPTION	CATALOG NUMBER
95-260Vac Main Power Supply	IC600PM507
24 Vdc Main Power Supply	IC600PM543

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

Series Six
Programmable Controllers

GEK-84862B

Redundant Processor Unit
Auxiliary Power Supply Module

March 1989

General Description

The Redundant Processor Unit (RPU) is designed **to** operate either with a single (Main) power supply module or with two power supply modules, the second being the Auxiliary Power Supply module.

The AC Auxiliary Power Supply module accepts 115 Vac or 230 Vac and provides regulated +5V and +12 Vdc to the RPU backplane. AC power is connected to terminals on the front panel and routed through a 2A fuse, line filter and then to a switching power supply.

The DC Auxiliary Power Supply module accepts 24 Vdc or Vdc and provides regulated +5V and +12 Vdc to the RPU backplane. DC power is connected to terminals on the front panel and routed through a 2A fuse, line filter and then to a switching power supply.

A Light-Emitting Diode (LED), visible through a lens on the front panel, is an indicator of the status of the module. Features and benefits are listed in Table 1, while module specifications are shown in Table 2.

Table 1. Features and Benefits

FEATURES	BENEFITS
Input Voltage Requirements: **95 - 260** Vac 47-63Hz	Compatible with a variety of power sources
Can be utilized along with a Main Power Supply module	Power Supply system redundancy
Visible LED monitor	Displays status of output voltages of module

Table 2. AC - DC Specification

Input:	AC: 95 - 260 Vac, 250 Va maximum Frequency: 47-63Hz DC: 24 Vdc, V maximum Frequency: 47-63Hz
Output:	+5 Vdc at 15.5 Amps maximum +12 Vdc at 1.0 Amp maximum
Allowable Power Interruption:	33 ms minimum @ 115 Vac line
Noise Immunity:	Meets requirements of NEMA ICS 2-230 and ANSI C37.90A
Dimensions:	12.46 x 9.00 x 2.75 (inches) 317 x 119 x 70 (mm)
Operating Temperature:	0° to 60° C (outside of rack)
Storage Temperature:	-40°C to 70°C
Humidity:	5% to 95% (non-condensing)

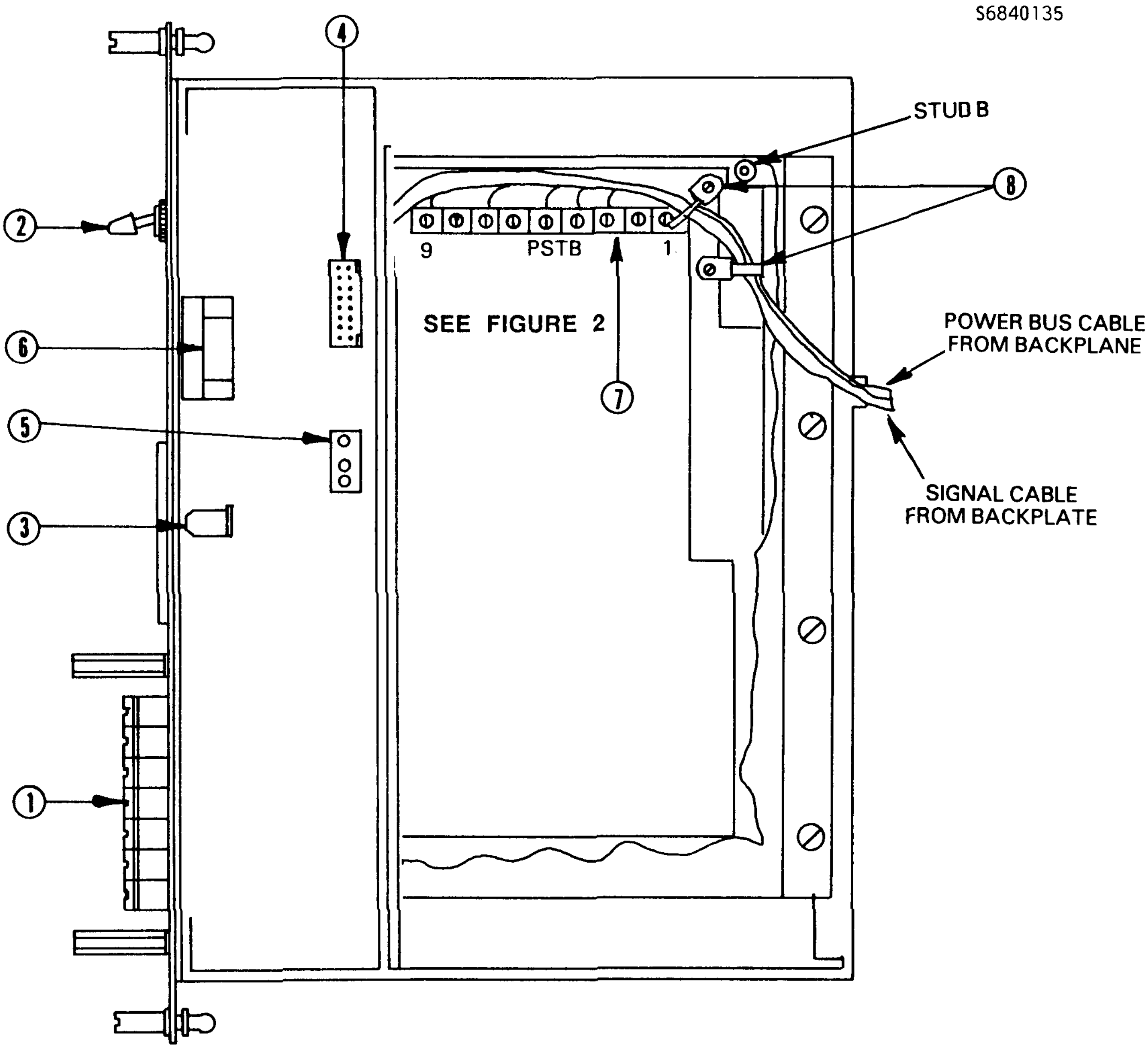


Figure 1. User Items

1. Front Panel Connector Block
2. Power Switch
3. RUN/HOLD Keyswitch
4. CPU1/CPU2/AUTO Keyswitch
5. Power-On LED

   On: The voltage levels of both DC outputs (+12V and +5V) are within tolerance.

   Off: At least one of these voltage levels is out of tolerance.
6. P1, 16-Pin Connector
7. P6, 3-Pin Connector
8. 2A Fuse
9. Power Supply Terminal Board
10. Cable Clamp

Installation

The RPU is designed to operate either with a single power supply module or with two power supply modules. The removal and replacement guidelines for a power supply module in a dual supply system also apply to a single supply system.

When two power supply Modules are used, the system offers power supply redundancy in such a way that:

- If both power supply modules are functioning normally, one module has the load and the other is on standby.
- If one power supply module fails, the other either continues to carry the load or automatically assumes it without affecting the normal operation of the RPU system.
- A power supply module should be able to be removed or installed while the RPU system is up and running without interrupting the normal operation of the RPU system.
- However, because there may be 'live' voltages on a power supply module, even after the switch to that module is turned off, the following removal and replacement guidelines should be observed.

Auxiliary Power Supply Module Replacement (RPU running)

1. Switch RUN/HOLD switch to HOLD.
2. Remove power to failed power supply by disconnecting AC or DC source.
3. Disconnect wiring to AC or DC and alarm terminals.
4. Remove partition faceplate between power supplies.
5. Release quarter-turn fasteners and slide power supply out to expose connectors located behind faceplate.
6. Disconnect the 4 wires from the supply chassis and 2 connectors from the monitor circuit board.
7. Remove the failed power supply.
8. Reverse the above procedure to install the replacement module.
9. After the replacement power module has been installed, apply power to module and verify that the POWER-ON LED is on.
10. Switch RUN/HOLD switch to RUN.

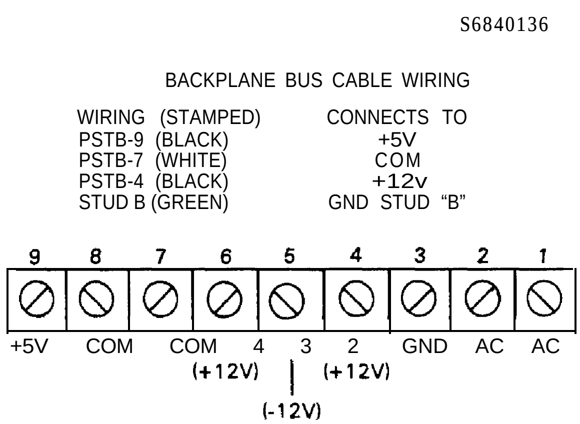


Figure 2. Power Supply Terminal Block

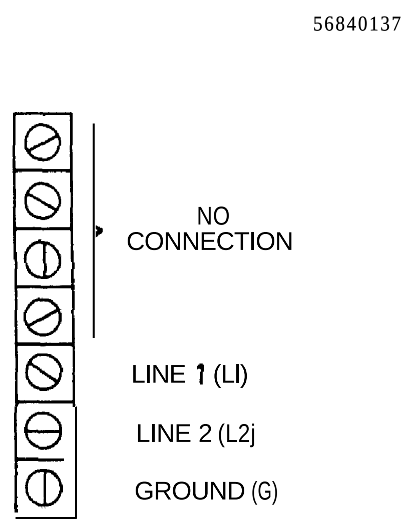


Figure 3. Front Panel Terminal Block

Series Six™
Programmable Controllers

GEK-84863B

March 1989

Redundant Processor Unit
Device Switch Module

General Description

The Device Switch module used in the Redundant Processor Unit (WU) includes 12 Form C reed relays to allow external peripherals such as CRTs, printers, etc., to be shared between CPUs connected to the RPU. A 36-point connector at the front of the module provides access to these relays. This module isolates the CPU and I/O Switch modules from and interfaces them to the Data Control Module and its memory in the RPU. A watchdog timer function and various status displays are also provided for external error indication. On-board jumpers allow the selection of various options, including data transfer requirements. The features and benefits of the Device Switch module are summarized in Table 1, while Table 2 provides module specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
12 Form C reed relays	Allows peripheral sharing between CPU's or DPU's
Seven segment display	Indicates system configuration and error status
Jumpers	Facilitates selection of data transfer options

Table 2. Specifications

Dimensions:	Circuit Board: 8,15 x 11.0 x 1.1 (inches) **208 x 280 x 28** (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)
Storage Temperature:	**-40 to +70C**
Operating Temperature:	**0° to 60° C** (Outside of rack)
Power Requirements:	5 V dc, 1.5 A (Supplied by RPU power supply)
Relay Contact Ratings:	Maximum current 250 mA Maximum voltage 25 Volts dc or ac Switch bounce 5 milliseconds maximum Resistive loads only
Humidity:	5% - 95 % (non-condensing)

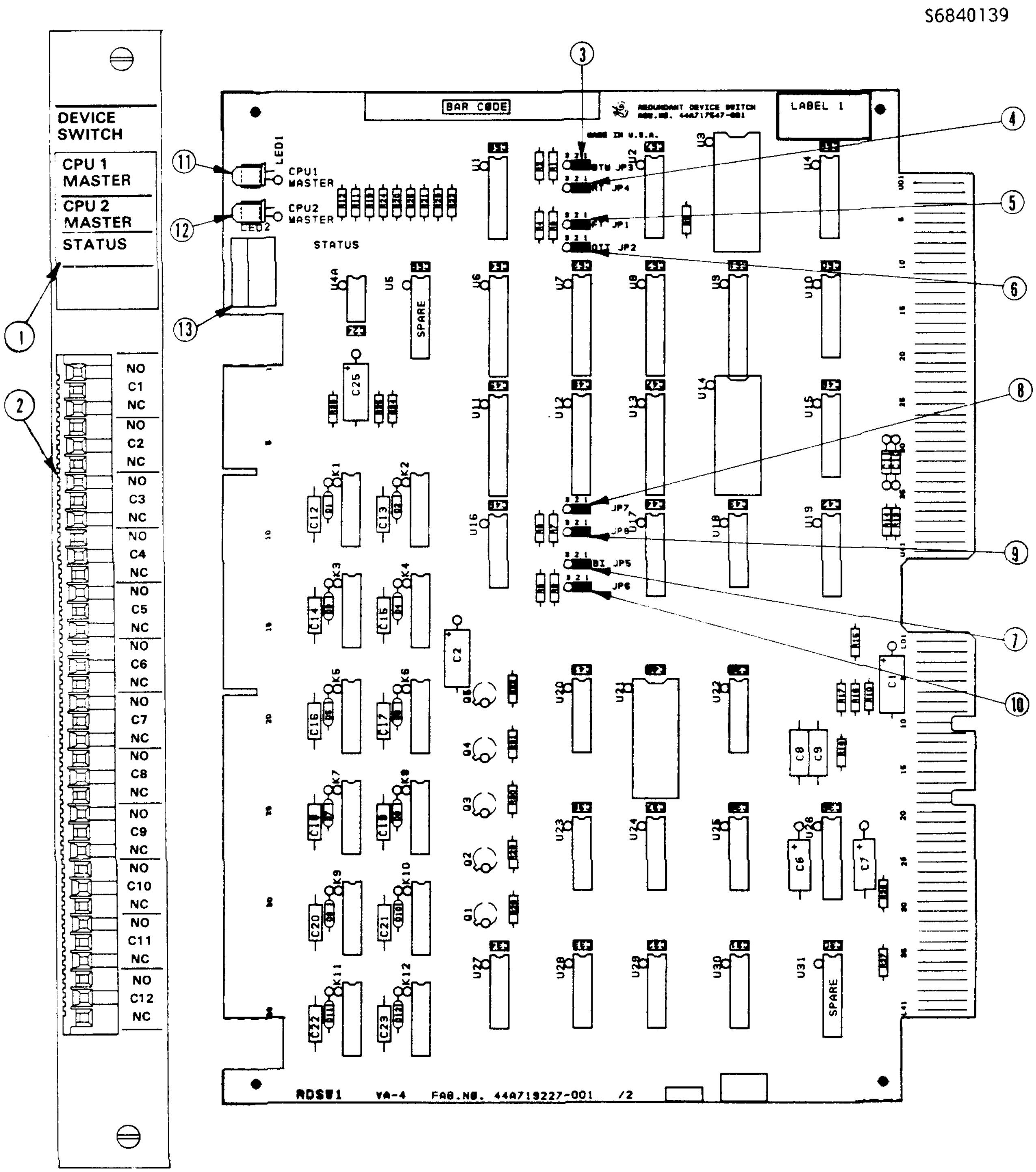


Figure 1. User Items

1. Faceplate
2. 36-point Connector
3. Jumper BT 3 2 1 (3 2 1 not active)

   Register 254 will be transferred from the Backup to the Master CPU each sweep.
4. Jumper RT 3 2 1 (3 2 1 not active)

   Allows specified registers to be transferred from the Master CPU to the Backup CPU each sweep. Start register value in R255, end register value in R256 of Master CPU.
5. Jumper FT 3 2 1

   Set at factory. Do not alter.
6. Jumper OTT 3 2 1 (3 2 1 not active)

   Output status table (Main I/O chain) and transition table will be transferred from the Master to Backup CPU each sweep.
7. Jumper BI 3 2 1

   The RPU will transfer up to 4096 registers, and all inputs, outputs, override and transition tables from the Master CPU to the Backup CPU whenever a CPU becomes a Backup. (From either off-line or Master status.)

   3 2 1

   The RPU will transfer only the data specified by the BTM, RT and OTT jumpers, in addition to the default transfers.
8. Jumper JP6

   3 2 1

   Enables 11024 to be used as Backup Bit in Backup CPU.

   3 2 1

   If your system uses PT4 I/O transmitter board(s), you will have to set RDSW board switch JP6 to the 1,2 position from the factory 2,3 position to move the Backup Bit to 11022.
9. Jumper JP7 Not used
10. Jumper JP8

    3 2 1

    Selects 150ms maximum scan time. Compatible with ALU2 and ALU3 CPU Arithmetic Logic Units.

    3 2 1

    Selects 250ms maximum scan time. Compatible only with ALU3 boards in both CPUs.

    NOTE

    These data transfer options may also be selected by certain Master CPU table bits. Input status table and timer time base values are always transferred from Master CPU to backup CPU each sweep. Data transfer options selected will impact Master and Backup CPU sweep time.
11. Status Display LED CPU1

    When on, indicates that CPU1 is selected to be the Master CPU.
12. Status Display LED CPU2

    When on, indicates that CPU2 is selected to be the Master CPU.

    STATUS, seven segment LED display

0 - Single I/O - No Aux. I/O 1 - Redundant I/O - No Aux. I/O 2 - Single I/O and Aux. I/O 3 - Redundant I/O and Aux. I/O	NORMAL OPERATION
4 - Hung I/O Bus 5 - Data Storage Card Failure 6 - Data PROM Card Failure 7 - Data Control Card Failure 8 - Device Switch Card Failure 9 - CPU Switch Card Failure	RPU ERRORS

NOTE

A flashing display indicates that the watchdog timer has timed out. (RUN/HOLD switch in "HOLD" position, processor failure, or any of errors 5-9 displayed).

Figure **1.** User Items **(Cont'd)**

Installation

Set the option jumpers as described in Figure 2. Install the Device Switch Module in the eighth slot from the left of the RPU, using the extraction/insertion tool supplied with the RPU to seat it firmly in place.

CAUTION

The module may be installed or removed under power, but the RPU RUN/HOLD switch on the Main Power Supply must be in the HOLD position, or damage to the equipment may result. Replacement of the Device Switch under power almost always results in system shut down, even in Hold Mode.

Before installing the faceplate, make any required connections to the 36 point connector attached to the faceplate. Connections include, but are not limited to:

Sharing a CRT or printer between a Master or Backup CPU (see Figure 2).

Sharing a communications line set up to an external Host computer, or modem between a Master and Backup CPU Communications Control Module.

Sharing an external analog device between two D/A or A/D cards located in the Master and Backup I/O chains.

The 12 device relays are Form C. The NO (normally open), NC (normally closed), and C (common) contacts for each relay are labeled on the faceplate. For example, relay 1 is labeled as NO, NC and Cl, relay 2 is labeled NO, NC and C2, and so on.

The C contact of each relay is made to its NC contact whenever the RPU bus position is CPUl. Conversely, the C contact of each relay is made to its NO contact whenever the RPU bus position is CPU2. See Table 2 for the relay contact specifications.

After all required connections have been made, guide the faceplate into position on the module, then secure the faceplate to the rack by tightening the thumbscrews at the top and bottom.

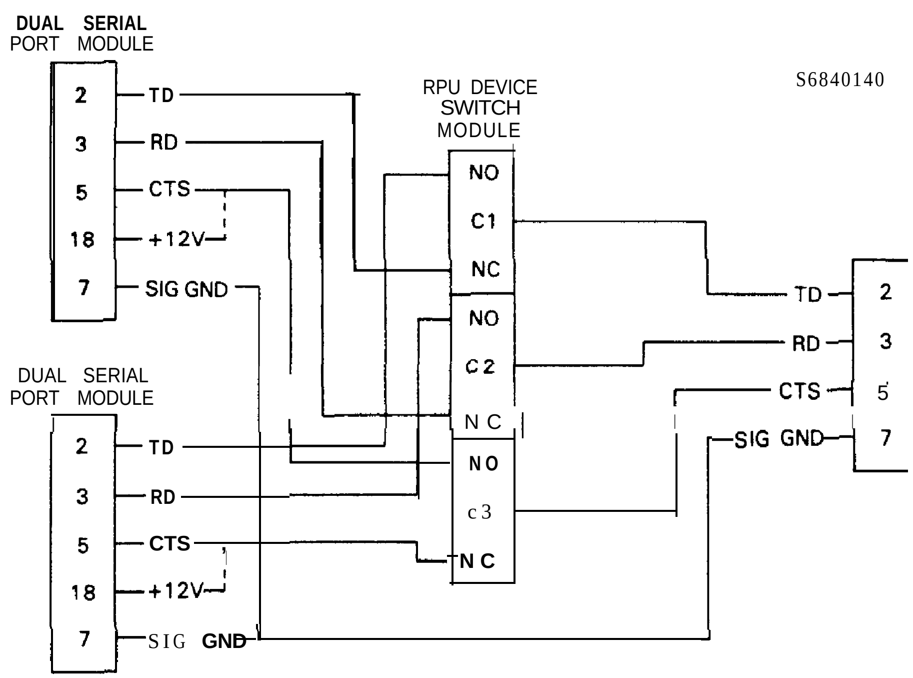


Figure 2. Peripheral Connections

Printer, CRT, etc. Connections

*Serial port CTS must be jumped to +12 V if the user device does not provide a CTS signal.

Table 3. Ordering Information

Circuit Board	Circuit Board and Faceplate	Faceplate
IC600RB752	IC600BF752	IC600FPI752

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

GEK-84864B

Redundant Processor Unit
I/O Switch Module

March 1989

General Description

The I/O Switch Module is used in the Redundant Processor Unit (RPU) to interface to and select one of two parallel I/O chains as the Master I/O chain.

Both I/O chains connect to the I/O Switch Module through two 37-pin D connectors located at the top and bottom positions on the front of the module.

The module transfers the selected I/O chain bus to the RPU backplane bus for use by the CPU Switch Module.

Two I/O Switch Modules can be used in an RPU; one for the Main I/O chain, and an optional module for the Auxiliary I/O chain,

A jumper is provided on the module to allow operation with a second I/O chain. Four LED indicators are provided to show CPU and I/O chain status. The features and benefits of the I/O Switch module are summarized in Table 1, while Table 2 provides module specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
Two paralle1 bus connectors	Provides RPU link for one or two I/O chains
Solid state bus switch	Provides bumpless transfer of I/O chain control
Status display	Shows CPU and I/O chain status

Table 2. Specifications

Dimensions:	Circuit Boar& 8.15 x 11.0 x 1.10 (inches) 208 x 280 x 28 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 **(mm)**
Power Requirements:	5 V dc, 2.0 A (Supplied by RPU power supply)
Storage Temperature:	-40° to +70° c
Operating Temperature:	0° to 60” C (Outside of rack)
Humidity:	5% - 95% (non-condensing)

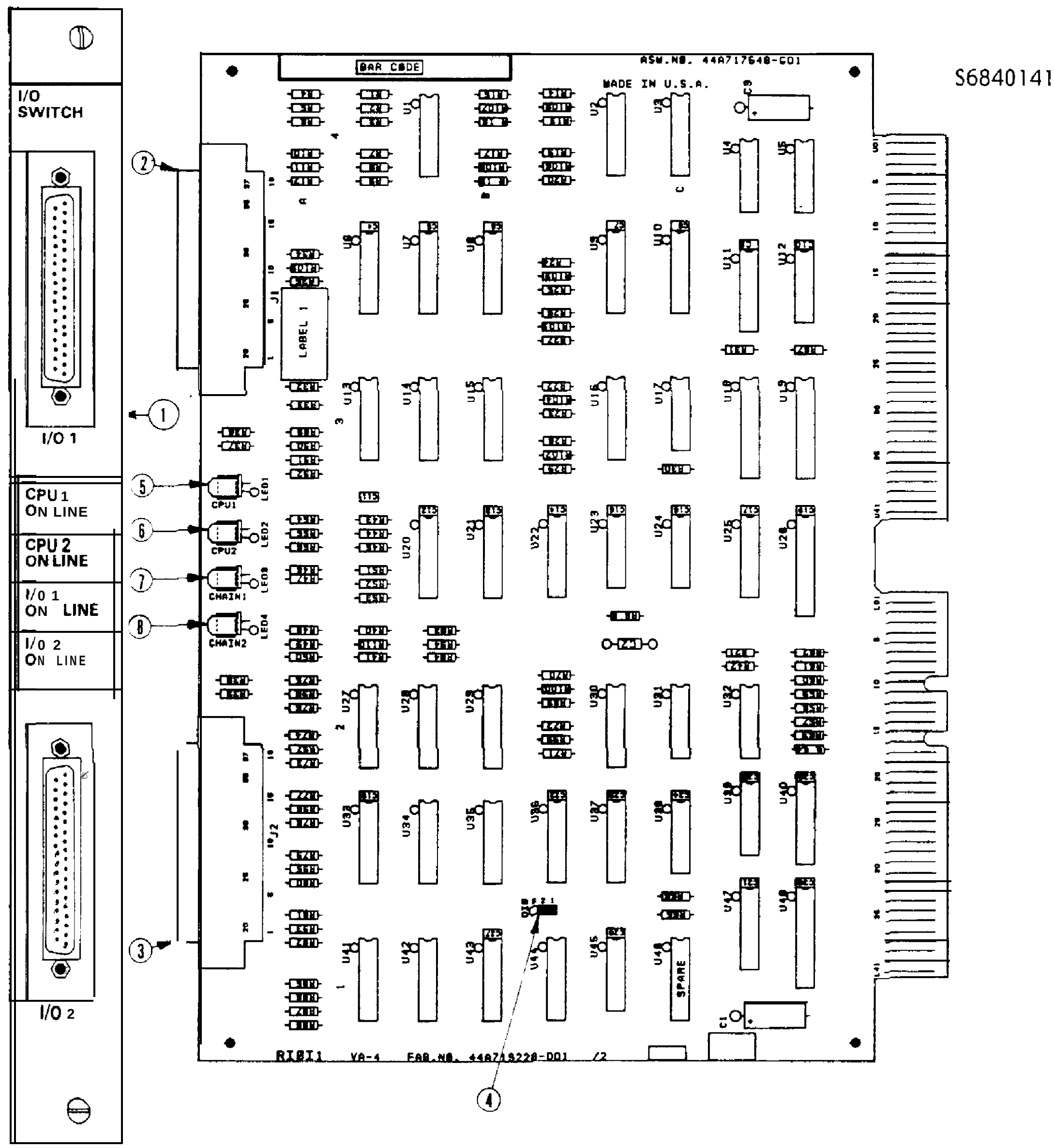


Figure 1. User Items

1. Faceplate.
2. I/O Chain No. 1 Connector.
3. I/O Chain No. 2 Connector.
4. Jumper (labeled DIO)

   Single I/O chain 3 2 1

   Dual I/O chains 3 2 1
5. CPU1 On-Line

   When on, indicates that CPU1 is available as the Master **CPU.**
6. CPU2 On-Line

   When on, indicates that CPU2 is available as the Master CPU.
7. I/O 1 On-Line

   When on, indicates that **I/O** chain No. 1 is available.
8. I/O 2 On-Line

   When on, indicates that I/O chain No. 2 is available.

Installation

Set the DIO jumper to the required position (See Figure 1). The I/O Switch Module must **be** installed in either the second or seventh slots (from the left) of the RPU, depending on whether it is to be used in the Auxiliary or Main I/O chain, respectively. Use the insertion/extraction **tool** provided with the RPU to ensure proper module seating. Guide the faceplate over the connectors; then secure the faceplate to the rack **by** tightening the thumbscrews at the top and bottom.

Connect a multi-pair cable from the I/O chain 1 port (37-pin D connector) on the RPU to the I/O Receiver card top 37-pin D connector which begins I/O chain No. 1.

If a second I/O chain is used, connect a multi-pair cable from the I/O chain No. 2 port (37-pin D connector) **on** the RPU to the I/O Receiver card top 37-pin D connector which begins I/O chain No. 2.

Repeat the previous two operations if the optional Auxiliary I/O chain(s) is used.

All **connectors** should be secured using the furnished screws.

CAUTION

While removing or installing the I/O Switch Module, power should be removed from the RPU. Removing either RIOI board from the RPU will cause an I/O Chain reset. The process controlled by the CPU will stop.

For best results, cables from the I/O Switch Module to either I/O chain should be routed separately from power, contactor or motor circuits containing high current or high frequency noise components. These cables should not exceed fifty feet in length, including cable when connecting to other I/O Receiver cards in the daisy chain.

Table 3. Ordering Information

Equipment	Catalog Number
Circuit Board and Faceplate	IC600RB750
Faceplate only	IC600FP750
I/O Chain Cable 2 feet (Ohm)	IC600WD002
I/O Chain Cable 5 feet (1.5m)	IC6OOWDOO5
I/O Chain Cable 10 feet (7.5m)	IC600WD010
I/O Chain Cable 25 feet (18.75m)	IC6OOWDO25
I/O Chain Cable 50 feet (37.5m)	IC6OOWD050

The UL symbol **on** the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

Series Six
Programmable Controllers

GEK-84865B

March 1989

Redundant Processor Unit
CPU Switch Module

General Description

The CPU Switch Module is used in the Redundant Processor Unit (RPU) to monitor and select one of two external Series Six CPUs as the Master CPU, as well as to provide a communications link to either CPU from the RPU Data Control Module.

The I/O chains from both CPUs interface to the CPU Switch Module through two 37-pin connectors located at the top and middle positions of the Module.

The CPU Switch Module transfers the selected CPU I/O chain bus to the RPU backplane bus for use by the I/O Switch Module.

Two CPU Switch Modules may be utilized in an RPU; one for the Main I/O chain and an optional module for the Auxiliary I/O chain. The features and benefits of the CPU Switch module are summarized in Table 1, while Table 2 provides module specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
Three parallel bus connectors	Provides RPU link to two CPUs
Solid state bus switch	Provides bumpless transfer of I/O chain control between CPUs

Table 2. AC Specifications

Dimensions:	Circuit Board: 8.15 x 11.0 x 1.1 (inches) 208 x 280 x 28 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)
Power Requirements:	5 V dc, 2.0 A (Supplied by RPU power supply)
Storage Temperature:	-40” to +70° c
Operating Temperature:	0° to 60° C (Outside of rack)
Humidity:	5% - 95% (non-condensing)

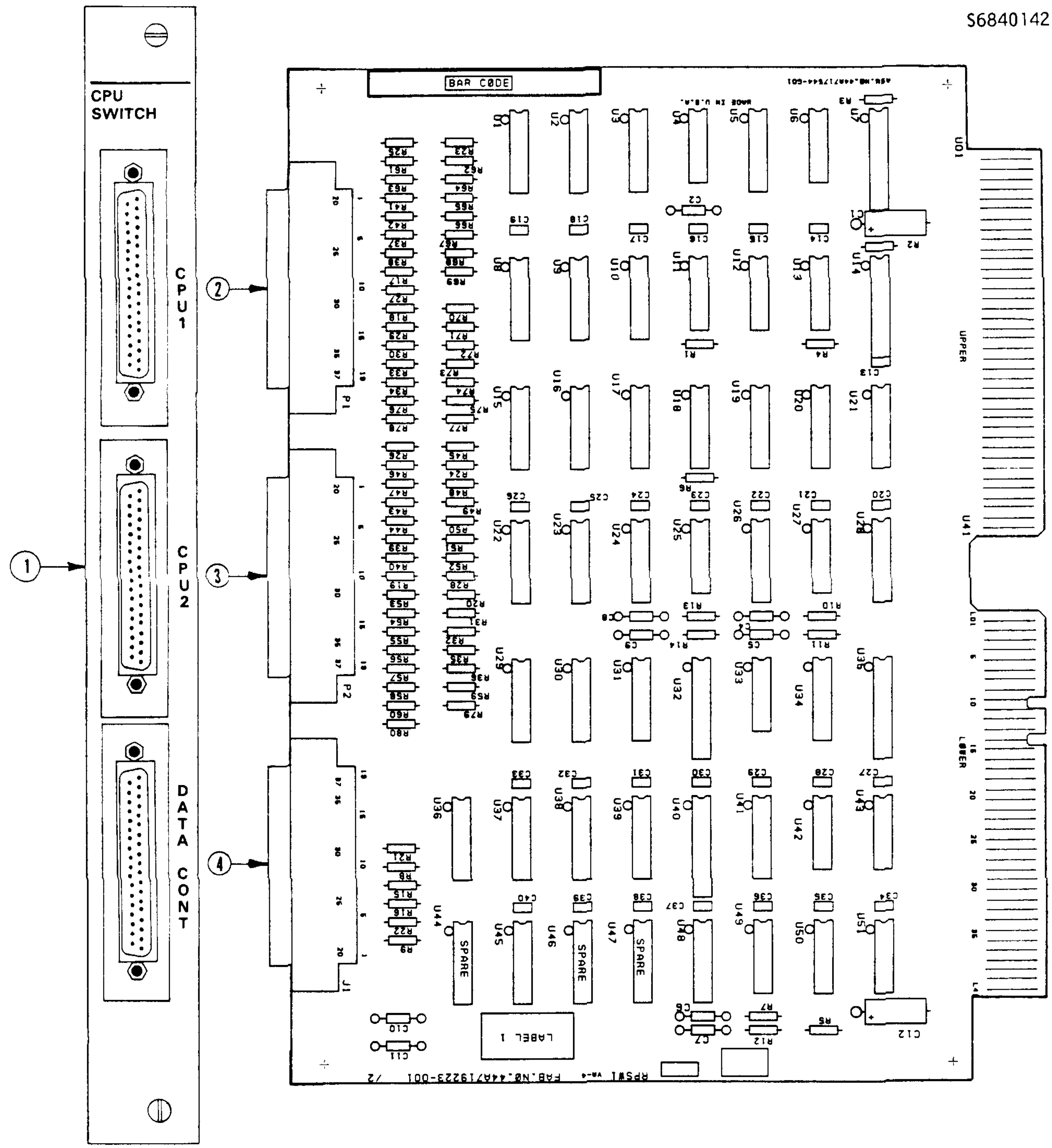


Figure 1. User Items

1. Faceplate.
2. CPU No. 1 Connector.
3. CPU No. 2 Connector.
4. Data Control Connector (Cable supplied with RPU)

Installation

The CPU Switch Module must be installed in either the first or sixth slot (from the left) of the RPU, depending on whether it is to **be** used in the Auxiliary *or* Main I/O chain, respectively. Use the insertion/extraction tool supplied with the RPU to ensure proper module seating. Guide the faceplate over the connectors; then secure the faceplate to the rack by tightening the thumbscrews at the top and bottom.

Connect a multi-pair cable from the CPU1 port (37-pin D connector) on the RPU to the I/O port (37-pin D connector) on the first CPU I/O Control Module or Auxiliary I/O Module for the Main or Auxiliary I/O chain, respectively.

Connect a multi-pair cable from the CPU2 port (37-pin D **connector)** on the **RPU** to the I/O port (37-pin D connector) on the second CPU I/O Control Module or Auxiliary I/O Module for the Main or Auxiliary I/O chain.

The other 37-pin connector on the CPU Switch module (Main I/O chain only) should be connected to the Data Control module bottom 37-pin connector using the short cable supplied with the RPU. All connectors should be secured using the furnished screws.

CAUTION

While removing or installing the CPU Switch Module, power should be removed from the RPU. Removing either RPSW board from the RPU will cause an I/O Chain reset. The process controlled by the CPU will stop.

For best results, cables from the CPU Switch Module to either CPU should be routed separately from power, contactor or motor circuits containing high current or high frequency noise components. These cables should not exceed 10 feet in length.

Table 3. Ordering Information

Equipment	Catalog Number
Circuit Board and Faceplate	IC600RB751
Faceplate only	IC600FP751
CPU No. 1 Cable 2 feet (0.6m)	IC600WD002
CPU No. I Cable 5 feet (1.5m)	IC600WD010
CPU No. 2 Cable 2 feet (0.6m)	IC600WH002
CPU No. 2 Cable 5 feet (1.5m)	IC600WH005
CPU No. 2 Cable 10 feet (7.5m)	IC600WH010
Data Control Cable	IC600WJ001

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

SERIES SIX

GEK-84866

PROGRAMMABLE CONTROLLERS

OPERATOR INTERFACE UNIT

GENERAL DESCRIPTION

The Operator Interface Unit (OIU) is a hand-held operator interface unit in the form of a micro-terminal that allows an operator to monitor or modify the register contents of the Central Processor Unit (CPU) of the Series Six Programmable Controller. Timers and counters can also be monitored and modified. Input/Output (I/O) states can be monitored, modified, and overridden.

The OIU is not a hand-held programmer. User logic cannot be examined or changed. It is not a substitute for the Program Development Terminal (PDT).

The OIU interacts with the CPU via the Communications Control module version 2 (CCM2). It is attached to the CCM2 in a single or polled fashion. Up to seven (7) OIUs can be supported in the polled configuration on each output port.

Figure 3 shows the keyboard layout of the OIU. The OIU is a lightweight, compact terminal. It has 28 functional and numeric keys and provides command/data entry to be transmitted to the CCM2 of the Series Six Programmable Controller.

The OIU always initiates a transmission of data between an OIU and a Series Six CPU. The CPU will only answer the request of the OIU. The CPU does not initiate communications with the OIU, it only scans or polls the OIUs that wish to communicate.

The OIU can either be connected to the Jl port (25-pin) or the J2 port (9-pin) of the CCM2. One OIU can be powered by the CCM2 through a cable connection to the Jl port. The user must supply his own power if he uses the J2 port, or uses more than one OIU, or is more than l0 feet from the CCM2 port.

The OIU has a 16-character display with horizontal scroll-left and scroll-right keyboard controls and permits review and editions of data entered before transmission to the CCM2 and display of data received from the CCM2.

Two 80-character buffers are provided for keyboard generated data. The Output Buffer holds a message being written, reviewed or edited. The Transmit Buffer holds a prepared message ready for transmission to the CCM2.

Similiary, two 80-character buffers are available for incoming messages from the CCM2. The Receive Buffer holds an incoming message until it can be transferred to the Input Buffer where it is displayed for the operator. With two buffers, a CCM2's input to the terminal can be reviewed while reception of a second CCM2's message can be proceeded and held in the receive buffer until called up for display.

STATUS INDICATION

There are five Light-Emitting Diode (LED) lights below the I6-character display that indicate various operating status conditions of the OIU. Left to right these status indications are:

COMM GOOD:
This LED light blinks when a good communications link has been established between the OIU and the CCM2.

CHANGE ALLOWED:
This LED light becomes illuminated when modification to the Series Six's CPU memory is allowed (not protected).

INPUT DISPLAY:
This LED light becomes illuminated when an input message from the Input Buffer enters the display buffer, causing it to be displayed.

OUTPUT PENDING:
This LED light becomes illuminated to indicate that an output message from the OIU has been enabled by the ENTER key. This output pending status will only occur during the polled mode of operation and only during the elapsed time between the time that the output has been enabled and this particular OIU is polled by the CCM2. At the time this OIU is polled the message will be transmitted to the CPU and the light will be extinguished.

MESSAGE WAITING:
This LED light will become illuminated to indicate that a message from the CCM2 is being held in the Input Buffer. This temporary storage is necessary in the event that the OIU is being used in the message composition or editing mode when the message is received. To transfer the message from the Input Buffer to the display it is only necessary to depress the CONT key.

MEMORY PROTECT FEATURE

When the memory protect keyswitch on the Series Six is ON, the operator using the OIU can ONLY monitor (display) data but cannot change (modify/enter) register values and I/O status. This is called the operator "lock-out." This feature can be defeated for all but the override functions through the contents of the CPU configuration register. The CPU configuration register can only be changed by using a PDT. For more detailed information refer to the Series Six Data Communications Manual, GEK-25364.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
1. Compact operator interface.	Low cost alternative to Series Six PDT, or an array of thumbwheels, pushbuttons and displays.
2. Examine or change register contents.	Monitor or change the value of any program variable such as timer and counter presets and actual values.
3. Display register content as signed or unsigned decimal, double precision or hexadecimal number.	Monitor a program variable in four different number formats.
4. Use preassigned registers for timer or counter presets and accumulated values.	Be able to reference 24 timers and 24 counters by ID numbers as preassigned. Up to a total of 512 counters and/or timers may be coded for ID numbers by using CPU "SCREQ" commands.
5. Examine or change I/O status, and override condition.	Troubleshoot a system by monitoring any I/O status or changing its status and override condition (except Auxiliary I/O).
6. Hardware or software lockout (memory protect).	Protect all or selected registers from being changed by unauthorized personnel, using CPU memory protect key or software configuration.
7. RS-422 serial interface.	Connect up to seven (7) units on a single serial interface up to 4000 feet from the CPU.
8. Water and dust resistant front panel and panel mount case.	Mount the unit on the outside of the plant floor enclosure for easy operator access.
9. Operates from + 5 V supplied by CCM2 (up to 10 feet).	Use the unit as a hand-held, portable operator interface or troubleshooting device for more than one CPU.
10. 16-character alphanumeric display.	Provides "conversational" status displays, editing displays and operator error messages.
11. LED indicators.	Verify if communications between CCM2 and OIU is active, and if lockout is on or off.
12. Can be used in a polled multi-drop system.	Allows the CPU to be communicated with from several locations by one or more operators.

APPLICATIONS

1. Mount one or more units at the machine or process site to allow the operator to change program variables such as timer, counter and analog loop preset values from one or more locations.
2. Use a single unit as a portable, hand-held diagnostic device to troubleshoot systems (before carrying out the Series Six PDT).
3. Use as a human interface for machine and process control, energy management system, inventory control and factory floor data collection, and information processing systems.

MODULE SPECIFICATIONS

Interface:
Requires a CCM2 plus +5 V power supply and cable (CCM2 provides necessary power for single OIU within 10 feet of CPU).

Display: l&character alphanumeric LED display.

Keyboard: Sealed, tactile feedback;
- 11 - numeric keys
- 9 - editing keys
- 8 - function keys

Communication: RS-422 serial interface at 19.2K baud rate (multi-drop).

Indication: 5 LED indicators.

Power Requirement: +5 V ± 0.25 Vat 650 mA
(Supplied by CPU Power Supply for a single OIU)
Must be supplied by user if there is more than one OIU or OIU is more than 10 feet away.

Dimensions: 8.5“ wide x 4.5” high x 0.6“ deep.

Configuration: Panel mount, hand-held or multi-drop.

Environment: 0°C to 60°C, 95% relative humidity (non-condensing).

Construction: 100% solid state
Dust proof/water resistant front panel.

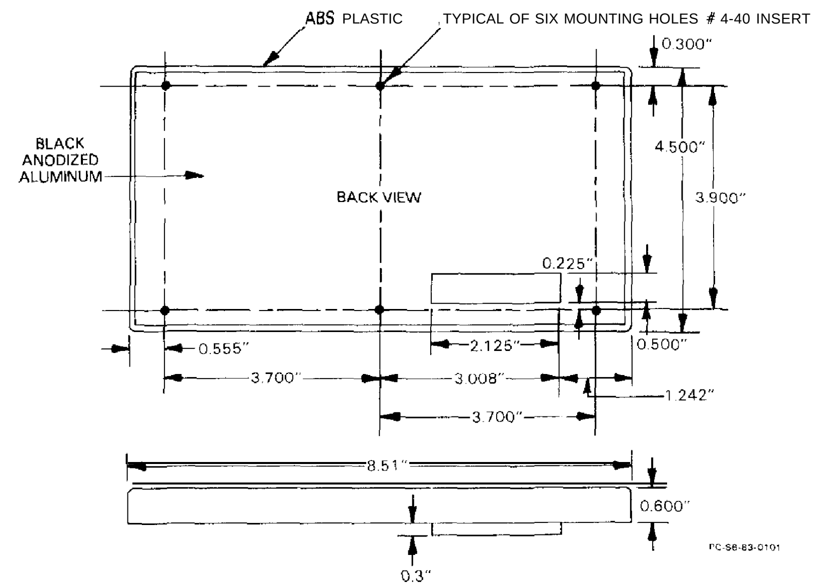
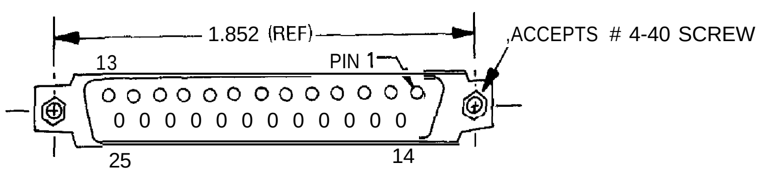


FIGURE 1. MECHANICAL DIMENSIONS



PROTRUDES 0.3 INCHES FROM BACK PANEL

THE OIU MATES WITH A CONNECTOR CONSISTING OF THE FOLLOWING AMP INC., PART NUMBERS:

1. MALE MDP CONNECTOR - 205208-I
2. INDIVIDUAL PINS (SOLDER CONNECTOR) - I-80506-0
3. HAND TOOL TO INSERT PINS IN CONNECTOR - 91067-2
4. MALE SCREW RETAINER KIT - 205980-I
5. SHIELD ASSEMBLY - 205 7 18- 1

PC-56-83-0102

FIGURE 2. 25-PIN D-TYPE CONNECTOR BACK PANEL OIU VIEW

Ref. PC-S6-83-0101
PC-S&83-0102

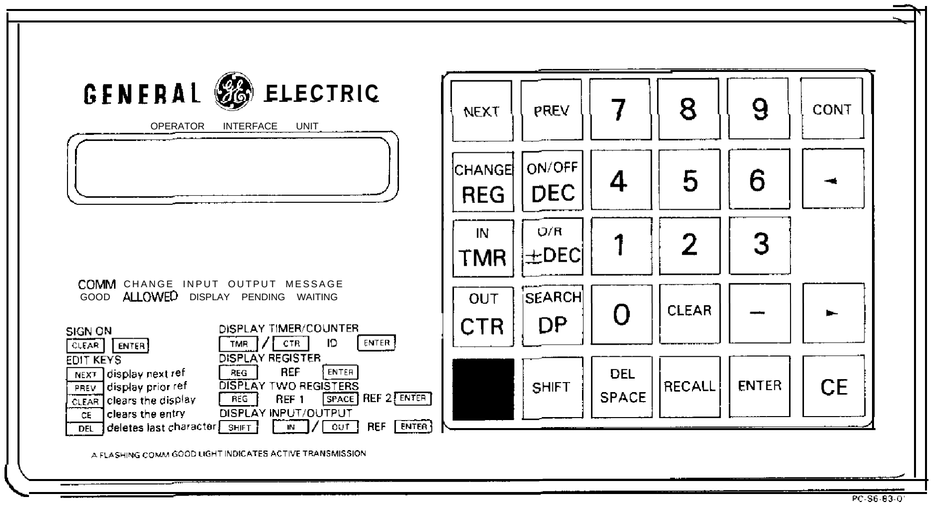


FIGURE 3. OPERATOR INTERFACE UNIT

CCM2 Connectors/RS-422 Cable Specifications

Length, Maximum - 4000 ft. (1.2Km) for RS-422

Overall Shield

24 AWG, Minimum

Connector to CCM2 Port Jl - D-Subminiature Type, Cannon DBC25PC37 with 207908-7 Hood or Equivalent (Standard RS-232C Connector)

Connector to CCM2 Port 52 - D-Subminiature Type, Cannon DE9PC37 with 207908-l Hood or Equivalent

Connector to OIU - see Figure 2

RS-422 Cable Selection
The following cables provide acceptable operation at data rates up to 19.2K BPS and distances up to 4000 feet.

Belden	9184
Belden	9302
NEC	222PlSLCBT

At shorter distances, almost any twisted pair or shielded twisted pair cable will work. It should be noted that RS-422 requires that the transmitter and receiver ground be within a few volts of each other or damage to the transmitter and receiver may result.

It is also noted that the twisted pairs should be matched so that both transmit signals make up one twisted pair and both receive signals make up the other twisted pair. If this is ignored, then cross-talk can result from the mis-matching which will affect the performance of the communication system.

Serial Data Format

BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	BIT 8	BIT 9	BIT 10
START 0	LSB	ACTIVE	DATA	BITS	1	OR	0	MSB	* PARITY	STOP 1

* Parity can be disabled on either port.

FIGURE 4. CONNECTORS/CABLE SPECIFICATION AND SERIAL DATA FORMAT

KEYBOARD FUNCTION OF THE OIU

There are nine editing keys and the eight keys for special functions. The functions of these keys are described below.

UNSHIFTED

KEY		MEANING
REG	CHANGE / REG	Display REGister(s).
TMR	IN / TMR	Display TiMeR(s).
CTR	OUT / CTR	Display CounTeR(s).
DEC	ON OFF / DEC	Display Register(s) in unsigned DECimal.
±DEC	O R / ±DEC	Display Register(s) in signed DECimal.
DP	SEARCH / DP	Display Register(s) in Double Precision.
NEXT	NEXT	Display NEXT item(s).
PREV	PREV	Display PREVious item(s).
SPACE	DEL / SPACE	Enter a SPACE on display.
RECALL	RECALL	Previously transmitted message will reappear.
CONT	CONT	Causes the display update to continue.
–	–	Causes a minus (-) sign to appear on display.
◄	◄	Scrolls the displayed message to the left.
►	►	Scrolls the displayed message to the right.
CE	CE	Clear the last incomplete entry.
CLEAR	CLEAR	Causes the display to clear.
ENTER	ENTER	Sends the displayed message to CPU.
SHIFT	SHIFT	Activates the top function on dual function keys.

SHIFTED

KEY			MEANING
CHANGE	SHIFT	CHANGE / REG	Modify item displayed.
IN	SHIFT	IN / TMR	Display INput(s).
OUT	SHIFT	OUT / CTR	Display OUTput(s).
ON/OFF	SHIFT	ON OFF / DEC	Force an input or output ON/OFF.
O/R	SHIFT	O R / ±DEC	Set the OverRide for an input or output ON/OFF.
SEARCH	SHIFT	SEARCH / DP	SEARCH for inputs and outputs that are overridden.
DEL	SHIFT	DEL / SPACE	Backspaces and erases one display character.

MODES OF OPERATION OF THE OIU

1. POWER UP (Non-operating Standby) mode:
   A sign-on function used when powering up or re-initializing the OIU terminal to get the OIU into the operational "READY" mode. This "sign on" function is accomplished by depressing the CLEAR and then the ENTER button.

2. READY mode:

   a. The READY mode is entered by pressing the CE key. This entry clears the Output Buffer. An "UP carrot" or A will be displayed to indicate that the OIU is in the READY mode.

   b. In the READY mode, a message from the CCM2 will be displayed immediately upon reception of the message. At the same time, the INPUT DISPLAY LED comes on.

   c. The OIU exits the READY mode whenever any character input from the keyboard is entered. This entry is stored temporarily in the Output Buffer prior to eventual transfer to the Transmit Buffer for transmission to the CCM2. The actual transfer of the data takes place upon pressing the ENTER key.

3. MESSAGE COMPOSITION mode:

   a. The MESSAGE COMPOSITION mode is entered by pressing any one of the character keys on the keyboard. It is indicated by a character being displayed.

   b. In the MESSAGE COMPOSITION mode, a message from the CCM2 will not be displayed immediately. However, it is held in the Input Buffer for later operator's inspection.

      The MESSAGE WAITING LED now comes ON to indicate a message is in the Input Buffer.

   c. To view the content of the Input Buffer, the operator can press either the RECALL or the CLEAR ENTRY (CE) key. The function of the RECALL key is to fill the Display Buffer so that the content of the Input Buffer is transferred to the Display Buffer and displayed. The Input Display LED comes ON when this happens.

   d. The – or – key may now be used to view the message in the Display Buffer.

   e. Note that pressing the RECALL key the second time will cause loading of the content of the Output Buffer into the Display Buffer and display the content. When this occurs, the Message Waiting LED goes off.

   f. When an input message is received from the CCM2 while the OIU is holding a previous message, both the Message Waiting LED and the Input Display LED come ON. The new input is stored in the Receive Buffer. Pressing the CONT key will cause the content in the Receive Buffer to be transferred to the Input Buffer. To view it, go to step c.

   g. The OIU exits the MESSAGE COMPOSITION mode when the CE or the ENTER key is pressed. It goes back to tbe READY mode.

DISPLAY OF THE OIU

Display formats are shown below.

LED READOUT / FUNCTION	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Input/Output Status	I	0	1	2	3		=			O	N					
	I	0	1	2	3		=			O	F	F				
	I	0	1	2	3		=			O	N			O	/	R
	I	0	1	2	3		=			O	F	F		O	/	R
Register	R	0	2	4	6		=		-	1	6	2	9	5		
	R	1	0	2	2		=		+	8	0	6				
	R	0	0	1	2		=			1	3	5	7			
Double Precision	-	1	2	3	4	5	6	7	8	9	0					
	+	2	1	1	3	4	7	9								
Dual Input/Output	O	N			O	/	R			O	F	F		O	/	R
	O	F	F		O	/	R			O	N			O	/	R
	O	N								O	N			O	/	R
	O	N								O	N					
	O	F	F							O	F	F				
Timer/Counter	1	2	3	4	5						1	2	3	4	5	
Dual Register		1	2	3	4	5						2	4	6	8	0
	-	1	2	3	4	5					-	1	2	3	4	5
	+	1	2	3	4	5					-	2	4	6	8	0
Sign On	W	A	I	T												
	R	E	A	D	Y		O	I	U		R	E	V		X	
Sign Off	O	F	F		L	I	N	E								

NOTE

Register, input and output address are displayed with leading zeroes (e.g., R 0 0 1 2). Register, timer and counter values will not have leading zeroes and immediately follow the + or - sign (or the position allocated for +/- if an unsigned decimal value is displayed).

The normal, if not called for otherwise, default mode of display for register value is in unsigned decimal. Signed decimal (+/- DEC) or double precision (DP) numbers can be displayed by using the respective function key.

Timer and counter values will always be displayed as unsigned decimal numbers.

Hexadecimal display is formatted as below.

COLUMN NUMBER	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	R	0	1	2	3		=			1	2	3	4	5						H	H	H	H

Details of the key functions are listed below.

SHIFT

The SHIFT key acts as a "second function" key. Depressing the SHIFT key followed by a dual-function **key** will implement the second function.

CHANGE/REG

To display a register and its content, depress the REG key, and up to four (4) numeric keys (O-9) for the address wanted and press the ENTER key. **Note** that leading zeroes are not needed to enter the address.

To display any two register contents, depress the REG key, up to 4 numeric keys, the SPACE key, up to 4 numeric keys and follow with the ENTER key.

To change the contents of a single register, display the register as described above. Depress the SHIFT key, the CHANGE key, up to 5 numeric keys and the ENTER key.

To change the contents of two registers being displayed, display each register separately and change the content of each register as described above.

To change the content of a double precision number (located in two consecutive registers), display the number in double precision format, depress SHIFT, CHANGE, and up to 10 numeric keys (preceded by a ▪ keystroke if negative) and ENTER.

To display the content of a single register as a hexa**decimal** number, display the register as an unassigned decimal number, depress the CLEAR key, the RECALL key and hold down the ← key until the last HEX digit or character appears in the right-most display position. The HEX number will only **be** displayed in the unsigned decimal number format: it will not be displayed in the dual-register, signed decimal, or double precision display made.

The shifted function CHANGE will allow the content or sign of a register to be changed. It functions only for single register display, or single timer/counter preset and accumulated value display.

The valid register address range is:

For a Model 60 CPU:	1 to 256
For Mode1 600 and 6000 CPUs:	1 to 1024

The valid range for input numbers is:

For unsigned decimal: 0 to 65535
For signed decimal: -32768 to 32767
For double precision:
-2147483648 to 2147483647

IN/TMR

To display the preset and accumulated value of preassigned timers 1-24, depress the TMR key, up to 3 numeric keys, and ENTER. More preassigned timer numbers may be coded by use of CPU "SCREQ" commands.

To display an input, depress the SHIFT key, the IN key, up to 4 numeric keys and ENTER. (Leading zeroes are not needed to enter an I/O address). Note that Auxiliary I/O cannot be displayed.

The valid input address range is 1 to 1024 (inputs).

OUT/CTR

To display the preset and accumulated value of preassigned counters l-24, depress the CTR key, up to 3 numeric keys, and ENTER. More preassigned counter numbers may be coded by use of CPU "SCREQ" commands.

To display an output, depress the SHIFT key, the OUT key, up to 4 numeric keys and ENTER. (Leading zeroes are not needed to enter an I/O address). Note that Auxiliary I/O cannot be displayed.

The valid output address range is 1 to 1024 (outputs).

Preassigned register locations for timers and counters (up to 24 of each).

Timer/Counter Identification Number	Preset Value Registers	Accumulated Value Registers
Timer No. 1	11	61
2	12	62
3	13	63
4	14	64
	1	1
24	34	84
Counter No. 1	36	86
2	37	87
	38	88
4	39	89
5	40	90
↓	1	↓
24	59	109

Up to 24 timers and 24 counters can be monitored using identification numbers (instead of register reference) by assigning timer/counter preset values and accumulated values to the registers listed. Care must be exercised that the registers used in this particular CPU program do not duplicate registers used here for the timer/counters.

NOTE

By use of "SCREQ" command in CPU up to a total of 512 counters and or timers may be coded with quick identification numbers. See <u>Series Six Data Communications Manual</u>, GEK-25364, for detailed instructions.

NEXT

Depressing the NEXT key will increment the address of the register, input, output, timer, or counter being displayed. The address will wrap-around to address 0001 when reaching the last valid address.

PREV

Depressing the PREV key will decrement the address of the register, input, output, timer, or counter being displayed. The address will wrap-around to the last valid address when reaching address 0001.

NOTE

When incrementing or decrementing a register address, the register display format will remain in the previous format. (Decimal, signed decimal, or double precision.) NEXT and PREV can be used on dual displays.

ON/OFF / DEC

Depressing the DEC key will cause the content of a register to be displayed as an unsigned decimal number with a range of 0 to 65535.

The shifted function ON/OFF will force an input or an output ON or OFF.

When used with the O/R (OverRide) key, the status of an input or an output can be set On or OFF for the duration of the override condition. It functions only with a single input or a single output display.

O/R / + /-DEC

Depressing the +/-DEC key will cause the content of a register to be displayed as a signed decimal number with a range of -32768 to +32767.

The shifted function O/R will toggle the override status of the displayed I/O point.

SEARCH/DP

Depressing the DP key will cause the content of two consecutive registers to be displayed as a double precision number with a range of -2147483648to +2147483647.

The shifted function SEARCH will automatically search through all input or output addresses, and stop at the next I/O address which has been overridden. It starts at the current address and if none is found, the search will stop at the last I/O address (either Input or Output 1024). It produces only a single I/O status display.

ENTER

Depressing the ENTER key will send a message to the CCM2. ENTER transmits a CR (Carriage Return) character following any other previously entered character.

CLEAR

Depressing the CLEAR key will cause the display to clear and a decimal point to appear in the display. A new entry may then be started.

The CE (Clear Entry) key whould be used to clear an incomplete entry instead of using the CLEAR key.

DEL/SPACE

Depressing the SPACE key will cause a blank to be entered on the display.

The DEL key backspaces and erases one display character.

← →

Depressing the left arrow key will cause the display to shift one character position to the left. The right arrow key will cause the display to shift one character position to the right.

Holding either key down will cause the display to scroll until the first character in the message is in the left-most/right-most position.

It functions properly only after depressing the CLEAR key followed by the RECALL key.

NUMERIC (0-9)

Depressing the numeric key will cause that number to appear on the display.

- (Minus)

Depressing the - (minus) key will cause a minus sign to appear on the display.

CONT

Depressing the CONT (CONTinue) key will cause the display update to continue and a new operation can be started. It is used in conjunction with the polled mode operation.

RECALL

Depressing the RECALL key will cause the previously transmitted message to appear on the display. Repeated depressing of the RECALL key will cause the display to alternate between the Input and Output Buffers.

CE

Depressing the CE key will cause the incomplete entry to clear. A new entry may then be started.

DETAILED SAMPLE OPERATOR SEQUENTIAL KEY OPERATIONS TO PERFORM VARIOUS OIU/CPU FUNCTIONS

FUNCTION	KEYSTROKE		DISPLAY	
SIGN ON (used when power-	CLEAR		Blank display	
ing up or re-initializing the	ENTER		WAIT	
terminal)			READY OIU REVX	
DISPLAY REGISTER	REG		REG?	
	x x x x		REG? XXXX	
	ENTER		RXXXX = 12345	
DISPLAY TIMER/	TMR	CTR	TMR?	CTR?
COUNTER	XXX or	x x x	TMR? XXX or	CTR? XXX
	ENTER	ENTER	12345 12345	12345 12345
DISPLAY INPUT/	SHIFT	SHIFT		
OUTPUT	IN	OUT	IN?	OUT?
	x x x x	x x x x	IN? XXXX	OUT? XXXX
	or		or	
	ENTER		IXXXX = ON	OXXXX = OFF
			or	or
			IXXXX = ON O/R*	OXXXX = OFF O/R*
			*O/R appears when override is set.	
DISPLAY TWO	REG		REG?	
REGISTERS	x x x x		REG? X X X X	
	SPACE		REG? XXXX	
	YYYY		REG? XXXX	YYYY
	ENTER		12345	12345
DISPLAY TWO INPUTS/	SHIFT			
OUTPUTS	IN		IN?	
	x x x x		IN? XXXX	
	SPACE		IN? XXXX	
	YYYY		IN? XXXX	YYYY
	ENTER		ON	ON O/R
DISPLAY SINGLE	SHIFT		IN?	
16-Bit I/O	IN		IN? XXXX-	
	xxxx-		0101101011001100	
	ENTER			
			NOTE 0 for OFF, 1 for ON, display starts from XXXX.	
DISPLAY COMPOSITE	SHIFT			
I/O	IN		IN?	
	x x x x		IN? XXXX	
	SPACE		IN? XXXX	
	YYYY		IN? XXXX	YYYY
			IN? XXXX	YYYY-
	SPACE		IN? XXXX	YYYY-
	z z z z		IN? XXXX	YYYY- z z z z
	ENTER		ON O/R 0011010100110011 OFF O/R	
DISPLAY SIGNED	REG		REG?	
DECIMAL CONTENT	x x x x		REG? x x x x	
	ENTER		RXXXX = 12345	
	+/-DEC		RXXXX = + 12345	

SAMPLE OPERATOR SEQUENTIAL KEY OPERATIONS (Continued)

FUNCTION	KEYSTROKE	DISPLAY
DISPLAY TWO SIGNED DECIMAL CONTENTS	REG	REG?
	x x x x	REG? XXXX
	SPACE	REG? XXXX
	YYYY	REG? XXXX YYYY
	ENTER	12345 12345
	+/-DEC	-12345 + 12345
DISPLAY HEXADECIMAL CONTENT	REG	REG?
	x x x x	REG? XXXX
	ENTER	RXXXX = 12345
	CLEAR	
	RECALL	RXXXX = 12345
	Hold left arrow key	12345 HHHH
	NOTE Depress CONT to continue normal function.	
DISPLAY DOUBLE-PRECISION NUMBER	REG	REG?
	x x x x	REG? XXXX
	ENTER	RXXXX = 12345
	DP	+ nnnnnnnnn
DISPLAY TWO DOUBLE-PRECISION NUMBERS	REG	REG?
	x x x x	REG? XXXX
	SPACE	REG? XXXX
	YYYY	REG? XXXX YYYY
	ENTER	12345 12345
	DP	+ nnnnnnnnn (1 st no.)
	CLEAR	
	RECALL	+ nnnnnnnnnn
	Left arrow ←	+ mmmmmmmmmm (2nd no.)
	Right arrow →	+nnnnnnnnnn (1st no.)
	NOTE Depress CONT to continue normal operation.	
CHANGE REGISTER VALUE	REG	REG?
	123	REG? 123
	ENTER	R0123 = 12345
	+/– DEC	R0123 = +12345
	SHIFT	R0123 = +12345
	CHANGE	MOD?
	-24680	MOD? -24680
	ENTER	R0123 = -24680
	NOTE **'-' is sign of number used with the signed decimal and double precision display.**	
CHANGE SIGN OF A REGISTER CONTENT		R0123 = +12345
	SHIFT	R0123 = +12345
	CHANGE	MOD?
		MOD? -
	ENTER	R0123 = -12345

SAMPLE OPERATOR SEQUENTIAL KEY OPERATIONS (Continued)

FUNCTION	KEYSTROKE	DISPLAY
FORCE I/O ON OR OFF	SHIFT	
	IN	IN?
	x x x x	IN? x x x x
	ENTER	IXXXX = ON
	SHIFT	
	ON/OFF	IXXXX = OFF
	SHIFT	
	ON/OFF	IXXXX = ON
SET OVERRIDE ON OR OFF	SHIFT	
	IN	IN?
	x x x x	IN? XXXX
	ENTER	IXXXX = ON
	SHIFT	
	O/R	IXXXX = ON O/R
	SHIFT	
	O/R	IXXXX = ON
CHANGE TIMER PRESET AND ACCUMULATE VALUES (See note below)	TMR	TMR'?
	10	TMR? 10
	ENTER	12345 **12345**
	SHIFT	**12345** **12345**
	CHANGE	MOD?
	11111	MOD? 11111
	ENTER	11111 **12345**
	SHIFT	11111 12345
	CHANGE	MOD?
	-22222	MOD? -22222
	ENTER	11111 **22222**
	SHIFT	11111 **22222**
	CHANGE	MOD?
		MOD? ▪
	ENTER	11111 0
		(The last step clears the accumulated value.)

NOTE

The first number displayed is the preset value for the timer/counter and the second one is the accumulate value. Same keystrokes are to be pressed to change the preset and accumulate values of a counter, except that the CTR key is now used in place of the TMR key.

SAMPLE OPERATOR SEQUENTIAL KEY OPERATIONS (Continued)

FUNCTION	KEYSTROKE	DISPLAY
SEARCH FOR AN OVERRIDE (Search and turn off)		10018 = OFF
	SHIFT SEARCH	10126 = ON O/R
	SHIFT O/R	IO126 = ON
	SHIFT SEARCH	11024 = ON
	SHIFT SEARCH	00112 = OFF O/R
	SHIFT O/R	00112 = OFF
	SHIFT SEARCH	01024 = OFF (Search ends)
INCREMENT/ DECREMENT REGISTER OR I/O ADDRESS	REG	REG?
	126	REG? 0126
	ENTER	R0126 = 12345
	NEXT	R0127 = 12345
	NEXT	R0128 = 12345
	PREV	R0127 = 12345
RECALL DUAL REGISTER OR I/O ADDRESS	REG	REG?
	123	REG? 123
	SPACE	REG? 123
	143	REG? 123 143
	ENTER	45 37
	PREV NEXT	RI23 143 DECIMAL 45 37
In in ±DEC format:		+45 +37
	PREV NEXT	R123 143 +/-DEC +45 +37
If in double-precision format:		+ 1234567
	PREV NEXT	R123 143 DBL PRC + 1234567
SIGN OFF (Polled mode)	CLEAR ENTER	• Signed OFF

ERROR MESSAGES

Error messages will be displayed to tell the operator that a syntax error or a transmission error has occurred. Error messages will be displayed after an ENTER keystroke (carriage return) or after a key function with a self-contained or automatically inserted carriage return. These messages will remain on the display until the operator initiates a new operation, a command entry, or depresses the CLEAR key.

Examples of Error Messages:

CAUSE OF ERROR	LED Readout - Column Number: 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
An illegal entry of register, input or output address; e.g., R1123, IN2000.	I	L	L	E	G	A	L		R	E	F					
Illegal key sequence; e.g., 1234 ENTER.	I	N	V	A	L	I	D		E	N	T	R	Y			
An out-of-range value; e.g., 66789**.	I	L	L	E	G	A	L		N	U	M	B	E	R		
An attempt is made to change a register value or the status of an I/O when the memory protect key is ON.	M	E	M		P	R	O	T	E	C	T			O	N	
An attempt is made to change a register value or the status of an I/O when the memory protect is ON via the CCM2 (user program control).	S	O	F	T		M	E	M		P	R	O	T	E	C	T
A data transmission error occurs between the OIU and the CCM2.	P	L	E	A	S	E			R	E	-	E	N	T	E	R

** When format is not double-precision.

INSTALLATION

The OIU is used in conjunction with a CCM2, The CCM2 *is* installed in a Model 60, 600 or 6000 Series Six CPU. Certain switches and jumpers on the CCM2 must be set up for selecting the appropriate user port options before connecting the OIU cable to the CCM2. This switch/jumper configuration is shown in Table 2.

If only one OIU is used with a Series Six CPU and it is used within 10 feet (3 meters) of the CPU a IC600WKOlOA cable may be used to interconnect the CPU and the OIU. In this instance power used by the OIU is obtained through the cable from the Series Six CPU. Interconnection is as shown in Figure 6. Connection is made from the connector on the OIU to the Jl port on the CCM2.

If only one OIU is used, but it is more distance than 10 feet but less than 4,000 feet, a cable must be assembled by the user. The cable can be made by following the wiring shown in Figure 7, following the CCM2 connectors/RS-422 cable specifications shown in Figure 4, and the OIU connector specification shown in Figure 2.

Power for the OIU must be locally supplied within 10 feet (3 meters) of the OIU by the user. This power consists of + 5 Vdc ± 0.25 Vdc at 0.65 amps. In this instance the Jl port or the J2 port of the CCM2 may be used.

If from 2 to 7 OIUs are to be used with the same Series Six CPU then a polled multi-drop system of wiring must be used as shown in Figure 8. The CCM2 connector specification, the RS-422 cable specification, and the OIU connector specification are shown in Figures 2 and 4. The polling address coding is shown in Figure 8. Power for each OIU must be locally supplied within 10 feet (3 meters) of each OIU by the user. This power consists of +5 Vdc ± 0.25 Vdc at 0.65 amps per OIU. In this instance the Jl port or the J2 port of th CCM2 may be used.

The OIU may be mechanically mounted using the mounting dimensions and holes as shown on Figure 1 or the unit may be hand-held.

CAUTION

Clean the Operator Interface Unit only with a mild water based detergent. Avoid industrial solvents that attack polycarbonate plastic.

OIU PIN OUTS	
OIU	25-Pin Connector
1	Power Supply Return
2	RS-422 OUT(+)
3	RS-422 OUT (-)
4	RS-422 IN(+)
5	RS-422 IN (-)
6	Al LED (ON is logic low)
7	Signal Ground
8	A2 LED (ON is logic low)
9	Parity PO
10	Parity Pl
11	Baud Rate BO
12	Baud Rate Bl
13	Baud Rate B2
14	+ 5 Vdc Power Supply
15	N/C
16	N/C
17	N/C
18	N/C
19	RESET IN (not used)
20	Data Terminal Ready Output
21	RESET OUT (not used)
22	AO* (Polling address)
23	A 1* (Polling address)
24	A2* (Polling address)
25	Reserved For Future Use

CCM2 PORT CONNECTORS	
Pin No.	J1 Port 25-Pin Connector
1	N/C
2	RS-232 Data Output
3	RS-232 Data Input
4	RTS* Output
5	CTS* Input
6	N/C
7	Signal Ground
8	- 12 Volts
9	Do Not Connect
10	Do Not Connect
11	Keyout
12	+ 12 Volts
13	RS-422 Input (+)
14	RS-422 Input (-)
15	Do Not Connect
16	Do Not Connect
17	RS-422 Output (-)
18	RS-422 Output (+)
19	Ground for OIU
20	+ 5 Vdc for OIU
21	RS-422 Clock Input (+)
22	N/C
23	RS-422 Clock Input (-)
24	RS-422 Clock Input (+)
25	RS-422 Clock Input (-)

CCM2	
Pin No.	J2 Port 9-Pin Connector
	RS-422 Data Out (+)
2	RS-232 Data Output
3	RS-232 Data Input
4	RTS*
5	CTS'
6	RS-422 Data Out (-)
7	Signal Ground
8	RS-422 Data In (+)
9	RS-422 Data In (-)

FIGURE 5. CONNECTOR PIN OUTS

OPERATOR INTERFACE UNIT CONNECTIONS
SINGLE DROP CONNECTION UNPOLLED

The OIU connects to the J1 port of the CCM2. The CCM2 communicates to the OIU via RS-422 receive and transmit signals at a data rate of 19.2K BPS. The J1 port also provides power to the OIU.

The CCM2 needs to be configured properly in order to interface to the OIU. The CCM2 should be set up for RS-422, 19.2K BPS, OIU ENABLED and OIU operating power connected. The connection between the CCM2 and the OIU is shown below.

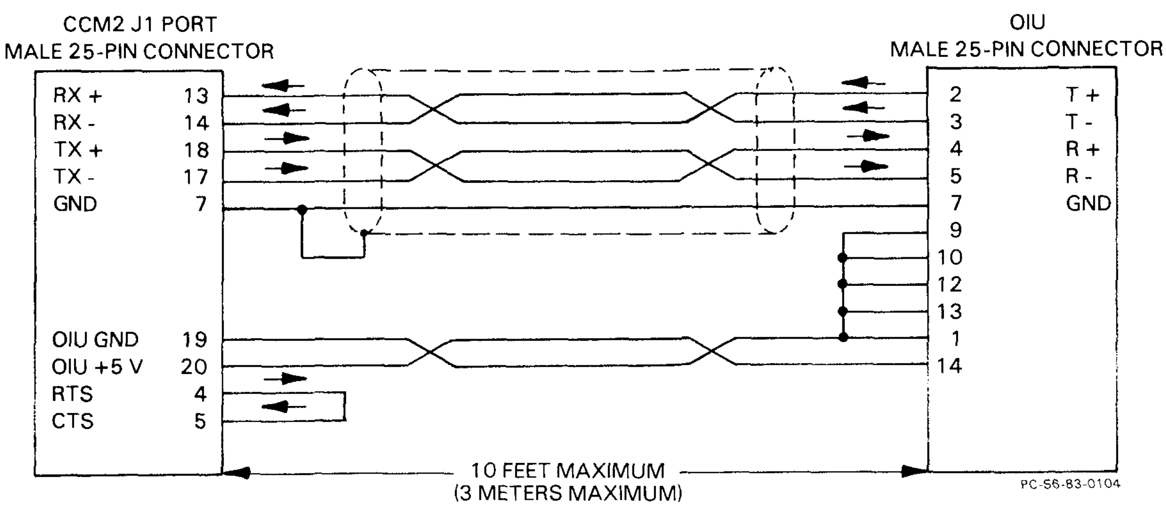


FIGURE 6. DIRECT J1 CCM2 TO OIU CONNECTION DIAGRAM

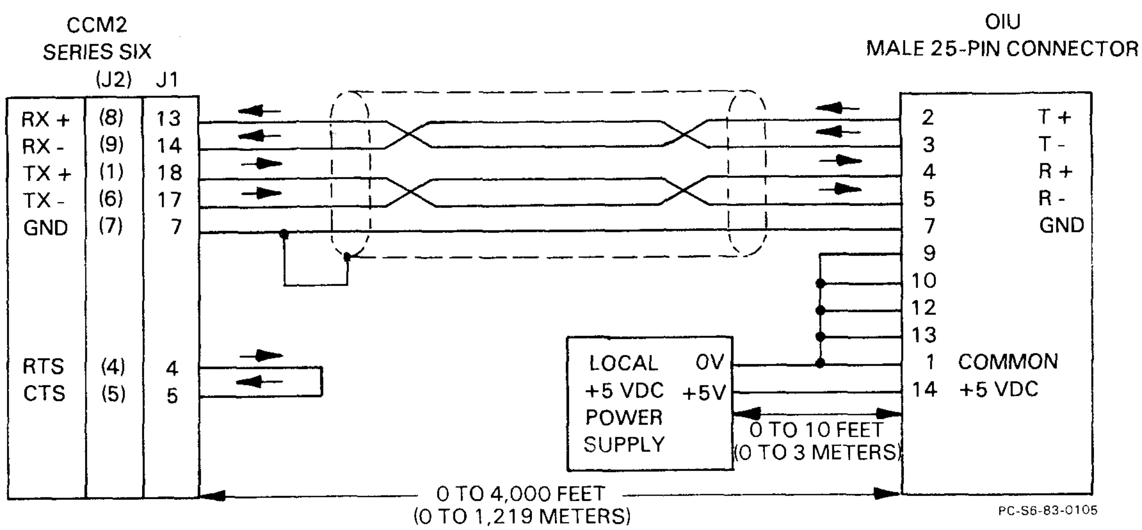
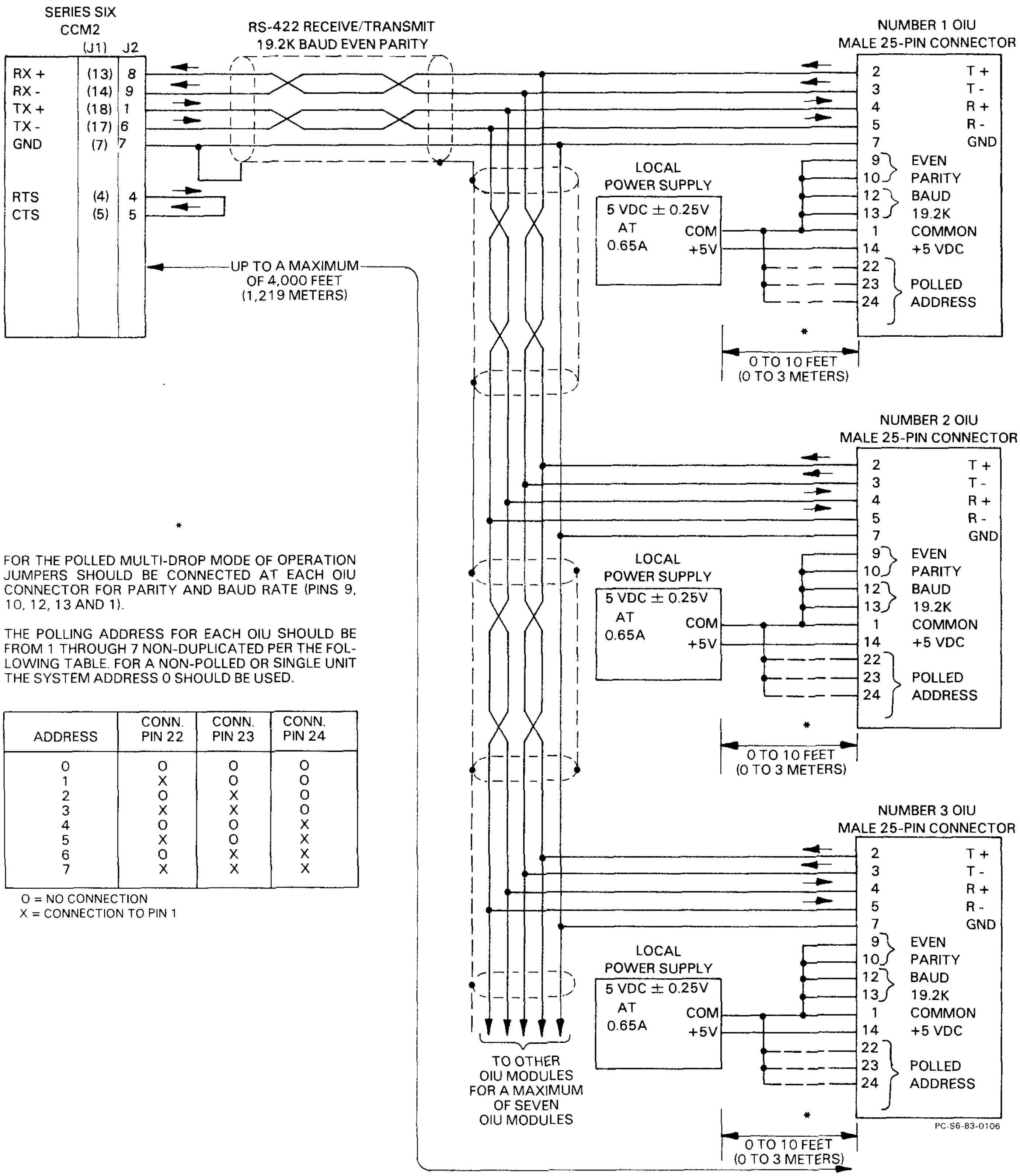


FIGURE 7. DIRECT CCM2-J1 OR J2 TO OIU CONNECTION DIAGRAM

Ref. PC-S6-83-0104
PC-S6-83-0105



*

FOR THE POLLED MULTI-DROP MODE OF OPERATION JUMPERS SHOULD BE CONNECTED AT EACH OIU CONNECTOR FOR PARITY AND BAUD RATE (PINS 9, 10, 12, 13 AND 1).

THE POLLING ADDRESS FOR EACH OIU SHOULD BE FROM 1 THROUGH 7 NON-DUPLICATED PER THE FOLLOWING TABLE. FOR A NON-POLLED OR SINGLE UNIT THE SYSTEM ADDRESS 0 SHOULD BE USED.

ADDRESS	CONN. PIN 22	CONN. PIN 23	CONN. PIN 24
0	O	O	O
1	X	O	O
2	O	X	O
3	X	X	O
4	O	O	X
5	X	O	X
6	O	X	X
7	X	X	X

O = NO CONNECTION
X = CONNECTION TO PIN 1

FIGURE 8. MULTI-DROP POLLED OIU WIRING

Switch/Jumper Configuration

TABLE 2. CCM2 CONFIGURATION DIP SWITCHES AND JUMPERS FOR OIU USE

JUMPERS
JP1 - 1-2 Position
JP2 - 1-2 Position
JP3 - 1-2 Position
JP4 - 2-3 Position
JP5 - 1-2 Position
JP6 - 2-3 Position
JP7 - 1-2 Position
JP8 - 1-2 Position

J1 PORT DIP SWITCHES (If Port Is Used)	
SW 9 - OPEN SW10 - CLOSED SW11 - CLOSED	Setup For 19.2K Baud
SW12 - CLOSED SW13 - OPEN SW14 - CLOSED	Peer RS-422 W/O Clocks
SW15 - OPEN SW16 - OPEN	Turn Around Delay OMS

J2 PORT DIP SWITCHES (If Port Is Used)	
SW1 - OPEN SW2 - CLOSED SW3 - CLOSED	Setup For 19.2K Baud
SW4 - CLOSED SW5 - OPEN SW6 - CLOSED	Peer RS-422
SW7 - OPEN SW8 - OPEN	Turn Around Delay OMS

SW17 - CLOSED
SW18 - Don't Care
SW19 - Don't Care
SW20 - Always OPEN

NOTE

If Dual In-Line Package (DIP) switches SW12, SW13, and SW14 are placed in the closed position, the CCM2 is placed into a special mode of operation identified as configuration from CPU registers (SW17 - CLOSED) or configuration from CPU Scratch Pad (SW17 - OPEN). A more detailed description of this operation is contained in the Series Six Data Communications Manual, GEK-25364.

ORDERING INFORMATION

Operator Interface Unit	IC600KD500A
10 Feet (3.05 Meters) OIU-CPU Cable	IC600WK010A

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

GEK-84867

Types: J, K+, S, T, B, E, R

SERIES SIX

PROGRAMMABLE CONTROLLERS

THERMOCOUPLE INPUT MODULES

GENERAL DESCRIPTION

The Thermocouple Input modules provide eight, eiectrically-isolated inputs for the detection of low-level, analog signals developed by thermocouple devices. These modules are available in seven versions: Type J, Type K+, Type S, Type T, Type B, Type E, and Type R. The features and benefits of the Thermocouple Input modules are summarized in Table 1.

The modules contain two, four-channel, thermocouple conditioners; either four-channel conditioner can be reassigned for use with any of the seven thermocouple types (J, K+, S, T, B, E, or R). The low-level input signal conditioning includes ± 1000V DC, isolation, high common mode rejection, filtering and low drift amplification. Signal integrity is further preserved by a high-accuracy programmable-gain amplifier and a 13-bit integrating A/D converter.

The output of this converter constitutes a 13-bit word (12 bits plus sign) equivalent to ± 4096 counts of resolution.

An on-board microprocessor then scales, linearizes and converts the input data to either degrees centigrade or fahrenheit. The temperature value is sent, along with binary information giving various status conditions and the channel number, to the Input Status Table in the Series Six CPU. Temperature values transferred to the Series Six CPU can be in either sign magnitude or 2's complement format, as jumper-selected by the user.

The input channels are sampled at a rate of 15 or 30 readings per second (for 60 Hz settings). The factory-set sample rate of 15 samples per second gives a Normal Mode Rejection (NMR) of 86 dB for each input. (NMR indicates immunity to power-line frequency noise added to the low-level input signals.) Where NMR is of lesser importance, the sample rate can be doubled, to 30 samples per second.

An external Cold-Junction Compensation element, which connects directly to the terminals on the module faceplate, eliminates the need for an ice-point reference function.

Refer to Figure 1 (next page) for Thermocouple Input module specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Seven types available: Type J Thermocouple Type K Thermocouple Type S Thermocouple Type T Thermocouple Type B Thermocouple Type E Thermocouple Type R Thermocouple	Useful in variety of applications
Eight isolated inputs per module	Low cost per input point
Contains cold-junction compensation and linearization routines	Direct interface to thermocouple devices
Thirteen-bit resolution	High conversion accuracy (1 part in 8192)
Temperature readings in degrees C or F	Ease of operation
Open thermocouple detection	Simplifies troubleshooting
APPLICATIONS * Injection Molding * Chemical Processing * Annealing Furnaces	

Power Requirements: 5V DC, 1.7 A maximum (Supplied by I/O Rack power supply)	Resolution: 13 bits (± 4096)
	Input to Series Six Isolation 1000V peak AC or DC
Input Requirements: J: -4.632 to +42.922 MV K+: -3.553 to +54.845 MV S: +2.323 to + 18.698 MV T': -5.603 to +20.869 MV B: +2.782 to + 13.814 MV E: -8.824 to +76.358 MV R: 0.000 to +21.105 MV	Low Pass Filter; High Noise Rejection Operating Temperature: 0" to 60°C (32" to 140°F) (at outside of rack) Storage Temperature: -20" to +80°C (-4" to + 176°F) Humidity: 5% - 95% (non-condensing)
Normal Mode Rejection: 86 dB at line frequencies: @ 15 sample/sec; @ 12.5 sample/sec.	

Thermocouple Temperature Range and Module Accuracy*

Type	°C	°F
J	-100 to 760°C ± 1.3"	-148 to 1400°F ± 2.34"
K+	-0 to 1371°C ± 1.4"	+32 to 2500°F ± 2.52"
S	300 to 1768°C ± 3.5"	572 to 3214°F ± 6.3"
T	-200 to 400°C ± 1.3"	-328 to 752°F ± 2.34"
B	750 to 1820°C ±3.0°	1382 to 3308 ± 5.4"
E	-200 to 1000°C ±3.0°	-328 to 1832 ± 5.4"
R	0 to 1768°C ±4.2°	32 to 3214 ± 7.5"

*NOTE: Total accuracy should also include accuracy of thermocouple wire. typically, ± 1 or 2 °C or 0.75%, whichever is greater.

Module Drift*
(Allow 15 minutes of operation for specified accuracy)

Type	Temp. Drift	Time Drift
J	± .1°C/°C	± .10°C/Month
K+	± .3°C/°C	± .15°C/Month
s	± .3°C/°C	± .15°C/Month
T	± .1°C/°C	± .10°C/Month
B	± .3°C/°C	± .15°C/Month
E	± .3°C/°C	± .15°C/Month
R	± .3°C/°C	± .15°C/Month

'NOTE: These specifications describe worst case variations in accuracy of Thermocouple Input module temperature readings (established at time and temperature of calibration) resulting from changes in ambient temperature per degrees centigrade and progression of time in months.

FIGURE 1. SPECIFICATIONS

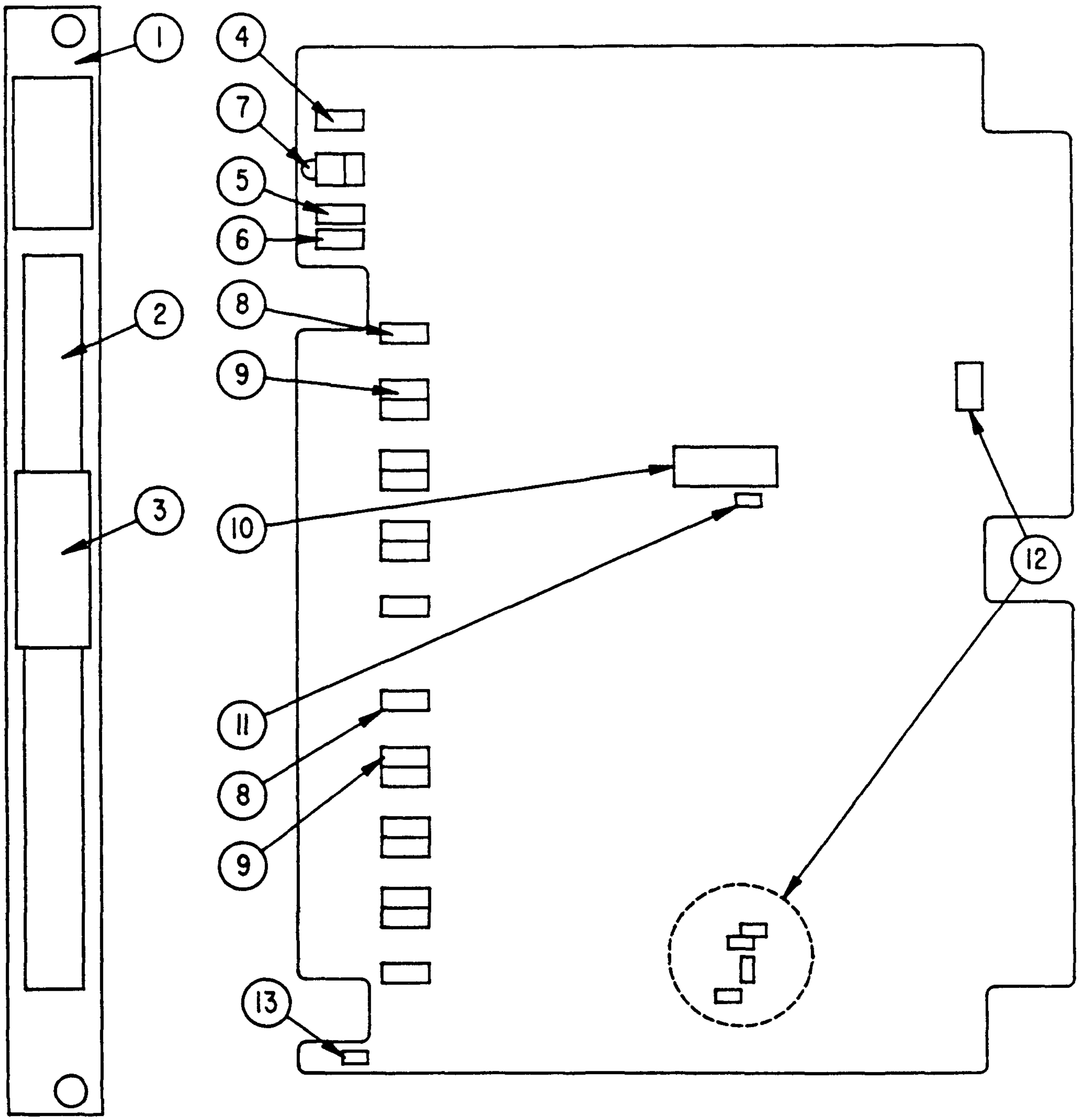


FIGURE 2. USER ITEMS (Part 1 of 2)

1. Faceplate
2. User Connector Block
3. Cold Junction Compensation Element
4. A/D Reference ADJ Refer to Calibration section.
5. Output Offset ADJ (Ch 5-8).
6. Output Offset ADJ (Ch 1-4).
7. Board OK LED:

   OFF: If module has failed board diagnostics

   ON: No module-level errors detected by board diagnostics
8. Offset ADJ Pots 1-8: Adjust voltage offsets for circuits 1-8, respectively. (Refer to Calibration section.)
9. GAIN ADJ Pots 1-8: Adjust voltage gains for inputs 1-8, respectively. (Refer to Calibration section.)
10. Configuration DIP switch: (Refer to the following chart).

DIP SWITCH
(□ Contains Rocker Switch Number)

Function	Group 1 (Inputs 1-4)			Group 2 (Inputs 5-8)				
	1	2	3	4	5	6	7	8
Type J T/C	ON	ON	ON	ON	ON	ON	–	–
Type K+ T/C	OFF	OFF	OFF	OFF	OFF	OFF	–	–
Type S T/C	ON	OFF	ON	ON	OFF	ON	–	–
Type T T/C	OFF	OFF	ON	OFF	OFF	ON	–	–
Type B	ON	OFF	OFF	ON	OFF	OFF	–	–
Type E	ON	ON	OFF	ON	ON	OFF	–	–
Type R	OFF	ON	OFF	OFF	ON	OFF	–	–
4-Channels (1-4)	–	–	–	–	–	–	ON	–
8-Channels (1-8)	–	–	–	–	–	–	OFF	–
°C	–	–	–	–	–	–	–	ON
°F	–	–	–	–	–	–	–	OFF

11. Data Format Jumper

Function	Jumper Setting
Sign Magnitude	57-58
2's Complement	56-57

12. Sample Rate Jumpers: The factory-set sample rate provides Normal Mode Rejection (NMR) of 86dB at either 50 or 60 Hz line frequencies where NMR is of lesser importance, the sample rate can be increased.

LINE FREQUENCY	SAMPLE/ SEC	JUMPERS
50 Hz	12.5	43-44, 45-46 50-51, 69-70
	25	43-44, 46-47 49-51, 68-69
60 Hz	15	42-43, 45-46 48-50, 51-52 69-70
	30	42-43, 46-47 48-49, 51-52 68-69

13. RUN/Calibrate Jumper

Function	Jumper Setting
RUN	1 - 2
Calibrate	2 - 3

FIGURE 2. USER ITEMS (Part 2 of 2)

INSTALLATION

The Thermocouple Input module can be installed in an I/O rack or in a Model 60 CPU rack. Before installing this module, set the dual-in-line-package (DIP) switches immediately behind the card slot on the rack backplane to reserve a group of 32 consecutive bits in the appropriate Input Status Table of the CPU. For specific DIP switch settings, refer to Figure 3.

Use the extraction/insertion tool furnished with the Series Six CPU to remove or install the circuit board. With the board in place in the rack, guide the faceplate over the circuit board so that proper contact is made. Then, secure the faceplate to the rack using the thumbscrews at the top and bottom.

Refer to Figure 4 (next page, left side) for typical user input connections. The connections to channel 1 (+1, -1) indicate a floating thermocouple; the connections to channel 2 (+2, -2) indicate a grounded thermocouple. Either connection can be used on any of the eight channels. Shielded wire may not be required for short distances. CJ1 through CJ4 are terminals for the Cold Junction Compensation Element. Table 2 (below) provides ANSI standard color codes and thermocouple polarities.

INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1- 32						353-384		X		X	X	705-736	X		X	X	
33- 64					X	385-416		X	X			737-768	X		X	X	X
65- 96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024	X	X	X	X	X
321-352		X		X		673-704	X		X		X		(NOT USED)				

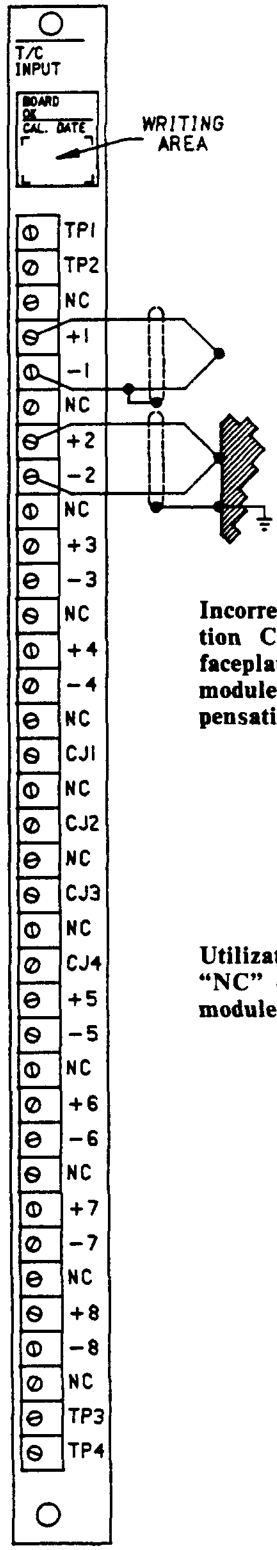
[X] = Switch in OPEN Position (Depressed to the Left)

Switches No. 1 and No. 2 should be in CLOSED Position

FIGURE 3. DIP SWITCH SETTINGS

TABLE 2. THERMOCOUPLE POLARITIES

THERMOCOUPLE TYPE	MATERIAL	POLARITY	ANSI COLOR CODE
J	Iron Constantan	+ -	White Red
K+	Chromel Alumel	+ -	Yellow Red
S	Platinum/10% Rhodium Platinum	+ -	Black Red
T	Copper Constantan	+ -	Blue Red
B	Platium/30% Rhodium Platinum/6% Rhodium	+ -	Gray Red
E	Chromel Constantan	+ -	Purple Red
R	Platinum/13% Rhodium Platinum	+ -	Black Red



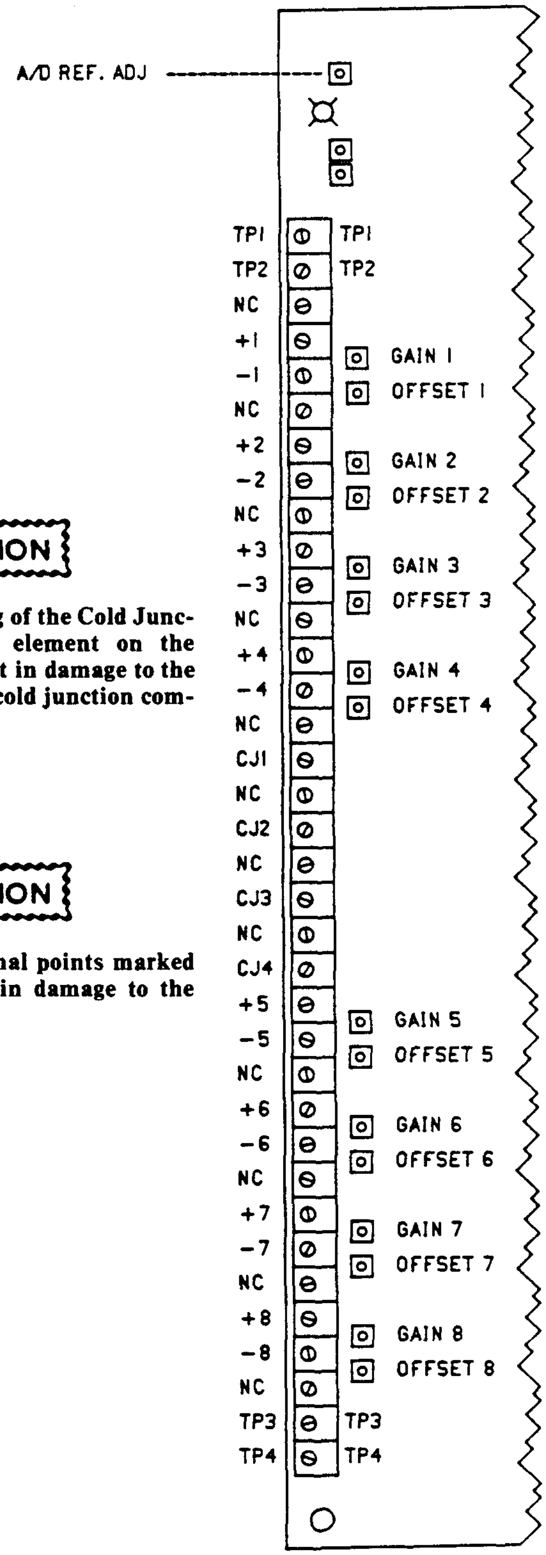
MODULE FACEPLATE

CAUTION

Incorrect positioning of the Cold Junction Compensation element on the faceplate could result in damage to the module, and/or the cold junction compensation unit.

CAUTION

Utilization of terminal points marked "NC" could result in damage to the module.



CALIBRATION CONNECTOR MOUNTED ON THERMOCOUPLE INPUT MODULE

FIGURE 4. USER CONNECTIONS

DATA FORMAT

The Thermocouple Module requires four consecutive, 8-bit, input address bytes to transfer data to the CPU. Data from a single T/C Input Channel is transferred with every I/O scan. The module automatically indexes to the next channel after it is read. This action is independent of the input sampling rate. (The Series Six CPU can strobe this module every 80 usec for up to 8 scans. It then must allow the module to return to its data sampling routine for 20 usec before reading the input points again.) The 32 bits that constitute the input address bytes are described below. All 32 bits are displayed in the Input Status Table.

Bits 1-8: Channel Number: 8-bit binary number giving the number of the channel (0 - 7) being read. It consists of three significant bits (bits 1-3) and five leading zeroes (bits 4-8).

Bit 9: Valid Data: HIGH if the data is valid, LOW if the data is invalid. (Invalid data could indicate: ambient temperature at Cold Junction Compensation module is less than 0°C or greater than 60°C; or data in process of being updated when I/O request occurs.)

Bit 10: (Unused)

Bit 11: Open Thermocouple: (Synchronous with channel number.)

Bit 12: Sign of data bit. (Sign Plus Magnitude only).

Bit 13: Board OK: HIGH if OK light is on. LOW if OK light is off. (Refer to Figure 2, User Item, No. 7).

Bit 14: Underrange: HIGH if input level is at or below the low end of the module range; LOW otherwise. The underrange values are in °F:

Type J < -346	Type B < +410
Type K+ < -350	Type E < -454
Type S < +32	Type R < -58
Type T < -454	

Bit 15: Overrange: HIGH if input level is at or above the high end of the module range; LOW otherwise. Refer to Figure 1 for overrange values.

Bit 16: Heartbeat: Changes state each time card is read.

Bits 17-28: Data: The 12 bits of temperature data. Bit No. 17 is the least significant bit (LSB).

Bits 29-32: These four bits function as sign extension for 2's sign plus format; they are zeros (four) in 2's complement format.

TABLE 3. INPUT STATUS TABLE

SIGN	TEMPERATURE												STATUS								CHANNEL NUMBER							
32 31 30 29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Z's COMP SIGN BITS - = 1 + = 0 OR SIGN PLUS MAG = ALL ZEROS	DATA BIT 12	DATA BIT 11	DATA BIT 10	DATA BIT 9	DATA BIT 8	DATA BIT 7	DATA BIT 6	DATA BIT 5	DATA BIT 4	DATA BIT 3	DATA BIT 2	DATA BIT 1	HEART BEAT	OVERRANGE	UNDERRANGE	BOARD OK	SIGN BIT	OPEN THERMOCOUPLE	NOT USED	VALID DATA	ZERO	ZERO	ZERO	ZERO	ZERO	CHANNEL NUMBER MSB	CHANNEL NUMBER	CHANNEL NUMBER LSB

CALIBRATION PROCEDURE

Required equipment:
- Voltmeter 4 digit
- Voltage source - resolution to 1 mv.
- Calibration connector (IC600MA508A)

Calibration of the Thermocouple Module should be performed every six months. For maximum accuracy the card should be calibrated at the normal ambient temperature which occurs in operation. Allow the thermocouple card to warm up for one hour before calibration.

1. Loosen the thumbscrews and remove the faceplate, taking case not to disturb the field wiring. Move the RUN/CAL jumper to the calibrate position (2 to 3). Refer to Figure 2, User Item No. 13. Place the calibration connector (P/N IC600MA508A) on the thermocouple board.

2. A/D Reference trim, (Refer to Figure 4, right side.) Place the (+) lead of the voltmeter on TP2 and the (-) lead on TP3. Adjust the A/D reference potentiometer to obtain a voltmeter reading of 2.048 volts.

3. Offset trim. In Figure 4, the offset adjustment potentiometers for channels 1 to 8 are labeled Offset 1 to Offset 8, respectively.

   Gain trim. In Figure 4, the gain adjustment potemtiometers for channels 1 to 8 are labeled Gain 1 to Gain 8, respectively.

   For each channel (l-8) adjust the offset potentiometer, then the gain potentiometer, as follows:

   a. Connect the (+) lead of the voltmeter to TPl and the (-) lead of the voltmeter to TP3.

   b. Connect the (+) and (-) leads of the voltage source to the (+) and (-) inputs, respectively, of the channel to be calibrated.

   c. Set the voltage source to 0.000 volts.

   d. Adjust the appropriate offset potentiometer to obtain a reading of 0.000 volts on the voltmeter.

   e. If the thermocouple card is type J or K, set the voltage source to 0.050 volts; if the card is type S, T, B, or R, set the voltage source to 0.025 volts; if the card is type E or K+, set the voltage source to 0.100 volts.

   f. Adjust the appropriate gain potentiometer to obtain a reading of 4.000 volts on the voltmeter.

4. Remove the calibration connector. Place the RUN/CAL jumper in the run position (I to 2). Refer to Figure 2, User Item No. 13. Replace the faceplate, taking case not to disturb field wiring.

5. Mark the calibration date on the faceplate lens in the space provided.

ORDERING INFORMATION *

Module	Circuit Board and Faceplate	Circuit Board Only	Faceplate
Type J	IC600BF813A	IC600YB813B	*IC600FP813A
Type K+	IC600BF814A	IC600YB814B	*IC600FP813A
Type S	IC600BF815A	IC600YB815B	*IC600FP813A
Type T	IC600BF816A	IC600YB816B	‘IC600FP813A
Type B	IC600BF817A	IC600YB817A	*IC6OOFP813A
Type E	IC600BF818A	IC600Y08~8A	*IC600FP813A
Type R	IC600BF819A	IC600YB819A	‘IC600FP813A

Calibration Connector

IC600MA508A

Cold Junction Compensation Element is included with the faceplate assembly IC600FP813A.

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE **Fanuc Automation North America, Inc., Charlottesville, Virginia**

OCTOBER, 1985

GEK-84868B
July, 1989

Standard I/O Rack
Power Supply

General Description

The I/O Rack Power Supplies, which provide power for Series Six I/O modules, are available in two versions: Standard and High Capacity. The Standard I/O power supply is integral to the Standard I/O rack; likewise, the High Capacity I/O power supply is integral to the High Capacity I/O rack. The Standard I/O power supply features and benefits are summarized in Table 1.

The Standard I/O power supply provides a regulated +5 Vdc voltage to the I/O rack backplane at a maximum current rating of 6.1 amps, The High Capacity supply provides regulated +5V, +12V and -12 Vdc to the I/O rack backplane. The High Capacity power supply provides power for high-current I/O module configurations and remote I/O applications (with RS232 modems).

The Standard I/O rack power supply operates from input voltages of 115 Vac or 230 Vac at frequencies of 47 to 63 Hz. The input power is applied to a terminal block on the front panel, then routed through a line filter, switch, and fuse to a switching power supply.

On the front panel of the Standard I/O rack power supply is an ON/OFF switch labelled, LOGIC POWER; visible through a lens is a Light-Emitting Diode (LED) that lights when the LOGIC POWER switch is in the ON position; and underneath a black plastic cover is an AC-input terminal block.

The I/O rack power supply also generate a power-fail signal (PSOK) which is used for system initialization and error indications.

Refer to Table 3 for Standard I/O rack power supply specifications.

Refer to GEK-84869 for a discussion and specifications of the High Capacity I/O power supply.

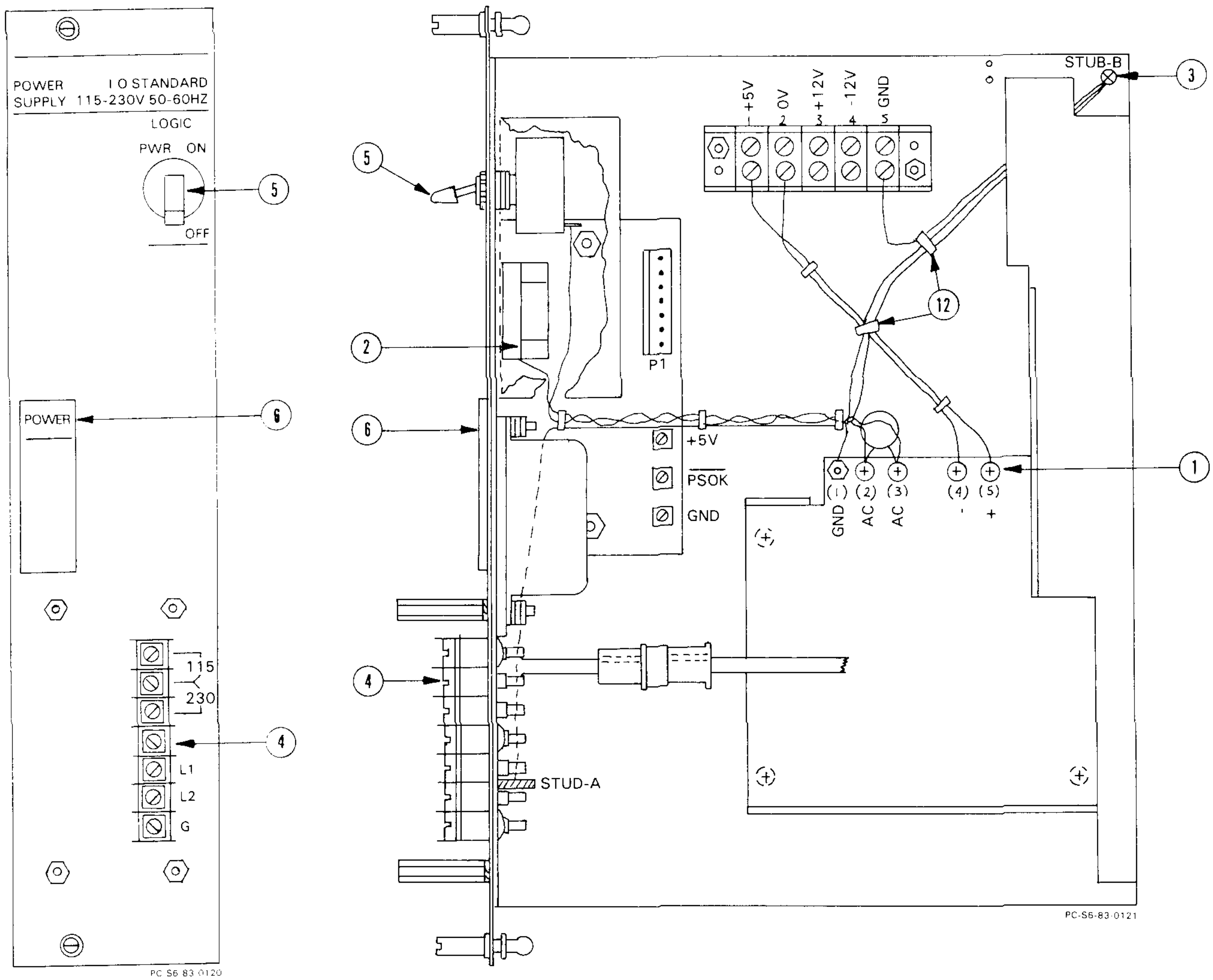
If addition of I/O modules in Standard I/O racks (IC600YR501B) should cause the Standard I/O power supply (IC600PM502B) to become overloaded, the High Capacity I/O power supply (IC600PM503B) may be substituted for the Standard I/O power supply without any wiring changes to the Standard I/O rack (IC600YR501B).

NOTE

An IC600PM503B, IC6OOPM504A, or ICBOOPM505A High Capacity power supply may not be substituted for the Standard I/O power supply IC600PM502A in the Standard I/O rack IC600YR501A. Refer to GEK-90751 for further discussion of interchangeability of I/O power supplies and I/O racks.

Table 1. Features and Benefits

Features	Benefits
Input voltage can be 115 Vac or 230 Vac, 47 to 63 Hz.	Can be utilized in most installations.
"POWER" indicator on front panel. Power-fail signal supplied to I/O rack to generate system failure indications.	Simplified troubleshooting.
Interchangeable with High Capacity I/O rack power supply.	Useful in a variety of applications to more properly satisfy I/O rack power requirements.



Ref. PC-S6-83-0120
PC-S6-83-0121

Figure 1. User Items (Part 1 of 2)

1. DC-Output Terminals (on large circuit board)
2. Fuse 2 amps
3. Ground Terminal
4. Front-Panel Terminal Block
5. Power Switch
6. POWER Light
7. POWER Light
   On: The voltage level of the +5 Vdc output is within tolerance.
   Off: The +5 Vdc voltage level is too low.

Figure 1. User Items (Part 2 of 2)

Installation

Verify that the Standard I/O power supply to be installed can accommodate the estimated load. Total the current units as indicated in Table 2, per the I/O modules to be utilized.

Verify also that I/O modules requiring ± 12 Vdc are not being powered by this power supply.

If modules requiring ± 12 Vdc are contained within this I/O rack then a high capacity I/O power supply must be used.

When installing a Standard power supply, the input voltage mode must be established by jumper on the front panel terminal block. Figure 3 indicates the two input modes selectable, 115 Vac or 230 Vac, and the corresponding positions of the jumper strap.

These steps define the procedures to be followed when a power supply is to be replaced on a Series Six I/O rack. The tools needed are a regular screwdriver, and a 5/16" wrench or nut driver.

1. Stop the system by switching the top key on the CPU to "STOP".
2. Switch off all units in the system, including the user's power supplies,
3. Remove all power from the system, preferably at the source (i.e. throw the main circuit breaker for the system).
4. Locate the I/O rack power supply to be changed. The power supply is in the far right side of the I/O rack.
5. Remove the plastic cover on the lower portion of the power supply and, using a volt-meter, make sure there is no AC power present.
6. Take note of the location and color of the AC wires and then remove them.
7. At the top and bottom of the power supply, there are l/4-turn thumbscrews. To loosen, turn the thumbscrews approximately l/4 turn counterclockwise.
8. Grasp the thumbscrews and gently pull outward. Be careful not to damage the internal wiring while pulling the supply out. Pull the power supply completely out.
9. Locate the wires that extend from the back of the I/0 rack to the terminal on the power supply. These wires should be labeled or stamped with their location; the circuit boards have wire locations stamped on them also. (Refer to Figure 3.) Remove these wires. There is also a plastic wire clamp holding these wires in place. Detach this from the frame if there is not a similar item on the replacement power supply, or cut the clamp if there is one on the new supply.
10. Take the replacement power supply and attach the wires as shown in Figure 3. Attach the wire clamp on the upper stud of the power supply frame, or if there is a clamp already there, wrap the wires in it.
11. Slide the power supply into the rack, being careful not to damage the wires, When the power supply is all the way in, turn the thumbscrews clockwise until they lock in.
12. Remove the plastic cover on the lower portion of the power supply and attach the AC wires as they were on the original supply (Refer to Step 6). Replace the plastic cover.
13. Restore system power. Turn on the I/O rack. Check to see if the POWER light is on. If it is, turn on the rest of the system and resume normal operation.
14. If the power on light does not come on, the power supply is bad or there are other problems within the I/O rack. When this occurs, you can call the Programmable Control Service Center EMERGENCY SERVICE NUMBER (804) 978-5747 for assistance.

Table 2. Summary of Units of Load for I/O Modules

Catalog Number	Module Description	Units of Load (1)		
		+5 V	+12 V	-12 V
IC600BF800	I/O Receiver	9	-	-
IC600BF801	Remote I/O Receiver	42	10	10(2)
IC600BF802	24 to 48 V dc Input	2	-	-
IC600BF804	115 V ac/dc Input	2	-	-
IC600BF805	230 V ac/dc Input	2	-	-
IC600BF806	12 V ac/dc Input	2	-	-
IC600BF808	Interrupt Input	3	-	-
IC600BF810	115 V ac/dc Isolated Input	2	-	-
IC600BF813	Type J Thermocouple Input	29	-	-
IC600BF814	Type K+ Thermocouple Input	29	-	-
IC600BF815	Type S Thermocouple Input	29	-	-
IC600BF816	Type T Thermocouple Input	29	-	-
IC600BF817	Type B Thermocouple Input	29	-	-
IC600BF818	Type E Thermocouple Input	29	-	-
IC600BF819	Type R Thermocouple Input	29	-	-
IC600BF827	High Speed Counter	19	-	-
IC600BF830	Advanced I/O Receiver	12	-	-
IC600BF831	High Density Input	4	-	-
IC600BF841	0 to 10 V dc Analog Input	29	-	-
IC600BF842	10 V dc Analog Input	29	-	-
IC600BF843	4 to 20 mA Analog Input	29	-	-
IC600BF900	I/O Transmitter	34	-	-
IC600BF901	Remote I/O Driver	38	10	10(2)
IC600BF902	24 V dc Sink Output	7	-	-
IC600BF903	48 V dc Sink Output	7	-	-
IC600BF904	115 V ac Output	9	-	-
IC600BF905	230 V ac Output	9	-	-
IC600BF906	12 V dc Sink Output	7	-	-
IC600BF907	12 V dc Source Output	7	-	-
IC600BF908	24 V dc Source Output	7	-	-
IC600BF909	48 V dc Source Output	7	-	-
IC600BF910	115 V ac Isolated Output	8	-	-
IC600BF912	230 V ac Isolated Output	8	-	-
IC600BF914	Reed relay output	13	-	-
IC600BF915	Axis Positioning Module, Type 1	23	7	3
IC600BF917	Axis Positioning Module, Type 2	21	11	6
IC600BF921	5 V TTL Output	3	-	-
IC600BF923	10 to 50 V dc Sink Output	3	-	-
IC600BF924	120 V dc Output	5	-	-
IC600BF929	10 to 50 V dc Source output	3	-	-
IC600BF930	115 V ac Protected Output	8	-	-

Table 2. Summary of Units of Load for I/O Modules - Continued

Catalog Number	Module Description	Units of Load (1)		
		+5 V	+12 V	-12 V
IC600BF941	0 to 10 V dc Analog Output	29	-	-
IC600BF942	10 V dc Analog Output	29	-	-
IC600BF943	4 to 20 mA Analog Output	29	-	-
IC600BF944	ASCII/BASIC Module (12K)	20	12	-
IC600BF949	ASCII/BASIC Module (28K)	20	12	-
IC600BF946	Loop Management Module	20	12	-
IC600BF947	I/O Link Local	20	12	-
IC600BF948	I/O CCM	20	12	-
IC600BF950	I/O CCM4	20	12	-
IC660CBB900	Genius Bus Controller	20	2	-
IC660CB902	Genius Bus Controller w/Diag.	20	2	-
IC660CBB901	Genius Bus Controller	20	2	-
IC660CB903	Genius Bus Controll wo/Diag.	20	2	

(1) For +5 V dc, 1 unit of load equals 60 mA (300 mw of power). For +12 and -12 V dc, 1 unit of load equals 25 mA (300 mw of power).

(2) +12 V and -12 V current is less than 1 unit of load if RS-232 mode is not used.

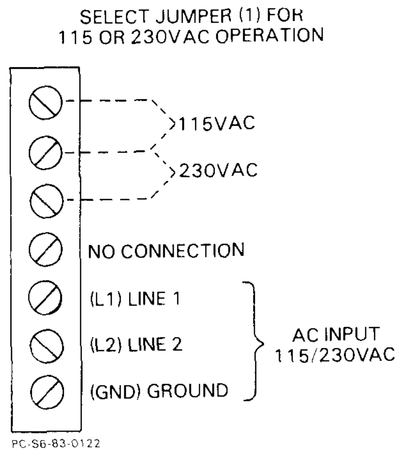


Figure 2. Standard I/O Power Supply Front-Panel Terminal Block

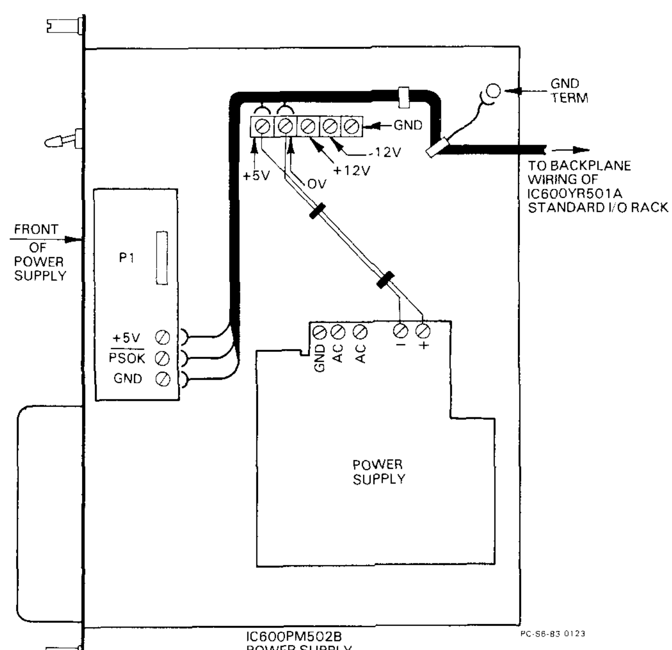


Figure 3. Standard I/O Power Supply External Wiring

NOTE

Power supply (IC600PM502B) can be used as shown in Standard I/O racks IC600YR501A and IC600YR501B. Power supply IC600PM502A can only be used in I/O rack IC600YR501A.

Table 3. Specifications

• **Dimensions:**	12.46 x 9.00 x 2.75 (inches) 317 x 229 x 70 (mm)
• **Input:**	95 to 130 Vac, or 190 to 260 Vac, 47-63 Hz 80 VA (max.)
• **Output:**	+5 Vdc, 6.1 A (max.) 100 Units of Load (see Table 2)
• **Allowable Power Interruptions:**	33 ms minimum at 115 Vac line.
• **Operating Temperature:**	0° to 60°C
• **Storage Temperature:**	-20° to +80°C
• **Humidity:**	5% - 95% (non-condensing)
• **Noise Immunity:**	Meets requirements of NEMA ICS 2-230 and ANSI C37.90A.

Table 4. Ordering Information

	115/230 Vac Input
Standard I/O Rack Power Supply	IC6OOPM502B

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

Series Six PLC
Programmable Controllers

GEK-84869B

July, 1989

High Capacity I/O Rack
Power Supply

General Description

The I/O Rack Power Supplies, which provide power for Series Six I/O modules, are available in two versions: Standard and High Capacity. The Standard I/O power supply is integral to the Standard I/O rack; likewise, the High Capacity I/O power supply is integral to the High Capacity I/O rack. The High Capacity I/O power supply features and benefits are summarized in Table 1.

The Standard I/O power supply provides a regulated +5 Vdc voltage to the I/O rack backplane. The High Capacity supply provides regulated +5V, +12V and -12 Vdc to the I/O rack backplane. The High Capacity power supply provides power for high-current I/O module configurations and remote (with modem) I/O applications.

The High Capacity I/O rack power supply operates from input voltages ranging from 95 to 260 Vac at frequencies of 47 to 63 Hz. The input power is applied to a terminal block on the front panel then routed through a line filter, switch, and fuse to a switching power supply.

On the front panel of the High Capacity I/O rack power supply is an ON/OFF switch labelled, LOGIC POWER; visible through a lens is a Light-Emitting Diode (LED) that lights when the LOGIC POWER switch is in the ON position; and underneath a black plastic cover is an AC-input terminal block.

The I/O rack power supply also generates a power-fail signal (PSOK) which is used for system initialization and error indications.

Refer to Table 3 for High Capacity I/O rack power supply specifications.

Refer to GEK-84868 for a discussion and specifications of the standard I/O power supply.

If additions of Input/Output modules in Standard I/O racks (IC600YR501B) should cause the Standard I/O power supply (IC600PM502B) to become overloaded, this High Capacity I/O power supply (IC600PM503B) may be substituted for the Standard I/O power supply without any wiring changes to the Standard I/O rack (IC600YR501B).

NOTE

An IC600PM503B, IC600PM504A, or IC600PM505A High Capacity power supply may not be substituted for the Standard I/O power supply IC600PM502A in the Standard I/O rack IC600YR501A. Refer to GEK-90753 for further discussion of interchangeability of I/O power supplies and I/O racks.

Table 1. Features and Benefits

Features	Benefits
Input voltage can be 95 Vac to 260 Vac, 47 to 63 Hz.	Can be utilized in most installations.
"POWER" indicator on front panel. Power-fail signal supplied to I/O rack to generate system failure indications.	Simplified troubleshooting.
Interchangeable with a Standard I/O rack power supply.	Useful in a variety of applications to more properly satisfy I/O rack power requirements.

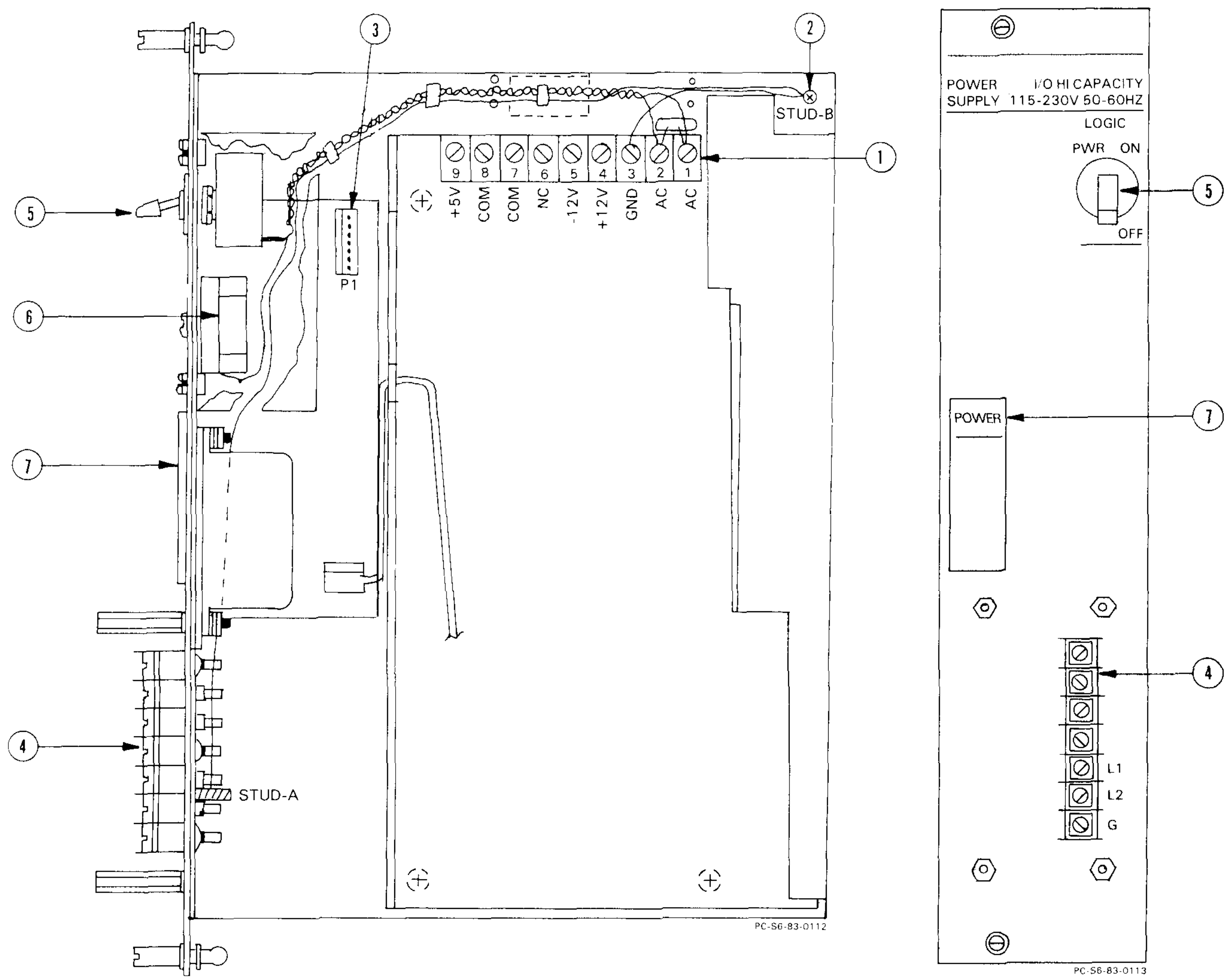


Figure 1. User Items (Part 1 of 2)

1. Main-Circuit-Board Terminal Strip
2. Ground Terminal
3. Auxiliary-Circuit-Board Connector
4. Front-Panel Connector Block
5. Power Switch
6. Fuse
7. Power Light
   On: The voltage levels of all three DC outputs (+12V, -12V, +5V) are within tolerance.
   Off: At least one of these voltage levels is too low.

Installation

Verify that the High Capacity I/O power supply to be installed can accommodate the estimated load. Total the current units as indicated in Table 2, per the I/O modules to be utilized.

These steps define the procedures to be followed when a power supply is to be replaced on a Series Six I/O rack. The tools needed are a regular screwdriver, and a 5/16" wrench or nut driver.

1. Stop the system by switching the top key on the CPU to "STOP".
2. Switch off all units in the system, including the user's power supplies.
3. Remove all power from the system, preferably at the source (i.e. throw the main circuit breaker for the system).
4. Locate the I/O rack power supply to be changed. The power supply is in the far right side of the I/O rack.
5. Remove the plastic cover on the lower portion of the power supply and, using a volt-meter, make sure there is no AC power present.
6. Take note of the location and color of the AC wires and then remove them.
7. At the top and bottom of the power supply, there are l/4-turn thumbscrews. To loosen, turn the thumbscrews approximately l/4 turn counterclockwise.
8. Grasp the thumbscrews and gently pull outward. Be careful not to damage the internal wiring while pulling the supply out. Pull the power supply completely out.
9. Locate the wires that extend from the back of the I/O rack to the terminal on the power supply. These wires should be labeled or stamped with their location; the circuit boards have wire locations stamped on them also. (Refer to Figure 3,) Remove these wires. There is also a plastic wire clamp holding these wires in place. Detach this from the frame if there is not a similar item on the replacement power supply, or cut the clamp if there is one on the new supply.

   Remove the molex connector that is on the narrow board in the front part of the power supply. The power supply should now be completely detached from the I/O rack.
10. Take the replacement power supply and attach the wires as shown in Figure 3. Be sure to connect the molex connector (Pl) to the power supply. Attach the wire clamp on the upper stud of the power supply frame, or if there is a clamp already there, wrap the wires in it.
11. Slide the power supply into the rack, being careful not to damage the wires. When the power supply is all the way in, turn the thumbscrews clockwise until they lock in.
12. Remove the plastic cover on the lower portion of the power supply and attach the AC wires as they were on the original supply (Refer to Step 6). Replace the plastic cover.
13. Restore system power. Turn on the I/O rack. Check to see if the "POWER" light is on. If it is, turn on the rest of the system and resume normal operation.
14. If the POWER light does not come on, the power supply is bad or there are other problems within the I/O rack. When this occurs, you can call the Programmable Control Service Center EMERGENCY SERVICE NUMBER (804) 978-5747 for assistance.

Table 2. Summary of Units of Load for I/O Modules

Catalog Number	Module Description	Units of Load (1)		
		+5 V	+12 V	-12 V
IC600BF800	I/O Receiver	9	-	-
IC600BF801	Remote I/O Receiver	42	10	10(2)
IC600BF802	24 to 48 V dc Input	2	-	-
IC600BF804	115 V ac/dc Input	2	-	-
IC600BF805	230 V ac/dc Input	2	-	-
IC600BF806	12 V ac/dc Input	2	-	-
IC600BF808	Interrupt Input	3	-	-
IC600BF810	115 V ac/dc Isolated Input	2	-	-
IC600BF813	Type J Thermocouple Input	29	-	-
IC600BF814	Type K+ Thermocouple Input	29	-	-
IC600BF815	Type S Thermocouple Input	29	-	-
IC600BF816	Type T Thermocouple Input	29	-	-
IC600BF817	Type B Thermocouple Input	29	-	-
IC600BF818	Type E Thermocouple Input	29	-	-
IC600BF819	Type R Thermocouple Input	29	-	-
IC600BF827	High Speed Counter	19	-	-
IC600BF830	Advanced I/O Receiver	12	-	-
IC600BF831	High Density Input	4	-	-
IC600BF841	0 to 10 V dc Analog Input	29	-	-
IC600BF842	10 V dc Analog Input	29	-	-
IC600BF843	4 to 20 mA Analog Input	29	-	-
IC600BF900	I/O Transmitter	34	-	-
IC600BF901	Remote I/O Driver	38	10	10(2)
IC600BF902	24 V dc Sink Output	7	-	-
IC600BF903	48 V dc Sink Output	7	-	-
IC600BF904	115 V ac Output	9	-	-
IC600BF905	230 V ac Output	9	-	-
IC600BF906	12 V dc Sink Output	7	-	-
IC600BF907	12 V dc Source Output	7	-	-
IC600BF908	24 V dc Source Output	7	-	-
IC600BF909	48 V dc Source Output	7	-	-
IC600BF910	115 V ac Isolated Output	8	-	-
IC600BF912	230 V ac Isolated Output	8	-	-
IC600BF914	Reed relay output	13	-	-
IC600BF915	Axis Positioning Module, Type 1	23	7	3
IC600BF917	Axis Positioning Module, Type 2	21	11	6
IC600BF921	5 V TTL Output	3	-	-
IC600BF923	10 to 50 V dc Sink Output	3	-	-
IC600BF924	120 V dc Output	5	-	-
IC600BF929	10 to 50 V dc Source output	3	-	-
IC600BF930	115 V ac Protected Output	8	-	-
IC600BF941	0 to 10 V dc Analog Output	29	-	-

Table 2. Summary of Units of Load for I/O Modules - Continued

Catalog Number	Module Description	Units of Load (1)		
		+5 V	+12 V	-12 V
IC600BF942	10 V dc Analog Output	29	-	-
IC600BF943	4 to 20 mA Analog Output	29	-	-
IC600BF944	ASCII/BASIC Module (12K)	20	12	-
IC600BF949	ASCII/BASIC Module (28K)	20	12	-
IC600BF946	Loop Management Module	20	12	-
IC600BF947	I/O Link Local	20	12	-
IC600BF948	I/O CCM	20	12	-
IC600BF950	I/O CCM4	20	12	-
IC660CBB900	Genius Bus Controller	20	2	-
IC660CB902	Genius Bus Controller w/Diag.	20	2	-
IC660CBB901	Genius Bus Controller	20	2	-
IC660CB903	Genius Bus Controll wo/Diag.	20	2	

(1) For +5 V dc, 1 unit of load equals 60 mA (300 mw of power). For +12 and -12 V dc, 1 unit of load equals 25 mA (300 mw of power).

(2) +12 V and -12 V current is less than 1 unit of load if RS-232 mode is not used.

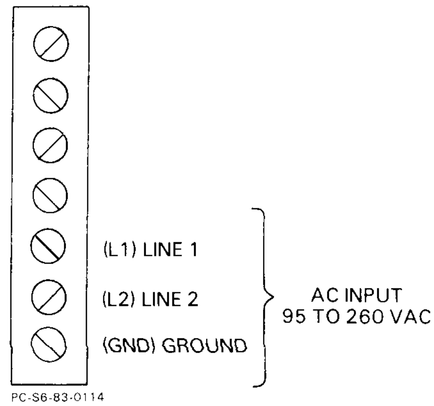


Figure 2. High Capacity I/O Power Supply Front-Panel Terminal Block

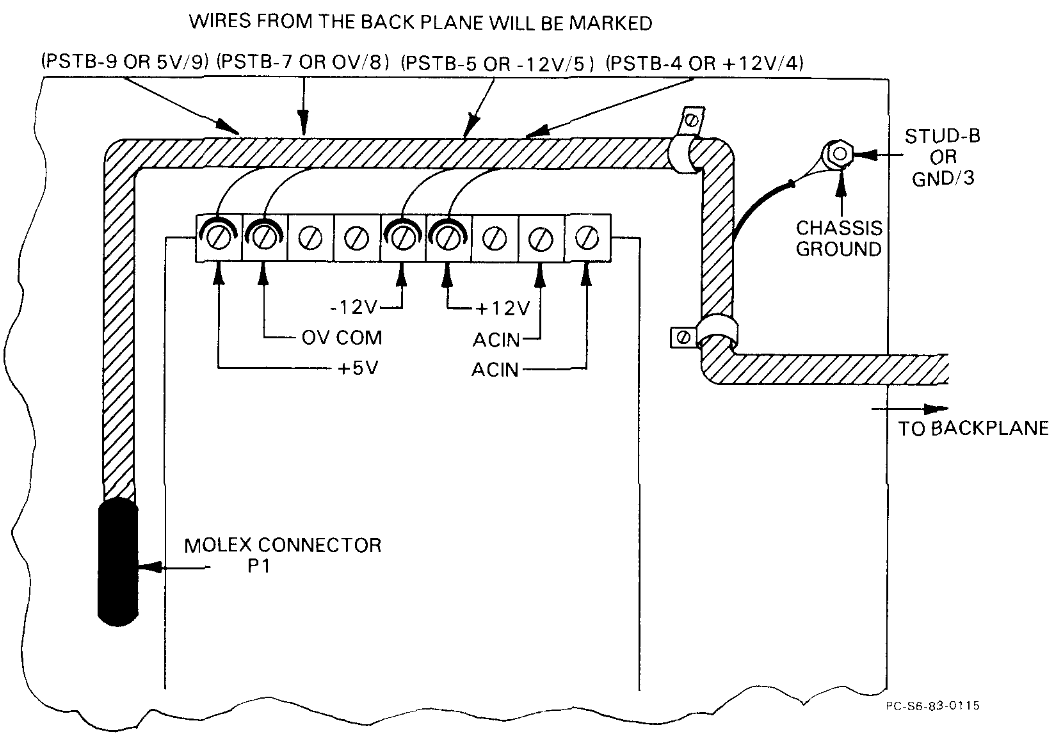


Figure 3. High Capacity I/O Power Supply External Wiring

NOTE

This High Capacity I/O power supply (IC600PM503B) is designed for use in the I/O rack IC600YR511A. It may be substituted directly into standard rack IC600YR501B without any wiring changes to the standard rack. To use this power supply with High Capacity I/O racks IC600YR510A and IC600YR512A an I/O power supply cable adapter kit must be used and the kit installation is described in GEK-90751.

Table 3. Specifications

• **Dimensions:**	12.46 x 9.00 x 2.75 (inches) 317 x 229 x 70 (mm)
• **Input:**	95 to 260 Vac, 250 VA (max.) 47-63 Hz
• **Output:**	5 Vdc, 16.5 A (max.) Total power +12 Vdc, 1.5 A (max.) is limited to 12 Vdc, 1.0 A (max.) 90 watts 275 Units of Load (see Table 2)
• **Allowable Power Interruptions:**	33 ms minimum at 115 Vac line.
• **Operating Temperature:**	0° to 60°C
• **Storage Temperature:**	-20° to +80°C
• **Humidity:**	5% - 95% (non-condensing)
• **Noise Immunity:**	Meets requirements of NEMA ICS 2-230 and ANSI C37.90A.

Table 4. Ordering Information

High Capacity I/O Rack Power Supply	95 - 260 Vac Input IC600PM503B

Catalog Number Revision Suffix

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No, 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GEK-84871B

March 1989

Redundant Processor Unit
Data Prom Module

General Description

The Data PROM Module contains the executive program for the Redundant **Processor** Unit (RPU). The module includes Programmable Read-Only Memory (PROM) devices which provide non-volatile storage of software required for RPU operations. The Data PROM Module features and benefits are summarized in Table 1, while module specifications are shown in Table 2.

Table 1. Featutes and Benefits

FEATURES	BENEFITS
Contains RPU executive firmware	Provides intelligent capabilities in the RPU
Programmable Read-Only Memory (PROM)	Provides reliable, non-volatile, storage

Table 2. Specifications

Dimensions:	Circuit Board: 8.15 x 11.0 x 1.1 **(inches)** 208 x 280 x 28 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)
Power Requirements:	5 V dc, 2.0 A (Supplied by RPU power supply)
Storage Temperature:	-40” to +70° c
Operating Temperature:	0° to 60° C (Outside of rack)
Humidity:	5% - 95% (non-condensing)

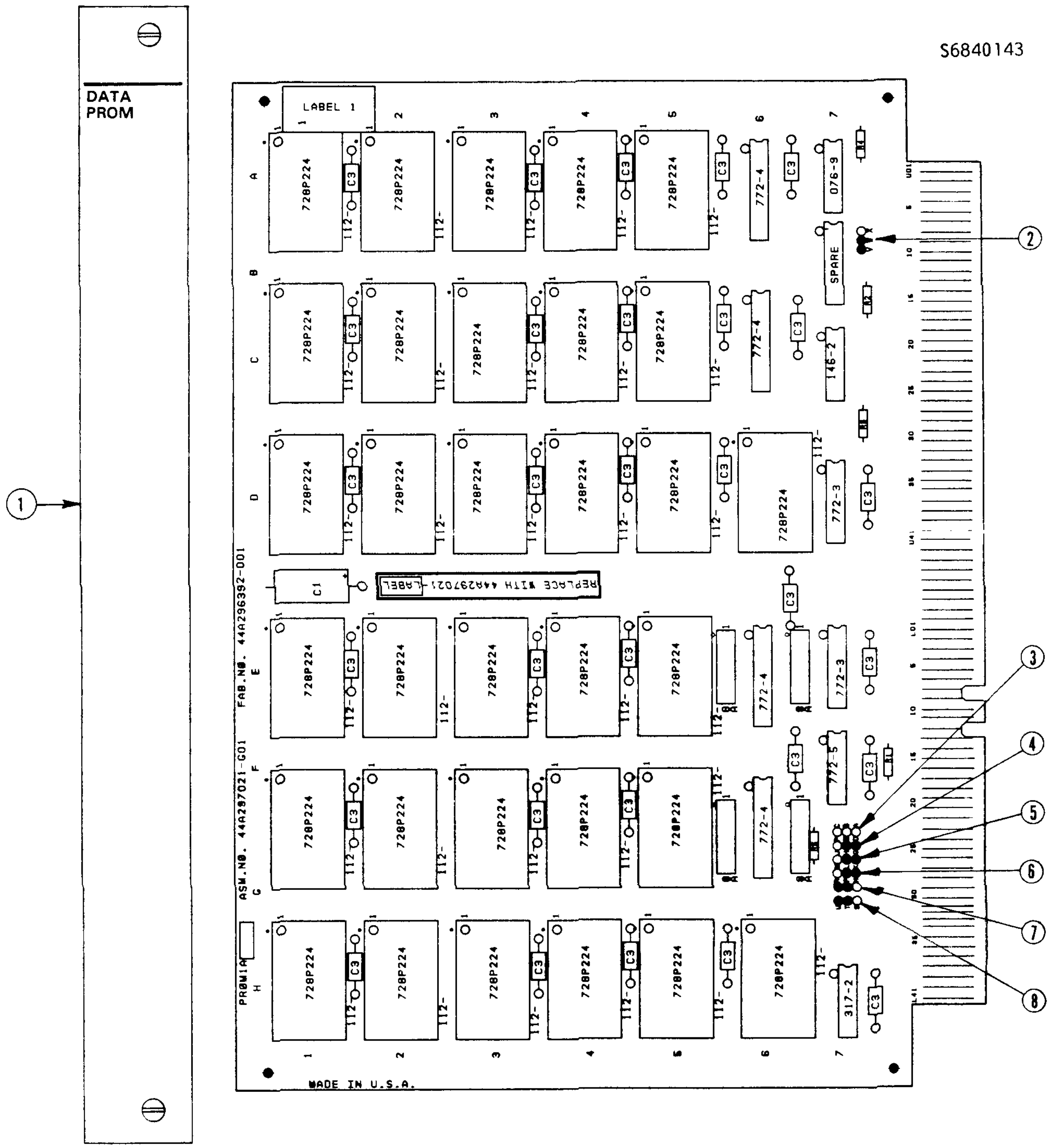


Figure 1. User Items

1. Faceplate.
2. Jumper VW Jumper position set at factory.
3. Jumper ABC No jumper
4. Jumper DE Jumper position set at factory.
5. Jumper GH Jumper position set at factory.
6. Jumper KL Jumper position set at factory.
7. Jumper PR Jumper position set at factory.
8. Jumper TU Jumper position set at factory.

Installation

Before installing the Data FROM module, verify the positions of the factory-installed jumpers as indicated **in Figure I.**

The module must be inserted in the fifth slot from the left in the RPU. To ensure proper installation, use the extraction/insertion tool supplied with the RPU. Secure the faceplate to the rack by tightening the thumbscrews at the top and bottom.

This module may be inserted or removed under power provided that the RUN/HOLD switch on the Main Power Supply is set to the HOLD position.

EPROM upgrade kits are provided from time to time. These typically replace only the operational firmware contained in the EPROMS at locations H5, D5, H3, and D3.

Table 3. Ordering Information

Equipment	Catalog Number
Circuit Board and Faceplate	IC600RM716
Faceplate	IC600FP701

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales **representative.**

GE FANUC

Series Six™
Programmable Controllers

GEK-84872B

Redundant Processor Unit
Data Control Module

March **1989**

General Description

The Data Control Module contains a 16-bit microprocessor (Intel 8086) that controls Redundant Processor Unit (RPU) parallel communications to both the master and backup CPUs while also monitoring and displaying RPU hardware status. The module maintains CPU synchronization and transfer of I/O and register data between master and standby CPUs.

Table 1 summarizes features and benefits of the Data Control module, while Table 2 lists module specifications.

The module provides two 37-pin, D-type connectors; the top connector is not used, but the bottom connector is connected to the CPU Switch Module, also within the RPU, via a multi-pair cable.

Table 1. Features and Benefits

FEATURES	BENEFITS
Powerful 16-bit microprocessor	Centralized control of all RPU Operations
On-board Direct Memory Access capability	Provides an efficient parallel link to the master or backup CPUs

Table 2. Specifications

Dimensions:	Circuit Board: 8.15 x 11.0 x 1.1 (inches) **208 x 280 x 28** (mm) Faceplate : 12.46 x 1.175 (inches) **317 x 30** (mm)
Power Requirements:	5 V dc, 2.0 A (Supplied by RPU power supply)
Storage Temperature:	**-40” to +70° c**
Operating Temperature:	**0° to 55° C** (Outside of rack)
Humidity:	5% - 95% (non-condensing)

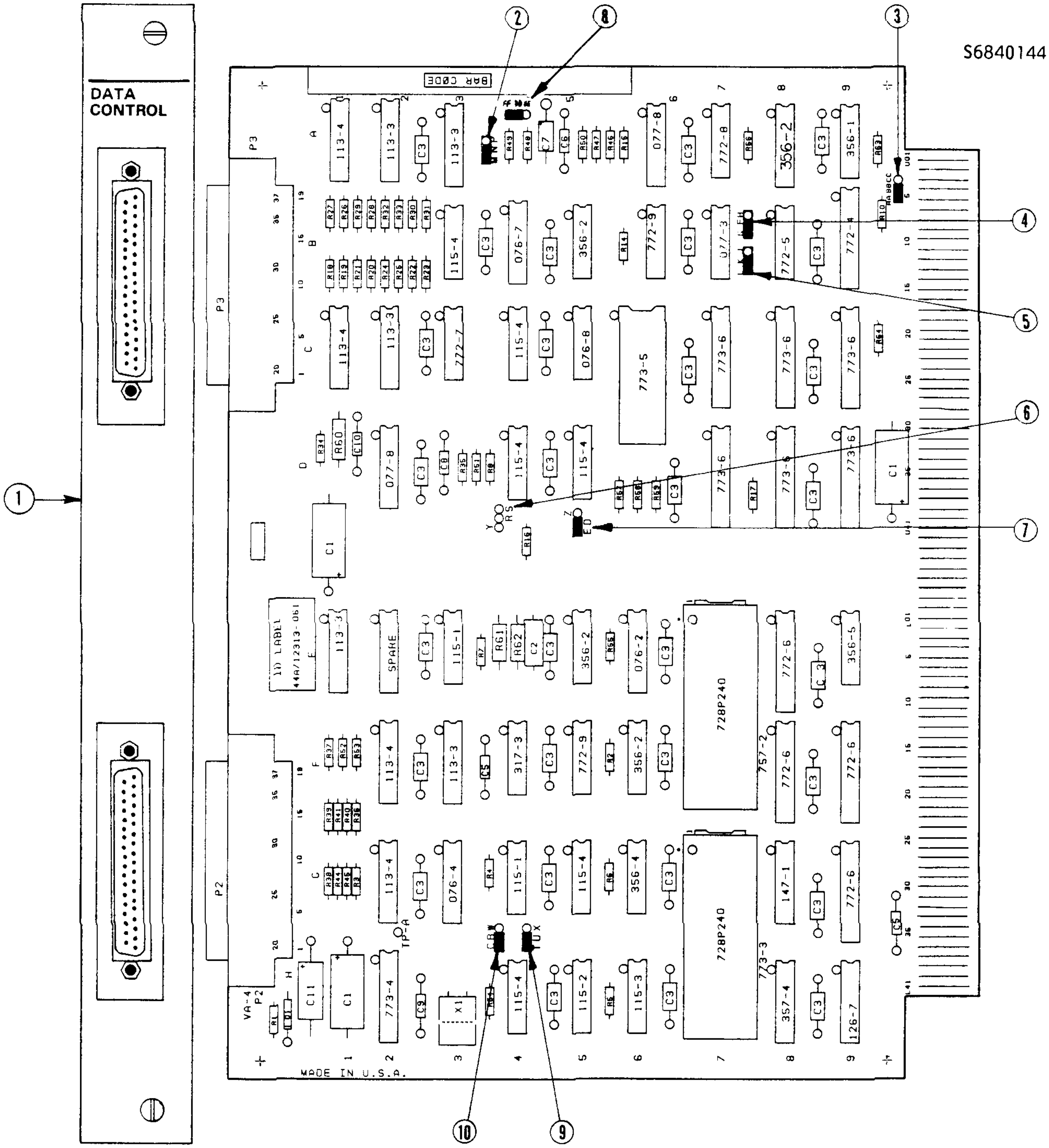


Figure 1. User Items

1. Faceplate.
2. Jumper NP Jumper position set at factory.
3. Jumper AA-BB Jumper position set at factory.
4. Jumper FH Jumper position set at factory.
5. Jumper KL Jumper position set at factory.
6. Jumper YRS No jumper
7. Jumper DE Jumper position set at factory.
8. Jumper DD-EE Jumper position set at factory.
9. Jumper TU Jumper position set at factory.
10. Jumper BC Jumper position set at factory.

Installation

Before installing the Data Control module, verify the positions of the factory-installed jumpers as indicated in Figure 1.

The Data Control module must be installed in the fourth slot from the left in the RPU. Use the insertion/extraction tool supplied with the RPU to firmly seat the module. Guide the faceplate over the connectors; then secure the faceplate to the rack by tightening the thumbscrews at the top and bottom.

Connect the short multi-pair Data Control cable supplied with the RPU between the bottom port (37-pin D connector) on the Data Control module and the bottom port of the CPU Switch module. The connector should be secured using the furnished screws. The top connector on the module is unused.

CAUTION

The Data Control module may be removed or inserted under power as long as the RUN/HOLD switch is set to the HOLD position.

Table 3. Ordering Information

Equipment	Catalog Number
Circuit Board and Faceplate	IC600RB753
Data Control Cable (supplied with RPU)	IC600WJ001
Faceplate	IC600FP700

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

Series Six
Programmable Controllers

GEK-84873C

Redundant Processor Unit
Data Storage CMOS Memory Module

March 1989

General Description

The CMOS Data Storage Memory Module (8K version) used in the Redundant Processor Unit (RPU) provides 8,192 words of random access memory. This module is supplied with a battery; however, since battery backup is not required for RPU functions, the battery and its associated status LED are not used in the RPU. The features and benefits of the Data Storage Memory module are summarized in Table 1, while Table 2 provides module specifications.

Table 1. Features and Benefits

Features	Benefits
CMOS RAM	Enhanced reliability through less power consumption and heat dissipation

Table 2. Specifications

Dimensions:	Circuit Board: 8.15 x 11.0 x 1.1 (inches) 208 x 280 x 28 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)
Power Requirements:	+5 V dc, 350 mA +I2 V dc, 10 mA (Supplied by RPU power supply)
Storage Temperature:	-40” to +70° c
Operating Temperature;	0° to 60” C (Outside of rack)
Humidity:	5 % - 95% (non-condensing)

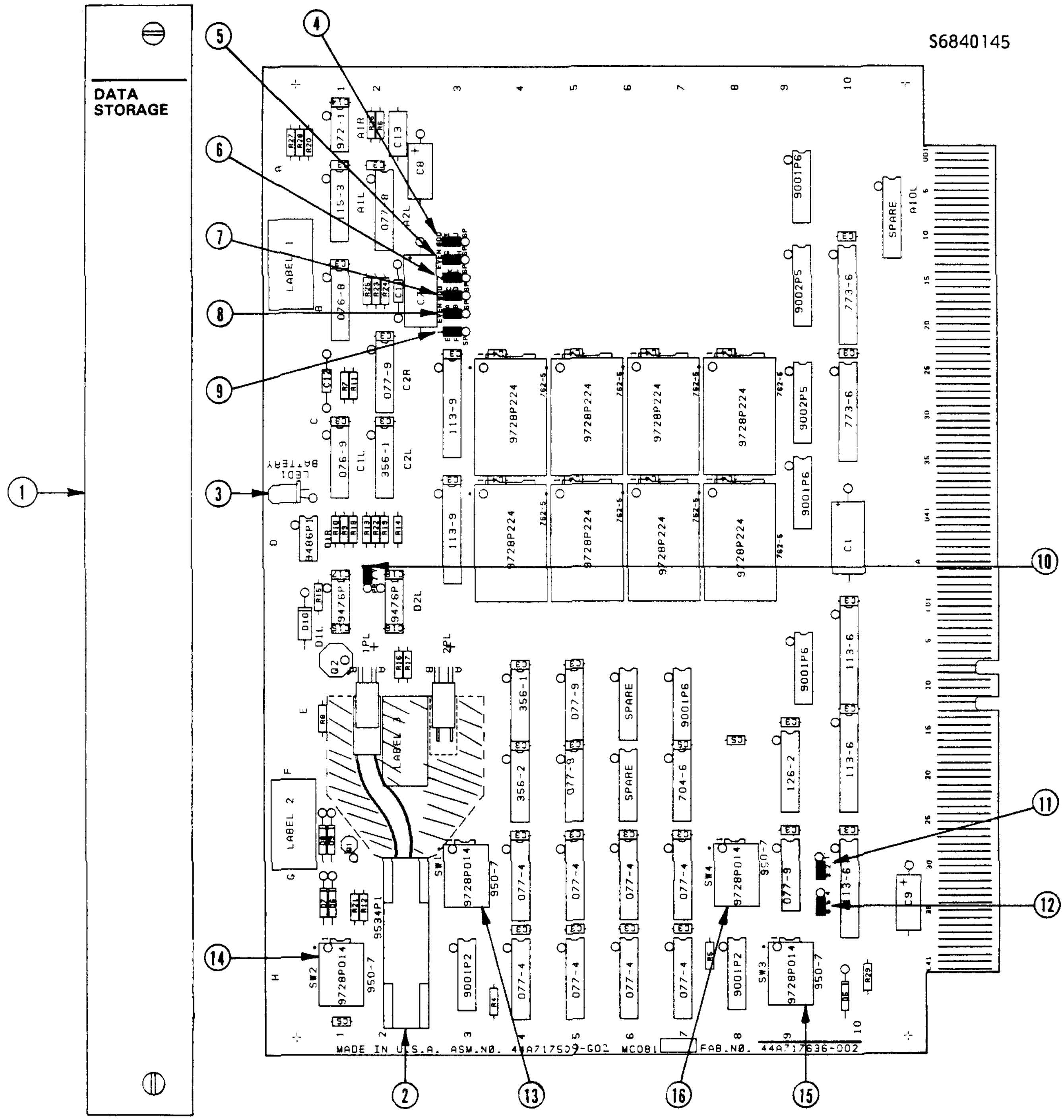


Figure 1. User Items

1. Faceplate.
2. Battery (not used in RPU)
3. Battery Status LED (not used in RPU)
4. Jumper IJ
5. Jumper GH
6. Jumper KL
7. Jumper CD
8. Jumper AB
9. Jumper EF
10. Jumper YZ
11. Jumper 3 2 1
12. Jumper 6 5 4
13. see below.

DIP SWITCHES	1	2	3	4	5	6	7
13 SW1	C	C	C	C	C	C	C
14 SW2	C	C	C	C	C	C	O
15 SW3	C	C	C	C	C	O	O
16 SW4	C	C	C	C	C	O	C

0 = Open, C = Closed

Figure 1, User Items (Cont'd)

Installation

Before installing the CMOS module in the RPU rack, verify the positions of the factory-set jumpers as shown in Figure 1.

Set the Dual-In-Line-Package (DIP) switches to the correct configuration (Refer to Figure 1, User Items 13-16).

The CMOS Data Storage module must be inserted in the third slot from the left in the RPU. Use the extraction/insertion tool supplied with the RPU to firmly seat the module. Secure the faceplate to the rack by tightening the thumbscrews at the top and bottom.

CAUTION

This module may be removed or inserted under power, provided that the RUN/HOLD switch on the Main Power module is set to the HOLD position.

Table 3. Ordering Information

Equipment	Catalog Number
Circuit Board and Faceplate	IC600RM715
Faceplate	IC600FP756

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

GEK-84874B

Redundant Processor Unit
To Central Processor Unit Cable

March 1989

General Description

This cable is used to interconnect the middle connector of the CPU switch module in either slot 6 or slot 11 of the Redundant Processor Unit (RPU) to the bottom connector of the I/O Control module in the CPU rack.

The cable has a male 37-pin D-type connector on one end and a female 37-pin D type connector on the other. The cable is made of 16 twisted pair (22 AWG) with an overall shield and a PVC jacket for a total of 32 wires plus shield. The features and benefits of this cable are summarized in Table 1, while Table 2 provides cable specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
Available in several lengths	Provides flexibility for Series Six hookup
Color-coded twisted pairs	Simplifies troubleshooting

Table 2, Specifications

Cable Outside Diameter:	0.465 ± 0.020 inches 11.81 ± 0.5 mm
Cable Length:	**2,** 5, and 10 feet **(0.61, 1.52,** and 3.05 meters)
Conductor Size:	**No. 22** AWG (each wire)
Jacket:	PVC material 300 V insulation Temperature: -20° C **to** +80° **C**
Internal Arrangement:	16 twisted pair (32 wires) with overall shield and jacket
Connectors:	37-pin D-type male 37-pin D-type female

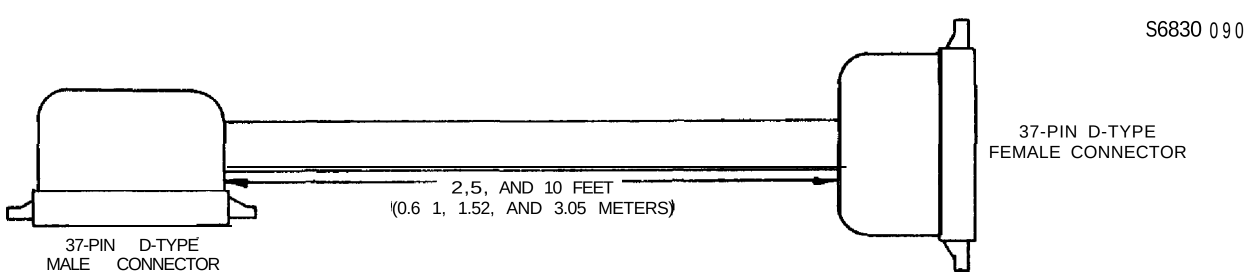


Figure I. Mechanical Assembly

Installation

The male end of this cable is made to connect to the bottom connector of the I/O Control module in the CPU rack.

The female end of this cable is made to connect with the middle connector of the CPU Switch module in the RPU rack.

All cables should be firmly secured at both ends by using the captive screws supplied with the connectors.

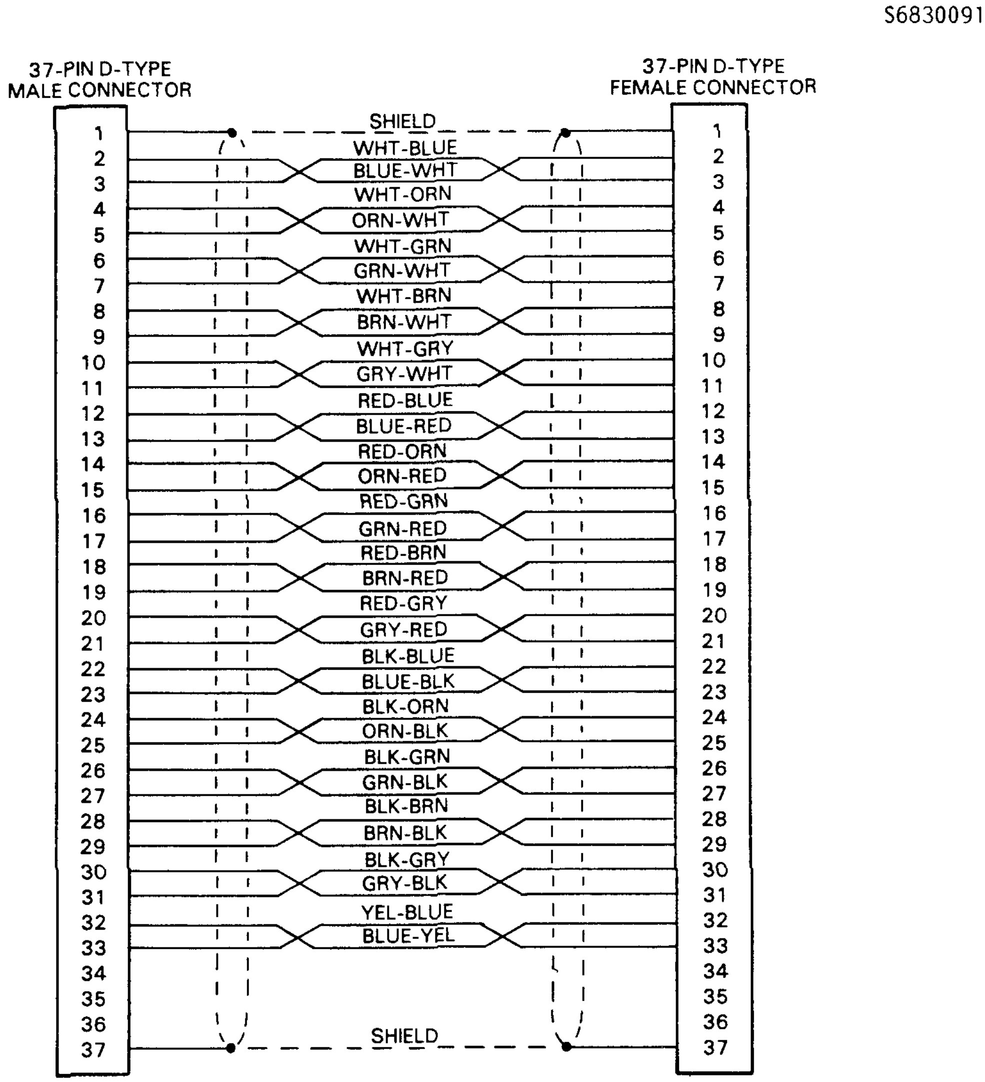


Figure 2. Wiring Diagram of Cable

Table 3. Ordering Information

Part Number	Description
IC600WH002	2 foot (.61 meters) cable with connectors each end
IC600WH005	5 foot (1.52 meters) cable with connectors each end
IC600WH010	10 foot (3.05 meters) cable with connectors each end

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales representative.

SERIES SIX

PROGRAMMABLE CONTROLLERS

REED RELAY OUTPUT MODULE

GEK-90494A

OUTPUT
240 V AC/DC
100 VA (Max)
2A (Max)

GENERAL DESCRIPTION

The Reed Relay Output module can be utilized in either an I/O Rack, a Model 60 CPU, or a Series Six Plus CPU to provide a compact, electrically-isolated, relay contact interface between user power supplies and discrete loads. The Reed Relay Output module features and benefits are summarized in Table 1.

The module includes six, Form C, mercury-wetted relays; each output circuit is separately fused and contains an LED that indicates when the circuit coil is energized. All six outputs are updated by the Series Six Plus CPU during an I/O scan.

The de-energized state of each relay is jumper-selectable by the user; either normally-open (N.O.) or normally-closed (NC.) contacts can be selected on a circuit-by-circuit basis.

The user also has the option to exclude the RC protection circuit provided for each output; this jumper-selectable option provides for low-level analog and instrumentation signals.

Refer to Table 2 (next page) for Reed Relay Output module specifications.

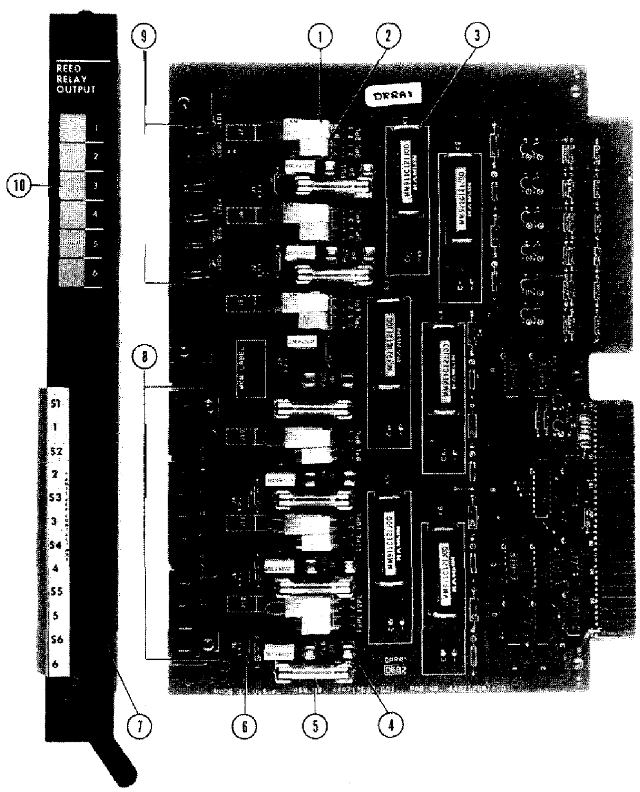
TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Normally Open/Normally Closed contact select ion	Useful in a variety of applications
6 relay outputs per module	Low cost per output point
Individual fuses and status indicators	Protection and monitoring aids
240 V AC/DC (100 Volt-Amps max)	Can be used with wide range of AC or DC loads
High-voltage isolation capabilities	Provides Electrical Isolation (1500 Volt Test) between user field devices and the Series Six Plus PLC

TABLE 2. SPECIFICATIONS

Dimensions: Circuit Board: 8.15 x 11.0 (inches) 200 x 260 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm) Power Requirements: +5V dc 750 mA maximum supplied by rack power supply. Operating Temperature: 0" - 60°C (at the outside of the rack) Storage Temperature:-20 to +80C Humidity: 5% -95%(non-condensing)	Contact Rating Type: Form C, N.O. or N.C.; jumper selectable Power: 100 VA (max) Voltage: 240 V AC/DC (Max) 4 V drop at 2 amp Current: 2 amp continuous, resistive Contact Resistance:.050 OHM(max) On Delay: 2 msec Off Delay: 3 msec Longevity: 108 operations with proper contact protection Contact Protection: 68 OHM and .012 of RC network, jumper selectable

82-PC-19



1. Jumpers: 2,4,6,8,10,12 PL - Select Normally Open Contacts
2. Jumpers: 3,5,7,9,11,13 PL - Select Normally Closed Contacts
3. Kl to K6, Mercury Wetted Contact Reed Relays
4. Fuse Clip, European Style Fuses (6)
5. Fuse, 3A Normal Blow (6)
6. Jumpers (J1-J6) for Selection Contact Protection RC Network to be In or Out of Circuit
7. User Terminal Block
8. Circuit Board Terminal Block
9. LED 1 to LED 6, On when Relay Coil Energized
10. Markable Lens Surface

FIGURE 1. USER ITEMS

INSTALLATION

Before installing the Reed Relay module in an I/O Rack (or Model 60 CPU or Series Six Plus CPU rack), determine if the factory configuration of the module is suitable for the application. The factory configuration includes normally-open contacts (refer to Figure 1, User Item 1) and RC protection circuits (Figure 1, User Item 6) for each of the six output circuits.

Also, establish the proper correspondence between the output terminals on this module and a group of six consecutive output numbers in the user program by setting the dual-in-line-package (DIP) switch on the rack backplane adjacent to the card slot. (Refer to table in the Installation section of the User's Manual, GEK-96602.

NOTE

Install the Reed Relay module in a vertically-oriented position. (That is, in a rack positioned right-side up.) Otherwise, the module will not function properly.

Use the extraction/insertion tool furnished with the Series Six Plus CPU to install the module in the rack. With the board in place in the rack, slip the faceplate over the circuit board so that the terminals near the bottom of each are mated; then, secure the faceplate to the rack using the thumbscrews at the top and bottom.

Refer to Figure 2 for typical user output connections. (Figure 2 includes a schematic representation of Reed Relay output circuit, No. 1. The RC protection circuit jumper (JP1), the N.O. jumper JP11, the N.C. jumper JP11, the energized-coil light (LED1), and fuse (FU1) are shown.) Connect one side of the load to be controlled by this module to the appropriate output terminal,(1 through 6). The other side of the load is connected through the user-supplied power source to terminals, S1 through S6, respectively. Each terminal can accommodate one No. 12 AWG or two No. 14 AWG wires. The terminal cover should be installed by guiding both its edges onto the top of the terminal block and sliding it downward over the terminals.

A markable area is provided on the plastic lens beside each indicator for noting the function or destination of each output.

WARNING

Voltages from user field devices could be present on the face-plate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of the module or any wires connected to it.

TPK.A.40356

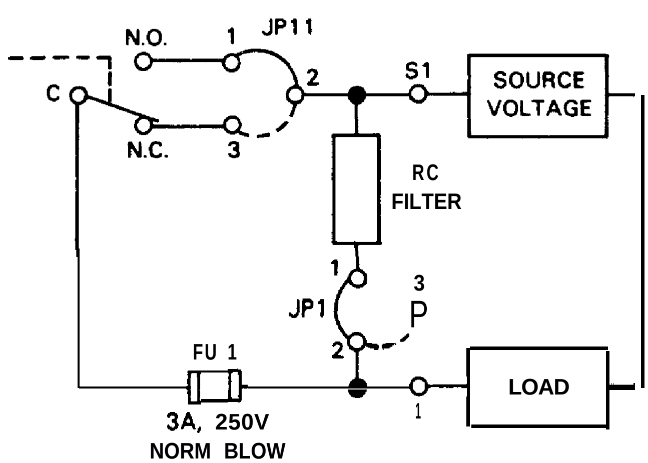


FIGURE 2. TYPICAL USER CONNECTIONS

ORDERING INFORMATION

Reed Relay Module

Circuit Board & Faceplate	Circuit Board Only	Faceplate Only
IC600BF914	IC600YB914	IC600FP914

Contact your local GE Fanuc Automation North America sales office for further information.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

SERIES SIX

PROGRAMMABLE CONTROLLERS

REDUNDANT PROCESSOR UNIT 24 V dc MAIN POWER SUPPLY MODULE

GEK-90512

Source Voltage:
20 to 32 V dc
Output Voltages:
+5, +12 V dc

GENERAL DESCRIPTION

The Redundant Processor Unit (RPU) is designed to operate either with a single (Main) power supply module or with two power supply modules, the second being the Auxiliary Power Supply.

The Main Power Supply module accepts 24 V dc and provides regulated + 5V and + 12 V dc to the RPU backplane. DC power is connected to terminals on the front panel and routed through a switch and fuse to a switching power supply.

Terminals on the front panel enable the user to access electromechanical relay contacts for connection to user indicators, or any device to be activated during an alarm condition.

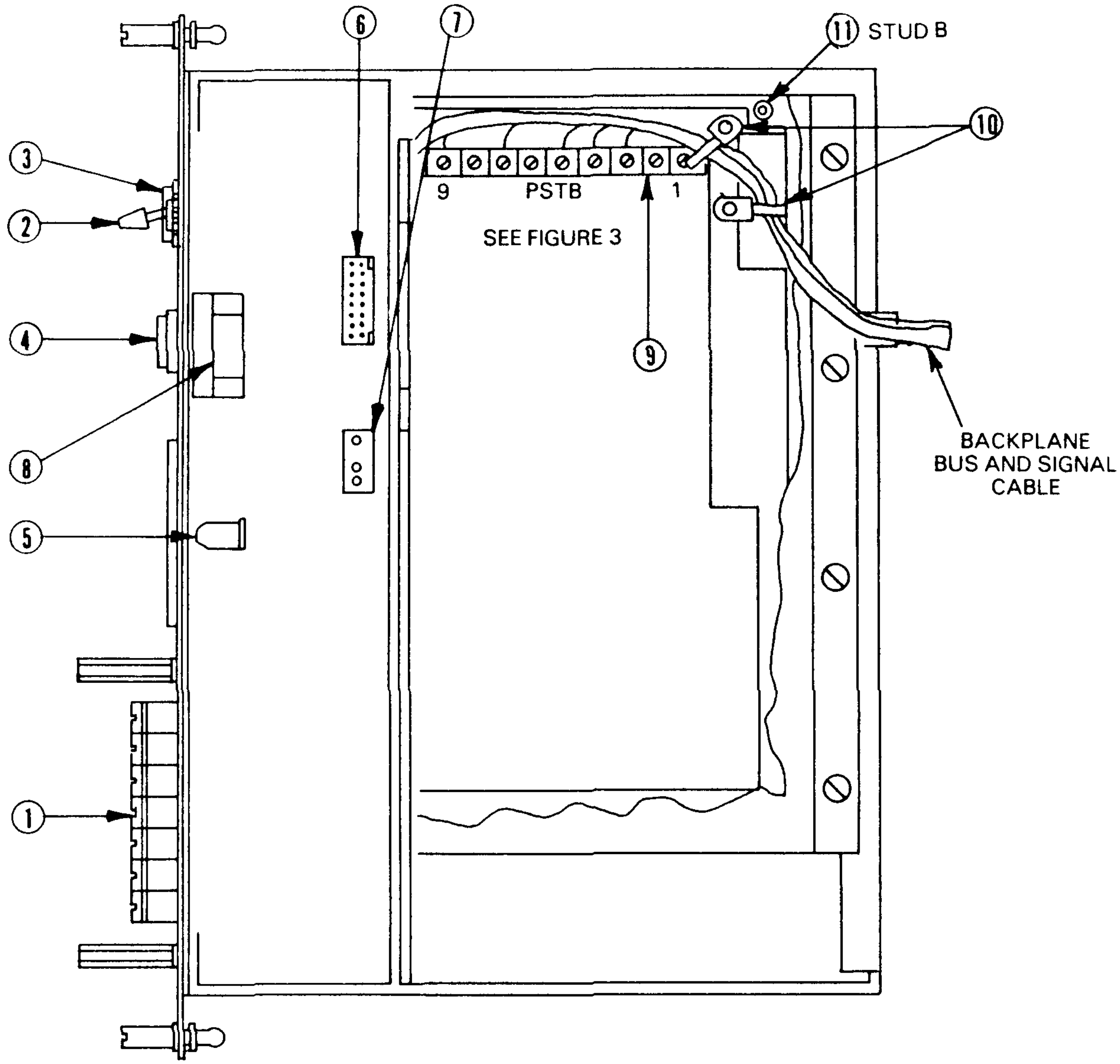
A Light-Emitting Diode (LED), visible through a lens on the front panel, is an indicator of the status of the module. A keyswitch mounted on the front panel is used to select either the RUN or HOLD mode of the RPU. A second keyswitch allows the user to select Central Processor Unit (CPU1), CPU2 or AUTO. A full description of the alarm relay fault conditions as well as rhe RUN/HOLD switch and CPUI/AUTO/CPU2switch operation is given in the RPU Manual, GEK-25366. Other features and benefits are listed in Table 1.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Input i'oltage Requirements: 20-32 V dc	Extends power source compatibility to 24 V dc systems.
Can be utilized along with an Auxiliary Power Supply module.	Power Supply system redundancy.
Provides access to electromechanical relay contacts.	Activates user-supplied fault annunciators.
Visible LED monitor.	Displays status of output voltages of module.

Input: 20 - 32 V dc, 8 Amp maximum output: + 5 V dc at 15.5 Amps maximum + 12 V dc at I .O Amp maximum Allowable Power Interruption: IO ms minimum @l 20 V dc line Noise Immunity: Meets requirements of NEMA ICS 2-230 and ANSI C37.90A	Dimensions: 12.46 x 9.00 x 2.75 (inches) 317x l19x70(mm) Operating Temperature: 0^o to 60^{o}C (outside of rack) Storage Temperature: -4ooc to 7ooc Humidity: 5% to 95% (non-condensing)

FIGURE 1. SPECIFICATIONS



1 Front Panel Connector Block

2 Power Switch

3 RUN/HOLD Keyswitch

4 CPU1/CPU2/AUTO Keyswitch

5 Power-On LED

On:	The voltage levels of both DC outputs (+12V and +5V) are within tolerance.
Off:	At least one of these voltage levels is out of tolerance.

6 P1, 16-Pin Connector

7 P6, 3-Pin Connector

8 8A Fuse

9 Power Supply Terminal Board

10 Cable Clamp

11 Chassis Ground Terminal

FIGURE 2. USER ITEMS

PC-S6-84-0132

INSTALLATION

The RPU is designed to operate either with a single power supply module or with two power supply modules. The removal and replacement guidelines of a power supply module in a dual supply system can also apply to a single supply system.

When two power supply modules are used the system offers power supply redundancy in such a way that:

- If both supply modules are functioning normally one module has the load and the other is on standby.

- If one power supply module fails the other either continues to carry the load or automatically assumes it without affecting the normal operation of the RPU system.

- A power supply module should be able to be removed or installed while the RPU system is up and running without interrupting the normal operation of the RPU system.

  However, because there may be live voltages on a power supply module, even after the switch to that module is turned off, the following removal and replacement guidelines should be observed.

Power Supply Module Replacement (RPU running)

1. Switch RUN/HOLD switch to HOLD.
2. Remove power to failed power supply by disconnecting DC source.
3. Disconnect wiring to DC and alarm terminals.
4. Remove partition faceplate between power supplies.
5. Release quarter-turn fasteners and slide power supply out to expose connectors located behind faceplate.
6. Disconnect the 4 wires from the supply chassis and 2 connectors from the monitor circuit board.
7. Remove the failed power supply.
8. Reverse the above procedure to install the replacement module.
9. After the replacement power module has been installed apply power to module and verify that the POWER-ON LED is on.
10. Switch RUN/HOLD switch to RUN.

NOTE

Care should be taken to avoid shorting components or leads on the module being replaced. The free-hanging connectors from this module should also be handled or positioned in such a way that they are not brought into contact with conductive surfaces.

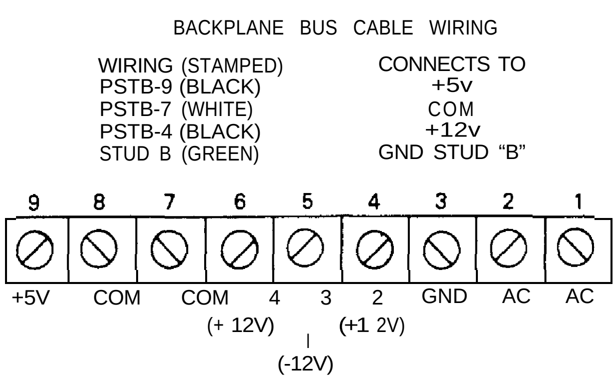


FIGURE 3. POWER SUPPLY TERMINAL BLOCK

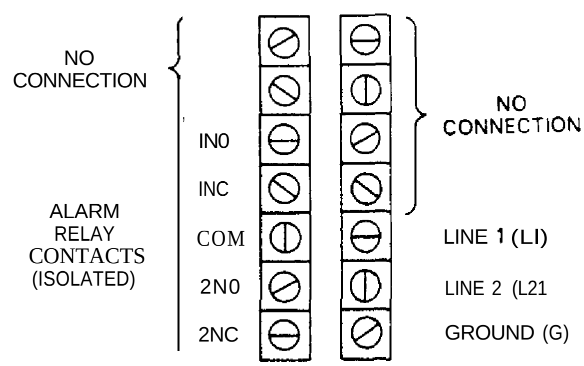


FIGURE 4. FRONT PANEL TERMINAL BLOCK

CAUTION

The alarm contacts consist of two sets of Form C contacts. The terminals marked 1 NO and 1 NC are associated with Alarm Type No. 1; the terminals marked 2 NO and 2 NC with Alarm Type No. 2. (Refer to the RPU Manual, GEK-25366 for further information on Alarm Nos. 1 and 2.)

The user devices connected to each set of alarm terminals on this module should present a resistive load drawing no more than one ampere (1A) of current at no greater than 115 V ac/28 V dc. Failing to observe this caution may result in damage to the module.

NOTE

During normal operation, the alarm relays are energized. During an alarm condition, when the relay becomes de-energized, the contacts marked 1 NO and 2 NO open, and those marked 1 NC and 2NC close.

ORDERING INFORMATION

Module	Catalog Number
24 V dc Main Power Supply	lC600PM543A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE **Fanuc Automation North America, Inc., Charlottesville, Virginia**

AUGUST, 1985

SERIES SIX

PROGRAMMABLE CONTROLLERS

G EK-905 13

Source Voltage:
20 to 32 V dc
Output Voltages:
+5, +12Vdc

REDUNDANT PROCESSOR UNIT
24 Vdc AUXILIARY POWER SUPPLY MODULE

GENERAL DESCRIPTION

The Redundant Processor Unit (RPU) is designed to operate either with a single (Main) power supply module or with two power supply modules, the second being the Auxiliary Power Supply module.

The Auxiliary Power Supply module accepts 24 V dc and provides regulated + 5V and + 12 V dc to the RPU backplane DC power is connected to terminals on the front panel and routed through a 8A fuse to a switching power supply.

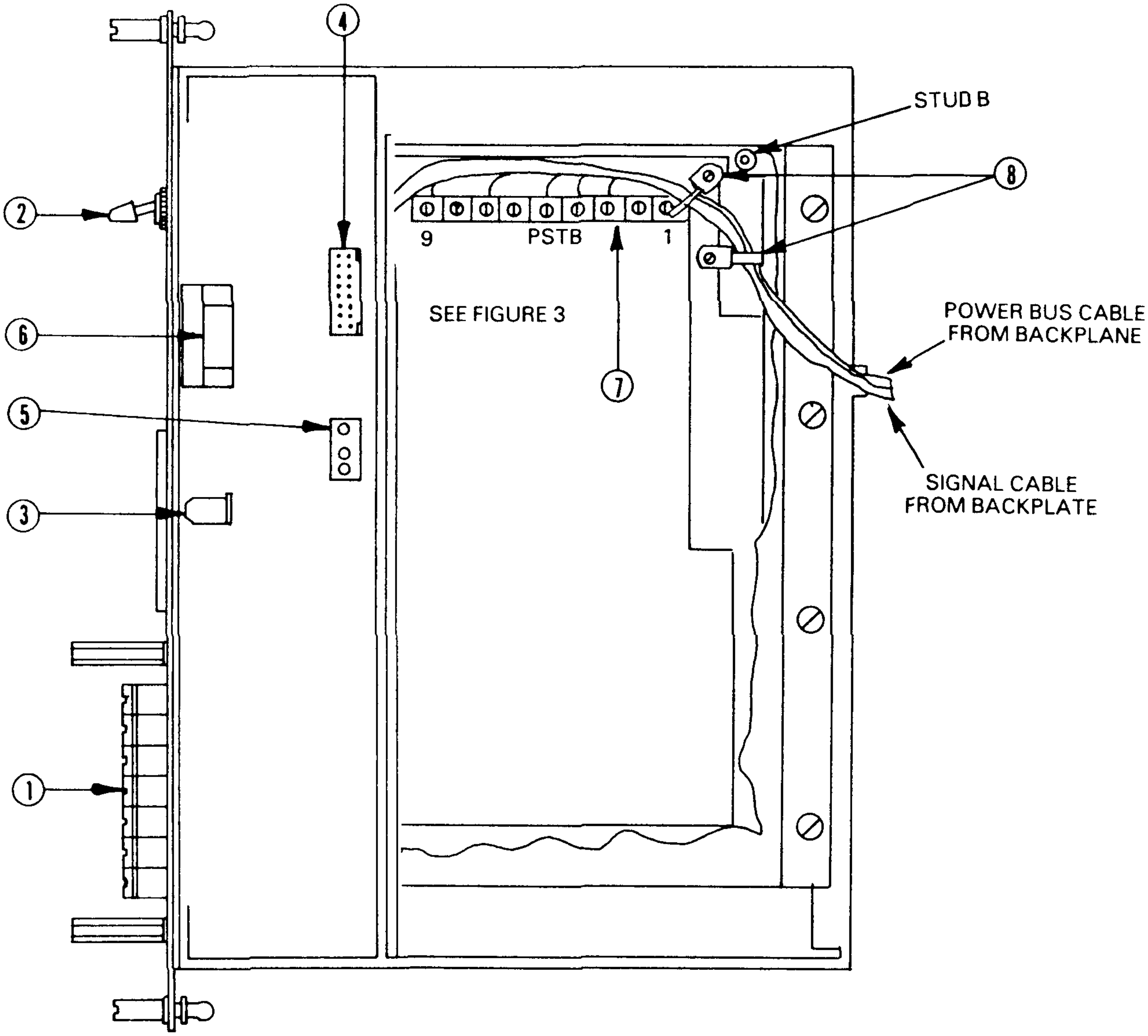
A Light-Emitting Diode (LED), visible through a lens on the front panel, is an indicator of the status of the module.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Input Voltage Requirements: 20- 32 Vdc	Extends power source compatibility to 24 V dc systems.
Can be utilized along with a Main Power Supply module	Power Supply system redundancy
Visible LED monitor	Displays status of output voltages of module

Input: 20 - 32 V dc, 8 Amps maximum Output: +5 V dc at 15.5 Amps maximum + 12 V dc at 1 .O Amp maximum Allowable Power Interruption: IO ms minimum @ 20 V dc line Noise Immunity: Meets requirements of NEMA ICS 2-230 and ANSiC37.90A	Dimensions: 12.46 x 9.00 x 2.75 (inches) 317x 119x70(mm) Operating Temperature: 0° to 60°C (outside of rack) Storage Temperature: -40°C to 70°C Humidity: 5% to 95% (non-condensing)

FIGURE I. SPECIFICATIONS



1 Front Panel Connector Block

2 Power Switch

3 Power-On LED

On: The voltage levels of both DC outputs (+12V and +5V) are within tolerance.

Off: At least one of these voltage levels is out of tolerance.

4 P1, 16-Pin Connector

5 P6, 3-Pin Connector

6 8A Fuse

7 Power Supply Terminal Board

8 Cable Clamp

FIGURE 2. USER ITEMS

INSTALLATION

The RPU is designed to operate either with a single power supply module or with two power supply modules. The removal and replacement guidelines for a power supply module in a dual supply system can also apply to a single supply system.

When two power supply Modules are used the system offers power supply redundancy in such a way that:

- If both power supply modules are functioning normally one module has the load and the other is on standby.
- If one power supply module fails the other either continues to carry the load or automatically assumes it without affecting the normal operation of the RPU system.
- A power supply module should be able to be removed or installed while the RPU system is up and running without interrupting the normal operation of the RPU system.

  However, because there may be 'live' voltages on a power supply module, even after the switch to that module is turned off, the following removal and replacement guidelines should be observed.

Auxiliary Power Supply Module Replacement (RPU running)

1. Switch RUN/HOLD switch to HOLD.
2. Remove power to failed power supply by disconnecting DC source.
3. Disconnect wiring to DC and alarm terminals.
4. Remove partition faceplate between power supplies.
5. Release quarter-turn fasteners and slide power supply out to expose connectors located behind faceplate.
6. Disconnect the 4 wires from the supply chassis and 2 connectors from the monitor circuit board.
7. Remove the failed power supply.
8. Reverse the above procedure to install the replacement module.
9. After the replacement power module has been installed apply power to module and verify that the POWER-ON LED is on.
10. Switch RUN/HOLD switch to RUN.

NOTE

Care should be taken to avoid shorting components or leads on the module being replaced. The free-hanging connectors from this module should also be handled or positioned in such a way that they not be brought into contact with conductive surfaces.

BACKPLANE BUS CABLE WIRING

WIRING (STAMPED)	CONNECTS TO
PSTB-9 (BLACK)	+5v
PSTB-7 (WHITE)	COM
PSTB-4 (BLACK)	+I2V
STUD B (GREEN)	GND STUD "B"

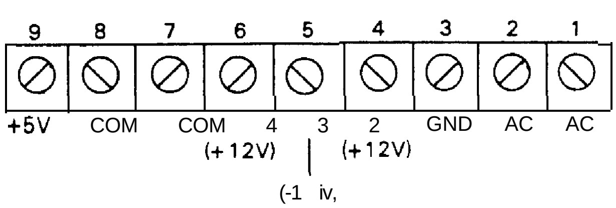


FIGURE 3. POWER SUPPLY TERMINAL BLOCK

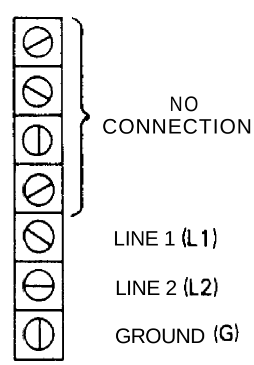


FIGURE 4. FRONT PANEL TERMINAL BLOCK

PC-S6-84-0136
PC-Sb-R4-0137

ORDERING INFORMATION

Module	Catalog Number
20 to 32 V dc Auxiliary Power Supply Module	IC600PM544A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

AUGUST, 1985

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-90516

Bumpless Transfer To Backup CPU Or I/O Chain

24 V dc REDUNDANT PROCESSOR UNIT

GENERAL DESCRIPTION

The Redundant Processor Unit (RPU) acts as a switch to transfer control from one Series Six Central Processor Unit (CPU) or I/O chain to a standby upon failure of the first. To accomplish this, the RPU monitors the CPU and I/O chain for fault conditions, and when detected, conducts an orderly transfer of control to the standby CPU. A bumpless transfer, one without loss or interjection of data, is accomplished within a few milliseconds, while maintaining program and I/O continuity. Actual transfer time varies up to 2 CPU sweeps depending where in the sweep cycle the fault occurs and the amount of data to be transferred.

The RPU includes a Data Control module, Data FROM and Storage modules, and CPU, I/O, and Device Switch modules, connected to a common power supply and backplane, all enclosed within a mountable rack. The RPU system is designed to directly interface with CPU Extended Software Revision 103 or above. Earlier releases can be upgraded to this level. The features and benefits of the RPU are summarized in Table 1. Figure 2 illustrates the standard rack configuration and cable connections to CPU's and I/O chains.

The Data Control module, which contains an Intel 8086 microprocessor, is used to control parallel communications between the master and standby CPU's and their I/O chains. CPU synchronization is maintained by this module as is transfer of I/O and register data between master and standby CPU's,

The DATA PROM module contains the executive program which controls the RPU, while Memories contained on the Data Storage module are used as intermediate storage locations for input, output override or register data read by the RPU. On every CPU scan the RPU reads the requested data from the master CPU and transfers it to the standby processor. The requested data is selected by hardware jumpers on the Device Switch module, or by setting of I/O bits and registers in the CPU.

Actual switching of the I/O data bus cable is accomplished through interaction of the CPU and I/O Switch modules.

The CPU Switch selects either the CPU1 or CPU2 I/O Bus, whichever is determined to be Master by the Data Control module, and connects this bus to the I/O Switch module through the backplane. The main function of the I/O Switch module is to select between I/O chains I or 2 and connect the selected chain to the master CPU I/O bus. If Auxiliary I/O chains are being used, a second pair of CPU and I/O Switch modules are inserted in the RPU rack for connection to these devices. Each of these modules contain 37-pin, D-type connectors for termination of the standard multi-conductor I/O bus cables.

The Device Switch module contains logic for interfacing the various modules and provides system status information. Additionally, 12 form C relays, whose state is dependent upon which CPU is master, are mounted on this module. A 36 point terminal connector is provided for connection to external devices such as CRT's and printers. By use of these low level contacts, external devices can be switched between master CPU's

The Main Power Supply provides the +5 and + 12 volts required for proper RPU operation. It also contains a RUN/HOLD keyswitch for selecting the state of operation, and another keyswitch whose function is to select which CPU is to be master or allow the RPU to automatically select the master. Two form C relay contacts are also available for user connection. One contact (Alarm No. 2) will annunciate if there is a problem within the RPU. CPU, or I/O system which requires attention, the total system is still operational. The other contact (Alarm No. 1) is used to annunciate a major fault which causes the total system to shut down.

For those applications that require maximum redundancy, an Auxiliary Power Supply is available for the RPU. This supply mounts in the RPU rack and will power the RPU system in the event of failure of the main power supply. Separate power sources can be connected to each RPU power supply to assure operation in the event of loss of one or the other power source.

TABLE I. FEATURES AND BENEFITS

FEATURES	BENEFITS
Dual I/O chains	Additional Redundancy Capability
Dual RPU power supplies	Additional Reliability
Device Switch card	Permits Transfer of Peripheral Devices
Automatic update when CPU returned to on-line status	Increased Performance
No Special Programming Required	Easy lnstallarion
RPU Fault Tolerant Operation	CPU System Operation Maintained for most RPU Failures
Digital Fault Annunciation	Simplifies Troubleshooting
Alarm Contacts	Separate Annunciation for major or minor faults

Dimensions:

Rack Mount:
19.0 x 14.0 x 10.3 (inches)
483x356x261 (mm)

Panet Mount:
20.0 x 14.0 x 10.3 (Inches)
508x356x261 (mm)

Weight (w,ith modules): 37 lbs (17Kg)

Storage Temperature: -40° to + 70°C

Operating Temperature: 0° to 55°C
(at the outside of the rack)

Humidity: 5% - 95% (non-condensing)

Power Requirements:
20 V to 32 V dc, 8A maximum.

FIGURE I. SPECIFICATIONS

INSTALLATION NOTES

Verify with the Program Development Terminal (PDT) that each CPU is equipped with Extended Software Revision 103 or later.

CPU I/O Control modules (IC600CB503A) and Auxiliary I/O Control modules (IC600CB513A) produced after January, 1984 (CPU Serial Number C188-8405-0000 and later), contain enhanced filter circuits. Because of the RPU's ability to monitor and sense externally induced disturbances these enhanced modules should be in CPUs being used in conjunction with an RPU system to improve the reliability of the total system. Inspection of CPU systems used with a RPU system should be made to make sure the proper enhanced modules are contained within the CPUs used.

These desired modules can be identified as folIows: I/O Control module lC600CB503A should be labeled Assembly Version R07 or later. Looking at the component side of the module, oriented with the backplane pins to the right, the assembly version label is a white affixed label at the bottom right hand edge of the module. Auxiliary I/O Control module (IC600CB513A) should be labeled Assembly Version R03 or later. Location of the Assembly Version label is approximately the same as the IC600CB503A module above.

If any questions arise concerning the module assembly versions or the extended software version of the CPU, contact PC Field Service at (804) 978-5747.

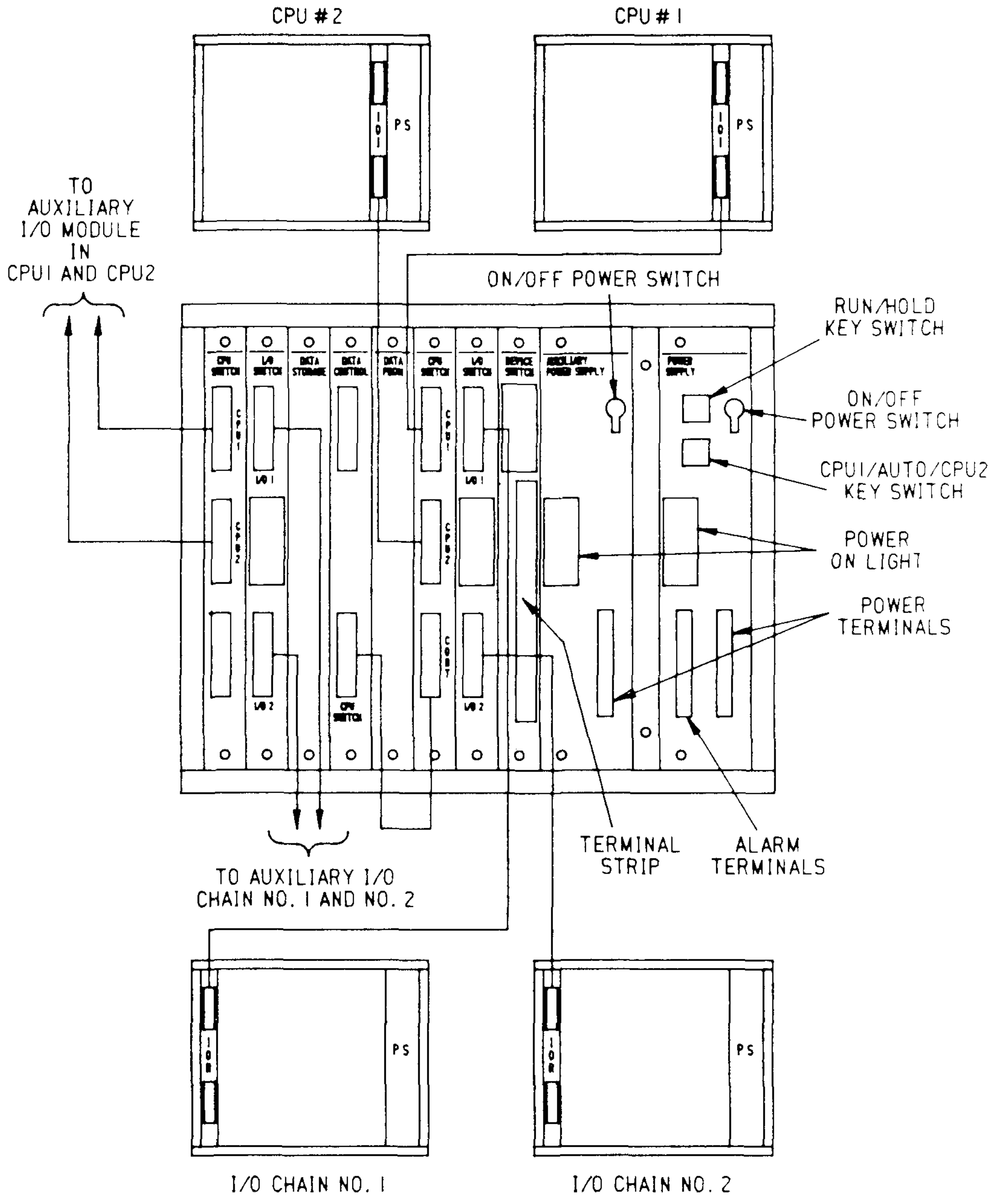


FIGURE 2. RPU RACK CONFIGURATION

INSTALLATION

This section provides a summary of the procedures described in the Installation section for the various RPU modules. Do not attempt to install the Redundant Processor Unit (RPU) without first reading this material.

1. The RPU can be rack, panel or wall mounted, depending on the orientation of the mounting brackets.

2. If Auxiliary I/O is to be used, insert the second pair of CPU and I/O Switch modules. Use the extraction/insertion tool supplied with he CPU to install these modules in the first and second (respectively) slots from the left.

3. Set Jumper on I/O Switch modules for either single or dual I/O chains.

4. Set jumpers on Device Switch module for data to be transferred.

5. If the Auxiliary Power Supply is to be used, connect the appropriate cables and wires and insert the power supply into the slot adjacent to the Main Supply.

6. Connect the multi-conductor cables from CPU1 and CPU2 I/O Control modules to the appropriate 37-pin connectors on the CPU Switch module.

7. Connect the multi-conductor cable from the I/O Receiver module of the I/O chain to the 37 pin connector marked I/O1 on the I/O Switch module.

8. If Redundant I/O or Auxiliary I/O is used, make similar connections to I/O Chain 2 and Auxiliary I/O chains.

9. Connect the short multi-conductor cable supplied with the RPU between the bottom 37-pin connectors of the Data Control and CPU Switch modules.

10. If peripheral devices are to be switched between CPUs, make the appropriate connections to the 36 point terminal strip on the Device Switch module.

11. Make the following connections to the terminal blocks on the RPU Main and Auxiliary Power Supplies.

    POS, NEG, GND
    Alarm-relay contacts (on Main Supply only).

12. Refer to the Installation Notes on page 2.

ORDERING INFORMATION

Equipment	Catalog Number
RPU AC System	IC600RP551A
RPU DC System	IC600RP554A
* Rack and AC Power Supply	IC600RR551A
* RPU and DC Power Supply	IC600RR554A
* Data Control	IC600RB753A
* Data Storage	IC600RM715A
* Data PROM	IC600RM716A
* I/O Switch	IC600RB750A
* CPU Switch	IC600RB751A
* Device Switch	IC600RB752A
* Cable, Data Control to CPU Switch	IC6OOWJ001A
**Cable 2 feet	IC600WH002A
**Cable 5 feet	IC6OOWH00SA
**Cable 10 feet	IC600WH010A
Main AC Power Supply	IC600PM507A
Auxiliary AC Power Supply	IC600PM508A
Main 24 V dc Power Supply	IC600PM543A
Auxiliary 24 V dc Power Supply	IC600PM544A

* Items marked are combined and sold as a basic AC RPU system under catalog number IC600RP551A.

** These cables are used to connect the RPU to CPU No. 2 only. The RPU to CPU No. 1 cable is the standard I/O chain cable IC600WD002A (2 ft), IC600WD005A (5 ft) or IC6OOWDOlOA (10 ft). RPU to I/O chain cables are also standard I/O chain cables.

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

C;E Fanuc Automation North America, Inc., Charlottesville, Virginia

AUGUST, 1985

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-90750

COMPLIANCE WITH FCC REQUIREMENTS FOR ELECTRICAL NOISE GENERATION

GENERAL DESCRIPTION

As of October 1, I983 all computing devices marketed in the United States must meet certain Federal Communications Commission (FCC) regulations. These regulations, as applied to Programmable Controllers (PCs), are referred to as Part 15 Subpart J. The FCC has set limits of electrical radiation beyond which a PC is likely to interefere with the reception of radio, TV and other signals.

While strictly industrial applications are exempt from the regulation, the extent of the exemption is not precise. If in doubt the rules set forth in this document should be followed. For example, for non-exempted application certain cables with metal hoods should be used instead of cables with plastic hoods.

Each individual chassis or rack in the Series Six system must be securely connected to earth ground by a low impedance connection. This connection is made from the power supply "G" or ground terminal on each rack's power supply to the earth ground connection. This low impedance connection from chassis to the earth ground connection should not exceed 0.05 ohms resistance (i.e., 15 feet of No. 14 wire). The earth ground connection to the earth ground plane should be in accordance with National Electrical Code Section 250-81, 83 or equivalent.

The metal framework of the racks, the cable shields, and cable metal hoods will effectively act as a blockage to radiated energy and a drain path for the radiated electrical energy generated within the Series Six enclosures and shunt this energy harmlessly **to** earth ground. This system effectively contains and limits any radiated energy to the confines of the Series Six enclosures.

The following statement is required to be published on all installation manuals by the FCC rules:

WARNING

"This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference."

BACKGROUND INFORMATION ON FCC REQUIREMENTS CONCERNING COMPUTING DEVICES

The FCC is a United States Government agency with overall responsibility of controlling the airwaves.

In order to carry out these responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the Radio spectrum, the commission has developed technical standards for radio frequency equipment and parts or components contained therein, One such standard or regulation is Subpart J of Part 15. Subpart J deals with computing devices. Computers and similar electronic equipment that use digital techniques generate and use radio frequency (RF) energy for timing and control purposes. Unless proper precautions are taken, some of this RF energy may be radiated into space or conducted along the power line (or combination of both) and may cause harmful interference to radio communications. Subpart J sets out technical and administrative specifications to reduce the interference potential of such equipment.

All digital electronic products which use timing and control signals or pulses at 10,000 hertz or greater, require certification or conformance to FCC part 15 Subpart J.

Computing devices are divided into two classifications A and B.

A Class A computing device is one that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public, or which is intended to be used in the home.

A Class B computing device is one that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environment (e.g., electronic games, personal computers, etc.).

There is a timetable for these requirements. It is as follows.

January 1, 1981 - Class B devices requiring certification must comply. All other devices must either comply or be labelled with a statement of noncompliance.

October 1, 1981 - All Class A and Class B devices manufactured for the first time after this date must comply.

October 1, 1983 - All Class A and Class B devices must comply.

Certain Class B devices must be certified by the FCC. All other Class B devices and all Class A devices must be verified. Verification is defined as a procedure where the manufacturer makes measurements or takes the necessary steps to insure that the equipment complies with the appropriate technical standards.

Series Six PCs are Class A computing devices and have been verified to comply with FCC 15.J when installed per this GEK. All non-exempted Series Six installations must comply. Industrial plants and public utilities are at present exempt.

This information has been prepared using currently available data. Changes to this ruling may occur. Although we have attempted to provide the most up-to-date information, we cannot be responsible for changes the FCC may implement which could affect the validity of some information provided herein. The FCC can provide the most current information.

INSTALLATION

If the following steps are observed the Series Six system will meet FCC rule Part 15, Subpart J.

1. Each individual chassis or rack in the Series Six system must be securely connected to earth ground by a low impedance connection. This connection is made from the power supply "G" or ground terminal on each rack's power supply to the earth ground connection. This low impedance connection from chassis to the earth ground connection should not exceed 0.05 ohms resistance (i.e., 15 feet of No. 14 wire). The earth ground connection to the earth ground plane should be in accordance with National Electrical Code Section 250-81, 83 or equivalent.

2. The following cables must be used:

   IC600WDF- – instead of IC600WD-- (I/O chain cables)

   IC600WEF- – instead of IC600WE- – (Interface cable)
   IC600WHF- – instead of IC600WH-- (RPU cable)
   IC6OOWJF- – instead of IC600WJ-- (RPU cable)

   These "F" cables basically have metal hoods and small differences in connection of the shield to the enclosure. See Figure 1 for typical general installation.

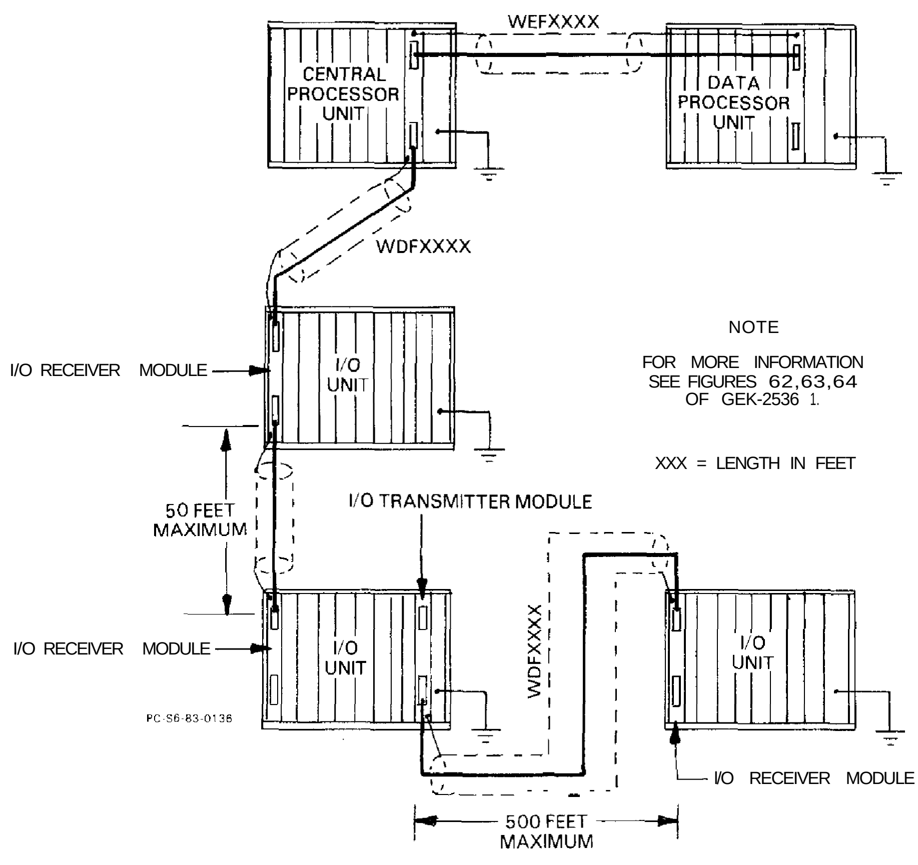


FIGURE 1, TYICAL GENERAL CABLE INSTALLATION

3. Some logic modules that plug into the racks will have mounted on them one or more "D" type connectors. Between each module and the connector is a metal dress plate (see Figure 2) painted with a black conductive paint. There are tapped metal studs as part of this dress plate that the cable will screw into. Between the dress plate and the connector is a metal face plate with a Radio Frequency Interference (RFI) gasket attached to the back of the non-painted pre-treated faceplate.

4. The cable shield is connected to the metal hood. The metal hood gets connected to the dress plate by the screws from the hood to the dress plate tapped studs. The dress plate, because of its conductive paint, connects by pressure to the conductive RFI gasket which in turn conducts to the back of the non-painted pre-treated steel faceplate. The pre- treated steel faceplate makes a secure pressure connection to the pre-treated rails of the Series Six rack which in turn is connected to earth ground by the connection on the terminal board of each power supply made by the user of the system.

   Check to make sure that the rack is marked that it complies with FCC rules. Check to see that the dress plates on the modules have black conductive paint. The backs of the faceplates should be unpainted and have a RFI gasket. Use the proper cables and ground the enclosure.

If steps 1, 2, 3 and 4 have been complied with then the Series Six system will comply with FCC Rule Part 15, Subpart J.

If the modules to which the cables are connected have older brown dress plates, they will not meet the FCC requirements. If this situation should occur, along with the need to meet FCC requirements, your local GE sales office should be contacted for assistance.

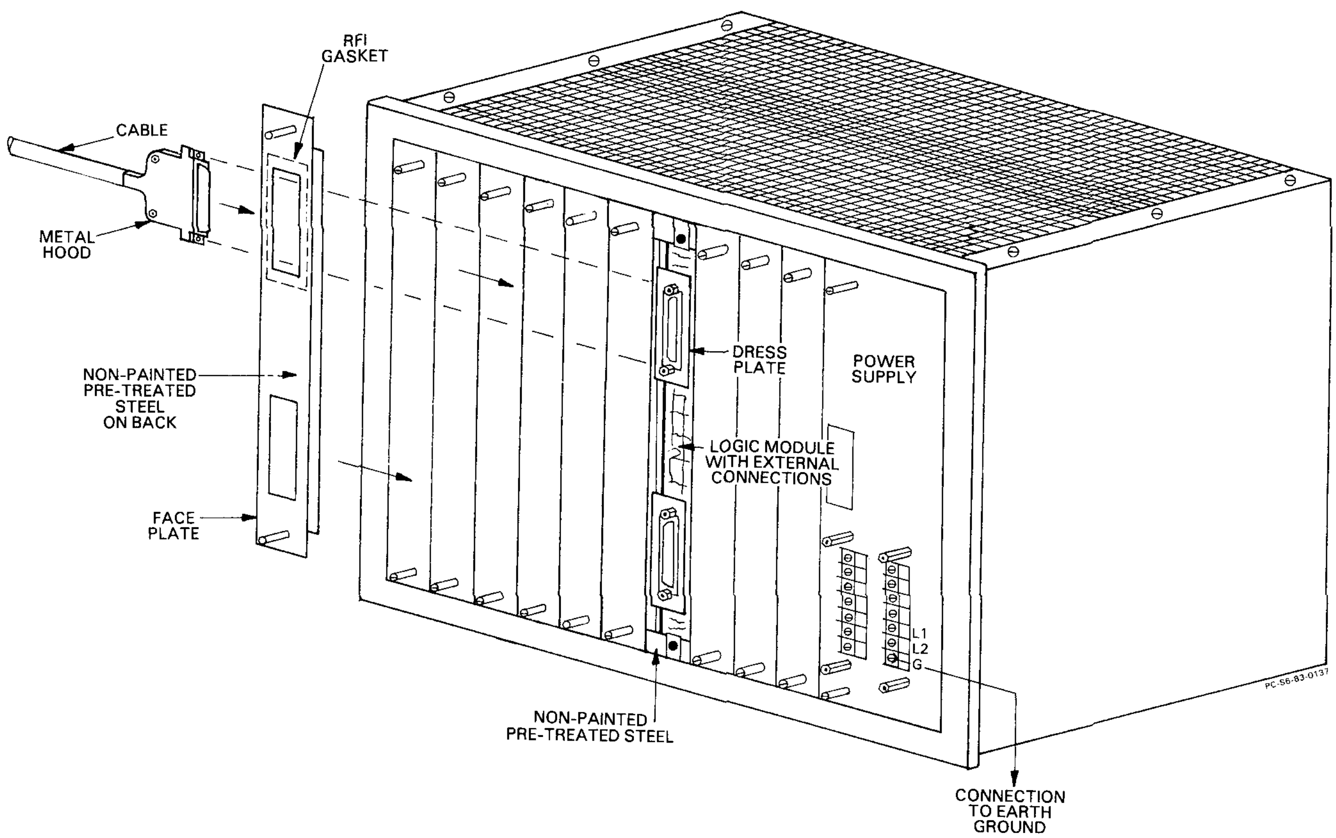


FIGURE 2. TYPICAL CABLE AND FACEPLATE CONNECTION

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-90752

2 feet to 500 feet lengths

I/O CABLE
(NON-INDUSTRIAL OR COMMERCIAL USE)

GENERAL DESCRIPTION

The Input/Output (I/O) cable, consisting of 19, twisted-pair wires and two connectors, provides electrical continuity and radiated energy shielding for the parallel I/O Bus as it extends from rack to rack within a Local, Central Processor Unit (CPU) or Remote I/O station; it can also connect a Local station to another Local station, or to a CPU station. Refer to Table 1 for I/O Cable features and benefits.

The cable is shielded and individual twisted-pair wires are color-coded. (Refer to Figure 3, next page). The cable is available in lengths ranging from 2 ft. (.6m) to 500 ft. (152.5 meters).

Refer to Figure 1 (below) for I/O Cable specifications.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Available in lengths from 2 feet to 500 feet.	Provides flexibility in Series Six setup.
Color-coded twisted-pairs.	Simplifies troubleshooting.
Radiated energy shielding.	Meets FCC Part 15 Subpart J requirements.

Cable Outside-Diameter:
0.465 ± 0.020 (inches)
11.8 ± 0.5 (mm)

Cable Length: 2 feet (0.6m) to 500 feet (152.4m) in standard lengths (determined by part number).

Conductor Size: No. 22 AWG (each wire).

Jacket: PVC material, 300V insulation
Temperature: -20°C to +80°C

Internal Arrangement: 19 twisted pair with overall shield.

Connectors37-Pin D-Type Connector. One male, one female connector per cable.

FIGURE 1. SPECIFICATIONS

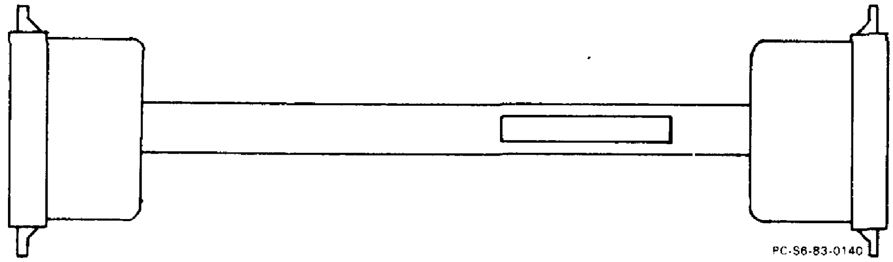


FIGURE 2. I/O CABLE

INSTALLATION

Note that the cable has one connector with male terminals and one with female terminals. As a general rule, the male connector on the cable connects to the upstream module, and the female connector to the downstream module. The specific modules which use this cable are: the I/O Control module, the Auxiliary I/O module, the I/O Receiver module, the I/O Transmitter module, and the downstream port of the Remote I/O Receiver module. All connectors should be secured using the furnished screws.

The shell of one of the connectors can be temporarily removed by loosening its screws, so that that end of the cable can be more easily slid into, and through, a section of conduit.

NOTE

The following constraints should be observed when using this cable to interconnect various parts of the Series Six I/O system:

1. The total cable length connecting the racks within an I/O station (the party-line bus) should be no more than 50 feet (15.2m).

2. The cable length between a Local I/O station and the CPU station or another Local station should be no more than 500 feet (152.4m).

3. The parallel I/O bus between any Local I/O station and the CPU rack should interface through no more than four I/O Transmitter modules.

Connector Terminal	Wire Color	Out Of (Pair)	Connector Terminal	Wire Color	Out Of (Pair)
# 1		NO CONNECTION	20	BROWN	BLACK/BROWN
2	BLACK	WHITE/BLACK	21	BLACK	BLACK/RED
3	WHITE	WHITE/BROWN	22	RED	BLACK/RED
4	BROWN	WHITE/BROWN	23	BLACK	BLACK/BROWN
5	WHITE	WHITE/RED	24	BROWN	BLACK/BROWN
6	RED	WHITE/RED	25	BLACK	BLACK/YELLOW
7	WHITE	WHITE/BROWN	26	YELLOW	BLACK/YELLOW
8	BROWN	WHITE/BROWN	27	BLACK	BLACK/GREEN
9	WHITE	WHITE/YELLOW	28	GREEN	BLACK/GREEN
10	YELLOW	WHITE/YELLOW	29	BLACK	BLACK/BLUE
11	WHITE	WHITE/GREEN	30	BLUE	BLACK/BLUE
12	GREEN	WHITE/GREEN	31	BLACK	BLACK/VIOLET
13	WHITE	WHITE/BLUE	32	VIOLET	BLACK/VIOLET
14	BLUE	WHITE/BLUE	33	BLACK	BLACK/GRAY
15	WHITE	WHITE/VIOLET	34	NOT USED	
16	VIOLET	WHITE/VIOLET	35	NOT USED	
17	WHITE	WHITE/GRAY	36	NOT USED	
18	GRAY	WHITE/GRAY	37	GRAY	BLACK/GRAY
19	BLACK	BLACK/BROWN			

NOTE

Shield drain wire connected to metal hoods each end.

FIGURE 3. TWISTED-PAIR COLOR CODES

ORDERING INFORMATION

Part Number	
IC6OOWDF002A	2-foot Cable with Connectors
IC600WDF005A	5-foot Cable with Connectors
IC600WDFOlOA	10-foot Cable with Connectors
IC600WDF025A	25-foot Cable with Connectors
IC600WDF050A	50-foot Cable with Connectors
IC600WDFlOOA	100-foot Cable with Connectors
IC600WDF200A	200-foot Cable with Connectors
iC600WDF50OA	500-foot Cable with Connectors

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

OCTOBER, 1983

Series Six
Programmable Controllers

GEK-90754B

Redundant Processor Unit
To Central Processor Unit Cable
(Non-Industrial or Commercial Use)

March 1989

General Description

This cable is used to interconnect the middle connector of the CPU switch module in either slot 6 or slot 11 of the Redundant Processor Unit (RPU) to the bottom connector of the I/O Control module in the CPU rack. This cable provides radiated energy shielding.

The cable has a male 37-pin D-type connector on **one** end and a female 37-pin **D** type connector on the other. The cable is made up of 19 twisted pair (22 AWG) with an overall shield and a PVC jacket for a total of 38 wires plus shield. The features and benefits of this cable are summarized in Table 1, while Table 2 provides cable specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
Available in several lengths.	Provides flexibility for Series Six hookup.
Color-coded twisted lairs.	SimDlifies troubleshooting.
Radiated energy shielding.	Meets FCC Part 15 Subpart J requirements.

Table 2. Specifications

Cable Outside Diameter:	0.465 +/-0.020 inches 11.81 ± 0.5 mm
Cable Length:	2, 5, and 10 feet (0.61, 1.52, and 3.05 meters)
Conductor Size:	No. 22 AWG {each wire)
Jacket:	PVC material 300 V insulation Temperature: -20°C to +80°C
Internal Arrangement:	19 twisted pair (38 wires) with overall shield and jacket
Connectors:	37-pin D-type male 37-pin D-type female

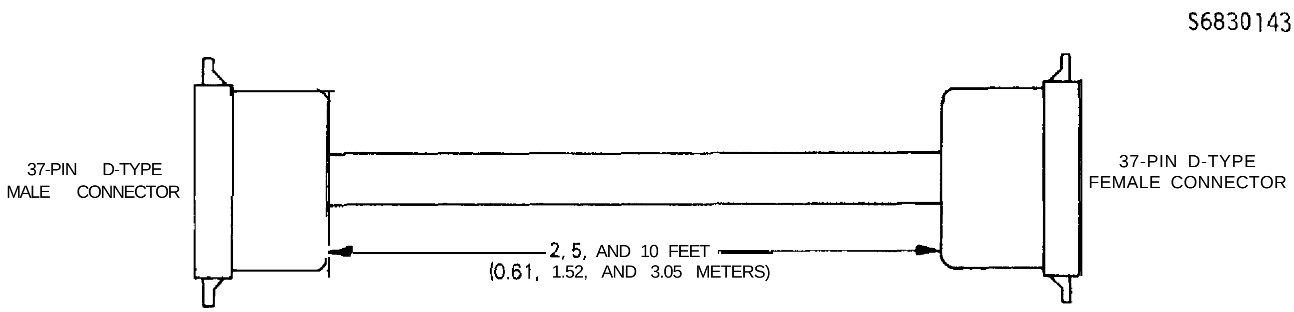


Figure 1. Mechanical Assembly

Installation

The male end of this cable is made to connect to the bottom connector of the I/O Control module in the CPU rack.

The female end of this cable is made to connect with the middle connector of the CPU Switch module in the RPU rack.

All cables should be firmly secured at both ends by using the captive screws supplied with the connectors.

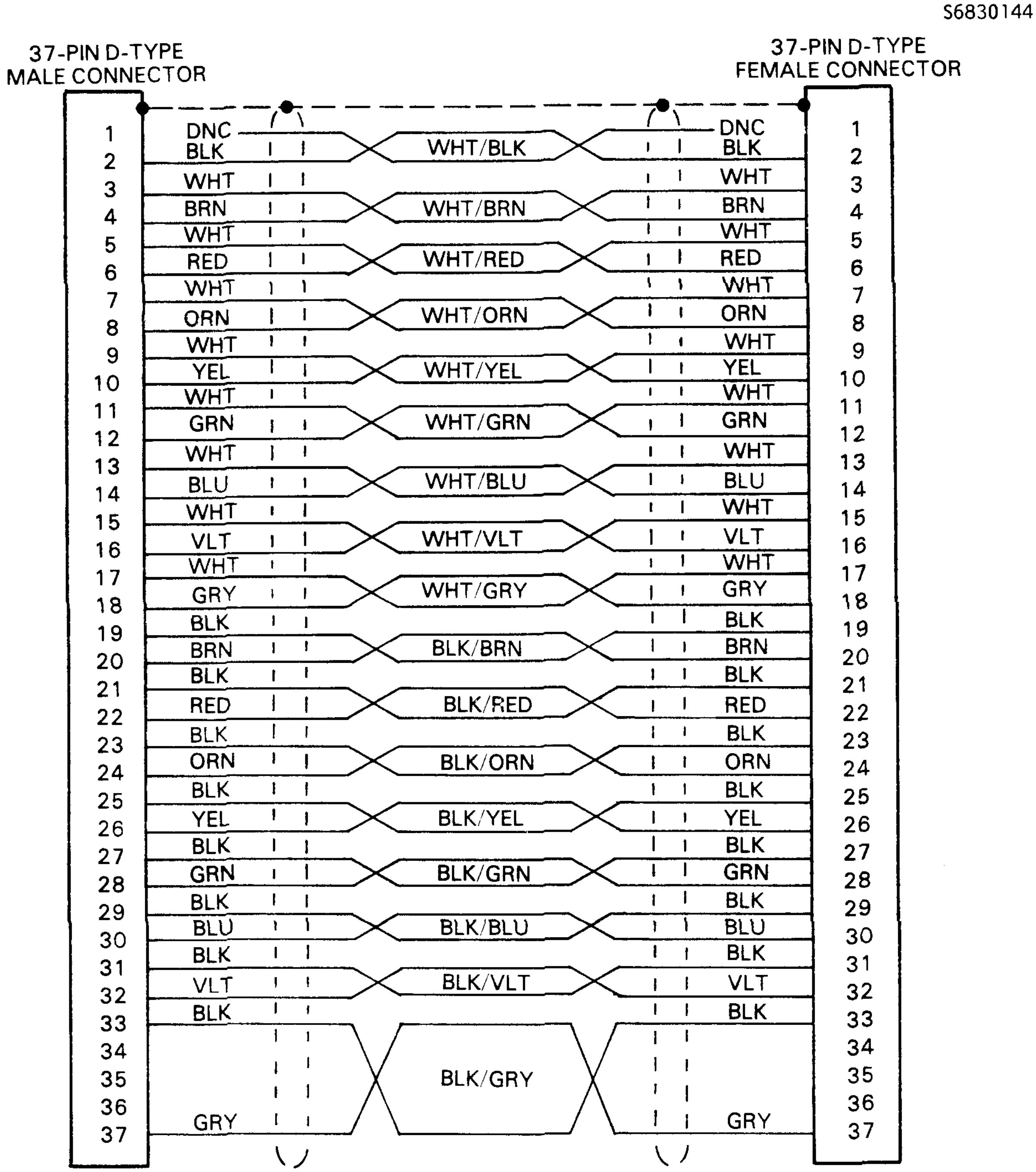


Figure 2. Wiring Diagram of Cable

Table 3. **Ordering Information**

Part Number	Description
IC6OOWHFOO2	2 foot (.6l meters) cable with connectors each end
IC600WHF005	5 foot (1.52 meters) cable with connectors each end
IC6OOWHFO 10	10 foot (3.05 meters) cable with connectors each end

For further information, contact your Local GE Fanuc sales representative.

GE FANUC

Series Six Programmable Controllers

GEK-90755B

Redundant Processor Unit DMA Cable (Non-Industrial or Commercial Use)

March 1989

General Description

The Redundant Processor Unit (RPU) DMA cable is used internal to the RPU to interconnect the Data Control module bottom connector in slot 8 to the bottom connector in slot 6. This cable provides radiated energy shielding.

The cable consists of a male 37-pin D-type connector on each end. The cable is made up of 19 twisted pair (22 AWG) with an overall shield and a PVC jacket for a total of 38 wires plus shield. The features and benefits of this cable are summarized in Table 1, while Table 2 provides module specifications.

Table 1. Features and Benefits

FEATURES	BENEFITS
Available in several lengths.	Provides flexibility for Series Six hookup.
Color coded twisted pairs.	Simplifies troubleshooting.
Radiated energy shielding.	Meets FCC Part 15 Subpart J requirements.

Table 2. Specifications

Cable Outside Diameter:	0,445 ± 0.020 inches 11.81 ± 0.5 mm
Cable Length:	One or two feet (30.5 or 61 cm)
Conductor Size:	**No. 22** AWG (each wire)
Jacket:	PVC material 300 **V** insulation Temperature: **-20°C** to +80°C
Internal Arrangement:	19 twisted pair (38 wires} with overall shield and jacket
Connectors:	37-pin D-type male connectors each end

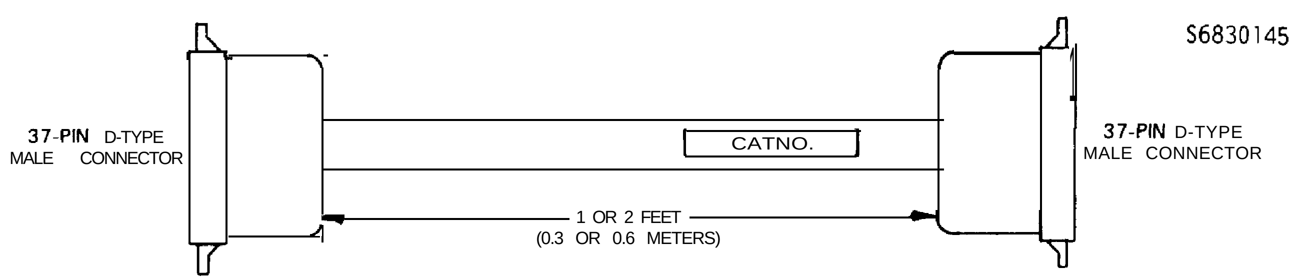


Figure 1. Mechanical Assembly

Installation

Either end of this cable may be connected to the bottom connector of the Data Control module in slot 8 of the RPU. The other end should be connected to the bottom connector of the CPU Switch module in slot 6.

All cables should be firmly secured at both ends by using the captive screws supplied with the connectors.

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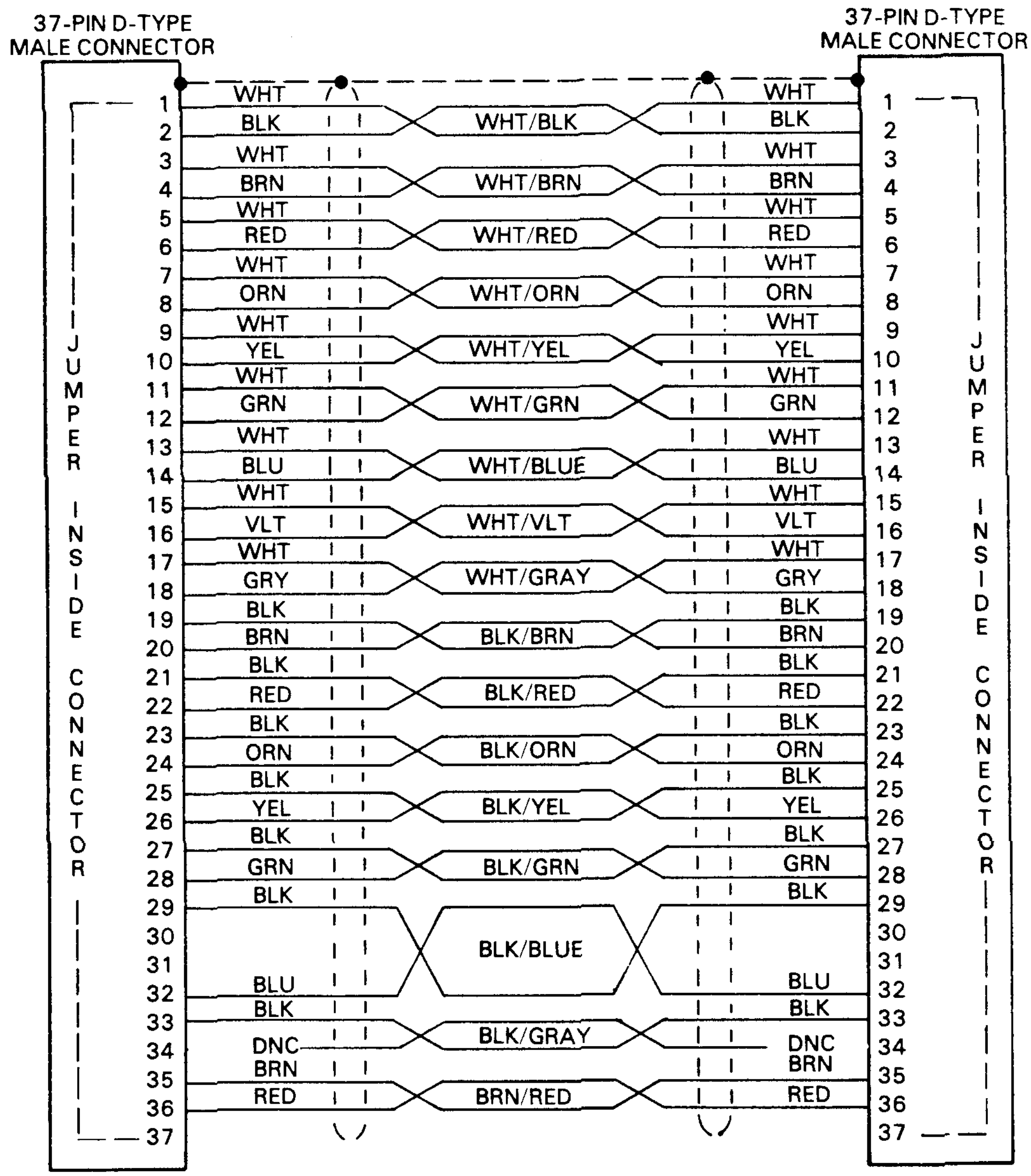


Figure 2. Wiring Diagram of Cable

Table 3. Ordering Information

Part Number	Description
IC600WJF001	1 Foot (.3 Meters) cable with connectors each end
IC600WJF002	2 Foot (.61 Meters) cable with connectors each end

For further information, contact your local GE Fanuc sales representative.

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-90756

120 VDC OUTPUT MODULE

GENERAL DESCRIPTION

The 120 Vdc Output module can be utilized in an Input/Output (I/O) rack, or in any of the I/O slots in a Model 60 Central Processor Unit (CPU), to provide discrete (on/off) control of each of its eight outputs. The first four outputs are grouped to share a common power source, as are the second four outputs, The 50 to 150 Vdc power source required by each group of four outputs is to be provided by the user and may be either a single source or two independent sources. Optically coupled isolators provide electrical isolation between the outputs of this module and the busses that link all modules to the CPU. Features and benefits of the 120 Vdc Output module are summarized in Table 1.

Each of the eight outputs uses a Field Effect Transistor (FET) as a switching device. The module also contains logic circuitry that determines which data on the internal Series Six data bus is applicable to this module. A buffer stores the applicable data and presents it to the output switching devices.

All output switching devices are automatically disabled if an I/O chain or CPU failure is detected, thus turning off any outputs which were on. Light-Emitting Diode (LED) indicators display the state (ON or OFF) of each output and the condition of the individual output circuit fuses. These LEDs use only the power from the user-provided power source(s) to provide an indication, so the user-provided power supplies must be energized in order to obtain an output ON or a blown fuse indication.

It is possible to parallel two outputs to obtain higher output current than can be delivered by one output alone, but the two outputs must: (1) be on the same module, (2) be on the same group of four outputs (outputs one through four are in one group and outputs five through eight are in the other group), (3) be adjacent outputs, and (4) be controlled by identical and adjacent rungs on the ladder diagram. Two outputs in parallel can deliver twice the continuous current that one output can deliver, but should not be connected to loads that exceed the inrush capability of one output.

Refer to Figure 1 (next page) for 120 Vdc Output module specifications.

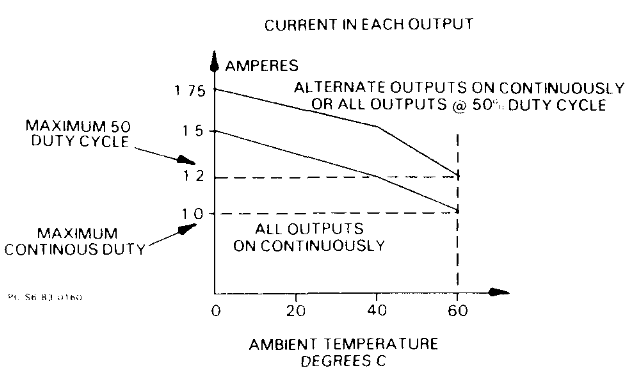
TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Wide switching range available: 50 to 150 Vdc. Available in source configuration.	Useful in a variety of applications. Provides output capability with existing user power supplies and devices.
Eight output points per module.	Efficient use of I/O rack space.
Optically coupled output drivers.	Provides electrical isolation between user field devices and the Series Six Programmable Controller.

APPLICATIONS

* High-speed switching: Solenoid valves, clutch-brake systems
* Battery-powered I/O systems
* Annunciators
* Indicators
* Relays

- Dimensions:
  - Circuit Board: 8.15 x 11.0 x 1.20 (inches)
208 x 280 x 31 (mm)
  - Faceplate: 12.46 x 1.175 (inches)
317 x 30 (mm)
- Faceplate Color: Yellow
- Storage Temperature: -20 to +80°C ambient
- Operating Temperature: 0 to 60°C ambient
- Humidity: 5% to 95% (non-condensing)
- Operating Altitude: Up to 6,600 feet above sea level
- Number of Outputs: Eight, in two groups of four. Each group shares common power supply H (high) and N (neutral) connections
- Isolation (user common to Series Six common - also between output groups when two independant user power supplies are used for one module):
  - Continuous: 240 Vdc or 50/60 Hz ac
  - Transient: 1,500 V peak, non-repetitive
- Noise Immunity to: Showering arcs per NEMA ICS 2.230.40
Surges per ANSI C37.90.9
5W transmitter, 27-450 MHz
- Radiated Interference: Complies with FCC Rule 15 for Class A computing devices
- Power Requirements:
  - Supplied by the I/O or Model 60 CPU power supply:
    - 5 Vdc @ 300 mA (maximum) or 5 units of load with all outputs ON
    - 5 Vdc @ 180 mA (maximum) or 3 units of load with all outputs OFF
  - Supplied by the user: 50 to 150 Vdc @ 50 mA (maximum) plus the current drawn by the output loads
- Total ON-State Current per Module:
  - Maximum: 10 A @ 0-40°C, 8 A @ 60°C
  - Minimum: 0 A
- ON-State Voltage Drop: 1.75 V (maximum)
- OFF State Leakage Current: 2 mA (maximum)
- Output Current: Any output with all outputs ON continuously: 1 ampere maximum at 60°C.
See Figure 1A for Duty Cycle Operation
- Non-repetitive Inrush Current peaks:
  - o 10 A for 5 ms
  - o 8 A for 15 ms
  - o 7 A for 50 ms
  - o 6 A for 250 ms
- Switching Delays: 10 microseconds OFF to ON, 100 microseconds ON to OFF

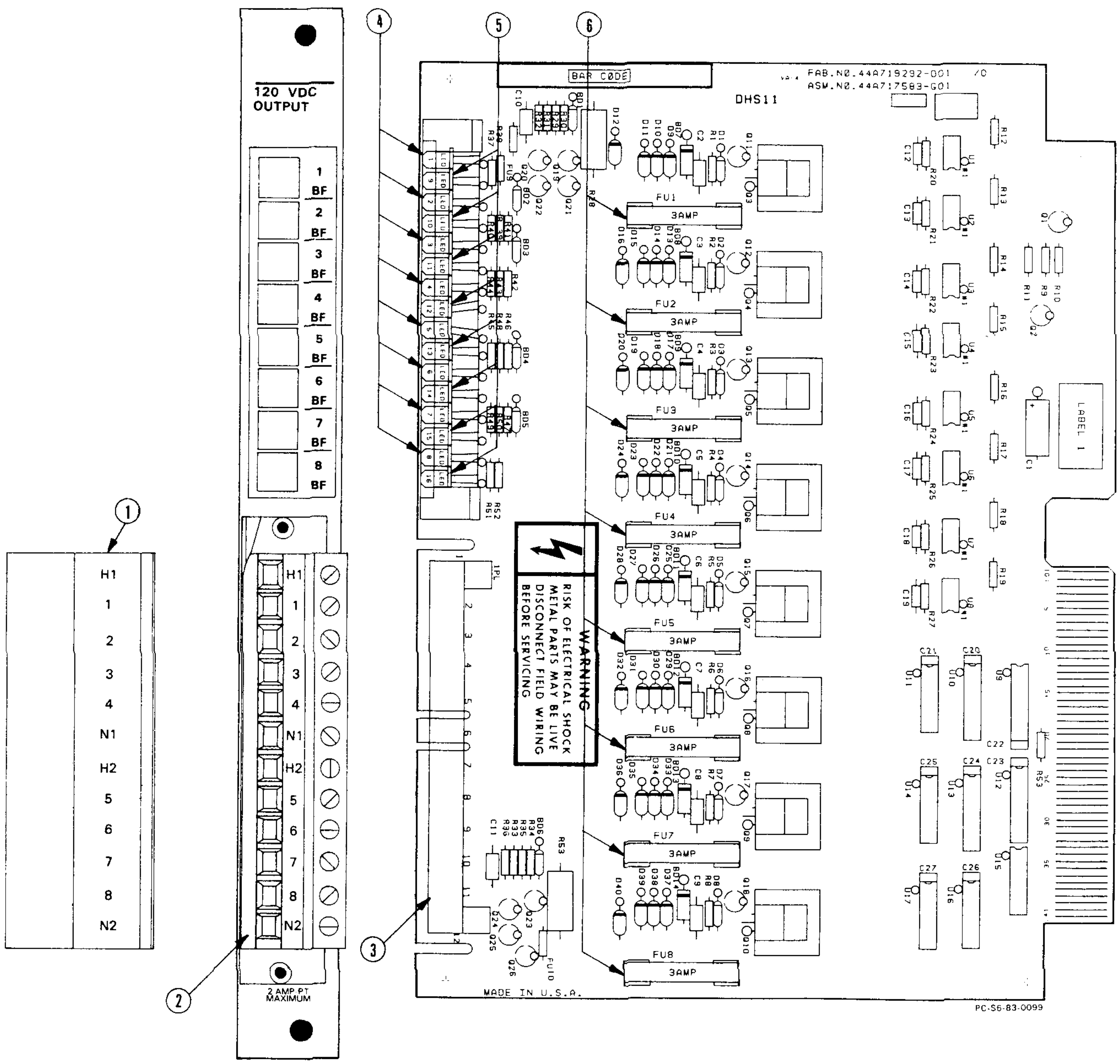


NOTE

Any odd-numbered output with no even-numbered outputs ON, or any even-numbered output with no odd-numbered outputs ON, or any output when no output is operating at a current greater than the continuous rating unless it is operating at a duty cycle of 50% or less and a period of 60 seconds or less: 1.2 amperes maximum at 60°C, increasing as shown in Figure 1A

Figure 1A

FIGURE 1. SPECIFICATIONS



① Terminal Cover

② User Terminal Block:
Accepts connections from user output devices and the DC power source(s). (Refer to Figure 3, Typical User Connections.)

③ Circuit-Board Terminal Block:
Mates with the user terminal block.

④ Output LED 1 →8
On: Corresponding output is in the ON state.
Off: Corresponding output is in the OFF state.

⑤ BF (Blown Fuse) LED 1 →8
On: The fuse for corresponding output is open (blown).
Off: The fuse for corresponding output is OK.

⑥ Output-Circuit Fuses: 3 A, (AGC 3)

FIGURE 2. USER ITEMS

INSTALLATION

The 120 Vdc Output module can be installed in an I/O rack or in the I/O slots of a Model 60 CPU rack. Before the module is installed, the Dual-In-line-Package (DIP) switches on the rack backplane directly behind the card slot should be set. This setting will establish the desired correspondence between the outputs on this module and a group of eight consecutive output numbers in the program. To determine the proper switch settings, refer to the table in the Installation section of the Series Six Installation and Maintenance Manual, GEK-25361,

The circuit board is designed to be installed and removed with the aid of an extraction/insertion tool. This tool should be used each time the board is removed or installed. Once the board is in place in the rack, the faceplate should be placed over it so that the connector at the lower part of the board mates with the faceplate connector. The faceplate should then be secured to the rack using the quarter-turn thumbscrews at the top and bottom of the faceplate.

Refer to Figures 3 for typical user connections to the 120 Vdc Output module. The positive side of each load to be controlled by this module should be connected to one of the output terminals numbered 1 through 8. The negative side of each of the loads connected to terminals I through 4 should be connected to neutral number I (terminal Nl). The negative sides of the loads connected to terminals 5 through 8 should be connected to neutral number 2 (terminal N2). A user-provided DC power source must be connected with its positive output connected to terminal HI and its negative output connected to terminal Nl to provide power for outputs 1 through 4. A user-provided DC power source must be connected with its positive output connected to terminal H2 and its negative output connected to terminal N2 to provide power for outputs 5 through 8. One source may be used for all eight outputs if the power source positive output is connected to both Hl and H2 and the power source negative output is connected to both Nl and N2. Each terminal on the module faceplate can accommodate one NO. 12 AWG wire or two No. 14 AWG wires. A terminal cover is provided for additional user protection. It is installed by mating the bottom ends of the grooves in the cover with the top ends of the tracks at the sides of the terminal strip and sliding the cover downward over the terminal strip.

A markable area is provided on the plastic lens beside each pair of LED indicators. This area may be used to note the function or destination of each output. The faceplate is color coded yellow to allow the I20 Vdc Output module to be readily distinguished from other types of I/O modules.

WARNING

The exposed metal parts on the circuit board and the field wiring and field wiring terminals may carry dangerous potentials. These potentials are derived from user power supplies which are not under the control of the ON/OFF switches on the Series Six CPU and I/O rack. Be sure all user supplies are de-energized before servicing a circuit board or working on field wiring. The circuit board may also be made safe for servicing by removing the faceplate, which breaks the connection between the board and any user supplies.

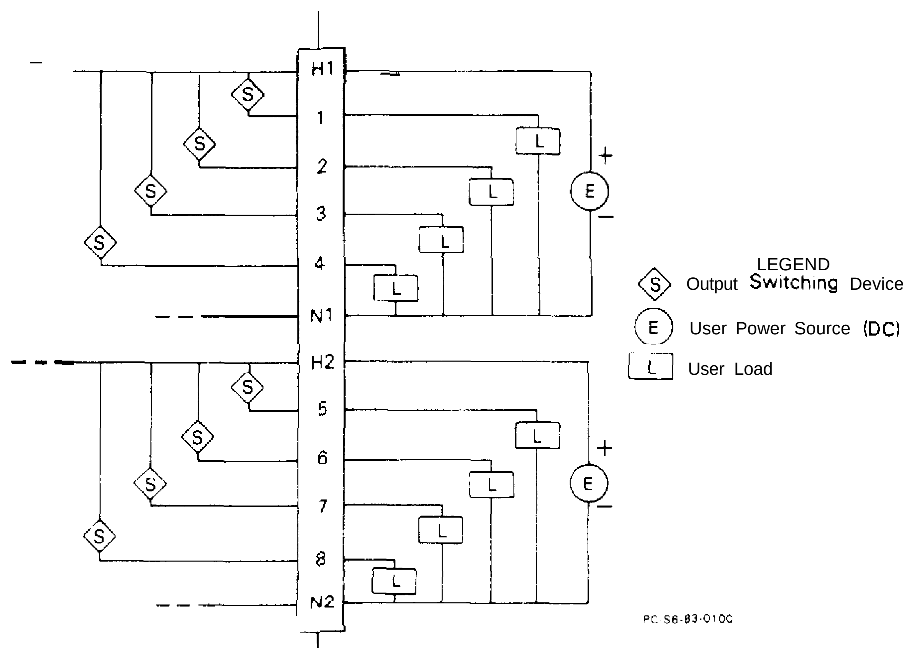


FIGURE 3. TYPICAL USER CONNECTIONS

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
IC600BF924A	IC6OOYB924A	IC600FP924A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

FEBRUARY, 1984

GEK-90757

SERIES SIX

PROGRAMMABLE CONTROLLERS

PROTECTED AC OUTPUT MODULE WITH MONITOR INPUTS

GENERAL DESCRIPTION

The Protected AC Output module consist of four isolated triac power switches and output monitoring circuitry for each. The module can be installed in either an Input/Output (I/O) Rack or a Model 60 Central Processor Unit (CPU). The module is used to switch user provided 115 Vac power sources to user loads in a programmable sequence. The power output to the user load is protected by monitoring circuitry which disables the output if a failure of the output triac occurs. The location of the failed circuit is reported to the CPU as an input signal. Loss of output because of a blown fuse or user input power loss is also reported to the CPU. The module uses both input and output I/O address locations to return monitor inputs and program outputs (Refer to Tables 2 and 3). The module may be used for many applications.

Non-Programmable Monitoring: (Program Fault Monitor Jumper position l-2). The application is as a four-circuit four amp isolated output driver with blown fuse feedback and triac failure feedback to the CPU. Part of the Triac Failure Monitor circuit is an automatic circuit which detects a voltage output when there should not be a voltage output and blows the fuse on that output. The Module will then notify the CPU that a failure exist. This type of operation exist when the Program Fault Monitor Jumper is in the normal monitor enabled position I-2. It is the option of the user to use or not to use the monitor feedback fault signals in his ladder diagram program.

Programmble Fault Monitoring: (Program Fault Monitor Jumper Position 2-3). A very useful application is with the program fault monitor jumper in the programmable monitor position (2-3). In this application the module is also used as a four-circuit four AMP isolated output driver with blown fuse feedback to the CPU. The basic difference is, should a triac circuit fault occur, the monitoring of the output and the subsequent forced blowing of the fuse is under the direct control of the User Ladder Diagram Program contained in the CPU. If a monitor input (M)to a particular circuit on this module is programmed in the user ladder diagram to **be** in the fault monitor state and an output triac fault should occur, then, the fuse for that circuit will automatically be blown and feedback given to the CPU of the circuit malfunction. If that circuit is not programmed by the user ladder diagram to be in the fault monitor state and an output triac fault should occur, there will be no feedback of fault and the fuse will not be blown to disable the circuit. This programmability of the fault monitor input allows standby redundant wiring of two drivers to the same user load. This monitor input control allows ladder diagram programming of an automatic switch-over from a primary driver to a secondary driver should a blown fuse or triac output fault occur in a circuit that is driving a critical load.

This allows the control to continue operating and delays shutdown of the control for repair until after a critical operation or batch process is completed. This is not to be implied that this operation is “FAIL SAFE”, bumpless transfer, or repairable while the control is in operation. It will also not protect against an external load malfunction or fault. This application is discussed in more detail in the Installation section, paragraph six.

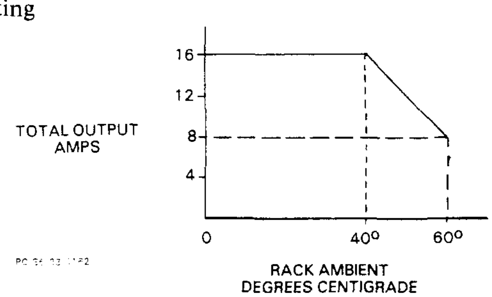
TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Failed output shutdown.	Prevents false energizing of load due to circuit component failure.
"Blown Fuse" report or loss of user power to each individual load.	Immediate identification of power loss to output load at the CPU.
"Failed Circuit" report.	Immediate identification of a failed board and location at the CPU.
Standby redundancy.	Automatic programmable switch over to a second output driver because of a detection of a primary output driver fault. Delays shutdown for repairs until after a critical operation or batch process is complete.
Module indicators.	Diagnostic and monitoring aid.
4 Ampere output circuits.	Large loads can be controlled without interposing relays.
Individually isolated outputs.	Allows each circuit to use a separate power source.
"Zero crossing" turn on.	Reduces EM1 and improves reliability of traics by reducing turn-on transients.
Dual Fuse Clips.	Accepts either .25 inch (AGC5) or a metric 5MM fuse.
APPLICATIONS	
★ Motor Control Centers	* High Power Loads
★ Critical Loads	* Batch Process

- Dimensions:
  Circuit Board: 8.15 x 11.0 inches (208 x 280 mm)
  Faceplate: 12.46 x 1.175 inches (317 x 30 mm)
  Module occupies one slot in I/O or Model 60 rack
- Storage Temperature: -20°C to + 80°C
- Operating Temperature: 0°C to + 60°C (air outside rack)
- Humidity: 5% to 95% (non-condensing)
- Altitude: Up to 10,000 feet above sea level (operating)
- Power Requirements:
  Supplied by I/O or Model 60 rack: +5 Vdc, 400 MA maximum or 8 power units Refer to I/O module load, Installation and Maintenance Manual, GEK-25361.
- User Supplied Voltage: 90-130 Vac, 47 to 63 Hz.
- Number of Outputs: Four (4) isolated, each with separate source (H), output (O) and neutral (N) connections.
- Output Leakage Current: Less than 4 ma (off state).
- Output "ON State" Load Current Ratings: Maximum per point: 4A.
  Maximum per module: 16 A; follow derating curve below for ambients above 40°C.

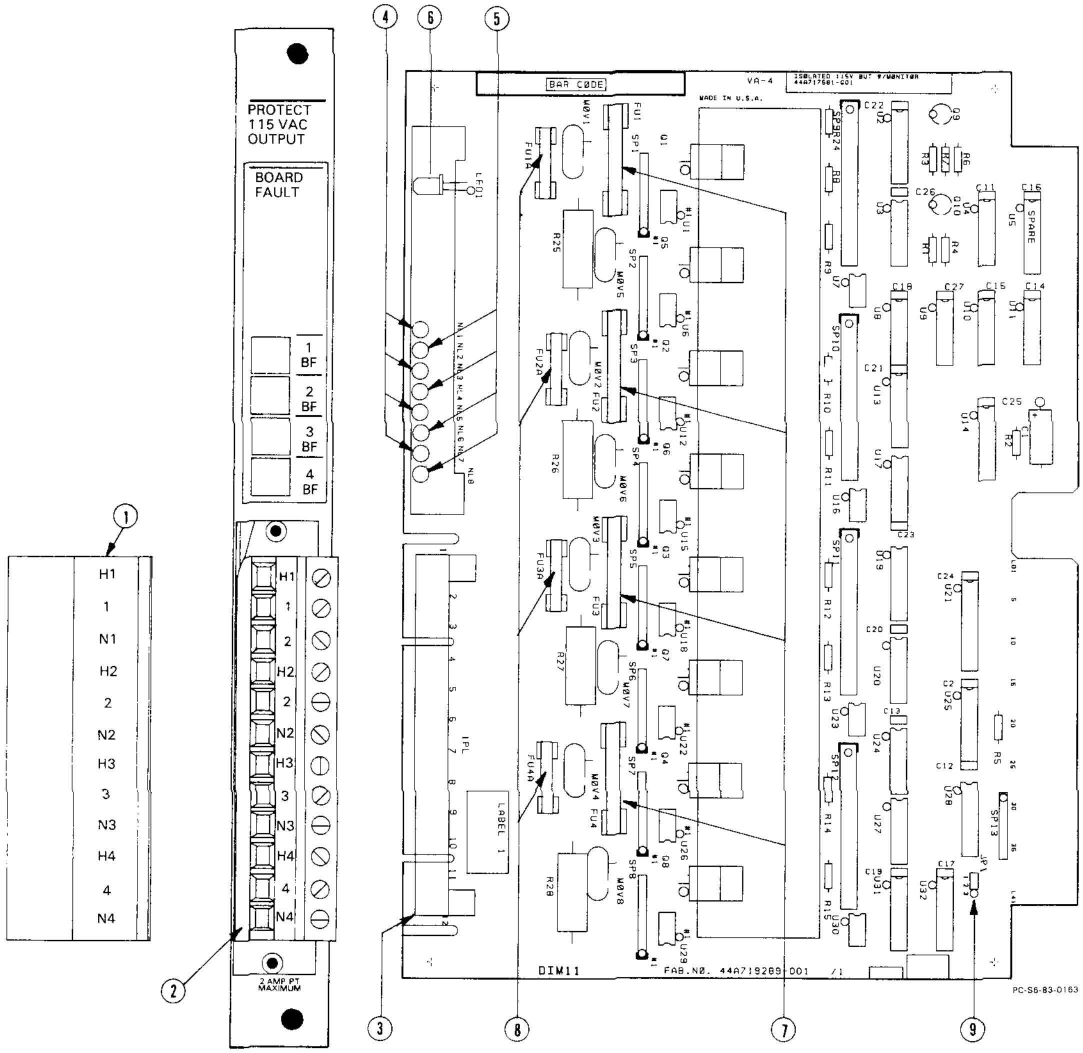
  Inrush: 40 amps for 33 MS per point.

  Minimum Load: 35 Milliamps resistive.
  50 Milliamps inductive (P.F. less than .7).
- Output Voltage Drop: 1.3V typical, 2.3V maximum at rated load.
- Isolation: (Between outputs or to Series Six common);
  Continuous: 240 Vdc or RMS AC, 50/60 Hz,
  Transient: 1500 Vdc, 1 second maximum, non-repetitive.
- Output turn on delay: 1/2 cycle maximum
- Output turn off delay: 1/2 cycle maximum
- Blown Fuse (BF) Input: This is present when output "on state" is required and no voltage is sensed on output. Response time 50 milliseconds maximum.
- Fault (FLT) Input: This indicates a detected failure to turn off. This responds within 250 milliseconds and remains latched so long as rack power is on.
- Noise and Transient Immunity: Not affected by: Showering arcs per NEMA ICS 2,230.40
  Surges per ANSI C37.90.9
  5W RF transmitter 27-450 MHZ
- Module current derating



NOTE

Total output amps equals sum of product of load current times duty cycle for all points.



① Terminal Cover

② User Terminal Block: Refer to Figure 4, Typical User Connections.

③ Circuit Board Terminal Block: Mates with the User Terminal Block.

④ Output NEON 1-4:

On: Corresponding Output is in the ON state.

Off: Corresponding Output is in the OFF state.

⑤ Blown Fuse NEON 1-4:

On: The fuse for corresponding output is open (blown).

Off: The fuse for corresponding output is OK.

⑥ Board Fault LED:

On: Board Fault detected; replace board.

Off: Board OK.

⑦ US Output Circuit Fuses: 5A, Normal Blow 1/4 X 1 1/4 inch (AGC5).

⑧ Metric Output Circuit Fuses: Used as alternative to 7 above 5 X 20mm, 5A.

⑨ Program Fault Monitor Jumper: Normal Position 1-2, Refer to Installation Notes for application (Paragraph 4.4 and Paragraph 6.1).

FIGURE 2. USER ITEMS

INSTALLATION

1. The Protected AC Output may be installed in an I/O rack or the I/O section of the Model 60 CPU rack. Before installing the module, the Dual-In-line Package (DIP) switches on the rack backplane should be set to establish the correct module address location. A group of eight consecutive I/O points are required to communicate with both the Output Status Table and the corresponding points on the Input Status Table. The DIP switch setting is done in the same fashion as for an eight point input or output board. For further information on the I/O Dip Switch Setting refer to the Installation and Maintenance Manual, GEK-25361. Tables 2 and 3 show the output and input table status displays.

2. The "Program Fault Monitor" jumper position should be verified. Refer to Sections 4.4 and 6.1 below for setting.

3. It is recommend that one use the extraction/insertion tool furnished with the CPU to remove or install the circuit board. With the board in place in the rack, the faceplate should be slipped over the circuit board so that the terminals near the bottom of each are mated. Then secure the faceplate to the rack using the thumbscrews at top and bottom.

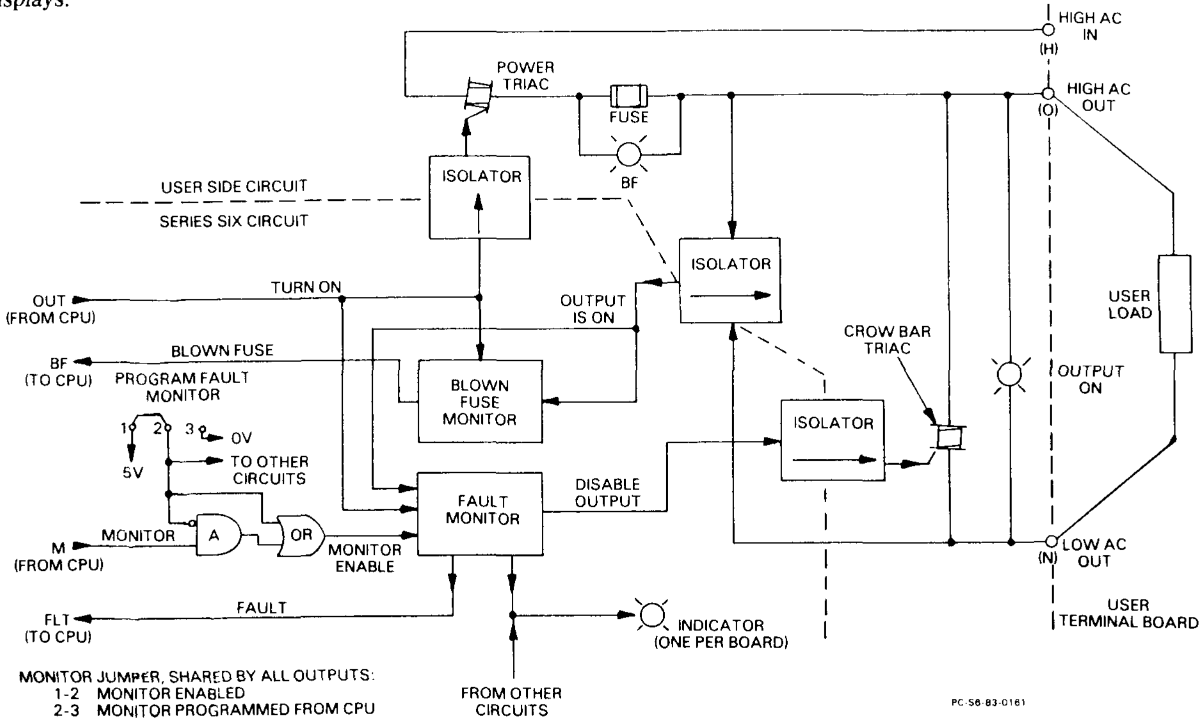


FIGURE 3. BLOCK DIAGRAM
AC OUTPUT WITH FAULT DETECTION FOUR DRIVERS PER MODULE

4. A simplified module block diagram is shown in Figure 3. The following signals shown on the block diagram are defined as follows:

4.1 OUT: This CPU signal turns on the AC output at the next zero crossing of the AC line.

4.2 BLOWN FUSE (BF) Output Signal: This input to the CPU is turned on when the output is called for and no load voltage is detected. This detects either a blown fuse or a loss of the user AC load power source. This signal is not latched and is independent of the monitor enable signal. Note that the module faceplate BF light indicates open fuse only, and relies on user AC input power, applied to the faceplate (H) terminal, to light.

4.3 Fault (FLT) Output Signal: The fault monitor compares the actual module output voltage to the CPU "OUT" command or status. If voltage is detected across the output when the CPU "OUT" instruction is in the "OFF" state, and the monitor is enabled, the FLT output to the CPU is turned ON. This signal is also used to turn on a "CROWBAR" triac to blow the fuse, and to light a shared module front indicator light. The FLT signal to the CPU and indicator is latched, and cannot be reset except by removing rack logic power.

4.4 Monitor (M) Input Signal: When the program fault monitor jumper is in the "ENABLED" position, (l-2). the monitor (M) output table states from the CPU are ignored by the module and these (M) outputs may be used for other purposes, One of these uses might be as internal ladder diagram coils. When the jumper is in the "PROGRAM FAULT MONITOR" position (2-3) the monitor (M) output table states from the CPU are read into the fault monitor circuit of the module. This mode of operation is used when it is desired to switch between two output circuits to drive a single load. This allows ladder diagram programming to control the change to backup driver operation when a problem is detected in the primary driver. This backup configuration wiring is shown in Figure 5. The backup driver operation is described in more detail in Section 6. Note that the jumper and M signals affect only the "FAULT MONITOR" circuit operation and crowbar triac operation after the FLT condition exists.

4.5 Table 2 shows the interface signals from the CPU to the module as they appear in the CPU output tables.

Table 3 shows the interface signals from the module to the CPU as they appear in the CPU input tables.

TABLE 2. OUTPUT STATUS TABLE DISPLAY

OUTPUT DATA TABLE*							
8	7	6	5	4	3	2	1
M 4	M 3	M 2	M 1	OUT 4	OUT 3	OUT 2	OUT 1

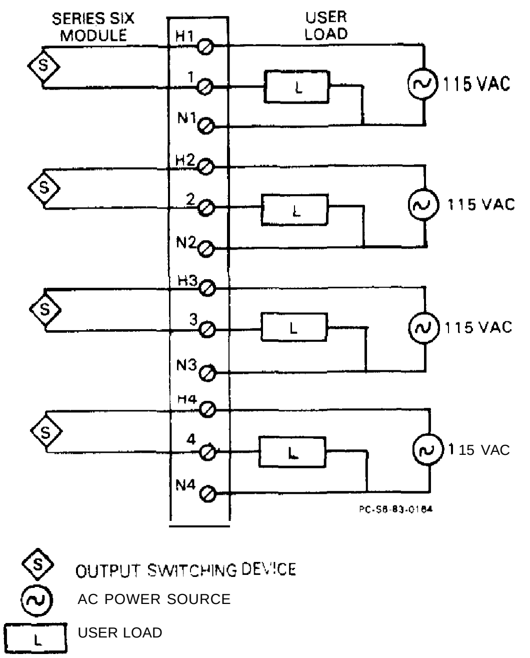
0 STATE = OFF
1 STATE = ON

TABLE 3. INPUT STATUS TABLE DISPLAY

INPUT DATA TABLE*							
8	7	6	5	4	3	2	1
FLT 4	FLT 3	FLT 2	FLT 1	BF 4	BF 3	BF 2	BF

* In each case Data Bit 1 is the first address set by the backplace dip switch.

5. Typical customer connections are shown in Figure 4.



WARNING

Voltages from user field devices could be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

CAUTION

Connect only loads to the output terminals (01, 02, 03 and 04). Never connect a user power source to the output terminals (01, 02, 03, and 04) for any reason. If a power source is connected to the output terminals damage to the module will occur. In this instance the monitor will mistake this power source connection for a shorted output triac and attempt to blow the internal fuse to prevent and incorrect output. In attempting to blow the internal fuse the crowbar triac in this module will place a short on the incorrectly connected user power source. This will result in the module crowbar circuit becoming overheated because of excessive current and destroying itself.

FIGURE 4. TYPICAL CUSTOMER CONNECTIONS

6. A TYPICAL CONNECTION for a "STANDBY REDUNDANCY" circuit is shown in Figure 5. In a standby redundant circuit, one output drives the load in the normal fashion while the standby output is forced off by CPU ladder diagram. If a fault is detected in the main driver and the proper program is contained within the user ladder diagram, then control is switched to the standby driver so operation can continue. This redundant mode is applicable to operations where it is desirable to delay shutdown for repairs until after a critical operation or batch process is completed. It is not to be implied that the operation is fail safe, bumpless transfer, or that the system is repairable while in operation.

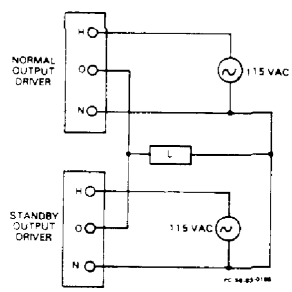
6.1 If a standby redundancy system of two drivers connected to the same user load is used as shown in Figure 5, several precautions must be observed. The output drivers may be in the same module or different modules of the same type, The user's power source to the two drivers may be the same or different sources. If separate sources are used, one side of the line must be common and the AC phase must be the same to prevent over voltaging whichever driver is off. The program fault monitor jumper should be set for "Programmable Monitor" position 2-3 on each driver module. The normal output driver being used should have the CPU output "M" signal set high or 1 while the standby output driver should have the CPU output "M" signal set low or 0.

If a "BF" (Blown Fuse or loss of user power to the "H" terminal) fault is detected on the normal output driver the "BF" signal will be returned to the CPU as an input. The user ladder diagram program should then acknowledge this signal by turning off the "Output Signal" to this normal output circuit, turning off the "monitor input" signal to this normal output circuit, turning on the CPU output signal to the standby driver, turning on the "monitor input" signal to the standby driver, and turning on an alarm output to acknowledge to the user that a blown fuse has been detected in the normal output driver and a transition has been made to the standby driver.

If an "FLT" (output triac or output circuit) fault is detected on the normal output driver the "FLT" signal will be latched into memory within the Output Driver module, returned to the CPU as an input, and used within the normal Output Driver module to turn on the crowbar triac and blow the output driver fuse. This blowing of the fuse will prevent wrong outputs from this driver. The user ladder diagram program should acknowledge this "FLT" input signal by first watching for the corresponding "BF" (Blown Fuse) input signal. When the "BF" signal is received the ladder diagram program should then turn off the monitor input signal to this normal output circuit. The CPU output signal should then be switched to control the standby output driver. The ladder diagram program should at this time enable the "MONITOR" input signal to the standby output driver. Finally the user ladder diagram program should signal that the transition has been made by turning on an alarm output to acknowledge that an output "FLT" signal has been received, acted upon, and transition has been made to the standby driver. The only way to reset this latched in "FLT" (output triac fault) signal from the driver module to the CPU is to remove and reapply AC power from the rack containing the driver module.

Using this standby redundancy type of output operation is not to be implied that the operation is fail safe, bumpless transfer, or that the system is repairable while in operation. This type of operation is only used where it is desirable to delay shutdown until after a critical or batch process is complete.

6.2 Attention is called to the warning note and caution note that is part of Figure 4. If separate power sources are used care should be taken to insure that one side of the line is common, and the AC phase must be the same to prevent over voltaging whichever driver is off. Also steps should be taken in the user ladder diagram program to prevent both outputs from being programmed on at the same time. This could cause circulating currents between the sources through the drivers and cause a fuse to blow. The "program fault monitor" jumper should be in Position 2-3 on both the normal and the standby output driver modules.



Monitorjumper in "Program Fault Monitor" position (2-3) for both output drivers.

FIGURE 5. STANDBY REDUNDANT OPERATION

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
IC600BF930A	IC600YB930A	IC600FP930A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above with catalog numbers as shown or with a higher alpha suffix in the last position is designed for UL applications as auxiliary control devices. This equipment is a direct replacement for equipment with a prior alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE **Fanuc Automation North America, Inc., Charlottesville, Virginia**

DECEMBER, 1983 Ref. PC-S6-83-0165

Series Six PLC
Programmable Controllers

GEK-90758A
July, 1989

ASCII/BASIC Module

General Description

The ASCII/BASIC module is a microprocessor-based module containing a BASIC language interpreter, with 12K or 28K bytes of memory available for user BASIC programs, and two serial I/O ports for external communications. The module is designed to operate with a Series Six Central Processor Unit (CPU) or it may be used as a stand-alone microcomputer.

This module contains 16K bytes of battery-backed (CMOS)RAM, of which approximately 12K bytes is available as user program space. There is 32K bytes of EPROM memory which contains an operating system with built-in diagnostic testing capability. The EPROM memory also contains a powerful GE/BASIC interpreter package which includes special-purpose routines designed to help the user manage various on-board functions as well as the interface to the Series Six CPU.

The GE/BASIC language has been enhanced to simplify programming in the Series Six environment, Included are provisions to control data flow between the module and the CPU and the capability to control many aspects of the module's operation. The language is powerful and is especially suited to providing formatted output, which would typically simplify the task of producing reports and CRT displays.

Under control of its BASIC program, the ASCII/BASIC module can transfer information to and from the Series Six CPU. It can read the contents of any register, scratch pad, or I/O table in the Series Six CPU. Conversely, it can write data into the registers and the I/O tables in the Series Six CPU.

A Series Six CPU with V104 software can initiate communications with an ASCII/BASIC module by executing a DPREQ instruction. Power flow out of the instruction indicates to the CPU's program whether the communications were successful or not, Multiple module applications, or applications using both a DPU and an ASCII/BASIC module require that the CPU contain V104 software or later. V103 software may be used in single module applications, though there are several restrictions pertaining to this usage.

This ASCII/BASIC module may be programmed by the user using any serial ASCII terminal connected to Port 1. The terminal protocol may be RS-232, RS-422, or a 20 ma Current Loop.

BASIC programs may be copied on tape, using a STR-LiNK IIA or III recorder connected to Port 2. Programs saved in this way may be re-loaded into the ASCII/BASIC module and verified before they are used again.

The two independent 25-pin serial I/O ports are user-configurable. Both ports support RS-232 and RS-422 protocols, with Port 1 supporting active/passive 20ma Current Loop in addition. Both ports are capable of supporting independent asynchronous serial communications with data rates up to 19.2K bits per second. The module can be used to communicate with external computers, terminals, CRTs, printers, Bar code readers, or other ASCII/BASIC modules using point-to-point, multi-drop, or modem-based RS-232 and RS-422 data links.

The isolated on-module power supply provides power to the receivers and transmitters as well as providing 1500 Volts of isolation protection from port to port or from the ports to the Series Six system.

Six Light-Emitting Diodes (LEDs) provide port activity and module status indications. If the on-board power-up diagnostics detect a failure, the BOARD OK LED will not turn ON and the remaining five LEDs will provide an error code.

A BATTERY OK LED indicates the on-board Lithium battery is within the voltage range required to maintain (CMOS) RAM memory. If this LED is off, or is flashing, the battery should be replaced.

The remaining four LEDs provide port activity indications for the respective transmitters and receivers. They will blink when a port is communicating and stay off when there is no activity on the port.

The ASCII/BASIC module consists of two boards in a mother-daughter board configuration If this module is to be used as a stand-alone microcomputer it may bc inserted into a single I/O slot in any Series Six High-capacity I/O rack or Model 60 CPU rack. However, if communications are to take place between the ASCII/BASIC module and the Series Six CPU, the ASCII/BASIC module cannot be placed in an I/O rack which is part of a Remote I/O sub-system.

Features, benefits, and applications of this module may be found in Table 1.

PROPRIETARY NOTICE

Table I. FEATURES AND BENEFITS

FEATURES	BENEFITS
GE/BASIC	An interpretive extended BASIC language which makes programming easy and flexible.
Full function floating point math.	Used in solving complex mathematical algorithms.
Dual communication ports.	Permits simultaneous and independent communications between the module and two external devices.
12K or 28K bytes of user memory, battery-backed.	Fully user addressable for storage of user program. Requires no CPU memory.
Special commands for CPU interface.	Easy, controlled access to all CPU input, output, and Register data.
Interrupts/Timers	16 software interrupts from CPU or internal timers or events.
8-character variable names.	Permits user recognizable variable names.
Status indicators.	Used for module diagnostics and to indicate serial data flow in/out.
Interfaces to STR-LINK IIA and III devices.	Enables programs to be easily stored, retrieved and verified.
Internal time/date.	Facilities report generation and time/date dependent activities.

Module Specifications	
Space Requirements:	One Series Six I/O slot in either a Model 60 CPU rack or a High-Capacity I/O rack
Power Requirements:	+ 5 Vdc, + 12 Vdc (Supplied by rack power supply) 5 Vdc -20 unit loads
Storage Temperature:	0 to 70°C
Operating Temperature:	0 to 60°C
Humidity:	5% - 95% (non-condensing)
Altitude:	Up to 10,000 feet (3,000 meters) above sea level (operating)
Isolation:	(Port to Port and either Port to Series Six common). Transient: 1500 Vac, 50/60 Hzs for 1 minute maximum, non repetitive. Continuous: 240 Vdc or RMS ac, 50/60 Hzs.
Noise & Transient Immunity:	Meets following specifications Showering arcs per NEMA ICS 2,230.40 Surges per ANSI C37.90.9 5 W R.F. transmitter 27-450 Mhz

RS-232C/RS-422 Cable Specifications

- Length, Maximum: 50 feet (15 meters) for RS-232C
  4000 feet 11.2 Km) for RS-422
- Overall Shield Recommended
- 24 AWG Minimum
- Mating connector to Port 1 or Port 2 is a D-Subminiature Type. Cannon DB25P (Solder Pot) with DB11096B-3 Hood or Equivalent. (Standard RS-232C male connector.)
- RS-422 Cable Selection

The foliowing cables provide acceptable operation at data rates up to 19.2K BPS and up to 4000 feet:

Belden	9184
Belden	9302
NEC	222P 1 SLCBT

At shorter distances, alsmost any twisted pair or shielded twisted pair will work. It should be noted that RS-422 requires that the transmitter and receiver ground be within a few volts of each other or damage to the transmitter and receiver may result.

It is also noted that the twisted pairs should be matched so that both transmit signals make up one twisted pair and both receive signals make up the other twisted pair. If this is ignored, then cross-talk can result from the mis-matching which will affect the performance of the communication system.

FIGURE 1. SPECIFICATIONS

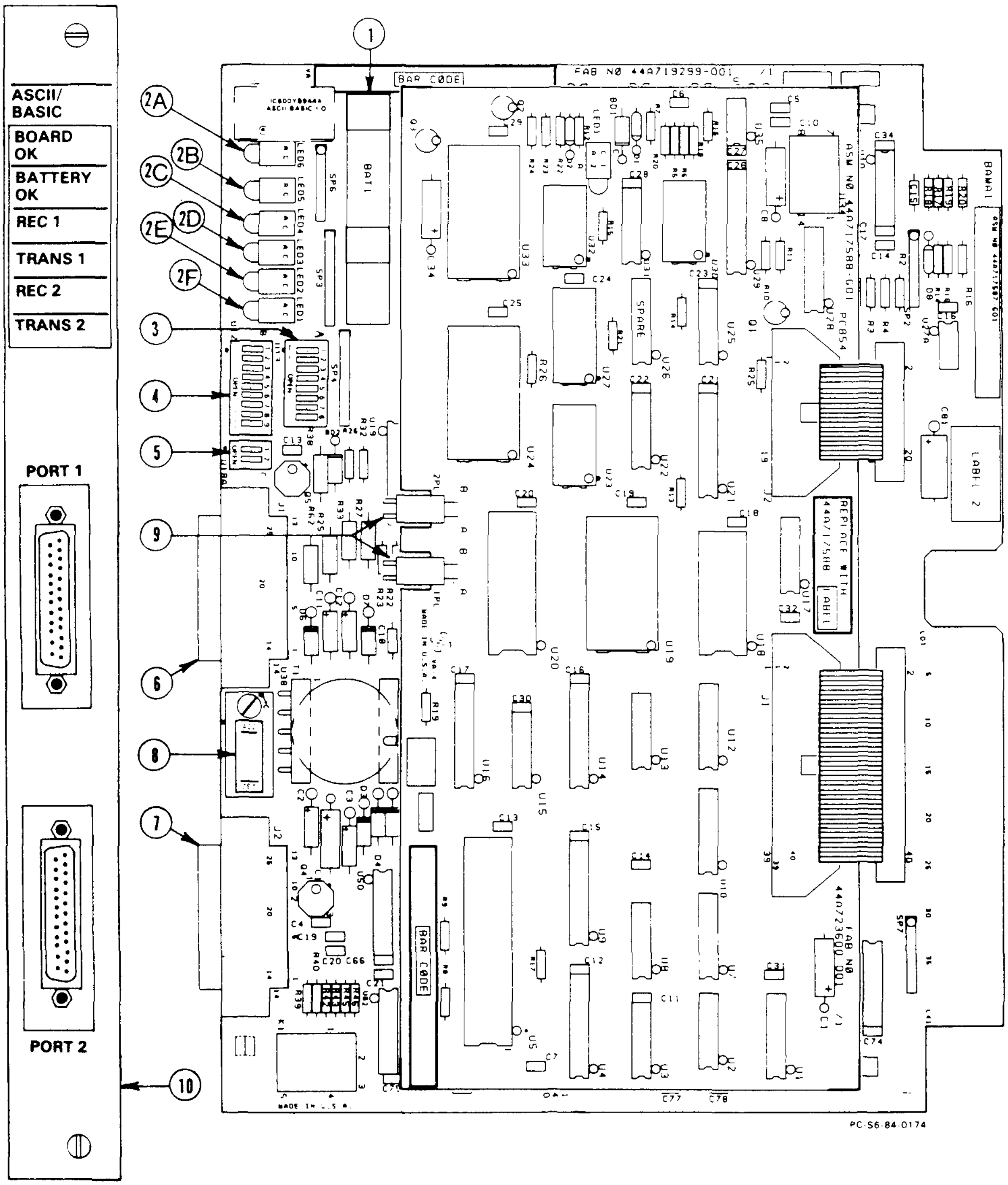


FIGURE 2. USER ITEMS (Part 1 of 2)

Ref. PC-S6-84-0174

1. Lithium-Manganese Dioxide Battery
2. LED Status Indicators (see below)
3. Bank A DIP Switches
4. Bank B DIP Switches
5. Bank C DIP Switches
6. J1 Connector: 25-pin D-type female connector (Programming Port 1).
7. J2 Connector: 25-pin D-type female connector (Communications Port 2).
8. J2 Communication selection DIP package: RS-232 or RS-422 configuration read from top of imprinted label.
9. Battery connectors
10. Faceplate

LED	DESCRIPTION
(2A) BOARD OK	ON: Board has passed self-diagnostics and is operating properly. OFF: Indicates a failure.
(2B) BATTERY OK	ON: Lithium battery voltage within limits. FLASHING: Battery performance marginal, replace battery. OFF: Lithium battery will not maintain user memory program in RAM.
(2C) REC 1	ON: Serial data present at receiver 1 input. OFF: Receiver 1 input inactive.
(2D) TRANS 1	ON: Serial data present at transmitter 1 output. OFF: Transmitter 1 output inactive.
(2E) REC 2	ON: Serial data present at receiver 2 input. OFF: Receiver 2 input inactive.
(2F) TRANS 2	ON: Serial data present at transmitter 2 output. OFF: Transmitter 2 output inactive.

FIGURE 2. USER ITEMS (Part 2 of 2)

INSTALLATION

The ASCII/BASIC module must be installed in a Series Six High-Capacity I/O rack or in a Model 60 CPU rack. Being an intelligent device, the ASCII/BASIC module can function independently of the CPU. As such, if communications with the CPU are not required, the module may be located in a High Capacity I/O rack in a remote I/O subsystem. Before installing the module, set the Dual-In-Line Package (DIP) switches adjacent to the card slot on the rack backplane to establish which group of eight consecutive input and output points in the CPU I/O tables will be used by the module being installed. For futher information on I/O DIP switch settings, refer to Figure 3 and Table 2.

Set the DIP switch banks A,B and C (user items 3,4 and 5 on Figure 2) on the module to the required configurations (see Figures 5a, 5b and 5c), Verify the position of the configuration hybrid DIP package located between JI and 52, it is user item 4 on Figure 2. It is marked "232" on one end and "422" on the other and is mounted on a socket. A small screwdriver is needed to turn the screw which releases the configuration hybrid DIP package from the socket. Position the package so as to provide either RS-232 or RS-422 communications on the lower port (Port 2). The selected communications mode may be read off the surface of the package. The mode selected will appear right-side up.

Use the extraction/insertion tool furnished with the Series Six rack to remove or install the module.

Guide the faceplate over the circuit board so that the proper contact is made. Then secure the faceplate to the rack using the thumbscrews at the top and the bottom. Power may now be applied to the module and terminals or other external ASCII devices may be connected to Port 1 and/or Port 2. The pinout definitions for Port I and Port 2 are defined in Table 3.

There are many devices to which this module can be connected and numerous ways to wire up these connections. A few of the more common wiring connections are shown in Figures 4(a)-(d).

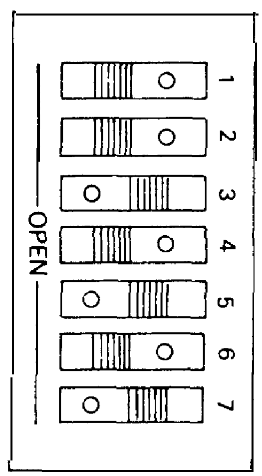


FIGURE 3. TYPICAL I/O BACKPLANE DIP SWITCH

Ref. PC-S&83-0126

TABLE 2. DIP SWITCH SETTINGS FOR I/O POINT SELECTION FOR THE ASCII/BASIC MODULE

DPREQ REGISTER CONTENTS DECIMAL (HEX) *	I/O POINT	DIP SWITCH POSITION 7	6	5	4	3	2	1
1001 (03E9)	1- 8							
1009 (03F1)	9- 16							X
1017 (03F9)	17- 24						X	
1025 (0401)	25- 32						X	X
1033 (0409)	33- 40					X		
1041 (0411)	41- 48					X		X
1049 (0419)	49- 56					X	X	
1057 (0421)	57- 64					X	X	X
1065 (0429)	65- 72				X			
1073 (0431)	73- 80				X			X
1081 (0439)	81- 88				X		X	
1089 (0441)	89- 96				X		X	X
1097 (0449)	97- 104				X	X		
1105 (0451)	105- 112				X	X		X
1113 (0459)	113- 120				X	X	X	
1121 (0461)	121- 128				X	X	X	X
1129 (0469)	129- 136			X				
1137 (0471)	137- 144			X				X
1145 (0479)	145- 152			X			X	
1153 (0481)	153- 160			X			X	X
1161 (0489)	161- 168			X		X		
1169 (0491)	169- 176			X		X		X
1177 (0499)	177- 184			X		X	X	
1185 (04A1)	185- 192			X		X	X	X
1193 (04A9)	193- 200			X	X			
1201 (04B1)	201- 208			X	X			X
1209 (04B9)	209- 216			X	X		X	
1217 (04C1)	217- 224			X	X		X	X
1225 (04C9)	225- 232			X	X	X		
1233 (04D1)	233- 240			X	X	X		X
1241 (04D9)	241- 248			X	X	X	X	
1249 (04E1)	249- 256			X	X	X	X	X
1257 (04E9)	257- 264		X					
1265 (04F1)	265- 272		X					X
1273 (04F9)	273- 280		X				X	
1281 (0501)	281- 288		X				X	X
1289 (0509)	289- 296		X			X		
1297 (0511)	297- 304		X			X		X
1305 (0519)	305- 312		X			X	X	
1313 (0521)	313- 320		X			X	X	X
1321 (0529)	321- 328		X		X			
1329 (0531)	329- 336		X		X			X
1337 (0539)	337- 344		X		X		X	
1345 (0541)	345- 352		X		X		X	X
1353 (0549)	353- 360		X		X	X		
1361 (0551)	361- 368		X		X	X		X
1369 (0559)	369- 376		X		X	X	X	
1377 (0561)	377- 384		X		X	X	X	X
1385 (0569)	385- 392		X	X				
1393 (0571)	393- 400		X	X				X
1401 (0579)	401- 408		X	X			X	
1409 (0581)	409- 416		X	X			X	X
1417 (0589)	417- 424		X	X		X		
1425 (0591)	425- 432		X	X		X		X
1433 (0599)	433- 440		X	X		X	X	
1441 (05A1)	441- 448		X	X		X	X	X
1449 (05A9)	449- 456		X	X	X			
1457 (05B1)	457- 464		X	X	X			X
1465 (05B9)	465- 472		X	X	X		X	
1473 (05C1)	473- 480		X	X	X		X	X
1481 (05C9)	481- 488		X	X	X	X		
1489 (05D1)	489- 496		X	X	X	X		X
1497 (05D9)	497- 504		X	X	X	X	X	
1505 (05E1)	505- 512		X	X	X	X	X	X
1513 (05E9)	513- 520	X						
1521 (05F1)	521- 528	X						X
1529 (05F9)	529- 536	X					X	
1537 (0601)	537- 544	X					X	X
1545 (0609)	545- 552	X				X		
1553 (0611)	553- 560	X				X		X
1561 (0619)	561- 568	X				X	X	
1569 (0621)	569- 576	X				X	X	X
1577 (0629)	577- 584	X			X			
1585 (0631)	585- 592	X			X			X
1593 (0639)	593- 600	X			X		X	
1601 (0641)	601- 608	X			X		X	X
1609 (0649)	609- 616	X			X	X		
1617 (0651)	617- 624	X			X	X		X
1625 (0659)	625- 632	X			X	X	X	
1633 (0661)	633- 640	X			X	X	X	X
1641 (0669)	641- 648	X		X				
1649 (0671)	649- 656	X		X				X
1657 (0679)	657- 664	X		X			X	
1665 (0681)	665- 672	X		X			X	X
1673 (0689)	673- 680	X		X		X		
1681 (0691)	681- 688	X		X		X		X
1689 (0699)	689- 696	X		X		X	X	
1697 (06A1)	697- 704	X		X		X	X	X
1705 (06A9)	705- 712	X		X	X			
1713 (06B1)	713- 720	X		X	X			X
1721 (06B9)	721- 728	X		X	X		X	
1729 (06C1)	729- 736	X		X	X		X	X
1737 (06C9)	737- 744	X		X	X	X		
1745 (06D1)	745- 752	X		X	X	X		X
1753 (06D9)	753- 760	X		X	X	X	X	
1761 (06E1)	761- 768	X		X	X	X	X	X
1769 (06E9)	769- 776	X	X					
1777 (06F1)	777- 784	X	X					X
1785 (06F9)	785- 792	X	X				X	
1783 (0701)	793- 800	X	X				X	X
1801 (0709)	801- 808	X	X			X		
1809 (0711)	809- 816	X	X			X		X
1817 (0719)	817- 824	X	X			X	X	
1825 (0721)	825- 832	X	X			X	X	X
1833 (0729)	833- 840	X	X		X			
1841 (0731)	841- 848	X	X		X			X
1849 (0739)	849- 856	X	X		X		X	
1857 (0741)	857- 864	X	X		X		X	X
1865 (0749)	865- 872	X	X		X	X		
1873 (0751)	873- 880	X	X		X	X		X
1881 (0759)	881- 888	X	X		X	X	X	
1889 (0761)	889- 896	X	X		X	X	X	X
1897 (0769)	897- 904	X	X	X				
1905 (0771)	905- 912	X	X	X				X
1913 (0779)	913- 920	X	X	X			X	
1921 (0781)	921- 928	X	X	X			X	X
1929 (0789)	929- 936	X	X	X		X		
1937 (0791)	937- 944	X	X	X		X		X
1945 (0799)	945- 952	X	X	X		X	X	
1953 (07A1)	953- 960	X	X	X		X	X	X
1961 (07A9)	961- 968	X	X	X	X			
1969 (07B1)	969- 976	X	X	X	X			X
1977 (07B9)	977- 984	X	X	X	X		X	
1985 (07C1)	985- 992	X	X	X	X		X	X
1993 (07C9)	993- 1000	X	X	X	X	X		

* For programming use only: add 1000 to I/O points.

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left).

TABLE 3. ASCII/BASIC MODULE PORT CONNECTOR PINOUTS

PIN	PROGRAMMING PORT (J1)	COMMUNICATIONS PORT (J2)
1	NC	NC
2	Data Out RS-232	Data Out RS-232
3	Data In RS-232	Data In RS-232
4	NC	RTS or Tx Clock Out (RS-232)
5	NC	CTS or Rx Clock In (RS-232)
6	NC	NC
7	Ground	Ground
8*	Data Out(+) I Loop	CD or Tx Clock In (RS-232)
9	Ground	Ground
10#	Data Out(+) RS-422	Data Out(+) RS-422
11	Data In (+) RS-422	Data In (+) RS-422
12	I Src(+) Rx	CTS(+) or Rx Clock In(+) (RS-422)
13*	I Src(+) Tx	CD (+) or Tx Clock In(+) (RS-422)
14	NC	Output Relay -Normally Closed
15+	RS-232 JMP 1	Output Relay -Normally Open
16+	RS-232 JMP 2	Output Relay -Common
17	Term. Rx RS-422	Terminate Rx RS-422
18	Data In(+) I Loop	Terminate CTS RS-422
19	Data In(-) I Loop	Terminate CD RS-422
20	NC	NC
21	Data Out(-) I Loop	NC
22#	Data Out(-) RS-422	Data Out(-) RS-422
23	Data In (-) RS-422	Data In (-) RS-422
24	I Src(-) Rx	CTS(-) or Rx Clock In(-) (RS-422)
25*	I Src(-) Tx	CD (-) or Tx Clock In(-) (RS-422)

* CD = Carrier Detect (or RLSD = Receive Line Signal Detect).

\+ Optional connection for Port 1 only, as switch in DIP bank C can be set to make this connection.

\# RS-422 transmit signals for the communications port are tri-stated for multi-drop links when the transmitter is active.

The dual-purpose pins have no function until they are determined by the user's software.

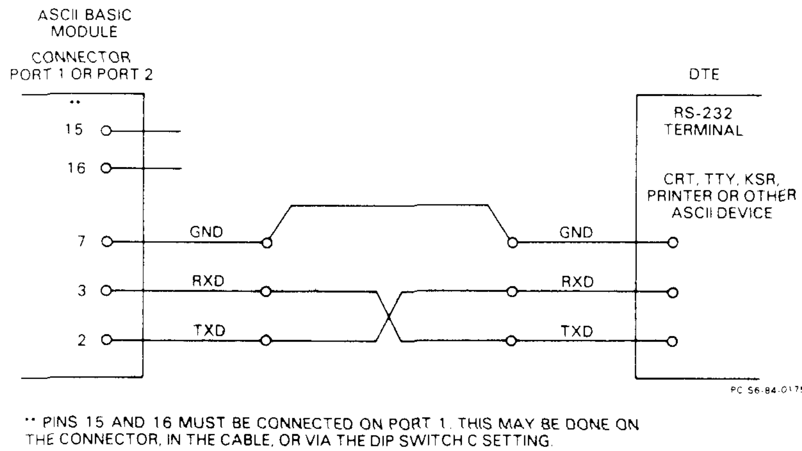


FIGURE 4(a). ASYNCHRONOUS RS-232 POINT-TO-POINT

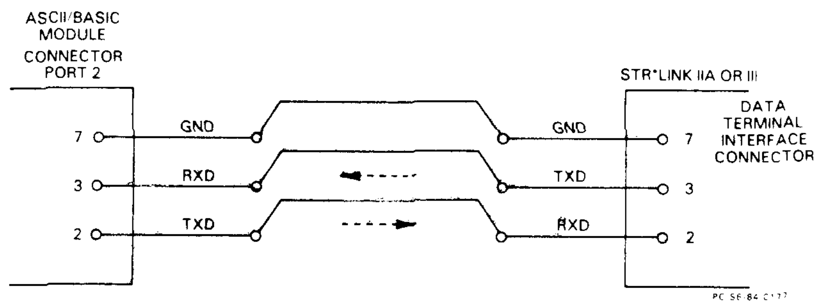


FIGURE 4(b). STR*-LINK CABLE

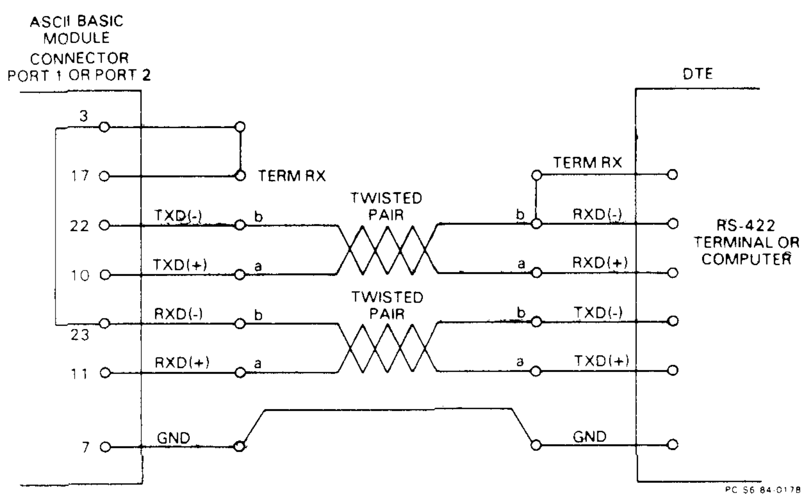
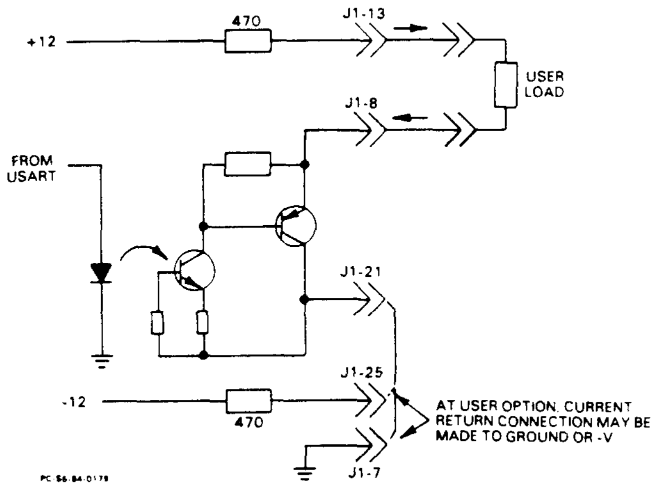
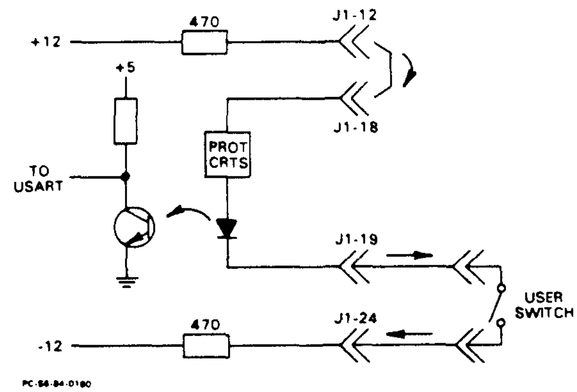


FIGURE 4(c). ASYNCHRONOUS RS-422 POINT-TO-POINT

*Trademark of Electronic Processors Inc.
Ref. PC-S6-84-0175
PC-S6-84-0177
PC-S6-84-0178



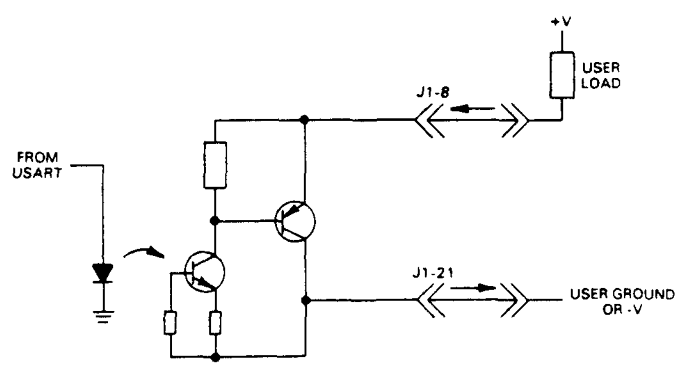
DATA TRANSMITTED FROM ASCII/BASIC MODULE
TO EXTERNAL DEVICE



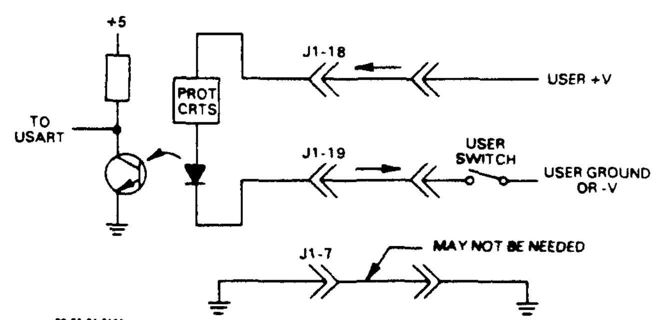
DATA RECEIVED FROM
EXTERNAL DEVICE

ACTIVE CURRENT LOOP

FIGURE 4(d). CURRENT LOOP POINT-TO-POINT (Part 1 of 2)



DATA TRANSMITTED FROM ASCII/BASIC MODULE
TO EXTERNAL DEVICE



DATA RECEIVED FROM
EXTERNAL DEVICE

PASSIVE CURRENT LOOP

FIGURE 4(d). CURRENT LOOP POINT-TO-POINT (Part 2 of 2)

Ref. PC-S6-84-0179
PC-S6-84-0180
PC-S6-84-0181
PC-S6-84-0182

Configuration

The settings of the DIP switches which configure Port 1 and perform other miscellaneous set up functions are:

TABLE 4 (a). BANK A DIP SWITCHES

1	2	3	BANK A Switch (Data Rate Selection)
closed	closed	closed	19.2K BPS
*open	*open	*open	9600 BPS
closed	open	open	4800 BPS
open	closed	open	2400 BPS
closed	closed	open	1200 BPS
open	open	closed	600 BPS
closed	open	closed	300 BPS
open	closed	closed	110 BPS

4	5	6	BANK A Switch (Framing and Parity Selection)
*open	*open	*open	7 data bits, parity bit = even
closed	open	open	7 data bits, no parity bit
open	closed	open	7 data bits, parity bit = odd
closed	closed	open	8 data bits, eighth bit = I, no parity bit
open	open	closed	8 data bits, parity bit = even
closed	open	closed	8 data bits, eighth bit = 0, no parity bit
open	closed	closed	8 data bits, parity bit = odd
closed	closed	closed	8 data bits, no parity bit

7	8	‘BANK A Switch (Full and Half-Duplex and type of echo)
*open	*open	Half duplex, send echo
closed	open	Reserved
open	closed	Half duplex, no echo
closed	closed	Full duplex, no echo

- Indicates the factory-set default position.

TABLE 4 (b). BANK B DIP SWITCHES

BANK B Switch	Position	Function
1	*open	RS-232-C/RS-422 selected for Port No.1
	closed	20 mA Current Loop selected for Port No. 1
2	*open	1 stop bit to be used on Port No. 1
	closed	2 stop bits to be used on Port No. 1
3	*open	Port No. 1 MARK/SPACE invert disabled
	closed	Port No. 1 MARK/SPACE invert enabled
4	*open	Port No. 1 BS/DEL editing enabled
	closed	Port No. 1 BS/DEL editing disabled
5	*open	Port No. 1 Xon/Xoff flow control disabled
	closed	Port No. 1 Xon/Xoff flow control enabled
6	*open	Program Mode Enabled
	closed	Program Protected
8	*open	Execute operational software
	closed	Execute factory test software
9	*open	ASCII/BASIC Module is enabled. (operations resume in PROGRAM mode)
	closed	ASCII/BASIC Module is reset.

* Indicates the factory-set default position.

TABLE 4 (c). BANK C DIP SWITCH

1	BANK C Switch	
	open	Disconnects Pins 15, 16 for Port 1 RS-422
	*closed	Connects Pins 15 and 16 for Port 1 RS-232-C operation (use external jumper if desired across pins 15-16)

* Indicates the factory-set default position.

Options available for Port 2 setup by user's BASIC program include:

- RS232 or RS422
- Any data rate between 75 and 19200 BPS
- 5 thru 8 data bits per character
- 1 or 2 stop bits
- Even, odd, or no parity
- Interactive editing enabled/disabled
- Internal or external clock or clock derived from data stream
- No encoding or NRZI encoding

SERIAL DATA FORMAT

Asynchronous Data Character Format:

```
START ---- DATA BITS ---- PARITY BIT --- STOP BIT
 BIT        (UP TO 8)      (OPTIONAL)     (1 OR 2)
```

ASCII/BASIC MODULE - SERIES SIX INTERFACE

The eight input points in the Series Six CPU which correspond to the address of an ASCII/BASIC module are used to provide the CPU with the status of the module.

The eight output points at this address may be used by the CPU logic to control the ASCII/BASIC module.

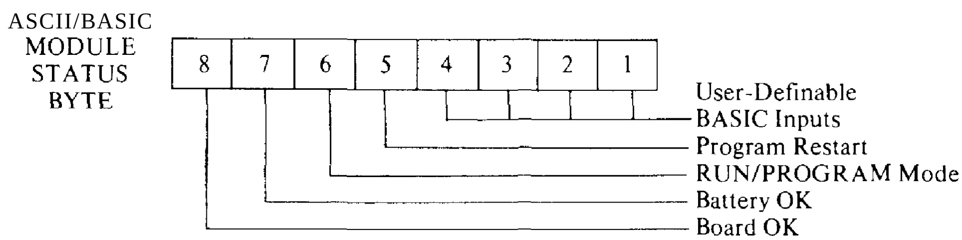


FIGURE 5(a). MODULE STATUS DATA IN SERIES SIX INPUT TABLE

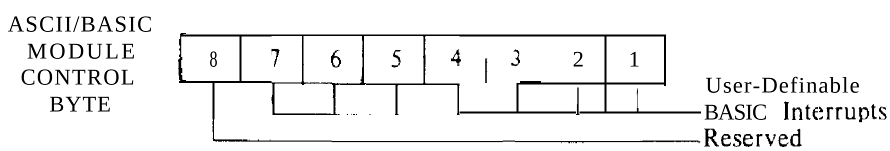


FIGURE 5(b). MODULE CONTROL DATA IN SERIES SIX OUTPUT TABLE

MODULE CHECKOUT USING V104 CPU SOFTWARE

1. Connect terminal to be used for programming and checking out this module to Port 1.
2. Set ASCII/BASIC module address switches for the desired I/O address.
3. Configure Port 1 DIP switches as required for terminal connected in step 1.
4. Bank B switches 6-9 should be open.
5. Bank B switch 6 must be open (program not protected position) and the CPU Memory Protect/Write Enable keyswitch must be in the Write Enable position to allow a program to be entered into the ASCII/BASIC module.

Program the Series Six CPU with the following ladder diagram for the checkout:

In this program, an ASCII/BASIC module will be serviced if output Oxxxx is on. The content of Rnnnn (note: this is shown as Hexadecimal number HHHH) must lie between + 1001 and + 2000 decimal. The contents of this register will correspond to the first I/O point address of the ASCII/BASIC module plus 1000 decimal. Example: If the ASCII/BASIC module address switches are set for I/O points 1-8, then HHHH should be 03E9 (decimal value is 1001).

If the ASCII/BASIC module is serviced without fauit, the output Oyyyy will remain off. If a fault occurs while the Module is being serviced, Oyyyy will turn on.

7. If a "*" prompt character appears on the programming terminal connected in step 1 above, BASIC programs may be entered into the ASCII/BASIC module and the programs may be edited from the terminal. If the "*" character is not present, the programming mode may be entered by sending Control/C to Port 1.

8. Enter the following BASIC program via the programming terminal to check data transfer between the ASCII/BASIC module and the Series Six CPU:

```
10 CLEAR
20 REGNO% = 2: ! use any free register in the Series Six.
30 SDATA% = X'AA55': ! use this as data pattern.
40 SETW REG REGNO%,1,SDATA%,0,RETF%: !send contents of SDATA% to Reg 2.
50 1% = DELAY%(20): ! allow plenty of time for write transfer.
60 IF RETF% > 0 THEN 80: ! success, if RETF% is greater than zero.
70 PRINT " WINDOW FAILURE : ASCII/BASIC MODULE TO CPU":STOP
80 SETR REG REGNO%,1,RDATA%,0,RETF1%: ! read back Reg 2 into RDATA%.
90 1% = DELAY% (20): ! allow plenty of time for read transfer.
100 IF RETF1% > 0 THEN 120: ! success, if RETF1% is greater than zero.
110 PRINT "WINDOW FAILURE : CPU TO ASCII/BASIC MODULE":STOP
120 PRINT "DATA TRANSFER BETWEEN CPU AND ASCII/BASIC MODULE IS OK"
130 END
```

9. Enter the RUN command into the terminal to execute the program listed above.

10. Upon completion of the above program, you will receive one of the following messages on the programming terminal:

  a. If OK- - "DATA TRANSFER BETWEEN CPU AND ASCII/BASIC MODULE IS OK"
  b. If data was not successfully sent from the CPU to the ASCII/BASIC Module - - - -"WINDOW FAILURE : CPU TO ASCII/BASIC MODULE"
  c. If data was not sucessfully sent from the ASCII/BASIC MODULE TO THE CPU- - - -"WINDOW FAILURE : ASCII/BASIC MODULE TO CPU"
  d. An error message- - -refer to the ASCII/BASIC Module programming reference manual (GEK-25398).

11. Correct any errors found and run program again until data transfer is OK.

BASIC SUMMARY

The following tables show the operators, format control characters, functions and types of statements which are available in BASIC.

For more detail refer to the ASCII/BASIC Module Manual, GEK 25398.

TABLE 5. OPERATORS

Arithmetic	Relational	Logical
-	=	NOT
^	>	AND
*	>=	OR
/	<	XOR
+	<=	
-	< >	
	=&	
String		**Assignment**
&		=
+		

TABLE 6. FORMAT CONTROL CHARACTERS

SYMBOL	CHARACTER FUNCTION
Z	Zero Suppression
9	Digit Position, including zero
.	Decimal Point
,	Insertion Character
+	Signum Printed (+ or -)
-	Minus Only Printed
CR	CR Printed for Minus
B	Blank Insertion
$	Floating Dollar
*	Asterisk Check Protect

TABLE 7. FUNCTIONS

	Arithmetic	
ABS (X)	LOG (X)	ATN (X)
INT(X)	EXP (X)	COS(X)
SGN (X)	SQR(X)	SIN(X)
MOD (M%,N%)	RND	TAN (X)
	String and Data	
ADD%(X)	ASC% (A$)	AS2% (A$)
CHR$(X)	CH2$(X)	FLL$(X,A$)
IND% (A$,B$)	LEN% (X$)	SPC$(X)
STR$(N)	TAB(X)	VAL(X$)
	@ (R%C%)	
	System	
ERN%	ERL%	SPR%
ISR% (N%)	INKEY$(A%)	INLEN% (A%)
SETTIME% (A$)	TIME$	TIMER%(I%,X%)
SETDATE% (A$)	DATE$	DELAY% (I%)
INTR% (A%,B%,C%)		STATUS%(A%,B%,C%)
	User	
	FNAs(v,...)	
	Conversion	
SSDP# (A%(1))		EXTP%(A# ,A%(1))

TABLE 8 STATEMENTS

Assignment	
CLEAR	LET v=e or v=e
COPYW A%,B%,C%	COPYL A%,B%,C%
SETW TYPE B%,C%,D%,E%,F%	SETR TYPE B%,C%,D%,E%,F%
SETPW TYPE B%,C%,F%	RANDOMIZE
Definition	
REM remarks	!remarks
DEF FNAs(v,...)	DIM v(x,y),...
SUBR name(v,...)	STRUC (v,P%,el ,e2)
OPTION	
Edit	
RENUM n,i	n\a\b
n	nl,n2
Program Control	
END	STOP
GOTOn	ON e GO TO n,...
GO SUB n	RETURN
ON e GOSUB n,...	RETURN n
CALL name(e,...)	RETURN FROM
CALL ASM(e,...)	
IF e THEN n	IF e THEN nl ELSE n2
IF e THEN s	IF e THEN sl ELSE s2
FOR v=el TOe2	NEXT v
FORv=elTOe2STEPe3	
FOR....WHILE	
FOR....UNTIL	
Input/Output	
DATA cl,c2,...	READ v1,v2,...[ONERR n]
RESTORE	RESTORE n
INPUT vl,v2,... [ONERR n]	PRINT el,e2,... [ONERR n]
INPUT1 vl,v2,... [ONERR nl	PRINT1 el,e2,.,. [ONERR n]
INPUT2 v1,v2,...[ONERR nl	PRINT2 el,e2,... [ONERR n]
PEEK (1%)	POKE I%,A%
DIN (1%)	DOUT I%,A%
System Control	
RUN	RUN < ESC >
CONT	PAUSE
NEW 'name'	NAME 'name'
LIST	LIST n,
LIST n	LIST nl,n2
LIST 1	LIST1 n,
LIST1 n	LIST1 nl,n2
LIST2	LIST2 n,
LIST2 n	LIST2 n 1 ,n2
SAVE 'name/dev'	VERIFY 'name/dev'
LOAD 'name/dev'	SETPR2 A%,B%,C%,D%,E%,F%,G%,H%,I%

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
12K Version IC600BF944A	IC600YB944A	IC600FP944A
28K Version IC600BF949		

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No, 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

SERIES SIX

PROGRAMMABLE **CONTROLLERS**

GEK-90759A

8K REGISTER MEMORY MODULE

GENERAL DESCRIPTION

The 8K Register Memory module is utilized in the Model 600 and 6000 Central Processor Units (CPU) with the Advanced functions. It provides 8192 (8K), 16-bit words of battery-backed, Complimentary Metal-Oxide Semiconductor (CMOS) memory reserved for Register-memory data. The features and benefits of this module are summarized in Table 1.

The module contains the CMOS memory devices; memory control circuitry, Lithium battery and Light-Emitting Diode (LED) indicators.

The LEDs, marked "PAR ITY" and "BATTERY", are visible through a lens on the faceplate. The "PARITY" LED turns off if there is a Register memory or Table memory (contained on the Internal Memory module) parity error; the "BATTERY" LED indicates the status of the on-board Lithium battery. The LEDs operate only when the module is installed in a properly powered CPU rack.

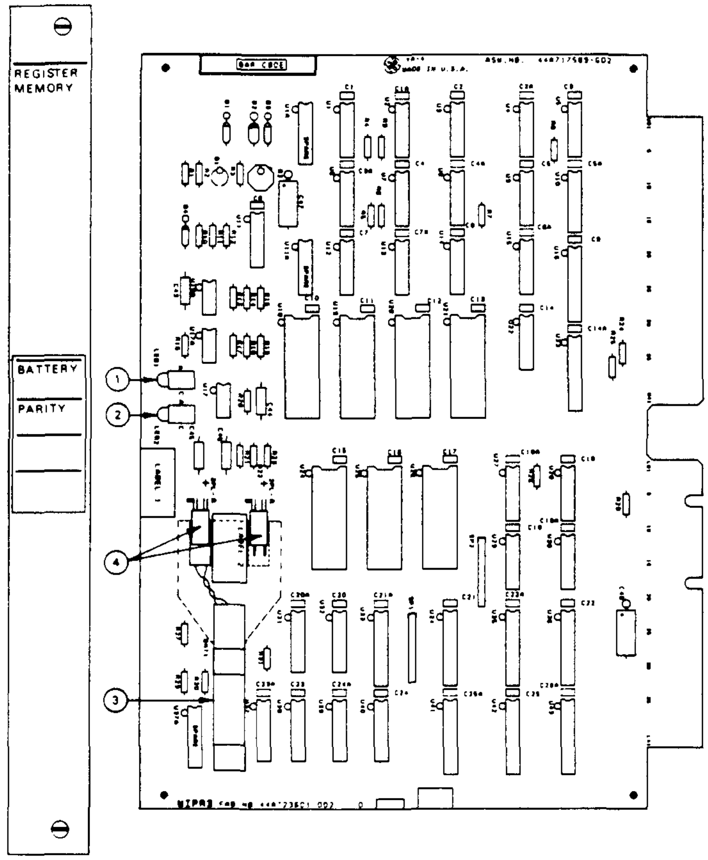
Refer to Figure 1 for Register Memory module specifications.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Battery-Backed CMOS memory.	Retains Register memory after power-down or power failure.
Two LED indicators: BATTERY PARITY	Simplifies troubleshooting.

Dimensions: Circuit Board: 8.15 x 11.0 (inches) 208 x 280 (mm) Faceplate: 12.46 x 5.175 (inches) 317 x 30 (mm)	Power Requirements: 5 V dc, 800 mA (Supplied by CPU power supply) Storage Temperature: 0°to 70°C Operating Temperature: 0°to 60°C Humidity: 5% - 95% (non-condensing>

PC-S6-84-0160



1 **BATTERY Light:**

Steady On: Battery Normal

Flashing: Battery Low: CPU continues running. No. 2 alarm is activated. To protect the memory contents, replace the battery before it fails.

Steady Off: Battery Failed: CPU continues running, but will not restart if stopped. No. 2 alarm remains activated. Memory contents will be lost when power is switched off or lost.

2 **PARITY Light**

On: Table Memory and Register Memory parity is OK.

Off: Table Memory and/or Register Memory parity error exists. An error message appears in the work area of the Program Development Terminal display.

3 **Lithium-Manganese Dioxide Battery**

4 **Battery Jacks**

For battery replacement information consult the <u>Series Six Installation and Maintenance Manual</u>, GEK-25361.

Figure 1. USER ITEMS

INSTALLATION

The Register Memory module can be installed in a Model 600 or 6000 CPU. The card slot to the immediate left of the Internal Memory module is reserved for this module. Follow these steps:

1. Remove top board cover after pinching white, plastic fasteners.
2. Connect 2-pin Lithium battery connector to either of male jacks beneath battery.
3. Place top board cover over component side of circuit board, making sure that white fasteners open and catch.
4. Use extraction/insertion tool furnished with CPU to insert (or remove) module into rack.
5. Secure faceplate to rack using thumbscrews at top and bottom.
6. Clear parity errors detected at initial power-up of the CPU. Refer to Chapter 2, Series Six Programming Manual (GEK-25362), for further details.

CAUTION

RELATIVELY SMALL AMOUNTS OF EXCESS CHARGE CAN CAUSE VERY INTENSE ELECTROSTATIC FIELDS IN METAL-OXIDE-SEMICONDUCTOR (MOS) DEVICES, DAMAGING THEIR GATE STRUCTURE. WHEN THE BOARD COVERS HAVE BEEN REMOVED, AVOID HANDLING THIS CIRCUIT BOARD IN A MANNER WHICH MIGHT CAUSE ELECTROSTATIC CHARGES. FAILURE TO OBSERVE THIS CAUTION COULD RESULT IN THE DESTRUCTION OF THE CMOS-RAM DEVICES IN THIS MODULE. WITH THE BOARD COVERS IN PLACE, IT IS UNLIKELY THAT NORMAL HANDLING OF THIS MODULE WOULD CAUSE ANY DAMAGE.

WARNING

DO NOT PLACE A SHORT CIRCUIT BETWEEN THE CONTACTS AND THE ENDS OF THE BATTERY. DO NOT ATTEMPT TO RECHARGE THE BATTERY. FAILURE TO OBSERVE EITHER OF THESE WARNINGS WILL CAUSE THE BATTERY TO EXPLODE, POSSIBLY RESULTING IN PERSONAL INJURY.

ORDERING INFORMATION

Circuit Board and Faceplate	Faceplate
IC600CB507A	IC600FP507A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

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For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

APRIL 1986

SERIES SIX

PROGRAMMABLE CONTROLLERS

24 VDC INPUT CPU/DPU POWER SUPPLY MODULE

GEK-9076 1

Source Voltage
20 to 32 VDC
Output Voltage
35, + 12, – 12 VDC

GENERAL DESCRIPTION

The 24 VDC Input CPU/DPU Power Supply Module, utilized in both the Central Processor Unit (CPU) and the Data Processor Unit (DPU), is available to be used with a power source from 20 to 32 Vdc. The features and benefits of this module are summarized in Table 1.

The 24 VDC Input CPU/DPU Power Supply Module provides regulated + 12, - 12 and +5DC voltages to the rack backplane. The input (or source voltage) is applied to terminals on the front panel, then routed through a switch and fuse to a switching power supply. For a given load the input power drain remains essentially constant. The power supply is protected against polarity reversal of the DC Input.

The module provides electromechanical relay contacts for connection to user indicators, or any device to be activated during an alarm condition. The module also provides a voltage regulator for an optional, auxiliary battery that provides battery back-up of Complementary Metal-Oxide Semiconductor (CMOS) memory contained in the processor rack.

A Keyswitch mounted on the front panel is used to select either the RUN or the STOP mode for the processor; a second Keyswitch allows the user to protect the contents of the processor memories by placing them in a READ ONLY mode. The same key operates both Keyswitches. Refer to Figure I (next page) for the CPU/DPU Power Supply module specifications.

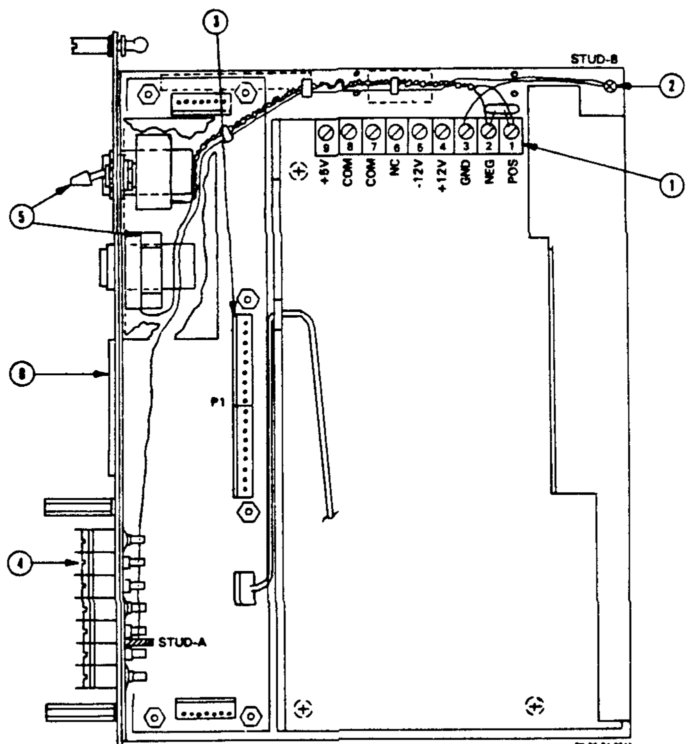
The 24 VDC Input CPU/DPU Power Supply Module may be used in place of a 115/230 VAC Input CPU/DPU Power Supply Module in an existing rack if 24 VDC input is desired.

TABLE 1. FEATURES AND BENEFITS

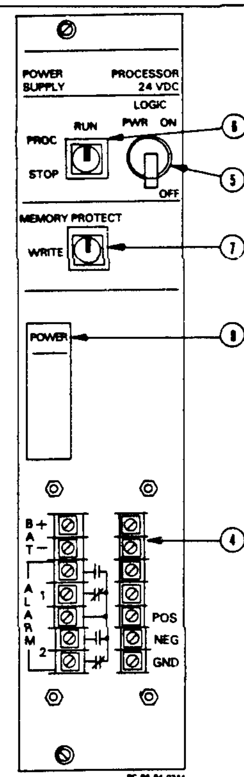
FEATURES	BENEFITS
Utilizes DC input power source.	Extends power source compatibility to 24 VDC systems.
Can be utilized in CPU and DPU racks.	Reduced spare-parts inventory.
Provides electromechanical-relay contacts for alarm indications.	Activates user-supplied power indicators.
Contains voltage regulator for auxiliary battery.	External battery back-up of CMOS memory.

FIGURE 1. SPECIFICATIONS

- Input: 20-32 Vac, 180 VA max.
- Output:
  +5 Vdc, 16.5 A max.
  +12 Vdc, 1.5 A max.
  −12 Vdc, 1.0 A max.
  } Total power from all outputs must be less than 90 watts.
- Allowable Power Interruptions:
  10ms minimum at 20 VDC line.
- Noise Immunity: Meets requirements of NEMA ICS 2-230 and ANSI C37.90A.
- Altitude: Up to 10,000 feet (3,000 meters) above sea level.
- Auxiliary Battery Input: 8-28 Vdc
- Dimensions: 12.46 x 9.00 x 2.75 (inches)
  317 x 229 x 70 (mm)
- Operating Temperature: 0^{o} to 60^{o}C (outside of the rack)
- Storage Temperature: -20^{o}C to +80^{o}C
- Humidity: 5%-95% (non-condensing)



SIDE VIEW



FRONT PANEL

① Internal Terminal Strip (Refer to Figure 3)

② Chassis Ground Terminal

③ 18-Pin Connector: Connects signal cable from rack backplane

④ Front-Panel Connector Block (Refer to Figure 4)

⑤ Power Switch/Fuse

⑥ CPU RUN/STOP Key Switch

⑦ MEMORY PROTECT Key Switch

⑧ POWER Light

On: The voltage levels of all three DC outputs (+12V, -12V, +5V) are within tolerance

Off: At least one of these voltage levels is too low

FIGURE 2. USER ITEMS

Ref. PC-S6-84-0243
PC-S6-84-0244

INSTALLATION

These steps define the procedures to be followed when a power supply is to be replaced on a Series Six CPU or DPU rack. The tools needed are a regular screwdriver, Phillips screwdriver, and a 5/16" wrench or nut driver.

1. Stop the system by switching the top key on the CPU to "STOP".

2. Switch off all units in the system, including the user's power supplies.

3. Remove all power from the system, preferably at the source (i.e. throw the main circuit breaker for the system).

4. Locate the power supply to be changed. The power supply is in the far right side of the CPU/DPU rack.

5. Remove the plastic cover on the lower portion of the power supply to be replaced and, using a volt-meter, make sure there is no DC power present.

6. Take note of the location and color of the DC wires and then remove them. Also, remove Auxiliary battery and/or Alarm connection(s) noting location, color, and polarity for correct replacement.

7. At the top and bottom of the power supply, there are I/4-turn thumbscrews. To loosen, turn the thumbscrews approximately l/4 turn counterclockwise.

8. Grasp the thumbscrews and gently pull outward. Be careful not to damage the internal wiring while pulling the supply out.

9. Locate the wires that extend from the back of the rack to the terminal on the power supply. These wires should be labeled or stamped with their location; the circuit boards have wire locations stamped on them also. (Refer to Table 3.) Remove these wires. There is also a plastic wire clamp holding these wires in place. Detach this from the frame if there is not a similar item on the replacement power supply, or cut the clamp if there is one on the new supply.

   Remove the 18-pin (PI) moIex connector that is on the narrow board in the front part of the power supply. The power supply should now be completely detached from the rack.

IO. Take the replacement power supply and attach the wires as shown in Figure 3. Be sure to connect the 18-pin molex connector (P 1) to the power supply.

Attach the wire clamp on the upper stud of the power supply frame, or if there is a clamp already there, wrap the wires in it.

11. Slide the power supply into the rack, being careful not to damage the wires. When the power supply is all the way in, turn the thumbscrews clockwise until they lock in.

12. Remove the plastic cover on the lower portion of the power supply and attach the DC wire, as well as the battery and alarm wires, as they were on the original supply (Refer to Step 6 and Figure 4). Replace the plastic cover.

13. Verify that the DC input lines are of the correct polarity before applying power. An inadvertant reversal of input polarity will cause the supply to draw excessive currents and may blow the internal fuse (8A slo-blo) which must then be replaced before proper operation can be resumed.

14. Restore system power. Turn on the CPU/DPU unit. Check to see if the POWER light is on. If it is, turn on the rest of the system and resume normal operation.

15. If the POWER light does not come on, the power supply may be bad, source voltage may not be turned on, or there may be other problems within the rack. Please call the Programmable Control Service Center EMERGENCY SERVICE NUMBER (804) 978-5747 for assistance.

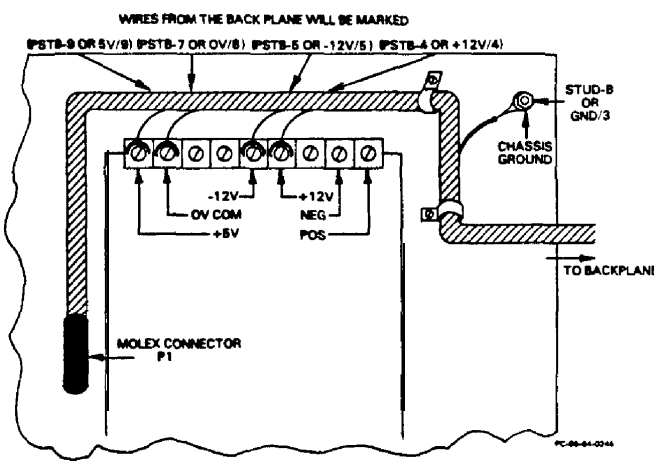


FIGURE 3.
POWER SUPPLY EXTERNAL WIRING DIAGRAM

CAUTION

If a memory auxiliary battery is used, the circuit connecting it to this module should be isolated from the rest of the system. If this CAUTION is not observed, the battery could be short-circuited.

The alarm contacts consist of two sets of normally-opened and normally-closed contacts. The terminals marked "1 NO" and "1 NC" are associated with Alarm Type No. 1; the terminals marked "2 NO" and "2 NC" with Alarm type No. 2. (Refer to Installation and Maintenance Manual, GEK-25361, for further information on Alarm Nos. 1 and 2.)

CAUTION

The user devices connected to each set of Alarm terminals on this module should present a resistive load drawing no more than one amp of current at no greater than 115 Vac/28 Vdc. Failure to observe this CAUTION may result in damage to the circuit board.

NOTE

During normal operation the alarm relays are energized. During an alarm condition the contacts marked 1NO and 2N0, open, and those marked 1NC and 2NC, close.

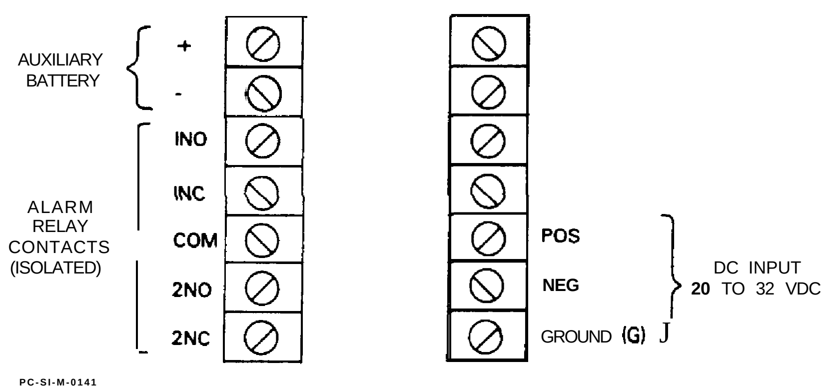


FIGURE 4. FRONT-PANEL TERMINAL BLOCK

ORDERING INFORMATION

Module	Part Number
24 VDC Input CPU/DPU Power Supply Module	IC600PM541A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc, Charlottesville, Virginia

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-90762

Source Voltage :
20 TO 32 V dc
Output Voltage:
+5, +12, -12 Vdc

24V dc INPUT HIGH CAPACITY I/O RACK POWER SUPPLY

GENERAL DESCRIPTION

The 24 V dc I/O Power Supply, which provides power for Series Six I/O modules, directly replaces a 115 V ac input high capacity I/O Power Supply should a change in source voltage become necessary or desirable. This power supply is a High Capacity model and does not substitute for a Standard I/O Power Supply.

The 24 V dc Input High Capacity I/O power supply features and benefits are summarized in Table 1. This supply provides regulated +5V, +12V and -12 V dc to the I/O rack backplane. The High Capacity power supply provides power for high current I/O module configurations and remote (with modem) I/O applications.

The 24 V dc High Capacity I/O power supply operates with input voltages ranging from 20 to 32 V dc. The input power is applied to a terminal block on the front panel, then routed through a switch and fuse to a switching power supply. For a given load the input power drain is essentially constant. The power supply is protected against polarity reversal of the dc input.

On the front pane! of the I/O rack power supply is an ON/OFF switch labeled, LOGIC POWER; visible through a lens is a Light-Emitting Diode (LED) that lights when the LOGIC POWER switch is in the ON posit ion; and underneath a black plastic cover is a source voltage terminal block.

The I/O rack power supply also generates a power-fail signal (PSOK) which is used for system initialization and error indications-

Refer to Table 2 (next page) for the High Capacity I/O rack power supply specifications.

Table 1 FEATURES AND BENEFITS

FEATURES	BENEFITS
Input voltage can be 20 to 32 V dc	Can be used with dc power sources
POWER indicator on front panel. Power-fail signal supplied to I/O rack to generate system failure indications.	Simplified troubleshooting.
Wide variety of output power combinations.	Useful in a variety of applications more properly satisfy I/O rack power requirements.

Table 2 SPECIFICATIONS

• Dimensions: 12.46 x 9.00 x 2.75(inches) 317 x 229 x 70 (mm)	• Allowable Power Interruption: 10 ms minimum at 20 V dc
• Input: 20 to 32 V dc 180 W (MAX)	• Operating Temperature: 0° to 60°C • Storage Temperature: -20° to +80°C
• Output: +5 Vdc, 16.5 A(max) +12 Vdc, 1.5 A(max) -12 Vdc, 1.0 A(max) } Total power is limited to 90 watts 275 Units of Load (see Table 3)	• Humidity: 5%-95% (non-condensing) • Noise Immunity: Meets requirements of NEMA ICS 2-230 and ANSI C37.90A.

TPK.A.41587

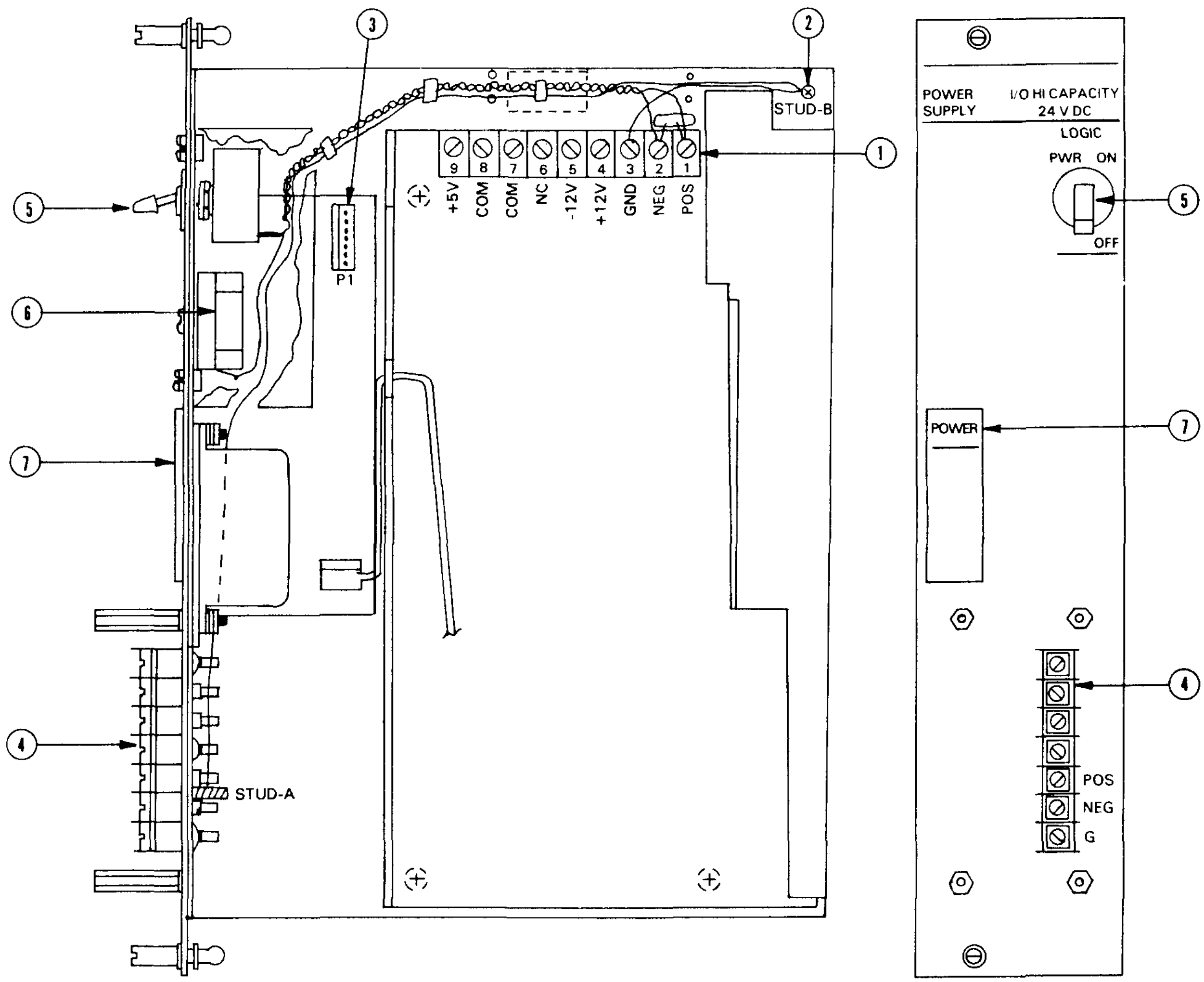


Figure 1 USER ITEMS (Part 1 of 2)

1. Main-Circuit-Board Terminal Strip
2. Ground Terminal
3. Auxiliary-Circuit-Board Connector
4. Front-Panel Connector Block
5. Power Switch
6. Fuse
7. POWER Light
   On: The voltage levels of all three DC outputs (+12V, -12V, +5V) are within tolerance.

   Off: At least one of these voltage levels is too low.

Figure 1 USER ITEMS (Part 2 of 2)

INSTALLATION

Verify that the 24 V dc High Capacity I/O power supply to be installed can accomodate the estimated load. Total the current units as indicated in Table 3, per the I/O modules to be used.

Input power requirements are a function of load. Typical efficiency at full load is approximately twice the estimated toad power as determined from Table 3.

Verify that the dc input lines are of the correct polarity before applying power. An inadvertant reversal of input polarity will cause the supply to draw excessive currents and may blow an internal 8A slo-blow fuse. This fuse must then be replaced and the input polarity reversed before proper operation can be attained.

These steps define the procedures to be followed when a power supply is to be replaced on a Series Six I/O rack. The tools needed are a regular screwdriver, and a 5/16" wrench or nut driver.

1. Stop the system by switching the top key on the CPU to STOP.
2. Switch off all units in the system, including the user's power supplies.
3. Remove all power from the system, preferably at the source (i.e. throw the main circuit breaker for the system).
4. Locate the I/O rack power supply to be changed. The power supply is in the far right side of the I/O rack.
5. Remove the plastic cover on the lower port ion of the power supply and, using a voltmeter, make sure there is no input power present.
6. Take note of the location and color of the input wires and then remove them.

7. At the top and bottom of the power supply, there are quarter turn thumbscrews. To loosen, turn the thumbscrews approximately 1/4 turn counterclockwise.

8. Grasp the thumbscrews and gently pull outward. Be careful not to damage the internal wiring while pulling the supply out. Pull the power supply completely out.

9. Locate the wires that extend from the back of the I/O rack to the terminal on the power supply. These wires should be labeled or stamped with their location; the circuit boards have wire locations stamped on them also. (Refer to Figure 3.) Remove these wires. These is also a plastic wire clamp holding these wires in place. Detach this from the frame if there is not a similar item on the replacement power supply, or cut the clamp if there is one on the new supply.

10. Remove the Molex connector that is on the narrow board in the front part of the power supply. The power supply should now be completely detached from the I/O rack.

11. Take the replacement power supply and attach the wires as shown in Figure 3. Be sure to connect the molex connector (PI) to the power supply. Attach the wire clamp on the uppper stud of the power supply frame, or if there is a clamp already there, wrap the wires in it.

12. Slide the power supply into the rack, being careful not to damage the wires. When the power supply is all the way in, turn the thumbscrews clockwise until they lock in.

13. Remove the plastic cover on the lower portion of the power supply and attach the Input wires as they were on the original supply (Refer to Step 6). Replace the plastic cover.

14. Restore system power. Turn on the I/O rack. Check to see if the POWER light is on. If it is , turn on the rest of the system and resume normal operation.

15. If the POWER light does not come on, the power supply is bad or there are other problems within the I/O rack. When this occurs, you can call your local authorized General Electric Programmable Control Distributor or your local General Electric Sales office for assistance.

Table 3 SUMMARY OF UNITS OF LOAD FOR I/O MODULES

Catalog Number IC600	Module Description	Units of Load (1) +5 V	+12 V	-12V	Applicable GEK Number
BF800	I/O Receiver	9	-	-	83512
BF801	Remote I/O Receiver	42	10	10 (2)	83537
BF802	24 to 48 V dc Input	2	-	-	83513
BF804	115 V ac/dc Input	2	-	-	83513
BF805	230 V ac/dc Inpt	2	-	-	83513
BF806	12 V ac/dc Input	2	-	-	83513
BF808	Interrupt Input	3	-	-	83524
BF810	115 V ac/dc Isolated Input	2	-	-	83521
BF813	Type J Thermocouple Input	29	-	-	84867
BF814	Type K+ Thermocouple Input	29	-	-	84867
BF815	Type S Thermocouple Input	29	-	-	84867
BF816	Type T Thermocouple Input	29	-	-	84867
BF817	Type B Thermocouple Input	29	-	-	84867
BF818	Type E Thermocouple Input	29	-	-	84867
BF819	Type R Thermocouple Input	29	-	-	84867
BF827	High Speed Counter	19	-	-	83545
BF830	Advanced I/O Receiver	12	-	-	90771
BF831	High Density Input	4	-	-	83546
BF841	0 to +10 V dc Analog Input	29	-	-	83525
BF842	±10 V dc Analog Input	29	-	-	83525
BF843	4 to 20 mA Analog Input	29	-	-	83525
BF900	I/O Transmitter	34	-	-	83515
BF901	Remote I/O Driver	38	10	10 (2)	83537
BF902	24 V dc Sink Output	7	-	-	83521
BF903	48 V dc Sink Output	7	-	-	83521
BF904	115 V ac Output	9	-	-	83514
BF905	230 V ac Output	9	-	-	83514
BF906	12 V dc Sink Output	7	-	-	83521
BF907	12 V dc Source Output	7	-	-	83521
BF908	24 V dc Source Output	7	-	-	83521
BF909	48 V dc Source Output	7	-	-	83521
BF910	115 V ac Isolated Output	8	-	-	83541
BF912	230 V ac Isolated Output	8	-	-	83541
BF914	Reed Relay Output	13	-	-	83540
BF915	Axis Positioning, Type 1	23	7	3	83543
BF917	Axis Positioning, Type 2	21	11	6	90800
BF921	5 V TTL Output	3	-	-	84857
BF923	10 to 50 V dc Sink Output	3	-	-	84859
BF924	120V dc Output	5	-	-	90756
BF929	10 to 50 V dc Source Output	3	-	-	84858
BF930	115 V ac protected Output	8	-	-	90757
BF941	0 to +10 V dc Analog Output	29	-	-	83526
BF942	±10 V dc Analog Output	29	-	-	83526
BF943	4 to 20 mA Analog Output	29	-	-	83526
BF944	ASCII Basic Module (12K)	20	12	-	90758
BF945	ASCII Basic Module (20K)	20	12	-	90758
BF946	Loop Management Module	20	12	-	90802
BF947	I/O Link Local	20	12	-	90825
660CBB900/01	Genius Bus Controllers	20	2	-	90486

(1). For +5 V dc, 1 unit of load equals 60 mA (300 mw of power).
For +12 and -12 V dc, 1 unit of load equals 25 mA (300 mw of power).

(2). +12 V and -12 V current is less than 1 unit of load if RS-232 mode is not used.

TPK.A.41588

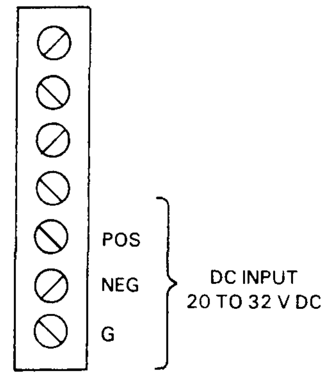


Figure 2 HIGH CAPACITY I/O POWER SUPPLY FRONT PANEL TERMINAL BLOCK

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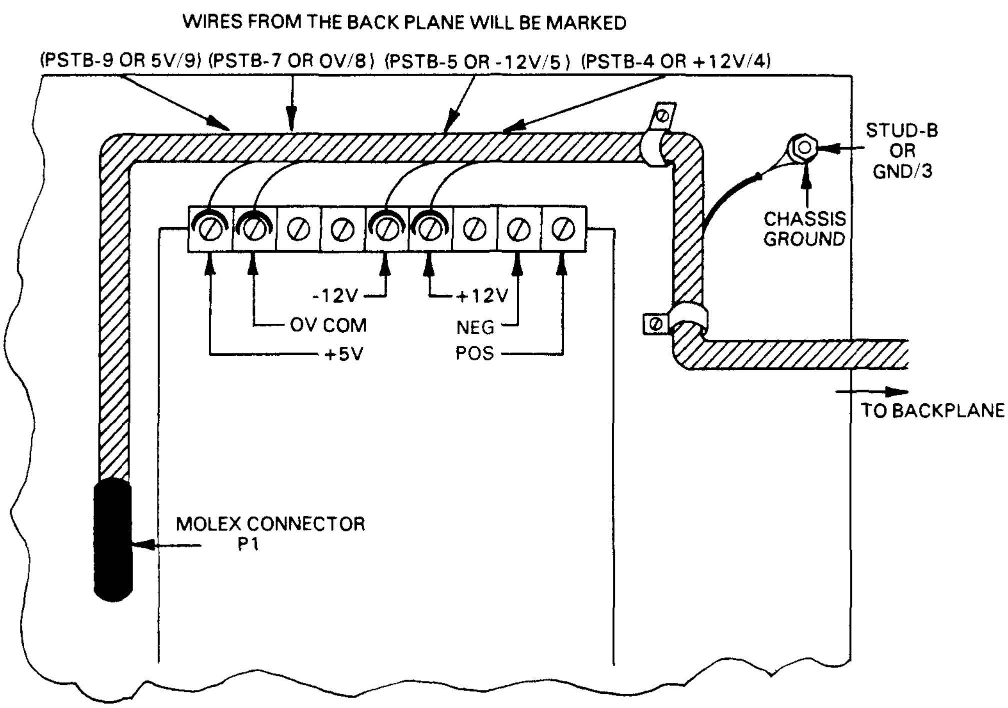


Figure 3 HIGH CAPACITY I/O POWER SUPPLY EXTERNAL WIRING

NOTE

This High Capacity I/O power supply (IC600PM542) is designed for use in the I/O rack IC600YR511. It may be substituted directly into standard rack IC600YR501 without any wiring changes to the standard rack. To use this power supply with High Capacity I/O racks IC600YR510 and IC600YR512 an I/O power supply cable adapter kit must be used and the kit installation is described in GEK-90751.

ORDERING INFORMATION

24 Vdc Input High Capacity I/O Rack Power Supply IC6OOPM542

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

November 1986

Workmaster ®

Series Six Programmable Controller

GEK-90764B
November, 1988

Terminator Board

General Description

The Workmaster/Series Six PLC Terminator board (IC640BLD304A) is one board of a two-board set. The set provides high-speed parallel communication between a Workmaster industrial computer and a Series Six programmable controller (PLC). This board contains all the circuitry necessary to terminate and protect data lines between a Workmaster computer and a Series Six CPU. The other board in the two-board set (the Workmaster/Series Six PLC Interface board) contains the microprocessor circuitry for controlling data transfer between a Series Six CPU and a Workmaster computer. The two boards are connected by a 34-wire ribbon cable.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
This terminator board contains no integrated circuit components.	When installed in the Workmaster computer, the hardware of the Workmaster computer is protected from surge damage caused by incorrect AC wiring of the Workmaster computer and the Series Six PLC. This is accomplished by fusing every line in the parallel bus with a 0.125 amp picofuse located on the terminator board. This protection is always in effect, regardless of the position of any of the DIP switches on the terminator board.
There are two modes of operation that can be selected by the two DIP rocker switches on the terminator board. All the DIP switches on the terminator board am set to the OFF (open) position in the factory. This is the proper setting for connecting a Workmaster computer to the I/O Control board in the CPU, or to an available I/O Receiver board in an I/O rack. When all the DIP switches on the terminator board are in the ON (closed) position, the parallel data bus from the Workmaster computer to the Series Six CPU is properly terminated for long distance communications through a Parallel Transmitter board. *Refer to step 3 of the installation instructions and the warning notice for further information.*	

Table 2. SPECIFICATIONS

Space Requirement:	One short board slot in the Workmaster computer.
fower Requirement:	None. Supplied by the Workmaster/Series Six PLC Interface.
Storage Temperature:	**-40° to +80° c.**
Operating Temperature:	**0° to 70" c.**
Humidity:	**5% to 95% (non-condensing).**
Altitude:	Up to 6,600 feet (2,000 meters) above sea level operating.
Noise and transient immumity:	Not affected by: Showering arcs per NEMA ICS 2,230.40
Dimensions:	**4.20 x 13.40 x 0.45** inches 107 x 340 x 12 MM
Dressplate:	Dressplate with cutout for 37-pin D connector.

Installation

The Workmaster Guide to Operation Manual, GEK-25373, contains detailed instructions for installing option boards in the Workmaster computer. References are made in the installation instructions provided in this publication to pages 4-13 through 4-23 and pages 4-54 through 4-63 of that manual.

1. Follow the instructions on pages 4-13 through 4-16 to prepare the unit and remove the cover. Then, follow the instructions on pages 4-17 through 4-19 to remove the six front panel screws holding the bezel assembly and slide the front panel assembly and inner chassis out of the case.

2. Pages 4-20 through 4-23 of GEK-25373 explain how to remove the adapter card retainer and the metal shield protecting the expansion board area.

3. All DIP switches on the terminator board are set to the OFF (open) position in the factory. This is the proper setting for connection of the Workmaster computer to the I/O Control board, or to any available parallel receiver board at a maximum cable distance of 10 feet (3 meters). A maximum cable distance of 500 feet (150 meters) can be achieved by setting all DIP switches to the ON (closed) position; but in that case, the other end of the cable must be directly connected to a Parallel Transmitter board (IC600BF900B) dedicated to that purpose.

4. Refer to pages 4-54 through 4-57 of GEK-25373 to install the terminator option board. Insert the terminator board into the short slot adjacent to the Disk Controller Adapter board. If an interface board is to be installed at this time, refer to GEK-90765, ***WorkmasterlSeries Six PLC Interface Board,*** for this procedure. A copy of GEK-90765 is included with the interface board. The interface board should be inserted into the long slot next to the Disk Controller Adapter board.

5. Plug the 34-pin ribbon cable connector from the terminator board into the 34-pin connector on the top of the interface board.

6. Refer to pages 4-58 through 4-63 of GEK-25373 for instructions to replace the adapter card retainer, the metal shield, and the cover of the Workmaster computer.

'7. Follow the power-on self-test procedure beginning on page 4-64 to verify a proper installation of the option boards.

WARNING

All the DIP switches on the terminator board must be properly set. Failure to do so may result in the Series Six CPU stopping in an incorrect state, or incorrect operation of the I/O bus which may cause the outputs to be directed to an incorrect state.

Table 3. ORDERING INFORMATION

DESCRIPTION	CATALOG NUMBER
Terminator Board for Workmastir Computer	IC640BLD304A

NOTE

This board cannot be ordered separately. It is part of the following catalog numbers:

IC640CPP549 Logicmaster 6 with one 3.5inch drive
IC640CPP550 Logicmaster 6 with two 35inch drives
IC640CPPSSI Logicmaster 6 with hard disk drive and 3.5inch drive
IC640CBP552A Logicmaster 6 conversion kit

For further information, contact your local GE Fanuc sales office.

GE FANUC

Workmaster ®
Series Six Programmable Controller

GEK-90765A
November, 1988

Interface Board

General Description

The Workmaster/Series Six PLC Interface board (IC64OBSS303A) is one board of a two-board set. The set provides high-speed parallel communication between a Workmaster industrial computer and a Series Six programmable controller (PLC). This board contains all the circuitry necessary to format and transfer data between a Workmaster computer and a Series Six CPU. The other board in the two-board set (the Workmaster/Series Six PLC Terminator board) provides termination resistors and surge protection for the two-board set and the Workmaster computer. The two boards are connected by a 34-wire ribbon cable.

Table I. FEATURES AND BENEFITS

FEATURES	BENEFITS
This interface board has no PROM or other non-volatile memory functions. The executive program is loaded into the on-board RAM memory. Future software improvements and revisions will not require any hardware changes on the board.	When installed in the Workmaster computer, in conjunction with the terminator board, the system is protected from surge damage caused by incorrect AC wiring of the Workmaster computer and the Series Six PLC.
This interface board contains no operator controls, jumpers, etc. All interfaces to the board occur through software.	The parallel nature of the interface permits real-time display of Series Six PLC status.

Table 2. SPECIFICATIONS

Space Requirement:	One full-length board slot in the Workmaster computer.
Power Requirement:	+5VDC supplied by the Workmaster computer.
Storage Temperature:	**-40** to **+80 c.**
Operating Temperature:	0 to 70° c.
Humidity:	5% to 95% (non-condensing).
Altitude:	Up to 6,600 feet (2,000 meters) above sea level operating.
Noise and transient immunity:	Not affected by: Showering arcs per NEMA ICS 2230.40
Dimensions:	4.20 x 13.40 x 0.45 **inches** **107 x 340 x 12 MM**
Dressplate:	None.

Installation

The Workmaster *Guide to Operation Manual,* GEK-25373, contains detailed instructions for installing option boards in the Workmaster computer. References are made in the installation instructions provided in this publication to pages 4-13 through 4-23 and pages 4-54 through 4-63 of that manual.

1. Follow the instructions on pages 4-13 through 4-16 to prepare the unit and remove the cover. Then, follow the instructions on pages 4-17 through 4-19 to remove the six front panel screws holding the bezel assembly and slide the front panel assembly and inner chassis out of the case.
2. Pages 4-20 through 4-23 of GEK-25373 explain how to remove the adapter card retainer and the metal shield protecting the expansion board area.

3. Refer to pages 4-54 through 4-57 to install the interface option board. Insert the interface board into the slot adjacent to the Disk Controller Adapter board. If a terminator board is to be installed at this time, refer to GEK-90764, *Workmaster/Series Six PLC Terminutor Board,* for this procedure. A copy of GEK-90764 is included with the terminator board. The terminator board should be inserted into the short slot next to the Disk Controller Adapter board.

4. Plug the 34-pin ribbon cable connector from the terminator board into the 34-pin connector on the top of the interface board.

5 Refer to pages 4-58 through 4-63 of GEK-25373 for instructions to replace the adapter card retainer, the metal shield, and the cover of the Workmaster computer.

6. Follow the power-on self-test procedure beginning on page 4-64 to verify a proper installation of the option boards.

Table 3. ORDERING INFORMATION

DESCRIPTION	CATALOG NUMBER
Circuit Interface Board for Workmaster Computer	IC440BSS303A

NOTE

This board cannot be ordered separately. It is part of the following catalog numbers:

IC640CPP549	Logicmaster 6 with one 35inch drive
IC640CPP550	Logicmaster 6 with two 3.5inch drives
IC640CPP551	Logicmaster 6 with hard disk drive and 3.5-inch drive
IC640CBP552A	Logicmaster 6 conversion kit

For further information, contact your local GE Fanuc sales office.

SERIES SIX™
PROGRAMMABLE CONTROLLERS

GEK-90766A

AXIS POSITIONING MODULE (TYPE 2)

GENERAL DESCRIPTION

The Axis Positioning Module TYPE 2 (APM II) is an intelligent, programmable, single-axis positioning controller integrated into the Series Six Programmable Controller (PC) system. The APM II provides a real time interface between the Series Six PC and a servo or stepper-controlled axis. The user can monitor and control the APM II from a Program Development Terminal (PDT) or Workmaster ™ while the APM II performs the complex calculations required to control a precision positioning system. Due to the complete integration of the APM II into the PC system, the Series Six provides a predictable, yet flexible, axis control capability.

The APM II is distinguished by its ability to operate in either servo *or* stepper Control Modes, by its use of encoders to provide position feedback, and by the programming of velocity and acceleration in terms of rates. The features and benefits of the APM II are summarized in Table 1

More details concerning the theory of operation, specific application information, and detailed wiring information for this module may be found in the Axis Positioning Module Type 2 manual (GEK-90800.)

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Dual function module	Command structure similar to APM Type 1. Permits open-loop stepper control with or without check-loop or closed-loop servo control with encoder feedback.
Preprocessed canned cycles	Permits repeated execution of move commands without preprocessing delays.
Programmable limit switches	Eight preset switch comparisons simplify user CPU programming of interlocks,
Programmable acceleration	Acceleration control independent of position loop gain.
Auxiliary analog input	Dual Range Bipolar input simplifies applications. – Alarm limits -Adaptive control
Tachometer output	Reduces user hardware cost. Electromechanical tachometer not required for many applications.
Force D/A output command	Permits user to directly command speed reference output during initial system checkout. Can be used to switch from position to other control modes.
Force commanded position	Direct control of position command from CPU for operation as a simple position regulator.
A Quad B Encoder position feedback	Compatible with many standard encoders.
Drive Enable Relay output	Use with brake to hold position or to permit free-wheeling.
Feedhold command	Permits cycle interruption.
Loop Contactor control relay output	Disconnect drive from motor.
Discrete inputs	Detect overtravel. Detect home position. Detect drive hardware functioning.
Set point programming	Minimize “air cutting” time.
Canned cycles	Simplifies PC program with 20 canned cycles
Wait to Move	Synchronized start from external device or master APM. Multiple axis interlocking.
Feedrate override	Adaptive control and gage control applications are easier to implement.
Out of sync sensing	Detects external and internal hardware failure. Detects wiring errors and protects drive and motor.
Velocity Feedforward	Reduces following error for multi-axis coordination and higher performance.
Find Home cycle	Permits precise location of machine reference position at high speed with programmable offsets.

TABLE 1. FEATURES AND BENEFITS (Continued)

FEATURES	BENEFITS
Digital speed regulation	No steady state velocity error.
Diagnostics	Reports command, control and drive system errors to reduce downtime and improve start ups.
Base Speed command	Permits instantaneous change of commanded velocity.

MODULE SPECIFICATION	
Space Requirements:	One Series Six I/O slot in either a Model 60 CPU rack or a High-Capacity I/O rack. A Standard I/O Rack cannot be used.
Power Requirements:	+5 V dc @ 1.25 amp maximum. + 12 V dc @ 265 mA maximum. -12 V dc @ 155 mA maximum. Approximately 38 UNIT LOADS A maximum of three (3) APM II modules may be installed in a Model 60 CPU rack. A maximum of six (6) APM II modules may be installed in a High Capacity I/O rack.
Storage Temperature:	0° to 70° c
Operating Temperature:	0° to 60° c
Humidity:	5% to 9 5% (non-condensing)
Altitude:	Up to 10,000 feet (3,000 meters) above sea level (operating)
Isolation:	(Faceplate connections to Series Six common> Encoder Inputs, Stepper Outputs, Switch Inputs, Relay Outputs: 50 V dc Continuous, 1500 V Peak Transient
Noise and Transient Immunity:	Switch inputs and relay outputs meet the requirements of: NEMA ICS 2-230 and ANSI C37.90A

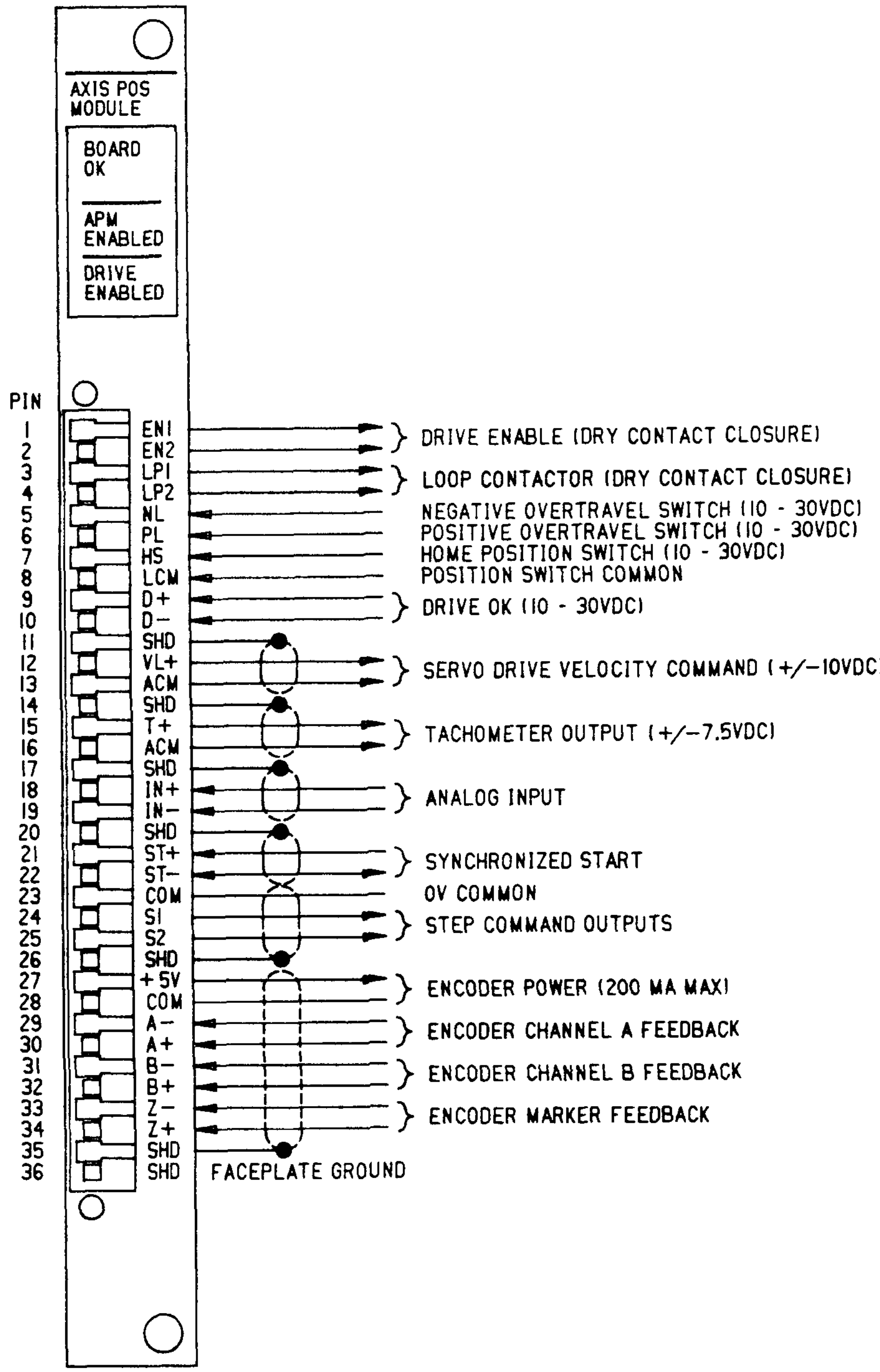


Figure 1. AXIS POSITIONING MODULE TYPE 2 FACEPLATE CONNECTIONS

TABLE 2. SPECIFICATIONS FOR FACEPLATE CONNECTIONS

INTERFACE	IN/OUT	CHARACTERISTICS
Drive Enable (optional)	output	Normally open relay contact; Contacts rated 24 V ac/dc, 1 amp maximum (resistive load only); dry contact
Loop Contactor (optional)	output	Same as Drive Enable.
Negative Overtravel Switch (optional)	Input	Requirements: CLOSED (ON) = IO-30 V dc OPEN (OFF) ≤ 3 V dc; Input current = 10 ma @ 24 V; Input impedance = 2000 ohms; Interpretation: OFF = overtravei. Disable using SW3-3
Positive Overtravel Switch (optional)	Input	Same as Negative Overtravel Switch.
Home Switch (optional)	Input	Requirements: Same as Negative Overtravel. Interpretation: CLOSED (ON) = Negative side of home switch. OPEN (OFF) = Positive side of home switch.
Drive OK (optional)	Input	Requirements: CLOSED (ON) = 10 - 30 V dc OPEN (OFF) = ≤ 3 V dc Input current: 10 ma @ 24 V Input impedance = 2000 ohms; Interpretation: CLOSED (ON) = Drive OK OPEN (OFF) = Drive Not OK Disable using SW3-4
Velocity Command	Output	Differential output of D/A converter with following characteristics: Resolution: 13 bits including sign. Linearity: .012% of full scale output 4 500 microvolts maximum Maximum output voltage: ± 10 V ± 3 V Minimum output load resistance: 2000 ohms Voltage between Analog Common (ACM) and Series Six Common: ± IV maximum.

TABLE 2. SPECIFICATIONS FOR FACEPLATE CONNECTIONS (Continued)

INTERFACE	IN/OUT	CHARACTERISTICS
Tachometer Output	output	The Tachometer Output is derived from the A QUAD B encoder input. Characteristics: Output voltage: ± 8.0 V maximum Minimum load impedance: 2000 ohms Output common mode range: ± 1.0 V (Analog Common to Series Six Common) Gain: (Programmable) 7.5 V = 200,000 x 100 cts/min 100,000 x 100 cts/min 50,000 x 100 cts/min 25,000 x 100 cts/min Offset at zero velocity: ± 1.0 mv maximum Output ripple: Gain — Ripple 7.5 v = 200,000 — 62 mv max 7.5 V = 100,000 — 125 mv max 7.5 V = 50,000 — 250 mv max 7.5 V = 25,000 — 500 mv max Output Polarity: Set by SW3-1 Factory setting: Positive velocity causes negative output voltage. Encoder Requirements: Minimum recommended resolution is 2000 counts per motor shaft revolution (500 line encoder)
Analog Input (optional)	Input	A/D converter input with the following characteristics: Input range: -10.0 to +9.92 V dc or -5.00 to +4.966 V dc (selected by sw3-5) Gain factor: 1 count = 78.12 mv or 39.06 mv. Input impedance: 20 kohms Common Mode range: ± 15 V
Synchronized Start (optional)		Output on Master APM II; Input on Slave APM II.

TABLE 2. SPECIFICATIONS FOR FACEPLATE CONNECTIONS (Continued)

INTERFACE	IN/OUT	CHARACTERISTICS
Step Command Outputs	Output	TTL open collector output with 1 kΩ pull-up resistor to isolated + 5 V. • Sink Output current: 30 mA max • Low Level Output voltage: 0.4 V max at 10 mA • Max pulse rate: 41.7 khz (49.5 khz with rate override = 110%) • Pulse width: 13.9 μs • Operating Modes:

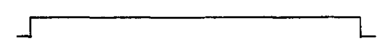
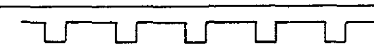
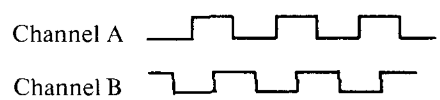
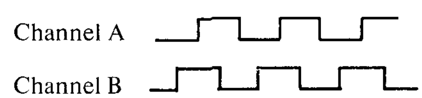
SELECTION	OUTPUT	FUNCTION	FORMAT OF SIGNAL	EXAMPLE OF SIGNAL OUTPUT
0 (default)	S1	STEP	HIGH PULSE	
	S2	DIRECTION	HIGH LEVEL (POSITIVE) DIRECTION	
			LOW LEVEL (NEGATIVE) DIRECTION	
1	S1	POSITIVE STEP	HIGH PULSE	
	S2	NEGATIVE STEP	HIGH PULSE	
2	S1	STEP	LOW PULSE	
	S2	DIRECTION	HIGH LEVEL (POSITIVE) DIRECTION	
			LOW LEVEL (NEGATIVE) DIRECTION	
3	S1	POSITIVE STEP	LOW PULSE	
	S2	NEGATIVE STEP	LOW PULSE	

TABLE 2. SPECIFICATIONS FOR FACEPLATE CONNECTIONS (Continued)

INTERFACE	IN/OUT	CHARACTERISTICS
Encoder Interface	Inputs	Input Characteristics: • Input type: Optically isolated, differential or single ended • Input voltage range: ± 15 V • Input threshold: • Single ended: + 1.0 V nominal • Differential: + 0.05 V ± 0.03 V • Input impedance: 5 kohms nominal from each input to isolated common. • Number of inputs: 3 (Channel A, Channel B, and Marker) • Line terminations: 180 ohm (nominal) line terminations are provided for use in differential mode. Terminations are selected using SW2-1 through SW2-3 • Maximum input frequency: 100 khz (each channel) • Quadrature tolerance: 90 degrees ± 45 degrees • Quadrature error detection: Simultaneous transitions on the Channel A and Channel B inputs will be detected as loss of quadrature. • Encoder power: +5.0 V ± .25 V @ 200 mA maximum • Encoder direction of travel: Channel A leading Channel B = motion in positive direction. Motion in Positive Direction  Motion in Negative Direction  • Z Channel (Marker) Input Polarity: A positive transition of the Z Channel is used in the FIND HOME cycle to initialize position • Feedback cable: 4 twisted pair, 22 gage with overall shield and jacket. 100 ft maximum length.

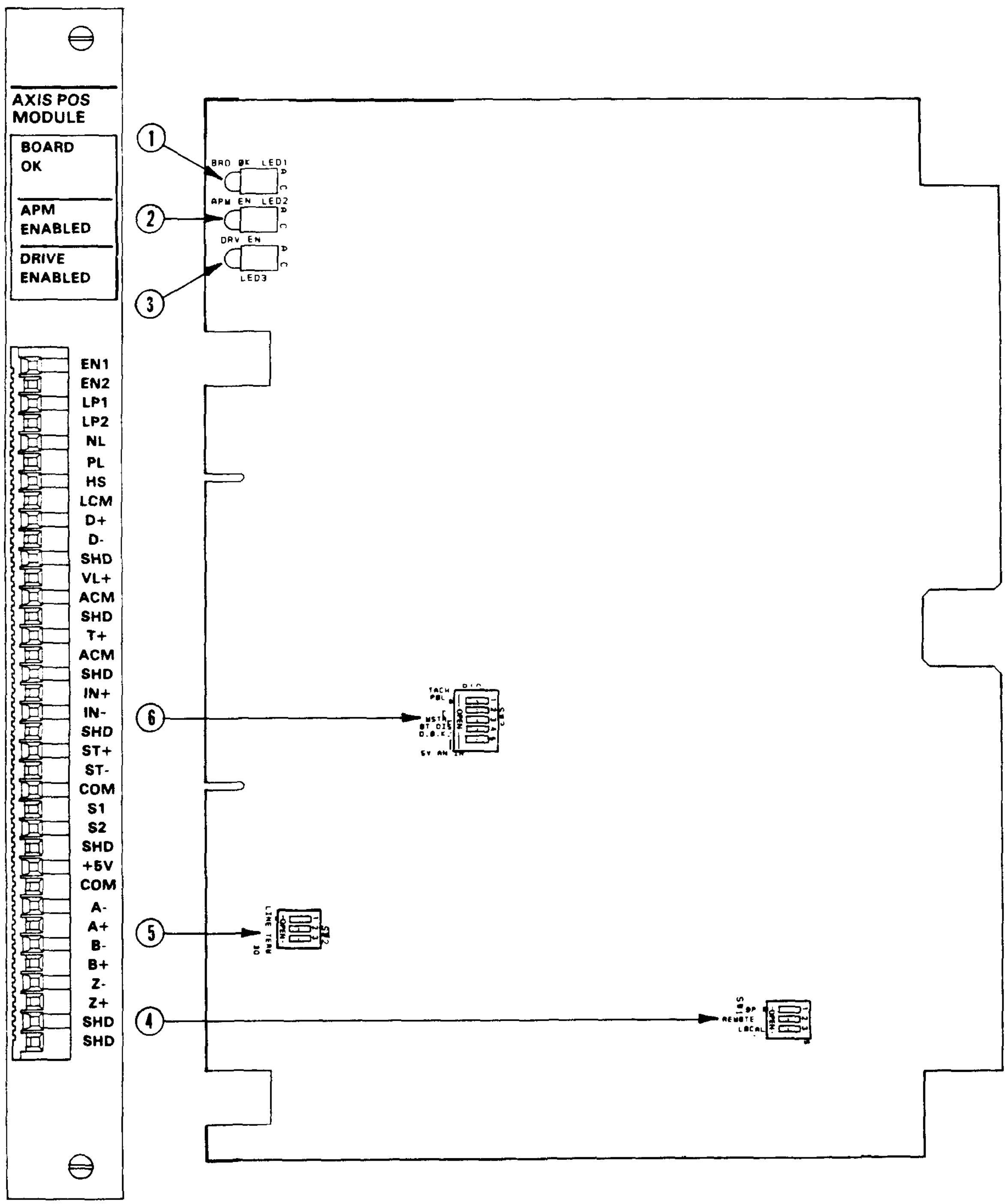


Figure 2. AXIS POSITIONING MODULE TYPE 2 USER ITEMS (Part 1 of 3)

INDICATOR LIGHTS

① BOARD OK	ON:	APM has passed self-diagnostic tests. These tests are performed when the I/O rack is turned on and whenever an ERROR condition occurs.
	OFF:	APM hardware failure.
② APM ENABLED	ON:	Board is OK and APM has received the ENABLE APM Command.
	OFF:	Turned off during power-up self-diagnostics, by any ERROR condition, or upon receiving the RESET Command.
③ DRIVE ENABLED	ON:	APM is capable of controlling position.
	OFF:	Turned off following power-up, in an ERROR condition or upon a RESET or DISABLE DRIVE Command.

USER ITEMS
Figure 2 (part 2 of 3)

MODULE DIP-SWITCH SETTINGS

4 Synchronizing Clock

	SW1-1	SW1-2	SW1-3
Independent (Factory Set Configuration)	OPEN*	OPEN*	CLOSED*
Master (Source of Backplane Clock)	CLOSED	OPEN	CLOSED
Slave Clock (Receives Clock from Backplane)	CLOSED	OPEN	OPEN

	SWITCH NO.	FUNCTION CLOSED = ON, OPEN = OFF	STATE
5	SW2-1	Encoder Channel A Input	
		Differential Input (terminated)	CLOSED
		Single-Ended Input	OPEN*
	SW2-2	Encoder Channel B Input	
		Differential Input (Terminated)	CLOSED
		Single-Ended Input	OPEN*
	SW2-3	Encoder Channel Z Input	
		Differential Input (Terminated)	CLOSED
		Single-Ended Input	OPEN*
6	SW3-1	Positive Velocity Causes	
		Negative Tachometer Output	OPEN*
		Positive Tachometer Output	CLOSED
	SW3-2	Sync Start Signal Direction Selection	
		Master (Output)	CLOSED*
		Slave (Input)	OPEN
	SW3-3	Overtravel Limit Switches	
		Enable	OPEN*
		Disable	CLOSED
	SW3-4	Drive OK Input	
		Enable	OPEN*
		Disable	CLOSED
	SW3-5	Full Scale Analog Input Selection	
		± 5 V	CLOSED
		± 10 V	OPEN*

* = Factory Set Default Position.

USER ITEMS
Figure 2 (part 3 of 3)

INSTALLATION

The Axis Positioning Module Type 2 may be installed in a Model 60 CPU rack or in a Series Six PC High-Capacity I/O rack. A maximum of three (3) APM II modules may **be** installed in a Model 60 CPU rack. A maximum of six (6) APM II modules may be installed in any Series Six High-Capacity I/O rack.

Before installing the module, set the Dual In-Line Package (DIP) switches adjacent to the card slot on the rack backplane where the module is to be placed to establish which group of 32 consecutive input and output points in the CPU I/O tables will be used by the module being installed. For further information on the I/O DIP switch settings, refer to Figure 3 and Figure 4.

Set the DIP switches SW-l, SW-2, and SW-3 on the module to the required operating configuration for this application. For reference refer to Figure 2 user items or the APM II Manual, GEK-90800.

Remove power from the rack while installing the module. Use the extraction/insertion tool furnished with the Series Six rack to remove or install the module.

Guide the faceplate over the circuit board so that proper contact is made. Then secure the faceplate to the rack using the thumbscrews at the top and bottom of the faceplate.

Connect the field wiring to the terminal board on the faceplate at this time. Verify that the proper wiring has been made. For guidance on the wiring of the external circuits to this module refer to the APM II Manual, GEK-90800.

WARNING

Voltages from user field devices could be present on the faceplate terminals of this module, even if the power supply in the Model 60 CPU rack or the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

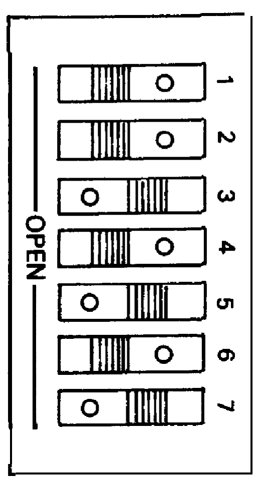


Figure 3 TYPICAL I/O BACKPLANE DIP SWITCH

I/O ADDRESSING

Figure 4 shows the allowable I/O addresses and corresponding Dual In-Line Package (DIP) switch settings.

INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION					INPUT NUMBER	DIP SWITCH POSITION				
	7	6	5	4	3		7	6	5	4	3		7	6	5	4	3
1-32						353-384		X		X	X	705-736	X		X	X	
33-64					X	385-416		X	X			737-768	X		X	X	X
65-96				X		417-448		X	X		X	769-800	X	X			
97-128				X	X	449-480		X	X	X		801-832	X	X			X
129-160			X			481-512		X	X	X	X	833-864	X	X		X	
161-192			X		X	513-544	X					865-896	X	X		X	X
193-224			X	X		545-576	X				X	897-928	X	X	X		-
225-256			X	X	X	577-608	X			X		929-960	X	X	X		X
257-288		X				609-640	X			X	X	961-992	X	X	X	X	
289-320		X			X	641-672	X		X			993-1024	X	X	X	X	X
321-352		X		X		673-704	X		X		X		(NOT USED)				

$\boxed{X}$ = SWITCH IN OPEN POSITION (DEPRESSED TO THE LEFT)

SWITCHES NO.1 AND NO.2 SHOULD BE IN CLOSED POSITION

Figure 4. DIP SWITCH SETTINGS

ORDERING INFORMATION

Circuit Board and Faceplate	Circuit Board	Faceplate
IC600BF917D	IC600YB917D	IC600FP917A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

MAY 1987

SERIES SIX

PROGRAMMABLE CONTROLLERS

ADVANCED I/O RECEIVER MODULE

GENERAL DESCRIPTION

The Advanced I/O Receiver module enables the Series Six I/O to be more versatile in the ways in which I/O failures are detected and enables the Series Six CPU to respond to these occasional faults in an intelligent and controlled manner. When using this module, all levels of Series Six software can be programmed using relay logic to respond to I/O faults, such as, a power supply failure or a break in the I/O cable. When this module is used with CPU software level 105 or above, relay logic can also be used to address the problems of input and output parity errors.

In many applications it is desirable to allow the user program to decide whether the CPU should stop on an I/O system error or continue to run under controlled conditions. This module allows that decision to be made. A decision can also be made to select a particular I/O chain (usually the chain that contains the fault) to be shut down while allowing the balance of the system to continue to run.

The Advanced I/O Receiver module provides status information accessible to the CPU user program indicating where in the I/O system an error occurred, and what type of error it was. Using this information the CPU can be programmed to respond in a controlled manner based upon the type of error detected. Errors sensed by this module include input and output parity, power supply failure, and I/O cable failures. The features and benefits of this module are provided in the following table.

Table 1
FEATURES AND BENEFITS

FEATURES	BENEFITS
Parity detection and generation circuits	I/O data integrity protection
Diagnostic status provided to CPU user program	Allows controlled response to I/O faults
Transient fault detection	Rapid fault isolation/repair
Faceplate LED indicators	Simplifies troubleshooting
Hardware configurable	Utilized in all I/O systems
Usable in all I/O racks	Reduce spare parts inventory

DESCRIPTION OF OPERATION

The Advanced I/O Receiver module (IC600BF830B) is designed to be placed into the left most slot of an I/O rack and has the ability to perform all the functions of the Standard I/O Receiver module (IC600BF800B) plus many additional fault diagnostic functions.

NOTE

The default switch settings on this module have all the advance features disabled, thus, permitting the module to respond as if it were a Standard I/O Receiver module (IC600BF800B).

To access the diagnostic information of the Advanced I/O Receiver module, the user must assign the module an Input and Output address location. Two 7-segment dip switches are provided on the lower right hand corner of the module for this purpose. One set of dip switches is used to select an Input address, while the other set is used to select an Output address. Unlike I/O modules the addresses DO NOT have to be the same, although identical addresses can be selected. The 7-segment switches are set in the same pattern as that used for standard I/O addressing. It is important to note that the I/O address accessibility is not enabled until SW3 on a third "Option Select" dip switch is set to the enabled position. The default address setting is I/O 993.

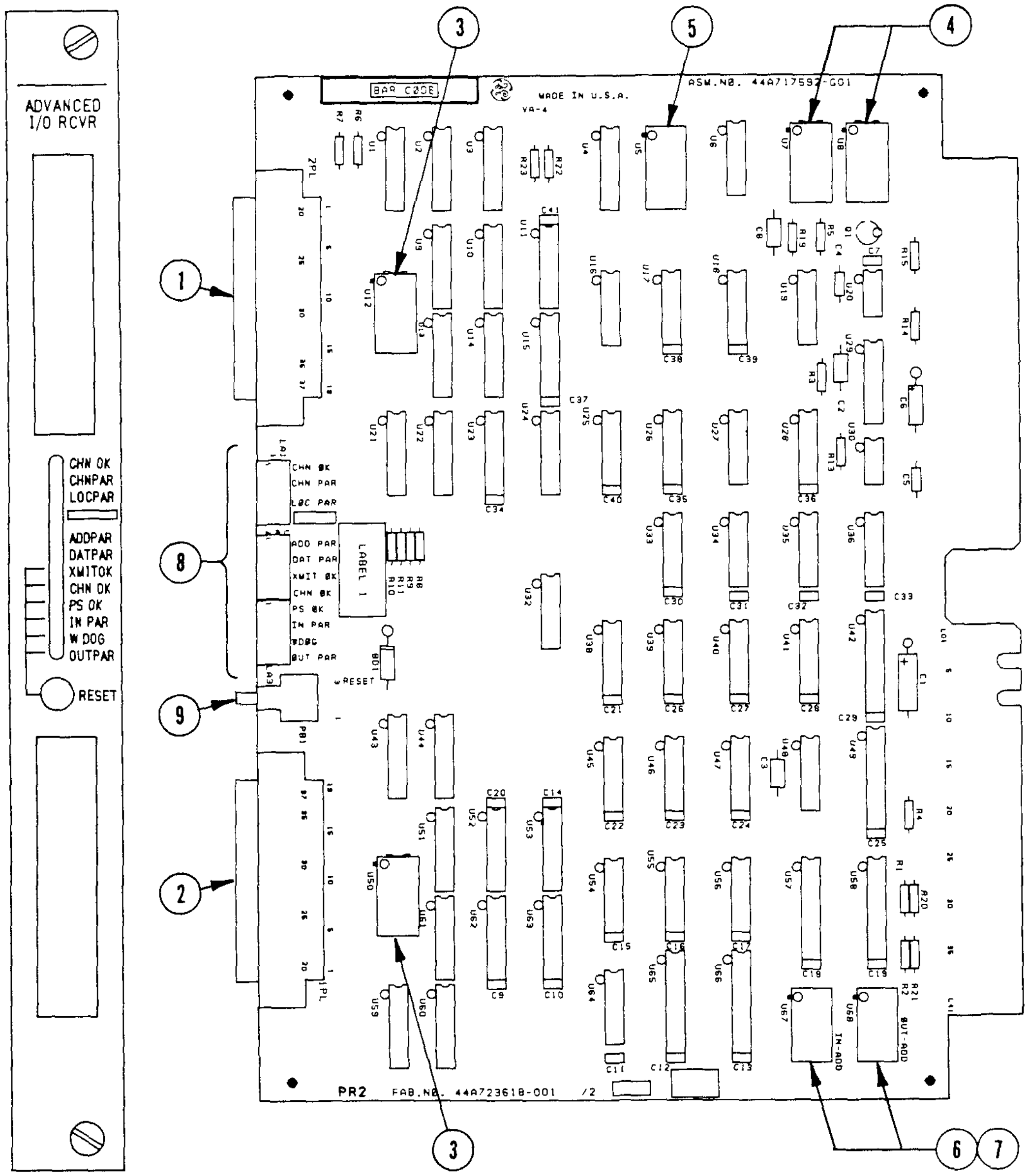
When the Advanced I/O Receiver module is placed in an I/O rack there are two 37-pin connectors available through the faceplate. The top connector receives an I/O cable that is connected to an upstream I/O rack or directly to the CPU. If coming from another upstream I/O rack, it may be connected to a Standard or Advanced I/O Receiver module, or to a Local I/O Transmitter module. The bottom connector can be left unconnected, connected to a Standard or Advanced I/O Receiver module, or be connected to a Workmaster Programmer or Program Development Terminal. Any of the above modules can be connected and intermixed to meet the requirements of a given application. On both the Standard and Advanced I/O Receivers, the top and bottom connectors are internally connected together, thus, data signals can pass through them even though the I/O rack may be nonfunctional. In the Advanced module, data can also pass through even if the power supply is turned off.

Located on the Advanced I/O Receiver module are two identical dip resistor pacs whose socket locations determines if the module is used in an intermediate I/O rack or used in the last rack of a given I/O chain. The module is configured for use in an intermediate rack when the dip resistor pacs are located in sockets U7 and U8 (default positions). When configured as the last rack in an I/O chain, the resistor pacs must be located in sockets U 12 and U50. The resistor pacs are identical and thus can be interchanged.

Refer to Table 1 and Figure 1 for module specification and user component layout.

Table 1
MODULE SPECIFICATIONS

Dimensions: Circuit Board: 8.15 x 11.0x 1.20 (inches) 208 x 280 x 31 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm) Power Requirements: 5VDC, 680 mA typical, 1.2A maximum, supplied by I/O rack power supply	Operating Temperature: 0 - 60°C (outside of rack) Storage Temperature: - 2 C - +80°C Humidity: 5% - 95% non-condensing



1 D-type 37-pin connector to upstream modules
2 D-type 37-pin connector to downstream modules
3 Resistor pac locations for last I/O rack in chain.
4 Resistor pac locations for intermediate I/O rack in chain.
5 Dip switch for selection of module options.
6 Dip switch for selection of Input address.
7 Dip switch for selection of Output address.
8 Location of 12 LED diagnostic indicators.
9 Location of external Reset pushbutton.

Figure 1
LOCATION OF USER ITEMS

Twelve LED diagnostic indicators, visible through the faceplate, are mounted on the Advanced I/O Receiver module. These LED's are used to indicate status and the results of diagnostic routines executed by the module. The last six indicators are latched-in (or turned off) when a fault is sensed as some faults may be transitory or intermittent. These latched-in fault indications can be reset (if the fault is cleared) by depressing the RESET pushbutton that is accessibIe through the faceplate, or by CPU logic sending a latch reset signal through the I/O chain, This signal is read by the module via the I/O addresses that have been previously set and enabled. Cycling the power of the rack that contains the module will also reset the LED indicators. Note that the power supply OK LED indicator will be latched off when this is done. The following table describes the function of each diagnostic indicator.

Table 2
LED INDICATORS

CHN OK	– CHAIN OKAY, ON if power is okay in all downstream racks, and if cable continuity is okay to all downstream racks; OFF if one of the above conditions is not met.
CHNPAR	– CHAIN PARITY, ON if Output Parity is okay on rack backplane; OFF if Output Parity Error is sensed from a Local Transmitter or Remote I/O Driver in this rack.
LOCPAR	– LOCAL PARITY, ON if Output Parity is okay in this rack; OFF if this module has detected an Output Parity Error entering from an upstream rack.
BLANK	– The state of this LED is controlled by CPU logic and transmitted to the module via its I/O address. The default state of this LED is ON.
ADDPAR	– ADDRESS PARITY, ON if no error is detected in the I/O address transmitted from the CPU through the l/O chain; OFF if a Parity Error is detected in the T/O address transmitted from the CPU. Successful retransmission of the address will clear the Parity Error.
DATPAR	– DATA PARITY, ON if no error is detected in the I/O data transmitted from the CPU through the I/O chain; OFF if a Parity Error is detected in the I/O data transmitted from the CPU. Successful retransmission of data will clear Parity Error.
XMITOK	– TRANSMIT OKAY, ON if power is okay and cable continuity is okay to all downstream racks connected to a Local Transmitter or Remote I/O Driver module that is located in this rack; latched OFF if the above conditions are not met in one or more of the connected racks.
CH OK	– CHAIN OKAY, ON if power and cable continuity is okay to all downstream racks directly connected to this Advanced I/O Receiver; latched OFF if the above conditions are not met in one or more of the connected racks.
PS OK	– POWER SUPPLY OKAY, ON if power supply in this rack is within tolerance; latched OFF if power supply should fall out of tolerance. LED will be latched off when power is applied to power supply.
IN PAR	– INPUT PARITY, the source of Input Parity Error is determined by the settings of SW6 and SW7 of the diagnostic dip switch; the LED is ON if no Input Parity Error is sensed; latched OFF if an Input Parity Error is sensed from either a Local I/O Transmitter or Remote I/O Driver module mounted in this rack, or from any downstream I/O rack that may be connected directly to the Advanced I/O Receiver module in this rack.
W DOG	– WATCH DOG TIMER, ON when communications to the CPU is okay; iatched OFF if the module has not communicated to the CPU within the last one second.
OUTPAR	– OUTPUT PARITY, ON if no Parity Error is detected in either the I/O address or I/O data transmitted from the CPU; latched OFF if a Parity Error is detected. This is a latch for ADDPAR and DATPAR indicators previously discussed.

Before discussing the selectable options available when using the Advanced I/O Receiver module, an understanding of Series Six CPU I/O diagnostics is required. Three I/O fault types are recognized by the CPU. They are:

Input Parity fault
Output Parity fault
I/O Chain fault,

The following discussion explains CPU and I/O fault response when using the Standard I/O Receiver module (IC600BF800B).

Input Parity can only be sensed by the CPU, and, when detected as an error, the CPU will issue a RESET command, and then, goto a STOP condition. The RESET command is sent to all I/O racks and will turn off all outputs except for those on a module that can be selected to Hold Last State, The input parity setting is first set in the I/O Receiver module of the rack which contains that I/O address. If the CPU calculates a different parity, it will automatically perform a single retry. If this retry also returns with a parity error, the CPU will set the Input Parity Fault bit, store the input address, issue a RESET command to the I/O bus and enter a STOP state.

Output Parity is sensed by each I/O Receiver module, even if its I/O rack wasn't set to the output address that the parity error was detected in. The output parity setting is first set in the CPU and sent to the I/O chain with every output address and data byte. If an I/O Receiver module detects an Output Parity error (CHNPAR LED), a signal will be returned to the CPU and a single retry will be attempted. If the error remains, the CPU will set the Output Parity Fault Bit, stores the output address, and issues a RESET command to the I/O bus forcing all outputs off, unless they are connected to a module which can select Hold Last State. After a RESET signal is sent, the CPU will goto a STOP condition. A Parallel Transmitter or a Remote Driver module can also detect Output Parity errors (LOCPAR LED) and issue the Parity Error signal to the CPU.

I/O Chain faults (CHN OK LED) can be sensed in any I/O Receiver module. The module is designed to detect downstream power supply faults, and faults in the I/O cable continuity, both of which will cause the I/O Chain Fault signal to be returned to the CPU. If this signal is received by the CPU, a RESET command will be issued to the I/O bus forcing all outputs off, unless they are connected to a module which can select Hold Last State. After the RESET signal is sent, the CPU will goto to a STOP condition.

Keeping the above facts in mind, the following will explain the function of each of the eight selections available on the Option Select dip switch located at the top center of the Advanced I/O Receiver module. The module is shipped with all eight switches in the closed or disabled position, allowing the module to perform only as a Standard I/O Receiver module. A table guide and explanation of the Option Select switches follows.

SWITCH 1:	Disable downstream I/O Chain Fault.
SWITCH 2:	Disable I/O Chain Fault from backplane.
SWITCH 3:	Enable Diagnostics
SWITCH 4:	Disable return of Output Parity.
SWITCH 5:	Disable Watchdog Timer RESET to backplane.
SWITCH 6:	Enable local parity error to turn on ‘IN PAR’ LED.
SWITCH 7:	Enable I/O Chain Parity to turn on ‘IN PAR’ LED.
SWITCH 8:	Not used.

SWITCH 1:

The Series Six I/O system has extensive error checking logic to verify that each rack has a functional power supply, and that each I/O cable is connected. The I/O Receiver modules are designed to check for downstream power supply and cable failures of racks connected in a daisy chain from the lower connector of the module and, issue an I/O Chain Fault signal to the CPU if a problem is detected. A failure of this type can mean a loss of a major portion of the control system, and thus, the CPU is normally setup to issue a RESET command and goto a STOP condition when an I/O Chain Fault signal is received. Switch 1 selects what the module does with this signal when it is received at the bottom cable connector. When **CLOSED,** the signal is passed through on towards the CPU and, unless intercepted by another Advanced I/O Receiver module upstream, will cause the CPU to issue a RESET command. Both CHN OK LED's will be turned off or latched off. If set in the **OPEN** position, the signal will be blocked, thus, allowing the CPU to continue to scan. With this switch setting, the first CHN OK LED will remain on, and the second CHN OK LED will be latched off and Bit 2 in the Input byte is set to a ' I'.

SWITCH 2:

The Series Six I/O system can also detect power supply and cable faults in I/O racks that are connected to the system via Local Transmitter or Remote I/O Driver modules. These downstream faults, if not inhibited by an Advanced I/O Receiver, are passed through the above modules and via the rack backplane to the Receiver module located in that rack. From here, the signal is passed upstream until it reaches the CPU, or is blocked by another Advanced Receiver module. This I/O Chain Fault signal, when received by the CPU will react as described above. Switch 2 selects what the module does with this signal when received from either a Local Transmitter or Remote I/O Driver module. When **CLOSED,** the signal is passed through the module to the next I/O rack or to the CPU. If a error is sensed, the CHN OK LED will be turned off, and the XMITOK LED will be latched off. If set in the **OPEN** position, the signal will be blocked, thus allowing the CPU to continue to scan. Whenever this fault is sensed, the CHN OK LED will remain **on, and** the XMITOK LED will be latched off and Bit 1 of the Input **byte is** set to a '1'.

SWITCH 3:

This switch provides overall control of ALL diagnostics provided by the Advanced I/O Receiver module. If **CLOSED,** the module will perform as a Standard I/O Receiver module (IC600BF800B), and, no additional diagnostics will occur. When set to the **OPEN** position, the diagnostic features selected via the other switches will be enabled, and, the I/O addresses selected on the remaining two 7-segment dip switches will be activated. In either switch setting, the LED indicators will all be active.

SWITCH 4:

All I/O data transfers are protected by a parity bit that is attached to the input or output data byte, and in the case of outputs, parity is also checked on the address byte. Parity is set at the sending end and verified by each module that it passes through. Input data parity returning to the CPU is checked at every Advanced I/O Receiver it passes through. If a parity fault is sensed, that module will latch off the IN PAR LED and set an internal bit that may be transferred to the CPU signaling the location(s) that sensed the error. An Input Parity error received by the CPU, after a second retry, will cause a RESET command to be sent to the I/O Chain followed by the CPU going to a STOP condition. Only with Level 105 or higher CPU software can this be prevented. Output Parity is checked at every I/O Receiver module the data passes through. Switch 4 determines what the module will do if it senses an Output Parity Error. In the CLOSED position, the module will sense a parity error and send the Output Parity Error signal up the chain to the CPU. The OUTPARLED will be latched off and either the ADDPAR or DATPAR LED will turn off. This Output Error signal will cause the CPU, after a second retry, to issue a RESET command and then goto a STOP condition. In the **OPEN** position, the Output Parity Error signal will be blocked from going upstream to the CPU only if the source of the error is from an upstream connection. Both the CHNPAR and LOCPAR LED's will remain on, while the ADDPARor DATPAR, and OUTPARLED's will turn off. Bit 6 of the Input byte is set to a '1'.

SWITCH 5:

The Advanced I/O Receiver module is provided with a built-in Watchdog Timer, similar to the one built into all CPU's The timer is reset whenever the I/O channel is accessed. If this Watchdog Timer should time out, 1 second +/-IO%, it will issue an internal RESET command to this rack (if not blocked) and to any rack connected via a Local Transmitter or Remote I/O Driver module. Upstream and downstream racks connected directly to the Advanced I/O Receiver module will not be effected. In effect, the rack has failed to communicate to the CPU for at least 1 second. CPU's that have their power shut off or an internal fault, or if an I/O cable should fail would cause the Watchdog Timer to time out. A CPU that had its keyswitch turned to the STOP position would not cause the timer to time out. Thus, in the unlikely event that the CPU should stop scanning, and the rack Output Enable line is set high, this timer would prevent outputs from being uncontrollably left on for long periods of time. Output devices that are set to Hold Last State, and have user power connected, will not be reset by the Watchdog Timer. The function of Switch 5 is to determine what to do with this signal if the timer should time out. In the CLOSED position, this signal will be blocked and will have no effect on the outputs. In the OPEN position, the RESET signal from the Watchdog Timer will be issued to the backplane causing its outputs and those connected via Local Transmitters or Remote I/O Drivers to be forced off. The W DOG LED will be latched off if this Watchdog Timer should ever time out. Bit 5 of the Input byte is set to 'I'.

SWITCH 6 and 7:

The IN PAR LED is controlled from two different internal signals. The first signal, controlled by Switch 6, comes from the rack backplane and contains an Input Parity Error that was received by a Local Transmitter or Remote I/O Driver. The second signal, controlled from Switch 7, comes from the bottom connector of the module and senses Input Parity Errors from a downstream rack. The function of switches 6 and 7 is to determine what signal(s) drive the IN PAR LED. In the CLOSED position, the signal is allowed to latch the LED off. The default setup allows both signals to drive the LED. If the OPEN position is set, the signal will be blocked, If both switches are open, no signal will be applied and the LED will remain ON with no function. Bit 4 of the Input byte will be set to a ' 1' if an Input Parity Error is detected.

SWITCH 8:

This switch has no function, but *must* be closed.

I/O ADDRESS FUNCTIONS

If the Advanced I/O Receiver module is set to use any or all of its advanced diagnostic functions (SW 3 of the Option Select switches set to OPEN), it will be required to use one or both of the Input and Output addresses selected by the individual dip switches on the module. Any valid I/O address can be selected. Refer to GEK-25361, Installation and Maintenance Manual, for details. The state of the output data (0 or 1) is controlled by the CPU relay logic entered by the user. The state of the input data bits (0 or 1) is controlled by the individual Advanced I/O Receiver modules. Tables of Input and Output bit assignments and a description of their use follows. Each address byte contains 8 bits of data, with bit 1 being the least significant bit.

Table 4
INPUT ADDRESS BYTE

BIT 1:	Set if Chain I/O Fault is sensed from backplane.
BIT 2:	Set if Chain I/O Fault is sensed from downstream rack connected to the bottom connector of the module.
BIT 3:	Set if rack power supply is out of tolerance or if power is turned on or restored to the rack.
BIT 4:	Set if Input Parity is sensed from any location.
BIT 5:	Set if Watchdog Timer times out.
BIT 6:	Set if Output Parity is detected.
BIT 7:	Set if resister pacs are set for intermediate rack.
BIT 8:	Set at all times to indicate an Advanced Receiver.

INPUT BYTE, BIT I: This bit is set to a '1' if an I/O Chain Fault is sensed on the backplane of the rack. The fault signal will come from either a Local Transmitter or a Remote I/O Driver module. Refer to Switch 2 and to LED's CHN OK and XMITOK. This bit will remain set to '1' as long as the XMITOK LED is latched off. The module will set this bit to '0' if a latch reset signal is received, if the Reset pushbutton is depressed, or if rack power is cycled.

INPUT BYTE, BIT 2: This bit is set to a '1' if an I/O Chain Fault is sensed coming from a downstream rack connected to the bottom connector of the module. Refer to Switch I and to LED's CHN OK and CHN OK. This bit will remain set to a 'I' as long as the CHN OK LED is latched off, The module will reset this bit to a '0' if a latch reset signal is received, if the Reset pushbutton is depressed, or if rack power is cycled.

INPUT BYTE, BIT 3: This bit is set to a '1' if the rack power supply is out of tolerance or if power has been cycled to the rack. Refer to PS OK LED. This bit will remain set as Iong as the PS OK LED is latched off. The module will set this bit to a '0' if 3 latch reset signal is received, if the Reset Pushbutton is depressed, or if rack power is cycled.

INPUT BYTE, BIT 4: This bit is set to a '1' if an Input Parity Error is sensed from either a Local Transmitter, a Remote I/O Driver, or from a downstream rack connected to the module. Refer to Switches 6 and 7 and LED IN PAR. This bit will remain set as long as the IN PAR LED is latched off. The module will set this bit to a '0' if a latch reset signal is received, if the Reset Pushbutton is depressed, or if rack power is cycled.

INPUT BYTE, BIT 5: This bit is set to a '1' if the on board one second Watchdog Timer has timed out. Refer to Switch 5 and LED W DOG. This bit will remain set as long as the W DOG LED is latched off. The module will set this bit to a '0' if a latch reset signal is received, if the Reset Pushbutton is depressed, or if rack power is cycled.

INPUT BYTE, BIT 6: This bit is set to a '1' if an Output Parity Error is detected on the module in a signal coming in from an upstream rack. Refer to Switch 4 and LEDs CHNPAR, LOCPAR, and OUTPAR. Output Parity errors from downstream racks will not set this bit. This bit will remain set as long as the OUTPAR LED is latched off. The module will set this bit to a '0' if a latch reset signal is received, if the Reset Pushbutton is depressed, or if rack power is cycled.

INPUT BYTE, BIT 7: This bit is set to a '1' only if the two identical dip resistor pacs are located in sockets U7 and US for use as an intermediate I/O rack. This bit is set to a '0' if the above condition is not true.

NOTE: If the dip pacs are not installed, or are improperly installed, the bit will be set to '0'.

INPUT BTYE, BIT 8: This bit is set to a '1' at all times and cannot be changed or reset. This bit is used to indicate to the CPU that an Advanced I/O Receiver module is

Table 5
OUTPUT ADDRESS BYTE

BIT 1:	If set, the CPU logic RESET command is sent.
BIT 2:	If set, the LED latches will be cleared.
BIT 3:	If set, the User LED will come on.
BIT 4:	If set, the module will write data to its Input add.
BIT 5:	If set, the module will block the CPU RESET command.
BIT 6:	If set, the module will not send local input data.
BIT 7:	If set, disable I/O Chain Fault from connector.
BIT 8:	If set, disable I/O Chain Fault from backplane.

OUTPUT *BYTE,* BIT 1: If set to a '0', no action is taken by the module. If set to a 'I', the module will react as if the CPU has sent a RESET command and will turn off all outputs in its rack and all outputs connected via a Local Transmitter or Remote I/O Driver. Output modules set to Hold Last State will not be effected. This RESET state will be held until this bit is set to a '0' value.

OUTPUT BYTE, BIT 2: If set to a '0', no action is taken by the module. If set to a 'I', the module will reset all LED latches, thusly, turning on any of the six LED's that may have been latched off, and removing from the Input byte any associated data. A leading edge trigger is used and latches will reset if the fault is not cleared. For maximum efficiency, it is desirable to have the input address byte less than or equal to the output address byte. Refer to Output Bit 4 where the opposite is true.

OUTPUT BYTE, BIT 3: This bit controls the state of the User LED. If set to a '0' the LED will be on. If set to a 'l', the LED will turn off. The User LED is controlled by the user's relay logic program and may be used to indicate which rack requires servicing based upon analysis of diagnostic data returned, or may merely turn on or flash to obtain an operator's attention. The User LED is the 4th LED down from the top.

OUTPUT BYTE, BIT 4; If this bit is set to 'O', the module will NOT send its Input data bits when the selected lnput address is polled. This bit MUST be set to a '1' for this data to be returned to the CPU. This function *is* provided so that several Advanced I/O Receiver modules can be multiplexed to the CPU using only one Input address byte. In this example, each module must have a different Output address so the CPU can select which module it wishes to receive data from. This function will help conserve valuable input addresses. When using this function to multiplex data, the output addresses must be lower than or equal to the input address.

OUTPUT BYTE, BIT 5 This bit is used to control the CPU RESET command which is sent whenever the CPU detects an internal fault or an external I/O Chain Fault or Parity Error, or if power is removed from the CPU. If this bit is set to a '0', the module will respond to this RESET signal and turn off all outputs in its rack and those connected via a Local Transmitter or Remote I/O Driver module. The RESET signal will pass through to downstream racks. Modules with Hold Last State set will not be effected. Also, a downstream Advanced I/O Receiver module may block transfer of this signal into its rack. If this bit is set to a 'l', the module will ignore the CPU RESET command, and all outputs will remain as set. The RESET signal is still passed through the bottom connector to downstream racks. If this output bit is set, and the CPU shuts down, the outputs will remain set for one second until the module's local Watchdog Timer times out.

Note: Switch 5 can disable the Watchdog Timer reset signal, and thus, ALL outputs will remain in a Hold Last State condition.

OUTPUT BYTE, BIT 6: Ii this bit is set to '0', the module will take no action. If set to a 'I', ALL Input data from Input modules plugged into this rack will be prevented from going to the CPU Input Table. Using this bit, inputs from multiple racks can be multiplexed into identical addresses. This feature also allows the tracking down of modules that are mistakenly set to the same input address.

OUTPUT BYTE, BIT 7: If this bit is set to '0', the module will take no action. If set to a 'I', it will have the same effect as Switch 1 and prevent an I/O Chain Fault, coming from the rack backplane, to be transmitted upstream to the CPU.

OUTPUT BYTE, BIT 8 If this bit is set to '0', the module will take no action. If set to a 'l', it will have the same effect as Switch 2 and prevent an I/O Chain Fault, coming from a downstream rack connected to the bottom connector of the module, to be transmitted upstream to the CPU.

CPU SOFTWARE LEVEL 105 OR HIGHER

In addition to the flexibility provided by the Advanced I/O Receiver module, changes in the CPU executive program must also be made if full diagnostic advantage is to be taken. In CPU software levels up to Level 104, the CPU is instructed to goto a STOP state whenever it reads two consecutive input or output parity errors on the same address or data byte. With the diagnostic functions made available with this module, this mandatory STOP feature may not be required or desired. A user diagnostic program can pinpoint the source of the problem, isolate it, force it to a safe or known condition, and thusly, allow the CPU to remain in RUN and execute control over the remaining I/O structure. Level 105 software (or above) will allow the user to have this level of control over the Series Six CPU.

Level 105 software takes advantage of the STATUS function and uses it in the following manner.

```
             Rnnnn
--] [---[STATUS]
             HHHH
```

When continuity is made to the STATUS function, the bits of Rnnnn take on the following meaning.

BIT 16: 0 - Level 105 enhancements are disabled.
1 - Level 105 enhancements are enabled.

BIT 15: 0 - Noaction.
1 - Set I/O Parity retries to the number set in Bits l-8.

BIT 14: 0 - No action.
1 - DO NOT stop CPU upon detection of I/O Parity fault even though all retries have failed. Input table will remain unchanged.

BITS 9-13: No function defined.

BITS l-8: Contains retry attempts, O-255. If 0, a single retry will be attempted.

When continuity is not made to the STATUS function, the bits of Rnnnn take on the following meaning.

BIT 16: 0 - Level 105 software not enabled.
1– Level 105 software is enabled.

BIT15: O- No Parity Error has occurred.
1– An I/O Parity Error occurred since the last time STATUS was read. It will be set even if the retry was successful.

BIT 14: 0 - No Parity Error has occurred.
1– An I/O Parity Error occurred since the last time STATUS was read and the prescribed number of retries were unsuccessful.

BITS 9-13: No function defined

BITS l-8: Contains the address of the last Parity Error or the last Memory Parity Error.

If Bit 16 is set to a 'l', and continuity is made to the STATUS function, the lower 8 bits will set the number of retries for a parity error. If continuity is not made, the lower 8 bits will display the number of retries. If Bit 16 is set to a '0', and continuity is made to the STATUS function, the DPU and CCM windows can be controlled. If continuity is not made, the lower 8 bits will display the status of the above window selection.

ORDERING [NFORMATION

CIRCUIT BOARD AND FACEPLATE .... , ...	JC600BF830B
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GE Fanuc Automation North America, Inc., Charlottesville, Virginia

MARCH, 1985

Series Six
Programmable Controllers

GEK-90824D
July 1989

Input/Output Communications Control Module (I/O CCM)

IC600BF948

General Description

The Input/Output Communications Control Module (I/O CCM) provides a serial data link between the CPU of a Series Six programmable controller and many other devices. Some devices which can be connected are:

- CCM2, CCM3, or I/O CCM in a Series Six PLC.
- Data Communications Unit (DCU) in a Series One, or Series One Plus or Series One Junior PLC.
- Data Communications Module (DCM) in a Series Three PLC.
- VuMaster and Factorymastersoftware running on the Workmaster computer.
- Intelligent devices such as a host computer.
- Process **Control** Systems.

The I/O CCM contains two independently configurable serial ports. Both ports support RS-232 and **RS-422** serial interfaces, with Port 1 also supporting active/passive 20 mA current loop. Both ports support asynchronous serial communications with data rates of up to 19.2 Kbps. The user may select any of the following options using DIP switches.

Data rate: 110 to 19.2 Kbps. Maximum data rate is limited to 4800 Kbps for current loop operation on Port 1.

Protocol type: For CCM mode -- master, slave, or peer. For Remote Terminal Unit (RTU) mode -- RTU slave.

Parity: even odd, none

Turn-around delay: 0 or 500 ms, Port 2 only.

The features and benefits of the I/O CCM are given in Table 1.

Table 1. Features and Benefits

FEATURES	BENEFITS
Contains two programmable communications interfaces.	Permits a data link between the Series Six PLC and a host computer, programmable terminals, and other intelligent devices.
Multiple modules per Series Six PLC.	Permits communication ports as required.
Redundant communications.	Permits duplication of communication hardware and separate data paths by using two I/O CCM modules for each Series Six CPU.
Interfaces to process control systems.	Allows the Series Six PLC to be used with process control systems.
Ability within the user logic program to initiate a data transfer or request to a host computer or another intelligent device.	Allows the Series Six PLC to act as a master or peer in its relationship with other PLC's, host computers, or smart terminals.
On-board diagnostics and board fault indicator lights.	Simplifies troubleshooting and indicates correct data transfer.

The I/O CCM can be used in communications systems using:

- Multidrop modem based links
- Multidrop RS-422 links
- Radio links (port 2 only)

NOTE

As a master device port 1 or port 2 can be used in multidrop configuration; As a slave device only port 2 can be used in multidrop configurations.

The module provides isolation of the serial port receivers and transmitters and also provides 1500 volts of isolation protection from port to port and from the ports to the rest of the Series Six PLC system.

Six Light-Emitting Diodes (LEDs) show port activity and module status. If the on-board power-up diagnostics detect a failure, the BOARD OK LED will remain OFF and the lower five LEDs will provide an error code to specify the error. (See Table 5 for the specific power-up error codes).

The CPU COMM LED blinks to indicate communications between the I/O CCM module and the Series Six CPU.

The remaining four LEDs show port activity of the transmitters and receivers on both ports. They will BLINK when a port is communicating and will be OFF when an error occurs on a particular port.

The I/O CCM may be inserted in a high-capacity I/O rack or a Series Six CPU rack I/O slot.

Table 2, RS-232C/RS-422 **Cable Specifications**

Length, Maximum - 50 feet (15 meters) for RS-232C;
4000 feet (1.2Km) for RS-422;
1,000 feet (305 meters) for current loop.

Overall Shield Recommended

24 AWG Minimum

Mating connector to Port 1 or Port 2 is a D-Subminiature Type. Cannon DB25P (Solder Pot) with DB11096B-3 Hood or Equivalent. (Standard RS-232C male connector.)

The following cables provide acceptable operation at data rates up to 19.2 Kbps and distances up to 4000 feet.

Belden - 9184

Belden - 9302

NEC - 222PlSLCBT

At shorter distances, almost any twisted pair or shielded twisted pair cable will work. It should be noted that RS-422 requires that the transmitter and receiver ground be within a few millivolts of each other or damage to the transmitter and receiver may result.

It is also noted that the twisted pairs should be matched so that both transmit signals make up one twisted pair and both receive signals make up the other twisted pair. If this is ignored, then cross-talk can result from the mis-matching which may affect the performance of the communication system.

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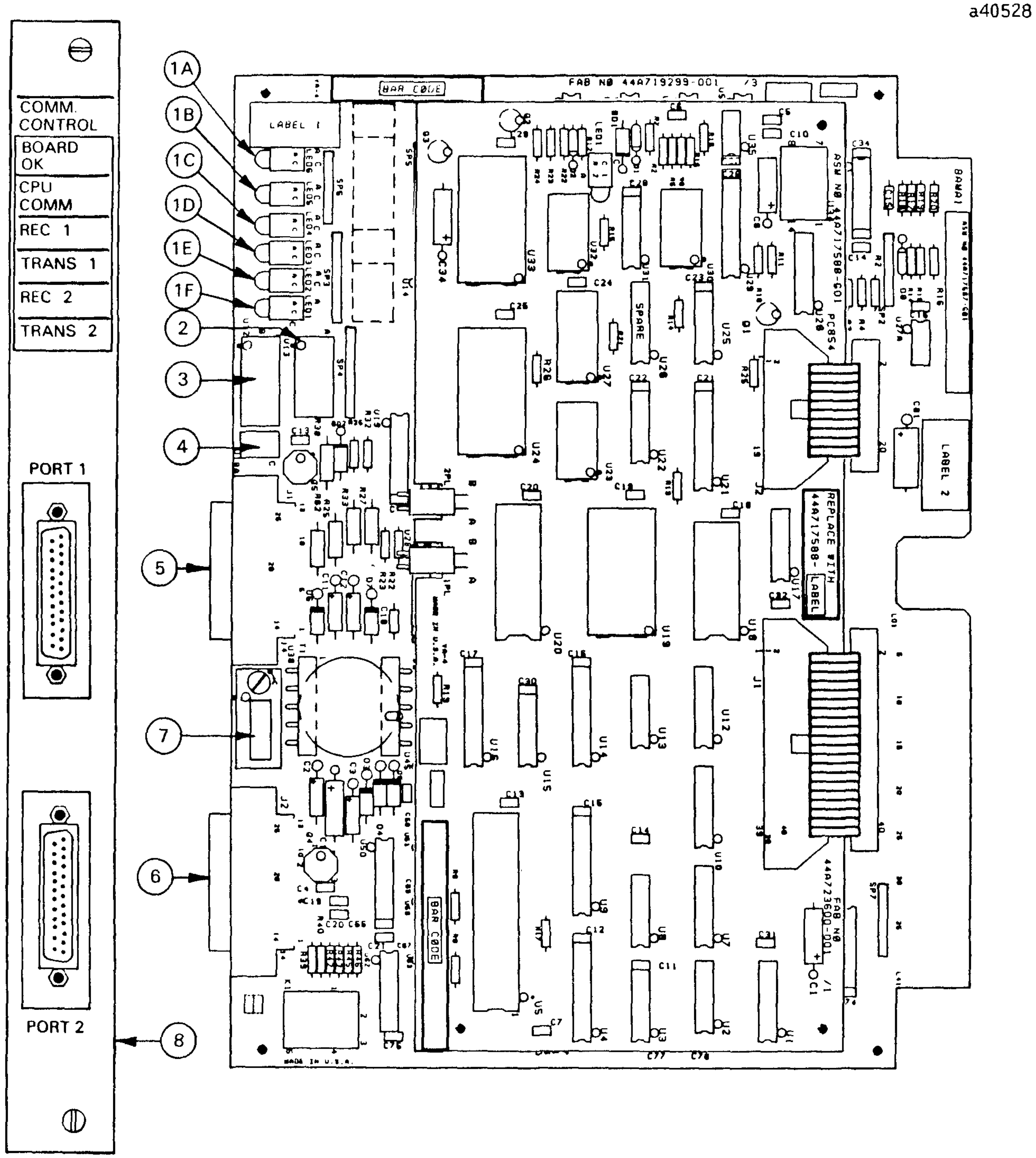

Figure 1. User Items

1. LED Status Indicators (see Table 3).
2. Bank A DIP Switches.
3. Bank B DIP Switches.
4. Bank C DIP Switches.
5. J1 Connector: 25-pin D-type female connector (Communications Port 1).
6. J2 Connector; 25-pin D-type female connector (Communications Port 2)
7. J2 Communication selection DIP package: RS-232 or RS-422 configuration. Read from top of imprinted label.
8. Faceplate

Table 3. LED Status Indicators

LED		DESCRIPTION
(IA) BOARD OK	ON: FLASHING: OFF:	Board has passed self-diagnostics and is operating properly. Invalid slave ID when either port is configured as a slave. Board has failed self-diagnostics (see Table 5).
(1B) CPU COMM	FLASHING	Board is communicating with the Series Six CPU properly. The rate of blink indicates the frequency of CPU communication windows.
	ON:	No communication between the Series Six CPU and the board. (Check DPREQ in ladder diagram and backplane DIP switches for the I/O slot if not flashing).
(1C) REC 1	ON: FLASHING: OFF:	Port 1 serial data communications normal. Serial data being received on Port 1. Port 1 serial data communications error occurred due to parity errors, bad blocks, or serial link timeout.
(lD) TRANS 1	ON: FLASHING: OFF:	Port 1 serial data communications normal. Serial data being transmitted on Port 1. Port 1 serial data communications error occurred due to parity errors, bad blocks, or serial link timeout.
(1E) REC 2	ON: FLASHING: OFF:	Port 2 serial data communications normal. Serial data being received on Port 2. Port 2 serial data communications error occurred due to parity errors, bad blocks, or serial link timeout.
(1F) TRANS 2	ON: FLASHING: OFF:	Port 2 serial data communications normal. Serial data being transmitted on Port 2. Port 2 serial data communications error occurred due to parity errors, bad blocks, or serial link timeout.

Table 4. Serial Data Format

SERIAL DATA FORMAT										
BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	BIT 8	BIT 9	BIT 10
	LSB							MSB	*	
START				ACTIVE	DATA	BITS			PARITY	STOP
0				1	or	0				1

* Parity can be disabled on either port.

If the BOARD OK light turns OFF after the power up self-diagnostics routine, the indicator lights will create one of the patterns below:

Table 5. Power-up Error Codes (• light on, ° light off)

LED	CODE 1	CODE 2	CODE 3	CODE 4	CODE 5	CODE 6	CODE 7
BOARD OK	o	o	o	o	o	o	o
CPU COMM	o	o	o	o	o	o	o
REC 1	o	o	o	o	o	o	•
TRANS 1	o	o	o	o	•	•	•
REC 2	o	o	•	•	o	o	o
TRANS 2	o	•	o	•	o	•	•

Code	Description	Code	Description
1	Processor test failed	5	EPROM test failed
2	Timer 0 test failed	6	RAM test failed (E000-FFFF); board location, U20
3	Timer 1 test failed	7	RAM test failed (C000-DFFF); board location, U19
4	Timer 2 test failed		

Installation

To install and operate the I/O CCM you must complete the following steps.

1. Calculate the power requirements for the rack which will contain the I/O CCM.
2. Set the I/O CCM address using the backplane DIP switches. (Reference Figure 3, Table 6)

   Refer to a later section, "Running at the DPU Executive Window", to set the I/O CCM module to run at the DPU address.
3. Configure the communications port using the on-board DIP switches. (Tables 7, 8, 9)
4. Check the RS-232/RS-422 DIP pack for desired orientation - Port 2 only. (Reference Figure 2)
5. Insert I/O CCM in the rack.
6. If not running at the DPU executive window, program the [DPREQ] or [WINDOW] instruction to establish windows between the I/O CCM and the CPU. The [WINDOW] instruction is valid for CPU microcode Version 130 and thereafter.
7. Program the registers containing the communications command and parameters for the required transfer of data if the I/O CCM is to initiate communications.
8. Set up valid CPU ID number through the CPU scratch pad.
9. Construct and install cable. (Reference Figures 5, 6, 7, and 8)

Power Requirements for the I/O CCM

The I/O CCM may be installed in a Series Six CPU rack I/O slot, the Series Six High-Capacity I/O rack, or a Series Six Plus CPU rack.

The Series Six CPU rack can support a maximum of 300 units of load. Consequently, four I/O CCMs can be powered by the Series Six CPU rack, and when no other loading exists for +12 Vdc, five I/O CCM modules may be installed.

A maximum of five I/O CCM modules can be powered by a high capacity I/O rack. In this case there are 140 units of load remaining for I/O modules with +5v power only.

When other types of I/O modules are to be placed in the same rack as an I/O CCM, calculate the power requirements of all the modules to ensure that the maximum power of the rack is not exceeded. Refer to the power requirements of the I/O CCM in Table 13, and to the appropriate manual or data sheet for other modules.

Positioning the RS-422/RS-232 Hybrid Dip Package

The RS-422/RS-232 hybrid DIP package affects the operation of port 2 only. Verify the position of the configuration hybrid DIP package located between ports Jl and J2, It is marked “232” on one end and “422” on the other end and is mounted on a zero insertion force socket.

Use a small screwdriver to turn the screw which releases the configuration hybrid DIP package from tie socket. Position the package with the desired interface type (RS-232 or RS-422) closest to port Jl. See Figure 2 for proper orientation.

Setting the Module Address

Before installing the module, set the Dual-In-Line Package (DIP) switches adjacent to the card slot on the rack backplane to establish which group of eight consecutive input points in the CPU I/O tables will be used by the module being installed. Figure 3 illustrates a typical I/O DIP switch set for address 673-680 and Table 6 shows switch settings for all possible module addresses.

Refer to a later section “Running at the DPU Executive Window' , to set the I/O CCM module to run at the DPU address.

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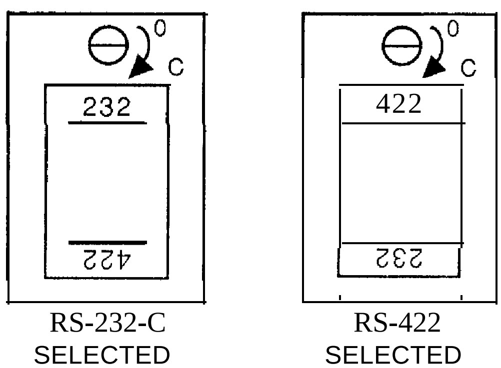

Figure 2. RS-232/RS-422 Hybrid DIP Package (for Port 2)

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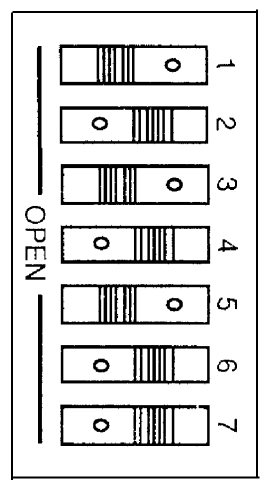

Figure 3. Typical I/O Backplane DIP Switch

Table 6. Setting the Backplane DIP Switch to Address the I/O CCM

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DPREQ REGISTER CONTENTS DECIMAL (HEX) *	I/O POINT	DIP SWITCH POSITION 7	6	5	4	3	2	1	DPREQ REGISTER CONTENTS DECIMAL (HEX) *	I/O POINT	DIP SWITCH POSITION 7	6	5	4	3	2	1
1001 (03E9)	1- 8								1505 (05E1)	505- 512		X	X	X	X	X	X
1009 (03F1)	9- 16							X	1513 (05E9)	513- 520	X						
1017 (03F9)	17- 24						X		1521 (05F1)	521- 528	X						X
1025 (0401)	25- 32						X	X	1529 (05F9)	529- 536	X					X	
1033 (0409)	33- 40					X			1537 (0601)	537- 544	X					X	X
1041 (0411)	41- 48					X		X	1545 (0609)	545- 552	X				X		
1049 (0419)	49- 56					X	X		1553 (0611)	553- 560	X				X		X
1057 (0421)	57- 64					X	X	X	1561 (0619)	561- 568	X				X	X	
1065 (0429)	65- 72				X				1569 (0621)	569- 576	X				X	X	X
1073 (0431)	73- 80				X			X	1577 (0629)	577- 584	X			X			
1081 (0439)	81- 88				X		X		1585 (0631)	585- 592	X			X			X
1089 (0441)	89- 96				X		X	X	1593 (0639)	593- 600	X			X		X	
1097 (0449)	97- 104				X	X			1601 (0641)	601- 608	X			X		X	X
1105 (0451)	105- 112				X	X		X	1609 (0649)	609- 616	X			X	X		
1113 (0459)	113- 120				X	X	X		1617 (0651)	617- 624	X			X	X		X
1121 (0461)	121- 128				X	X	X	X	1625 (0659)	625- 632	X			X	X	X	
1129 (0469)	129- 136			X					1633 (0661)	633- 640	X			X	X	X	X
1137 (0471)	137- 144			X				X	1641 (0669)	641- 648	X		X				
1145 (0479)	145- 152			X			X		1649 (0671)	649- 656	X		X				X
1153 (0481)	153- 160			X			X	X	1657 (0679)	657- 664	X		X			X	
1161 (0489)	161- 168			X		X			1665 (0681)	665- 672	X		X			X	X
1169 (0491)	169- 176			X		X		X	1673 (0689)	673- 680	X		X		X		
1177 (0499)	177- 184			X		X	X		1681 (0691)	681- 688	X		X		X		X
1185 (04A1)	185- 192			X		X	X	X	1689 (0699)	689- 696	X		X		X	X	
1193 (04A9)	193- 200			X	X				1697 (06A1)	697- 704	X		X		X	X	X
1201 (04B1)	201- 208			X	X			X	1705 (06A9)	705- 712	X		X	X			
1209 (04B9)	209- 216			X	X		X		1713 (06B1)	713- 720	X		X	X			X
1217 (04C1)	217- 224			X	X		X	X	1721 (06B9)	721- 728	X		X	X		X	
1225 (04C9)	225- 232			X	X	X			1729 (06C1)	729- 736	X		X	X		X	X
1233 (04D1)	233- 240			X	X	X		X	1737 (06C9)	737- 744	X		X	X	X		
1241 (04D9)	241- 248			X	X	X	X		1745 (06D1)	745- 752	X		X	X	X		X
1249 (04E1)	249- 256			X	X	X	X	X	1753 (06D9)	753- 760	X		X	X	X	X	
1257 (04E9)	257- 264		X						1761 (06E1)	761- 768	X		X	X	X	X	X
1265 (04F1)	265- 272		X					X	1769 (06E9)	769- 776	X	X					
1273 (04F9)	273- 280		X				X		1777 (06F1)	777- 784	X	X					X
1281 (0501)	281- 288		X				X	X	1785 (06F9)	785- 792	X	X				X	
1289 (0509)	289- 296		X			X			1793 (0701)	793- 800	X	X				X	X
1297 (0511)	297- 304		X			X		X	1801 (0709)	801- 808	X	X			X		
1305 (0519)	305- 312		X			X	X		1809 (0711)	809- 816	X	X			X		X
1313 (0521)	313- 320		X			X	X	X	1817 (0719)	817- 824	X	X			X	X	
1321 (0529)	321- 328		X		X				1825 (0721)	825- 832	X	X			X	X	X
1329 (0531)	329- 336		X		X			X	1833 (0729)	833- 840	X	X		X			
1337 (0539)	337- 344		X		X		X		1841 (0731)	841- 848	X	X		X			X
1345 (0541)	345- 352		X		X		X	X	1849 (0739)	849- 856	X	X		X		X	
1353 (0549)	353- 360		X		X	X			1857 (0741)	857- 864	X	X		X		X	X
1361 (0551)	361- 368		X		X	X		X	1865 (0749)	865- 872	X	X		X	X		
1369 (0559)	369- 376		X		X	X	X		1873 (0751)	873- 880	X	X		X	X		X
1377 (0561)	377- 384		X		X	X	X	X	1881 (0759)	881- 888	X	X		X	X	X	
1385 (0569)	385- 392		X	X					1889 (0761)	889- 896	X	X		X	X	X	X
1393 (0571)	393- 400		X	X				X	1897 (0769)	897- 904	X	X	X				
1401 (0579)	401- 408		X	X			X		1905 (0771)	905- 912	X	X	X				X
1409 (0581)	409- 416		X	X			X	X	1913 (0779)	913- 920	X	X	X			X	
1417 (0589)	417- 424		X	X		X			1921 (0781)	921- 928	X	X	X			X	X
1425 (0591)	425- 432		X	X		X		X	1929 (0789)	929- 936	X	X	X		X		
1433 (0599)	433- 440		X	X		X	X		1937 (0791)	937- 944	X	X	X		X		X
1441 (05A1)	441- 448		X	X		X	X	X	1945 (0799)	945- 952	X	X	X		X	X	
1449 (05A9)	449- 456		X	X	X				1953 (07A1)	953- 960	X	X	X		X	X	X
1457 (05B1)	457- 464		X	X	X			X	1961 (07A9)	961- 968	X	X	X	X			
1465 (05B9)	465- 472		X	X	X		X		1969 (07B1)	969- 976	X	X	X	X			X
1473 (05C1)	473- 480		X	X	X		X	X	1977 (07B9)	977- 984	X	X	X	X		X	
1481 (05C9)	481- 488		X	X	X	X			1985 (07C1)	985- 992	X	X	X	X		X	X
1489 (05D1)	489- 496		X	X	X	X		X	1993 (07C9)	993- 1000	X	X	X	X	X		
1497 (05D9)	497- 504		X	X	X	X	X										

* For programming use only: add 1000 to I/O points.

X = Switch in OPEN Position (Depressed to the Left).

Configuring the Communications Ports

Set the DIP switch banks A, B, and C (user items 2, 3, and 4 on Figure 1) on the module to the required configurations (see Tables 7, 8, and 9).

Table 7. Configuration Switches for Port 1 (Bank A)

	SWITCH		FUNCTION
1	2	3	Data Rate Selection
open	open	open	110 bps
closed	open	open	300 bps
open	closed	open	600 bps
closed	closed	open	1200 bps
open	open	closed	2400 bps
closed	open	closed	4800 bps**
open	closed	closed	9600 bps
closed*	closed”	closed*	19.2 Kbps*
4	5	6	Protocol Selection
open	open	open	CCM Master RS-232/RS-422
closed	open	open	CCM Master Current Loop**
open	closed	open	CCM Slave RS-232/‘RS-422
closed	closed	open	CCM Slave Current Loop**
open*	open*	closed*	CCM Peer RS-232/RS-422*
closed	open	closed	CCM Peer Current Loop**
open	closed	closed	RTU Slave RS-232fRS-422
closed	closed	closed	RTU Slave Current Loop**
7	8		Parity Selection
open	open	No parity	
closed	open	No parity	
open*	closed’	Odd parity*	
closed	closed	Even parity	

* Indicates the factory-set default position.

** Maximum data rate for current loop operation is 4800 bps.

Table 8. Configuration Switches for Port 2 (Bank B)

	SWITCH		FUNCTION
1	2		Data Rate Selection
open	open		300 bps
closed	open		1200 bps
open	closed		9600 bps
closed*	closed*		19.2 Kbps*
3	4	5	Protocol Selection
open	open	open	CCM Master RS-232
closed	open	open	CCM Master RS-422
open	closed	open	CCM Slave RS-232
closed	closed	open	CCM Slave RS-422
open*	open*	closed*	CCM Peer RS-232
closed	open	closed	CCM Peer RS-422
open	closed	closed	RTU Slave RS-232
closed	closed	closed	RTU Slave RS-422
6			Turn-Around Delay for CCM and RTU
open*			0 ms*
closed			500 ms
7			Parity Selection
open			No Parity
closed*			Odd Parity*
8			Module Operation
open*			Execute I/O CCM operational software*
closed			Execute factory test software
			Reset Switch
open*			I/O CCM module is enabled*
closed			I/O CCM module is reset

* Factory-set default position.

Table 9. Configuration Switches for Port 1 (Bank C)

SWITCH	FUNCTION
1	RS-232 Operation
open	Disconnects Pins 15, 16 for Port 1 RS-232
* closed	Connects Pins 15 and 16 for Port RS-232 operation (use external jumper if desired across pins 15-16).

* Factory-set default position,

Inserting the I/O CCM in its SIot

Use the extraction/insertion tool to remove or install the module in the Series Six CPU rack, I/O slot, or Series Sk Plus rack.

Guide the faceplate over the circuit board so that proper contact is made. Then secure the faceplate to the rack using the thumbscrews at the top and the bottom of the faceplate.

Power may **now** be applied to the module and other external devices may be connected to either of the ports. After power up diagnostics, the indicator lights should all turn ON.

Programming the I/O CCM

There are two methods of generating window communications between the I/O CCM and the CPU.

DPREQ Windows

DPU Executive Windows

NOTE

The DPU Executive Window method of communication may be used with the following versions (or later) Series Six Logic Control Function cards : IC6OOCB525 for Advanced, IC6OOCB526 for Expanded, and IC600CB515 Expanded II.

Earlier Logic Control Function cards (CB502 for Advanced, CB512 for Expanded) require that a DPREQ be programmed to communicate with the I/O CCM, and the CPU must be set to RUN mode.

Programming the DPREQ

The ladder logic program grants communication windows to the I/O CCM through the programmed DPREQ or WINDOW instruction. The ladder logic programs initiate serial data transfers to another device by loading a command into the I/O CCM command registers.

Program the DPREQ or WINDOW instruction to establish windows between the I/O CCM and the CPU. The WINDOW instruction is valid for CPU microcode Version 130 or thereafter.

Program the registers containing the communications command and parameters for the required transfer of data if the I/O CCM is to initiate communications.

Establishing I/O CCM to CPU Communications Windows

The CPU provides a window to the I/O CCM using the DPREQ instruction (or WINDOW instruction) as shown below. When properly entered, the CPU COMM LED will start blinking to indicate that windows are occurring.

Example ladder logic rung for programming the DPREQ instruction.

```
oxxxx  Rnnnn                                  OYYYY
-1 [---[DPREQ]---------------------------(  )
       HHHB
```

In this program, the I/O CCM will receive a CPU communications window if output Oxxxx is on. The contents of register Rnnnn must correspond to the first I/O point address of the I/O CCM plus 1000 decimal. If the I/O CCM address is for inputs 1-8, then HHHH equals 03E9H (decimal 1001).

When the I/O CCM services the CPU communications window without fault, output Oyyyy will remain off. If a fault occurs during the CPU communication window, Oyyyy will turn on.

The I/O CCM does not process serial transfers until the first window is received after the module has powered up. The module needs the first window to determine the CPU ID number and the CPU register and user **logic** size.

The CPU COMM LED blink rate will show the frequency of DPREQ windows. The LED blinking means that the module detects that the window opened and closed successfully. (The module may or may not transfer data during that window).

The frequency of DPREQ windows to the I/O CCM module affects the performance (time to complete a message) of the serial links. Therefore, the user should guarantee that the module receives windows on a regular basis. For the fastest response times on the serial link, the module can be given a window once per scan or even multiple windows per scan.

The I/O CCM has a 5-second timeout on waiting for a window to transfer data to or from the Series Six CPU. If the timeout occurs, the I/O CCM will abort the serial link (sends EOT or an error response).

Running at the DPU Executive Window

With the enhanced I/O CCM (Version 203 Hex, or thereafter), it is possible to get windows with the CPU without having a DPREQ in the ladder logic. This feature allows windows to continue while the CPU is stopped.

NOTE

> You must have CPU microcode version V107 Advanced, VI18 Expanded, V130 Expanded II (or later versions) for windows to continue while the CPU is stopped.

The following stops are required to set-up the I/O CCM to run at the DPU address.

- Power-down the unit.

  Set the backplane DIP switch for Inputs 1009-1016 to be addressed (7E hexadecimal).

  Refer to Figure 4 for switch configuration (Switch 1 CLOSED, all other switches OPEN).

  Connect the I/O terminator plug. Refer to Tables 10 and 11, for the I/O Terminator Plug wiring.

- Power-up the unit.

a42720

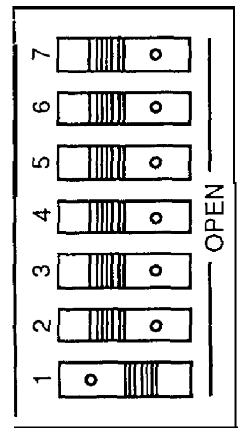


Figure 4. Backplane Switch Setting for Running at DPU Window

I/O Terminator Plug (DPU)

A special I/O terminator plug may be required when operating the I/O CCM module at the DPU Executive Window. The I/O Terminator Plug requirement is dependent upon: whether the I/O CCM is placed in a CPU rack or an I/O rack, and whether the I/O Controller card installed in the CPU rack is type I014 or IOI5.

Installing the I/O CCM **in a CPU Rack:** When the I/O CCM is installed in a CPU rack (e.g., Series Six Plus or Series 60 PLC) along with the 1014 card, the I/O terminator plug (wired as Table 10) must be used.

Table 10. I/O Terminator Wiring (CPU Rack)

PIN	SIGNAL	JUMPER
30	FIN+	Pins: 30, 35, 37
35	DPE+	
37	GND	
31	FIN-	Pins: 31, 34, 36
34	+5v	
36	DPE-	

Position the 37-pin, male connector plug on the I/O port of the I/O Controller (1014) card in the Series Six CPU -- Slot 1.

Installing the I/O CCM in an I/O Rack: When the I/O CCM is installed in an I/O rack along with the IOI4 card in the CPU rack, the I/O cable must be modified at the connector going to the CPU rack.

Verify that the CPU connector end of the I/O cable is wired as shown in Table 11.

Also, a jumper setting for the 1014 card is required -- Locate Jumper ABC in A-B position.

Table 11. Connector Modification (I/O Rack)

PIN	SIGNAL	JUMPER
34 36	+5v DPE-	Pins: 34, 36
35 37	DPE+ GND	Pins: 35, 37

Installing the I/O CCM with I/O Controller (IO15): When the I/O CCM is installed in either a CPU rack or I/O rack along with the I/O Controller (IOI5) card, the I/O terminator plug is NOT required.

Position the 1015 card jumper (Jumper ABCK) in A-K position.

Programming the Communications Command and Parameter Registers

Each I/O CCM has an associated communications command register. This register is monitored by the I/O CCM for communication commands which the user program wants to initiate. The command register corresponds to the first input point of the address of the module.

For example, if the I/O CCM is addressed (using the backplane DIP switches) at inputs 9-16, then the communications command **register in the Series** Six CPU is register 9.

The format of these commands and the command parameters is the same as for the CCM2 and CCM3. The main difference is that for the I/O CCM, the <u>command register reference must always correspond to the module address</u>.

Therefore, the reference for the DPREQ register must not be the same as the command register reference.

When the user sets up one of these commands for execution, the I/O CCM will read the communications command number and the command parameters. It will then zero the communications command register to notify the user that the command was read by the I/O CCM. The I/O CCM status byte indicates when the command is in progress and when the command has completed.

The module is addressed for I/O points l-8 (01001 dec or 03E9 hex). The CPU communications window is opened once each scan. The example below shows the logic necessary to initiate a serial request using the BLOCK MOVE function in the Series Six CPU.

Refer to GEK-25364, Series Six PLC Data Communications Manual for definitions of the command and parameter registers, and for programming examples.

```
               Command           Command  Parameters
               Register

            ROOOl
   -1 E--                          BLOCK  MOVE                          ]+-(   )
            xxxx    nnnn   nnnn    nnnn    nnnn     nnnn     nnnn    0000
                    (Rn)  (Rn+1)  (Rn+2)  (Rn+3)   (Rn+4)   (Rn+5)

                                 Open  Communication  Window

      CONST                  R0200       R0200
   -[   A        MOVE          B       ]+[DPREQ]
       01001                 01001        03E9
```

I/O CCM Status Byte

DPREQ Windows: The eight input points in the Series Six CPU which correspond to the address of the I/O CCM Module are used to provide the CPU with the status of the module.

DPU Executive Windows: When the I/O CCM is running at the DPU executive window the status address is IO993 - 11000. In this way, the I/O CCM **status byte will not be** in conflict with the CCM2/3 status byte.

DPREQ and DPU: The I/O CCM status byte has the same format as the CCM2 and CCM.3 status bytes. See GEK-25364 for the status byte format.

The I/O CCM status byte is updated in the same way as the CCM2 and CCM3 status bytes. The module guarantees that the pulsed status bits will be pulsed a minimum of three windows.

Port Characteristics and Wiring Diagrams

Table 12. Pinouts of the Port Connectors

PIN	COMMUNICATIONS PORT (Jl)	COMMUNICATIONS PORT (J2)
1	NC	NC
2	Data Out RS-232	Data Out RS-232
3	Data In RS-232	Data In RS-232
4	NC	RTS (RS-232)
5	NC	CTS (RS-232)
6	NC	NC
7	Ground	Ground
8	Data Out (+) Current Loop	NC
9	Ground	Ground
lO#	Data Out (+) RS-422	Data Out (+) RS-422
11	Data In (+) RS-422	Data In (+) RS-422
12	Current Source (+) Rxd	NC
13	Current Source (+) Txd	NC
14	NC	Output Relay - Normally Closed
15+	RS-232 JMP 1	Output Relay - Normally Open
16+	RS-232 JMP 2	Output Relay - Common
17	Terminate Rxd RS-422	Terminate Rxd RS-422
18	Data In (+) Current Loop	NC
19	Data In (-) Current Loop	NC
20	NC	NC
21	Data Out (-) Current Loop	NC
22#	Data Out (-) RS-422	Data Out (-) RS-422
23	Data In (-) RS-422	Data In (-) RS-422
24	Current Source (-) Rxd	NC
25	Current Source (-) Txd	NC

\+ Optional connection for Port 1 only, switch in DIP bank C can be set to make this connection,

\# RS-422 transmit signals for communications port J2 only are tristated for multi drop links when the transmitter is inactive.

The following diagrams include the basic configurations. For more information on RS-232 and RS-422 connections and for connections to the CCM2 or CCM3 refer to GEK-25364 Series Six PLC Data Communications Manual.

Cable Configuration

Cable wiring for the I/O CCM will vary depending upon the desired configuration. A few of the more common applications are shown in the following figures.

General guidelines for cable construction are as follows:

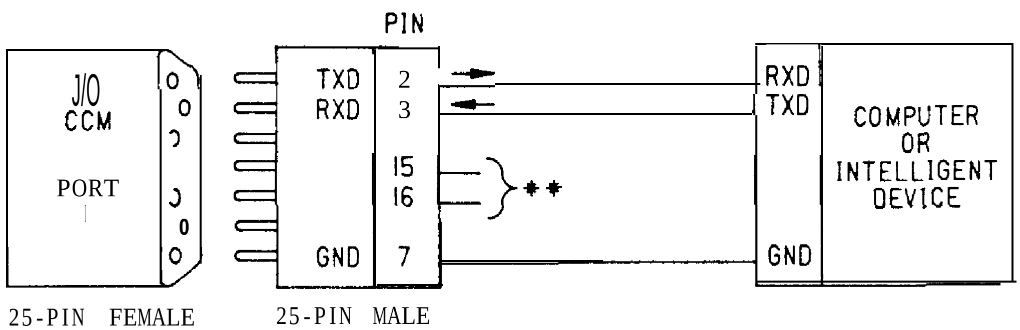
At short distances (under 1000 feet) almost any twisted shielded pair will work. The specified cables will provide reliable operation at data rates up to 19.2 Kbps and distances up to 4000 feet.

Good wiring practices must be observed. Twisted pairs must be matched (i.e., one pair is transmit, the other pair is receive.)

When routing communication cables outdoors transient suppression devices should be used to reduce the possibility of damage due to lightning or static discharge. Best results have been obtained with General Semiconductor Industries Transzorb SA series wired from each signal line to earth ground at both ends of the cable.

RS-232 Cables

a40523



** PINS 15 AND 16 MUST BE CONNECTED ON PORT1.THIS MAY BE DONEON THE CONNECTOR,ON THE CABLE,OR VIA THE DIP SWITCH C SETTING.

Figure 5. RS-232 Point-to-Point Wiring (Port 1)

a40524

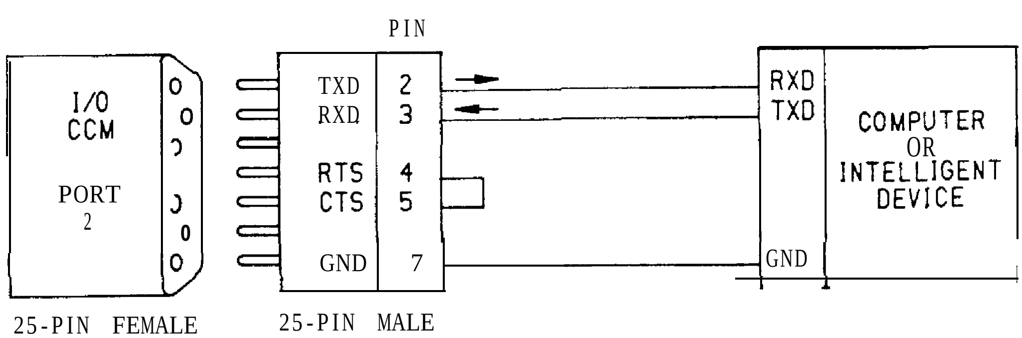


Figure 6. RS-232 Point-to-Point Wiring (Port 2)

RS-422 Cables

a40525

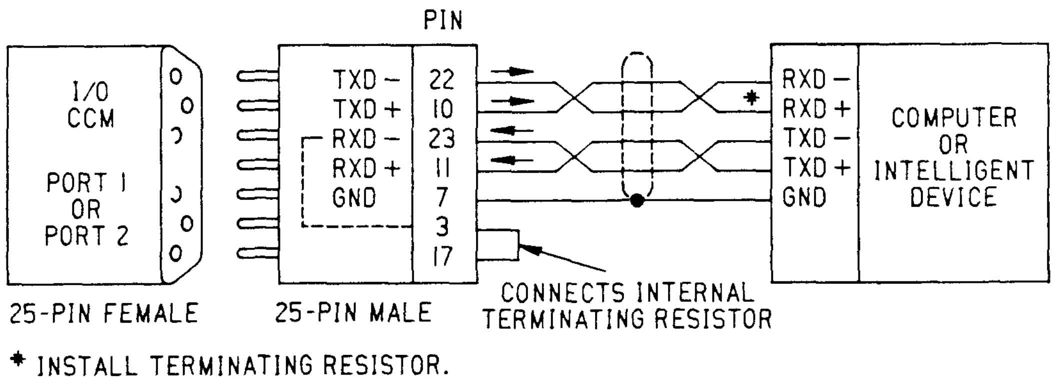


Figure 7. RS-422 Point-to-Point Wiring

a40526

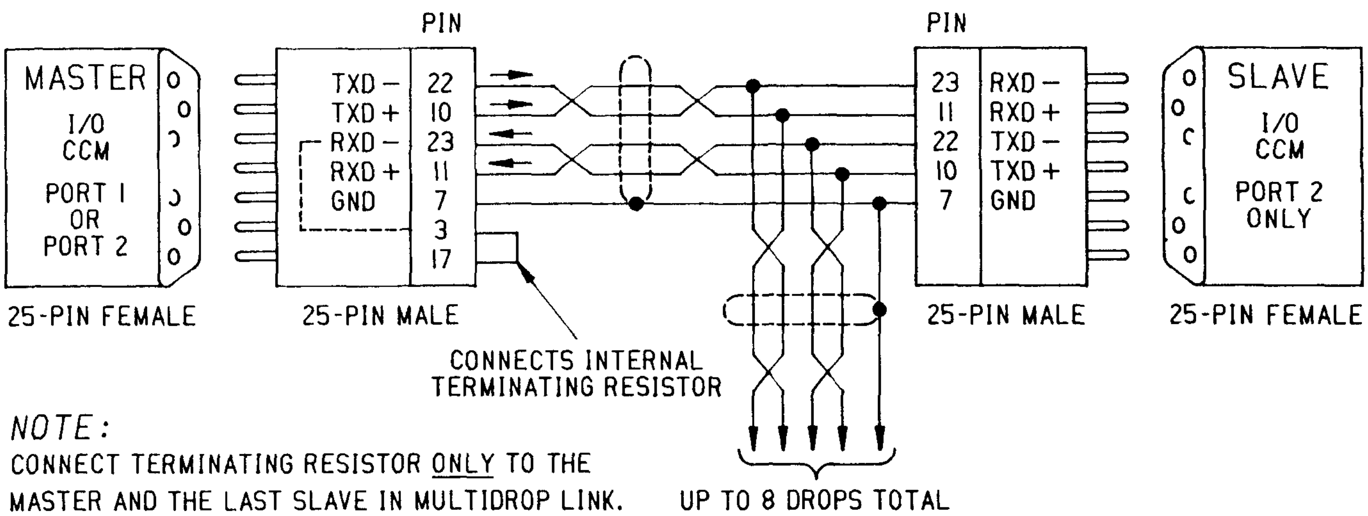


Figure 8. RS-422 Multidrop Wiring

Convention for RS-422 Direct Cable Diagrams

The RS-422 signal nomenclature used in this data sheet are cross referenced to the RS-422 EIA standard as follows:

CCM SIGNAL NAME	RS-422 STANDARD SIGNAL NAME
RS-422 out + (TXD+)	B
RS-422 out - (TXD+)	A
RS-422 in + (RXD+)	B'
RS-422 IN - (RXD-)	A'

During a mark condition (logic 1), B will be positive with respect to A.

During a space condition (logic 0), B will be negative with respect to A.

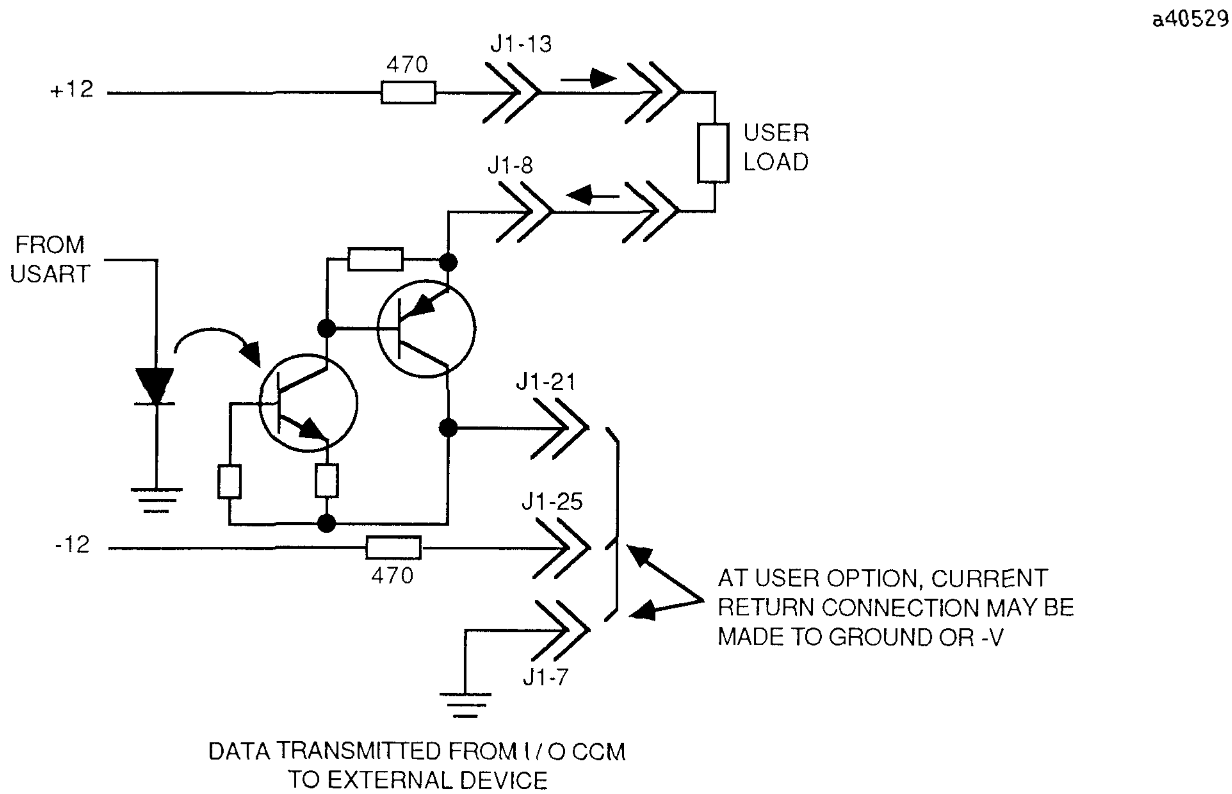


Figure 9. Active Current Loop Data Transmit

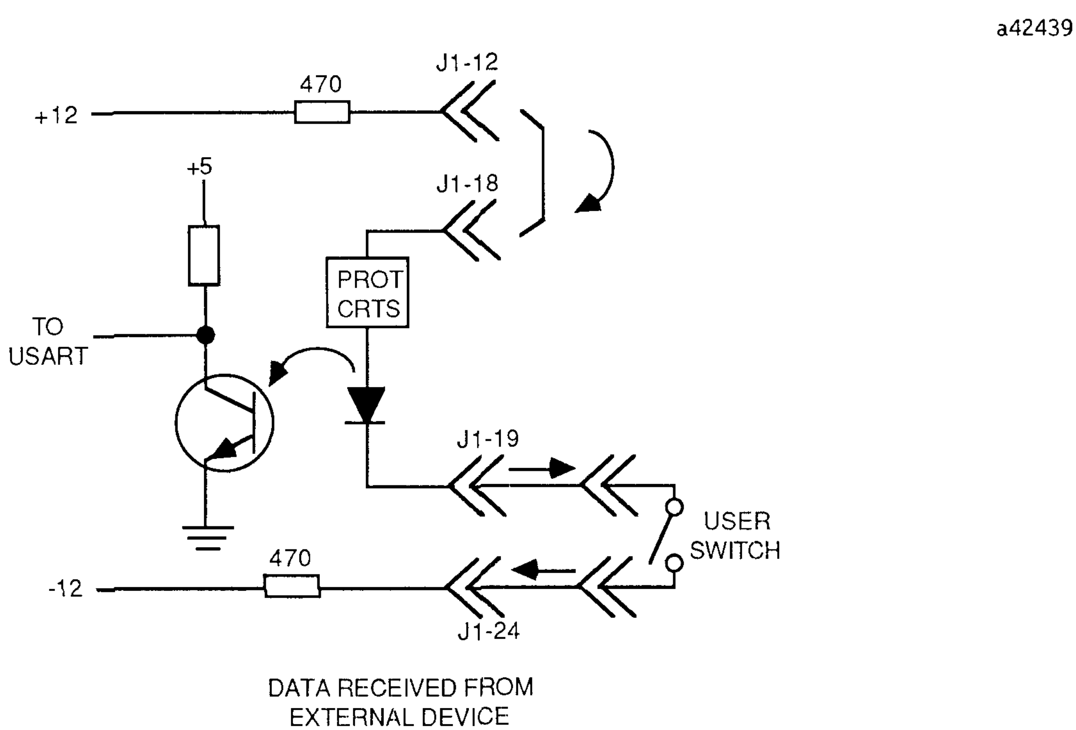


Figure 10. Active Current Loop Data Receive

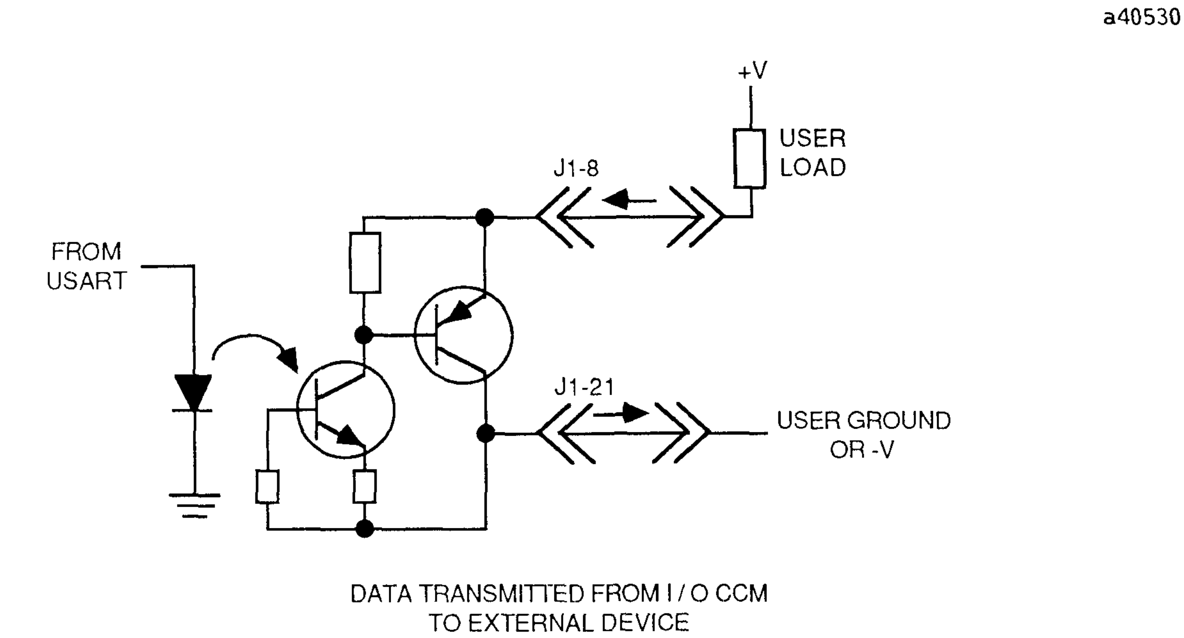


Figure 11. Passive Current Loop Data Transmit

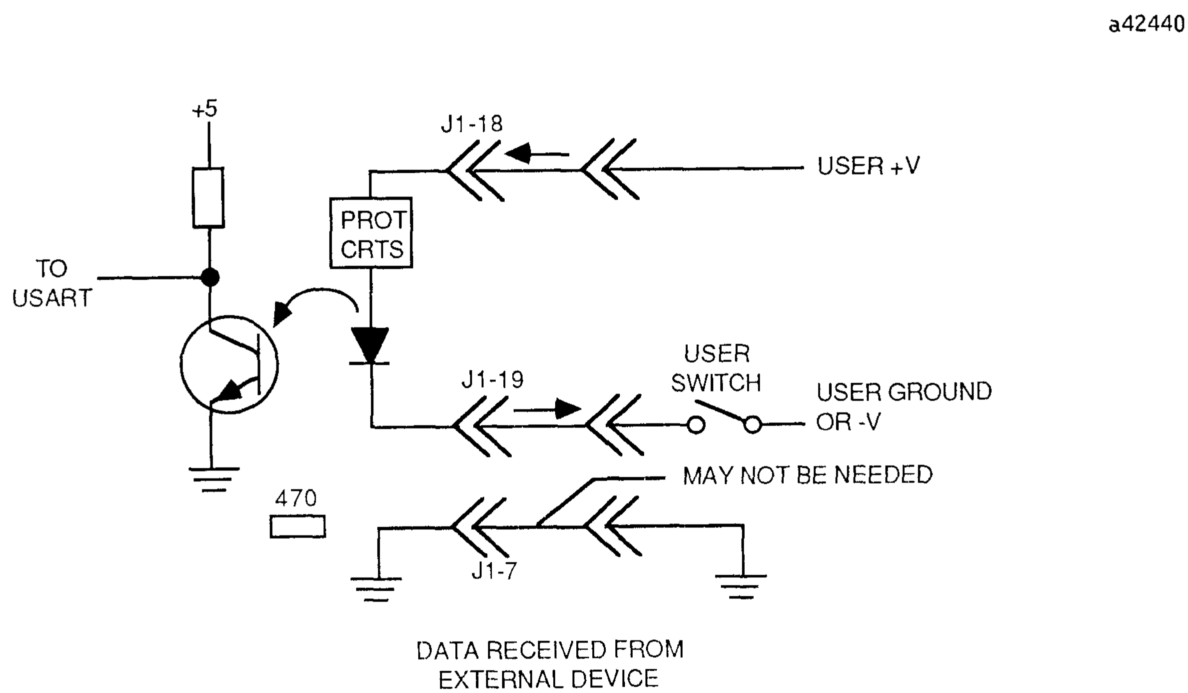


Figure 12. Passive Current Loop Data Receive

I/O CCM Notes for Users Familiar with CCM2/3

1. An external device can perform program uploads and downloads using the enhanced I/O CCM module firmware.

   With the X/O CCM module firmware (Version 203 Hex, or later) uploads and downloads may be performed using either the Advanced, the Expanded or the Expanded II, CCU5. Refer to Table 14, Ordering Information.

2. The user is not restricted from executing CCM protocol functions to write to memory areas which might stop the Series Six CPU (i.e., sub-routine vector addresses and User Logic). This could result in error conditions in the I/O CCM. The I/O CCM receives windows from the CPU only if the CPU is running when the I/O CCM does not use the DPU executive window.

3. The software version number as read from Diagnostic Status Word 12 for the I/O CCM will start with 512 (200H) and increment by one (1) for each revision thereafter. This relates to the CCM2 and CCM3 as follows:

Board	Diagnostic Status Word 12 Software Version # Range
CCM2	1 - 255 (1 - 0FFH)
CCM3	256 - 511 (100H - IFFH)
I/O CCM	512 - 767 (200H - 2FFH)

4. When a serial protocol error occurs when using the CCM protocol on the I/O CCM, both the Txd and Rxd LEDs for the associated port will go out. When the next successful message is sent or received, the LEDs will turn on again. The Rxd and Txd LEDs will reflect the reception and transmission of characters.

5. The I/O CCM cannot be configured from registers.

6. The I/O CCM does not perform tape or OIU operations

7. The I/O CCM does not use a battery.

8. The port 2 relay and RTS are turned on before all serial transmissions on Port 2. The port 2 relay can be heard opening and closing when communications are occurring on port 2; this is normal.

9. The RTU protocol can be selected to use the 500 msec turn-around delay on the J2 port.

10. The I/O CCM module will check for commands (in the communications command register) between communications with serial devices and continually when idle.

11. The maximum data rate for current loop operation is 4800 bps.

NOTE

If commands are not going to be initiated from the I/O CCM, a value of zero should be placed in the command register. The five successive command parameter registers can then be used as desired.

Table 13, Module Specifications

Space Requirements:	One I/O slot in either a Series Six CPU rack, Series Six Plus CPU rack, or a High-Capacity I/O rack
Power Requirements:	+5 Vdc requirement is 1.5A or 20 units of load +12 Vdc requirement is 300 mA or 12 units of load (supplied by rack power)
Storage Temperature:	**0 to 70 C**
Operating Temperature:	**0 to 60 C**
Humidity:	5% - 95% (non-condensing)
Altitude:	Up to 6,600 feet (2,000 meters) above sea level (operating)
Isolation:	(Port to Port and either Port to Series Six common),
	Transient: 1500 Vac, 50/60 Hz for 1 minute maximum, non repetitive.
Noise & Transient:	Continuous: 240 Vdc or RMS ac, 50/60 Hz.
Immunity:	Meets following specifications
	Showering arcs per NEMA ICS 2,230.40
	Surges per ANSI C37.90.9
	5 W R.F. transmitter 27-450 MHz

Table 14. Ordering Information

DESCRIPTION	CATALOG NUMBER
Circuit Board & Faceplate (I/O CCM)	IC600BF948
Advanced CCU5	IC6OOCB525
Expanded CCU5	IC600CB5526
Expanded II CCU5	IC600CB515
Faceplate	IC600FP948

For further information, contact your local GE Fanuc Automation - NA sales representative.

SERIES SIX

PROGRAMMABLE CONTROLLERS

GEK-90826

16K 16-bit words of Register Memory

16K REGISTER MEMORY MODULE

GENERAL DESCRIPTION

The 16K Register Memory module may be used in the Model 600 and 6000 Central Processor Units (CPU) with Advanced functions. It provides 16,384 (16K), 16-bit words of battery-backed, Complimentary Metal-Oxide Semiconductor (CMOS) memory reserved for Register-memory data. The features and benefits of this module are summarized in Table 1.

The module contains CMOS memory devices; memory control circuitry, a Lithium battery and Light-Emitting Diode (LED) indicators.

The LEDs, marked “PARITY” and “BATTERY”, are visible through a markable lens on the faceplate. The “PARITY” LED turns off if there is a Register memory or Table memory (contained on the Internal Memory module) parity error; the “BATTERY” LED indicates the status of the on-board Lithium battery. The LEDs operate only when the module is installed in a properly powered CPU rack.

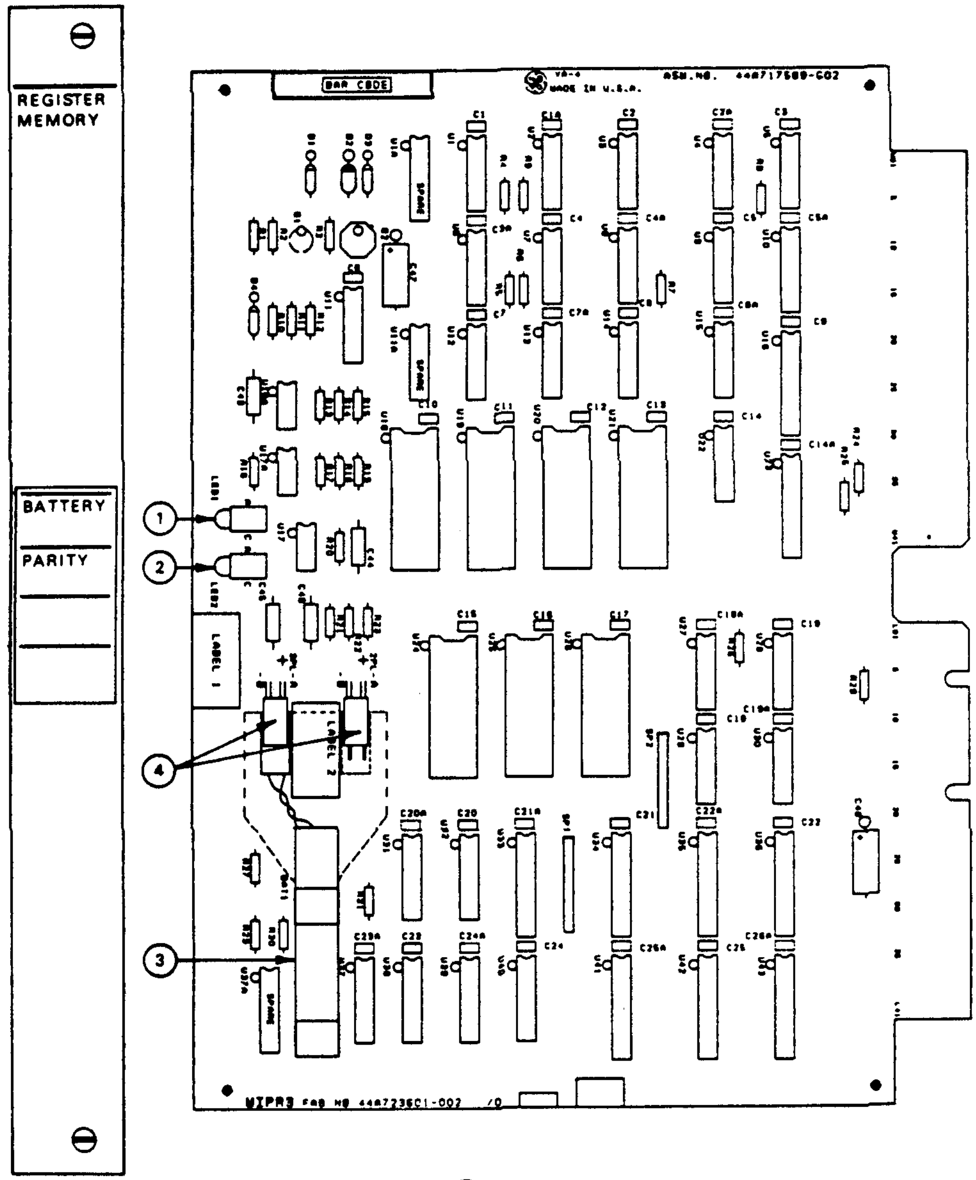
Refer to Figure 1 for Register Memory module specifications.

TABLE I. FEATURES AND BENEFITS

FEATURES	BENEFITS
Battery-Backed CMOS memory.	Retains Register memory after power-down or power failure.
Two LED indicators: BATTERY PARITY	Simplifies troubleshooting.

Dimensions: Circuit Board: 8.15 x 11.0 (inches) 208 x 280 (mm) Faceplate: 12.46 x 1.175 (inches) 317 x 30 (mm)	Power Requirements: 5 Vdc, 800 mA (Supplied by CPU power supply) Storage Temperature: 0 to 70°C Operating Temperature: 0 to 60°C Humidity: 5% - 95% (non-condensing)

FIGURE 1. SPECIFICATIONS



① BATTERY Light:

Steady On: Battery Normal

Flashing: Battery Low: CPU continues running. No. 2 alarm is activated. To protect the memory contents, replace the battery before it fails.

Steady Off: Battery Failed: CPU continues running, but will not restart if stopped. No. 2 alarm remains activated. Memory contents will be lost when power is switched off or lost.

For battery replacement information consult the Series Six Installation and Maintenance Manual, GEK-25361.

② PARITY Light

On: Table Memory and Register Memory parity is OK.

Off: Table Memory and/or Register Memory parity error exists. An error message appears in the work area of the Program Development Terminal display.

③ Lithium-Manganese Dioxide Battery

④ Battery Jacks

FIGURE 2. USER ITEMS

INSTALLATION

The Register Memory module can be installed in a Model 600 or 6000 CPU. The card slot to the immediate left of the Internal Memory module is reserved for this module. Follow these steps:

1. Remove top board cover after pinching white, plastic fasteners.
2. Connect 2-pin Lithium battery connector to either of male jacks beneath battery.
3. Place top board cover over component side of circuit board, making sure that white fasteners open and catch.
4. Use extraction/insertion tool furnished with CPU to insert (or remove) module into rack.
5. Secure faceplate to rack using thumbscrews at top and bottom.
6. Clear parity errors detected at initial power-up of the CPU. Refer to Chapter 2, Series Six Programming Manual (GEK-253621, for further details.

CAUTION

Relatively small amounts of excess charge can cause very intense electrostatic fields in metal-oxide-semiconductor (MOS) devices, damaging their gate structure. When the board covers have been removed, avoid handling this circuit board in a manner which might cause electrostatic charges. Failure to observe this CAUTION could result in the destruction of the CMOS-RAM devices in this module. With the board covers in place, it is unlikely that normal handling of this module would cause any damage.

WARNING

Do not place a short circuit between the contacts and the ends of the battery. Do not attempt to recharge the battery. Failure to observe either of these WARNINGS will cause the battery to explode, possibly resulting in personal injury.

ORDERING INFORMATION

Circuit Board and Faceplate	Faceplate
IC60OCB511 A	IC600FP511 A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (U L Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GE Fanuc Automation North America, Inc., Charlottesville, Virginia

OCTOBER, 1985

GFK-0015C

December, 1989

Carrierband Network Interface

IC650ESS003

IC650ESS001

- Direct PLC attachment to MAP Carrierband network.
- Works with Series Six Plus PLC.
- Three concurrent data transfer services: MAP, DATAGRAM, and GLOBAL DATA
- Software (sold separately) is easily loaded or upgraded via RAM load.
- Software is retained through power outages up to 72 hours.
- Comprehensive station management and diagnostic tools

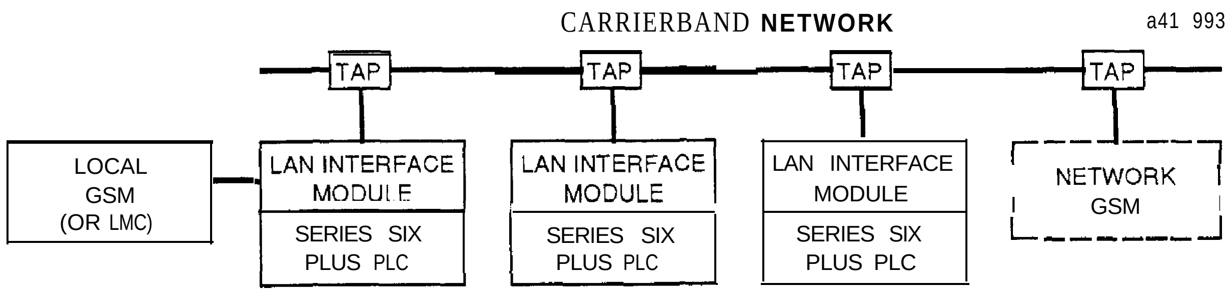


Figure 1. LAN **Interface Module Connects the Series Six Plus PLC to a Carrierband Network**

The LAN Interface module for the Series Six programmable controller is a member of the family of GEnet Factory LAN communication products. These products provide a range of options for interconnecting automation controllers and for integrating them into multi-vendor networks.

The Series Six LAN Interface module fulfills its role in the family by providing a direct connection for a Series Six Plus programmable controller to a carrierband network.

The GEnet Factory LAN architecture is based on standards set forth in the Manufacturing Automation Protocol (MAP) specification.

MAP has been an evolving standard. Series Six LAN Interface modules support the MAP specification versions 3.0 and 2.2. The version of MAP protocol is simply loaded into Random Access Memory (RAM) on the appropriate LAN Interface module. This allows upgrade to a new revision of software without modification to the hardware.

Features of the LAN Interface Module

The features of the GEnet Factory LAN Interface module are described briefly here. For a more complete description see the appropriate *GEnet Series Six PLC Network Interface User' s Manual.* Other related publications are listed on page 7.

Direct LAN Attachment to the Carrierband Network

The LAN Interface module consists of two boards (controller board and modem board) which plug directly into the Series Six Plus CPU rack. Figure 1 illustrates the LAN Interface module as part of the network.

The LAN Interface module connects directly to the Carrierband Network through the 5 Mbps modem board. Intermediate devices such as bridges or gateways are not required, The direct connection provides the high performance required for real-time control applications.

The communications software is down-loaded to the LAN Interface and stored in Random Access Memory (RAM). This makes it easy to reconfigure or upgrade the communications software simply by downloading it again. An on-board capacitor provides 72-hour **memory** retention which will prevent loss of the communication software due to most power loss situations.

Carrierband Networks: Networks of up to 72 stations or up to 2000 feet cable span can be constructed using simple do-it-yourself carrierband technology. The 75 ohm coaxial cable plant contains no active (powered) components. Received signal strength limits network size and depends on the number of intervening stations and the cable distance over which the signal must travel.

For carrierband cable design, refer to GFK-0014, *Carrierband Cable Plant Design and Installation Manual* for step-by-step instructions. GEnet carrierband complies with the IEEE 802.4 Phase Coherent standard, operating at 5 Mbps.

Communication Services

There are three different communication protocols for transferring data on the network: MAP, Datagram, and Global Data. The LAN Interface software for these protocols is offered as two separate software packages, one for MAP 3.0, and the other for MAP 2.2.

Regardless of which MAP version you choose; MAP, Datagram, and Global Data operate simultaneously on the network and within each station.

MAP Protocol (7-layer)

MAP protocol is defined by the Manufacturing Automation Protocol (MAP) specification. MAP is an approved standard. MAP-compatible products are available from a variety of manufacturers, and their interoperability has been established.

The primary service offered by the MAP protocol is reliable message transfer between two interconnected stations. MAP protocol provides automatic error recovery for most kinds of errors. MAP is ideal for transferring large amounts of data between two specific stations, such as PLC program downloads.

A feature of MAP is that the two communicating stations need not be on the same LAN, so long as the different LANs are connected by an appropriate intermediate station.

MAP commands are directed from an initiating station to a single specific responding station. Each message exchange is explicitly initiated.

Datagram Protocol (3-layer, miniMAP, EPA)

GEnet Datagram protocol is a subset of the MAP/EPA standard specified in MAP Version 3.0.

MAP/EPA represents an optional enhancement of the basic MAP standard, toward improved real-time performance for direct control applications. These applications, in contrast to MAP applications, send short messages but demand very quick response.

GEnet Datagram protocol provides basic read and write data transfers between two stations on the same LAN. Like MAP, automatic error recovery is provided.

GEnet Datagram commands are directed from an initiating station to a single specific responding station. Each message exchange is explicitly initiated.

Global Data Protocol

GEnet Global Data protocol is a proprietary innovation of GE Fanuc - NA.

Global Data provides periodic data transfers from a source station to unspecified receiving station(s). Receiving stations elect to receive specific data according to symbolic variable-names, but from unspecified source station(s). The receiving ladder logic program is notified only if the data is not updated in a timely fashion.

GEnet Global Data provides highly efficient transfer of periodic data to one or many stations on the same LAN. Symbolic data references permit independent programming of the stations.

A single command initiates the transfer, which then proceeds periodically without further attention by the ladder logic program unless an exception condition occurs.

Station Management and Diagnostics Tools

The station management and diagnostic tools featured are:

- GEnet System Manager (GSM) (called Local Management Console or LMC with the MAP 2.2 software)
- The Local Station Manager (LSM)

GEnet System Manager (GSM)

GEnet System Manager (GSM) is a software package which runs on an IBM PC or IBM-compatible (e.g., Workmaster) computer.

GSM is used to perform the following functions:

- Create and store configuration files to be downloaded as the communication software to a Series Six PLC LAN Interface.
- A terminal mode of operation provides access to the local Station Manager of Series Six LAN Interfaces.

GSM Software Versions

The GEnet System Manager (GSM) comes in two versions: Local and Network.

Local GSM comes as part of the MAP software and allows connection from the computer COMMl port to the 9-pin port on the Series Six LAN Interface.

Network GSM is an optional software package (purchased separately) which allows GSM to work over the network. The appropriate MAP Interface card is required for the personal computer on which GSM is to be installed. A download server is included with network GSM to load configuration files to Series Six LAN Interfaces over the network.

Local Station Manager

The Local Station Manager (LSM) is a part of the basic Series Six LAN Interface communication software. The LSM executes as a background activity on the LAN Interface module to provide online supervisory access to it.

The LSM can be accessed in three ways:

- Via the 9-pin serial port to a locally connected user-provided terminal.
- Via the network from GEnet System Manager.
- Limited access is also provided directly to the ladder logic program of the associated Series Six PLC.

The LSM provides all the following services via the local serial port or over the network to GSM. A subset is available directly to the ladder logic program.

- An interactive set of commands for interrogating and controlling the LAN Interface module.
- An online “help” facility.
- Unrestricted access to observe internal statistics, an error log, and configuration parameters.
- Password security for commands that change the LAN Interface states or configuration.

Installation

The Carrierband LAN Interface Module consists of two boards that plug into two adjacent card-slots in the Series Six Plus PLC.

- The digital controller board
- The modem board

A separate ribbon cable connects the two boards together.

Each board is also shipped with a faceplate.

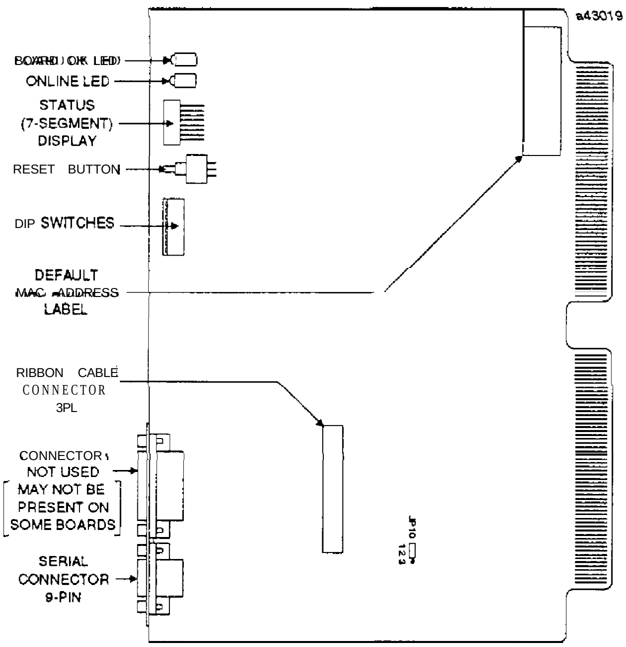


Figure 2. Controller Board

Digital Controller Board

The digital controller (see Figure 2) connects the LAN Interface to the backplane of the Series Six PLC, allowing data to flow to and from the PLC. It contains RAM storage for LAN communication software which is downloaded to the board using GEnet System Manager (GSM) software.

The controller board has the following user-accessible elements:

1. BOARD OK LED
   This LED is ON if the LAN Interface hardware has passed diagnostics and is operating properly.

   It is OFF if either the board fails diagnostics or if a hardware problem occurs on an operating board.

2. ONLINE LED
   The ONLINE LED is ON when the LAN Interface module is periodically receiving the right to transmit on the network,

   It is BLINKING when the module is transferring data to or from the network.

   It is OFF when no other stations are connected and communicating, when the network is not communicating due to a disruption of the cable, or when the local station has malfunctioned.

3. STATUS DISPLAY
   The Status Display is a seven-segment display used to show a diagnostic code during the power-up diagnostics. It is also used to show the status of the station after it is operating. See *GEnet Series Six PLC Network Interface User's Manual,* for the meaning of codes which may be displayed.

4. RESTART BUTTON
   Pressing the Restart button forces a reset of the LAN Interface module. This causes the power-up diagnostics to be run and the software on the module to be reset. Any data being transferred by the LAN Interface module at the time of the restart will be lost. The button is used to force a restart of the LAN Interface module after changes have been made to the maintenance switches.

   The Restart button is inaccessible when the module faceplate is installed.

   NOTE

   Depending on the ladder logic program in the Series Six PLC, depressing the Reset button when the Series Six RUN/STOP keyswitch is in RUN may result in failure of the LAN Interface backplane diagnostic,

5. OPTION SWITCHES
   On the exposed edge of the digital controller board is a set of 8 DIP switches which are used to enable various maintenance options. For a complete description of these switches, refer to *GEnet Series Six PLC Network Interface User's Manual*, Appendix C. Normally, all these switches should be positioned to the right (OPEN).

   The option switches are inaccessible when the Digital Controller faceplate is installed.

6. SERIAL PORT
   The GSM terminal is connected to this 9-pin port and communication software may be loaded to the module through this port. For pinouts of this port, refer to Table 2.

Carrierband Modem Board

The modem board (see Figure 3) connects to the digital controller board through the ribbon cable, but does not connect directly to the Series Six PLC's backplane; the modem board's backplane connection provides mechanical support only. The LAN Interface module is connected to the network through the coaxial LAN connector on the modem board.

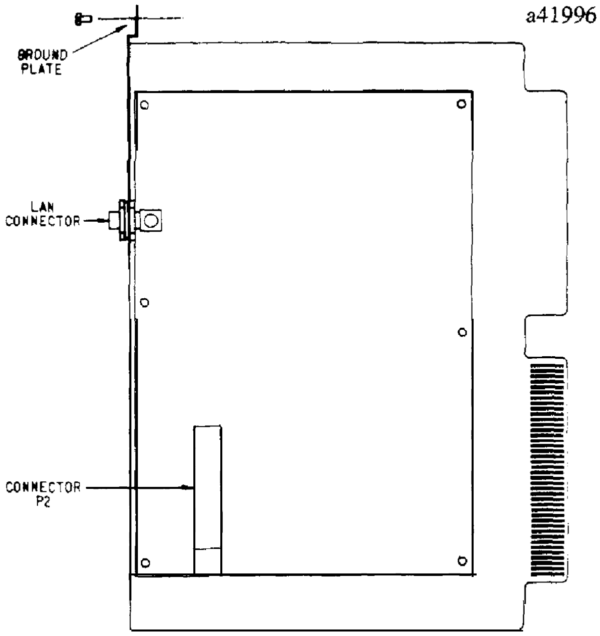


Figure 3. Modem Board

The modem board has the following user accessible elements:

1. GROUND PLATE
   Grounds modem and coaxial cable shield to the chassis of the Series Six PLC rack.

WARNING

The ground plate must be securely fastened to the chassis of the Series Six PLC rack using the screw provided, Failure to do so may cause personal injury or improper operation of the equipment.

2. LAN CONNECTOR
   The connector for attaching the drop cable of the LAN cable plant.

CAUTION

The LAN connector and LAN Interface module may be damaged if other than recommended cable plant components are used. *See GFK-0014, Carrierband Cable Plant Design and Installation Manual* for recommended components. Such damage is not covered by the LAN Interface module equipment warranty.

Installing and Powering-Up the LAN Interface Module

1. The Series Six PLC power must be OFF before beginning the module installation.
2. Set the Series Six PLC's backplane DIP-switches for the COM I/O slot (slot 6) all to the OPEN position.
3. Examine JP10 on controller board (see Figure 2.) and insure that the jumper connects pins 1 and 2.
4. Attach the keyed end of the ribbon cable to connector 3PL on the controller board. Be sure to orient the connector so that the cable is routed toward the front of the board.
5. Locate the COM CON slot (slot 5) of the PLC rack. Carefully remove the COM CON label and remaining adhesive from the PLC rack. This will expose the screw hole that will receive the safety screw from the Modem board ground plate.

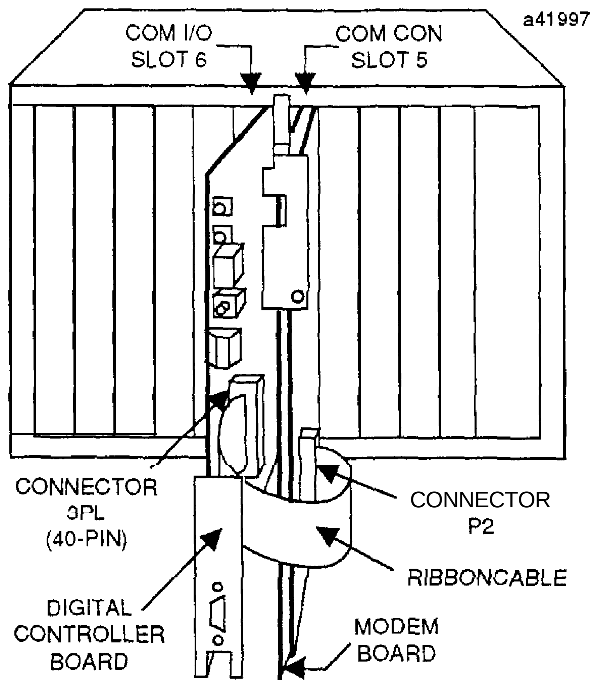


Figure 4. Series Six Plus Rack Layout

6. Slide the Controller board into the CPU rack COM I/O slot (slot 6) of the Series Six Plus. Be sure to dress the ribbon cable out the front of the rack.

7. Slide the Modem board into the COM CON slot (slot 5) of the CPU rack.
8. Connect the loose end of the ribbon cable to connector P2 on the modem board. See Figure 4.
9. Back out the screw in the Modem board ground plate part way, and seat both boards using the extraction/insertion tool.
10. Tighten the ground plate screw, securing the ground plate to the chassis of the rack.
11. Make sure all option switches on the edge of the controller board are positioned to the right (OPEN).
12. If available, connect the drop cable from the cable plant to the LAN Interface connector of the Modem board, first threading it through the hole in the unattached faceplate. Tighten to a snug fit using a small wrench.

CAUTION

The LAN connector and LAN Interface module may be damaged if other than recommended cable plant components are used. See GFK-0014, *Carrier-band Cable Plant Design and Installation Manual* for recommended components.

13. Set the Series Six RUN/STOP keyswitch to STOP. This will prevent the local application program (if any) from initiating any command that may affect the operation of the module.
14. Power up the PLC rack. The Controller board executes self diagnostics and its progress is shown by a sequence of characters which appear on the 7-segment Status display.

    After diagnostics are complete, the status of the LEDs and display should be as shown in Table 1 below. Refer to ***GEnet Series Six PLC Network Interface User's Manual,*** Appendix E, for details.

    NOTE

    The first time the Controller board is powered after several days without power, the self diagnostics may not commence for a period of up to one minute. This is normal. This is the time required to recharge the capacitor used for memory retention.

15. Attach the faceplate(s) to both the Controller and Modem.

Correct Results of Installation Procedure

After performing steps 1 - 15 above, the status of the LEDs and Status Display should be as shown in Table 1.

Table 1. LED and Status Display

LED	RESULTS
BOARD OK	LED must be ON.
ON LINE	LED should be OFF (could be ON only if the communication software has been loaded previously and if modem is connected to operating network).
STATUS (7-segment) DISPLAY	Should display an "L" (Indicating a request for Load) or a "0" (indicating that the board has been loaded successfully at a previous time). If an "L" appears, the module is ready to receive a load via the local 9-pin serial port and LMC. If an "1" (lower case L) appears, the module is ready to receive a load via the LAN and NMC. If a "0" appears, but you wish to reload the LAN Interface module, you must first manually force a reload (see instructions in ***GEnet Series Six PLC Network Interface User's Manual.*** The LAN Interface does not require a reload if you are sure the currently loaded communication software and configuration parameters are correct for this LAN Interface module.

Corrective Actions

If the BOARD OK LED is ON, but the STATUS display is other than shown in Table 1, this may indicate a problem with the software configuration which was loaded previously. Refer to the loading instructions in *GEnet Series Six PLC Network Interface User's Manual*, for more information.

If the BOARD OK LED is OFF, then something is wrong with the LAN Interface module or its installation, Turn off power, remove the interface module, and examine the backplane for bent or broken pins. Repeat the installation procedure. If you still do not get the results *in* Table 1, refer to Appendix ***E*** in ***the GEnet Series Six PLC Network Interface User's Manual*** for further instructions.

Configuring and Loading the LAN Interface Module.

Each station on the network must have its own unique configuration file which is down-loaded with the communication executive software.

See GEnet Series Six PLC Network Interface User's *Manual,* for instructions on configuring and loading the LAN Interface module. These operations are necessary before the LAN Interface can be brought on line.

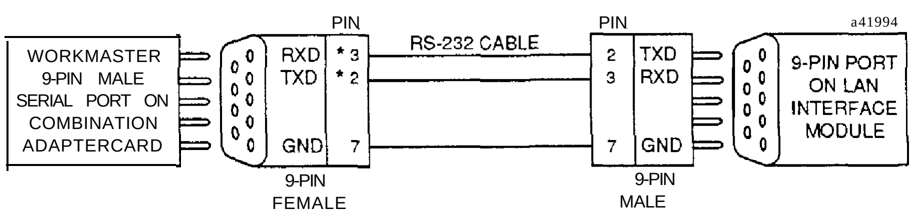
Serial Port Characteristics

The 9-pin serial port (RS-232C interface) is used to connect the serial version of GSM to the LAN Interface module. The pinouts of the port are shown in the Table 2. The LAN Interface module is a Data Terminal Equipment **(DTE)** device.

Table 2. RS-232 Port Pinouts

PIN	SIGNAL	DESCRIPTION NUMBER
1		Reserved
2	TX	Transmit data <out)
3	RX	Receive data (in)
4		Reserved
5		Reserved
6		Reserved
7	GND	Signal Ground
8		Reserved
9		Reserved

A cable is needed to connect the GSM to the LAN Interface. Figure 5 shows how to construct this cable.



* THE PINS AND CONNECTOR MAY BE DIFFERENT FOR THE IBM PC OR ASCII TERMINAL, BUT THE SIGNAL NAMES WILL BE THE SAME. CONSULT THE MANUAL FOR YOUR TERMINAL OR ASCII TERMINAL FOR THE CORRECT SIZE AND PIN NUMBERS.

Figure 5. Cable to Connect the GSM to the LAN Interface

Related Publications (GEnet Factory LAN)

Series Six Network Interface User's Manual (MAP3.0)	GFK-0364
Series Six Network Interface User's Manual (MAP2.2)	GF'K-0013
Carrierband Cable Plant Design and Installation Manual	GF'K-0014
GEnet System Manager User's Manual	GFK-0413
GEnet Factory LAN System ***User's Manual***	GEK-96608

Table 3. Module Specifications

Power Consumption (Typical):	Power consumption for the Carrierband LAN Interface module includes external RS-232 loads, The module is powered by the CPU rack+
	+5 Vdc / +12 Vdc / -12 Vdc
Power Requirements:	1.40 A / 0.25 A / 0.25 A
Units of Load:	23 / 10 / 10
Memory Retention:	An on-board capacitor provides backup power {up to 72 hours) when power is removed from the CPU rack containing the LAN Interface module. Maintenance free; no batteries are required.
Phvsical Dimensions:	
Each Circuit Board:	8.15 x 11.0 inches (207 x 279 mm)
Faceplate:	12.46 x 1.175 inches (317 x 30 mm)
Environment:	Operating Temperature 0° to 60° C Storage Temperature -40° to 70° C Humidity {non-condensing) 5% to 95%
Mounting:	The two-board set plugs into the Series Six CPU rack in specific card slots and are interconnected by a 40-conductor flat ribbon cable. - Controller Board in the COM I/O slot (6th slot from the right) - Modem Board in the COM CON slot (5th slot from the right) Reset, maintenance switches, indicators (front edge of controller board behind faceplate) BOARD OK LED, ONLINE LED STATUS (7-segment) Display
Connectors:	LAN (to Local Area Network) Type F female connector - 32. 1 female 9-pin D-connector
Interface Specifications:	LAN (to Local Area Network) IEEE 802.2 Logical Link Control Class XII IEEE 802.4 Token Bus Medium Access Control - 48-bit Address Option - Priority Option - Immediate Response Option IEEE 802.4 Chapter 12, Single-Channel Phase-Coherent-FSK physical layer (modem) - Data Rate: 5 Mbps - Minimum network slot time: 64 octet times (102 microsec) - Worst-case station delay: 512 octet times (820 microsec) - Supports Optional Receive Signal Source and Transmitter Enable/Disable selection J2 RS-232 DTE, 9600 bps
Certification:	Conforms to FCC (part 15, Subpart J) for Class A computing equipment. The product is listed by Underwriters Laboratories, Inc.

Table 4. Ordering Instructions

Complete Interface	Controller and Modem boards, Ribbon Cable and Faceplates for MAP 3.0 Controller and Modem boards, Ribbon Cable and Faceplates for MAP 2.2	IC650ESS003 IC650ESS00l*
Configuration Software	MAP 3.0 Software and Documentation (Includes Local GSM)	IC65 lESS003
GSM **Network Version**	GSM Software, and User Documentation (PC with MAP I/F Required}	IC651MMZ300

Replacement Parts

Controller Board	Board and Faceplate Faceplate only (Controller)	IC65OAELOO3 IC65QAMP010
Modem Board	Board and Faceplate Faceplate only (Modem) Ribbon Cable (Controller/Modem Interconnect)	IC65OAEMOOO IC65OAMPO30 IC65OACC010

* Obsolete 1st Quarter 1990

SERIES SIX

PROGRAMMABLE CONTROLLERS

125 V DC INPUT CPU POWER SUPPLY MODULE

Source Voltage
100 to 150 V dc
Output Voltage
+5, +12, -12 V dc

GENERAL DESCRIPTION

The 125 V dc Input CPU Power Supply Module, used in the Central Processor Unit (CPU), is available to be used with a power source from 100 to 150 V dc. The features and benefits of this module are summarized in Table 1.

The 125 V dc Input CPU Power Supply Module provides regulated +12, -12 and +5 dc voltages to the rack backplane. The input (or source voltage) is applied to terminals on the front panel, then routed through a switch and fuse to a switching power supply. For a given load the input power drain remains essentially constant The power supply is protected against polarity reversal of the dc Input.

The module provides electromechanical relay contacts for connection to user indicators, or any device to be activated during an alarm condition. The module also provides a voltage regulator for an opt ional, auxiliary battery that provides battery back-up of Complementary Metal-Oxide Semiconductor (CMOS) memory contained in the processor rack.

A Keyswitch mounted on the front panel is used to select either the RUN or the STOP mode for the processor; a second Keyswitch allows the user to protect the contents of the processor memories by placing them in a READ ONLY mode. The same key operates both Keyswitches. Refer to Table 2 for the CPU Power Supply module specifications.

The 125 V dc input CPU Power Supply Module may be used in place of a 115/230 V ac or a 24 V dc Input CPU Power Supply Module in an existing rack if 125 V dc input is desired.

TABLE 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Uses dc input power source.	Extends power source compatibility to 125 V dc systems.
Can be used in any CPU rack.	Reduced spare-parts inventory.
Provides electromechanical-relay contacts for alarm indications.	Activates user-supplied power indicators.
Contains voltage regulator for auxiliary battery.	External battery back-up of CMOS memory.

Table 2. SPECIFICATIONS

Input: 100 to 50 V dc, 2 A max.

output:
1. +5 V dc, 16.5 A max.
2. +I2 V dc, 1.5 A max.
3. -12 V dc, 1.0 A max.
4. +I2 V dc, 2.0 A max.

$\Big\}$ Total power from all outputs must be less than 90 watts.

Output number 4 rated at 12.0 V dc nominal when output supply currents are:
(I) +5 V dc @ 8.0 A
(2) +12 V dc @ 1 .0 A
(3) -12 V dc @ 0.5 A
(4) +12 V dc @ 1.0 A

Allowable Power Interruptions:
4ms minimum at 100 V dc line.

Noise Immunity: Meets requirements of NEMA KS 2-230 and ANSI C37.90A.

Altitude: Up to 10,000 feet (3,000 meters) above sea level.

Auxiliary Battery Input:
8-28 V dc

Dimensions: 12.46 x 9.00 x 2.75 (inches) 317 x 229 x 70 (mm)

Operating Temperature:
0°C to 60°C
(outside of the rack)

Storage Temperature:
-20°C to +80°C

Humidity: 5% to 95%
(non-condensing)

INSTALLATION

These steps define the procedures to be followed when a power supply is to be replaced on a Series Six or Six Plus CPU rack. The tools needed are a regular screwdriver, Phillips screwdriver, and a 5/16” wrench or nut driver.

1. Stop the system by switching the top key on the CPU to “STOP”.

2. Switch off all units in the system, including the user’s power supplies.

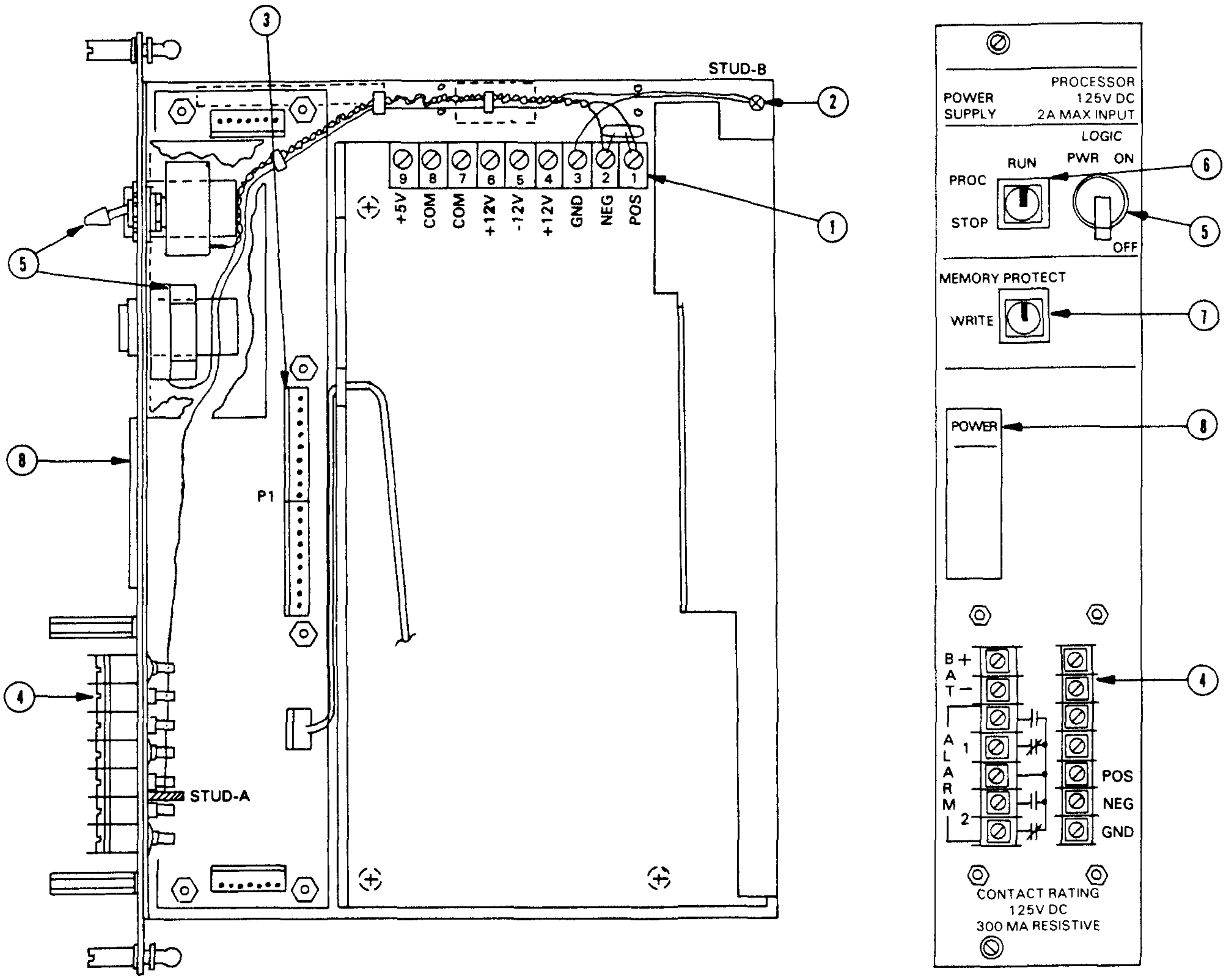
3. Remove all power from the system, preferably at the source (i.e. throw the main circuit breaker for the system).

4. Locate the power supply to be changed. The power supply is in the far right side of the CPU rack.

5. Remove the plastic cover on the lower portion of the power supply to be replaced and using a volt-meter, make sure there is no dc power present.

6. Take note of the location and color of the dc wires and then remove them. Also, remove Auxiliary battery and/or Alarm connection(s) noting location, color, and polarity for correct replacement.

Ref. PC-S6-84-0243
Ref. PC-S6-84-0244



SIDE VIEW

FRONT PANEL

1 Internal Terminal Strip (Refer to Figure 2)

2 Chassis Ground Terminal

3 18-Pin Connector: Connects signal cable from rack backplane

4 Front-Panel Connector Block (Refer to Figure 3)

5 Power Switch/Fuse

6 CPU RUN/STOP Keyswitch

7 MEMORY PROTECT Keyswitch

8 POWER Light

On: The voltage levels of all three DC outputs (+12V, −12V, +5V) are within tolerance

Off: At least one of these voltage levels is too low

FIGURE 1. USER ITEMS

INSTALLATION (Continued)

7. At the top and bottom of the power supply, there are l/4-turn thumbscrews. To loosen, turn the thumbscrews approximately l/4 turn counterclockwise.

8. Grasp the thumbscrews and gently pull outward. Be careful not to damage the internal wiring while pul l ing the supply out.

9. Locate the wires that extend from the back of the rack to the terminal on the power supply. These wires should be labeled or stamped with their location; the circuit boards have wire locations stamped on them. Remove these wires. There is also a plastic wire clamp holding these wires in place. Detach this from the frame if there is not a similar item on the replacement power supply, or cut the clamp if there is one on the new supply.

   Remove the 18-pin (P1) molex connector that is on the narrow board in the front part of the power supply. The power supply should now be completely detached from the rack.

10. Take the replacement power supply and attach the wires as shown in Figure 2. Be sure to connect the 18-pin molex connector (P1) to the power supply. Attach the wire clamp on the upper stud of the power supply frame, or if there is a clamp already there, wrap the wires in it.

11. Slide the power supply into the rack, being careful not to damage the wires. When the power supply is all the way in, turn the thumbscrews clockwise until they lock in.

12. Remove the plastic cover on the lower portion of the power supply and attach the DC wires, as well as the battery and alarm wires, as they were on the original supply (Refer to Step 6 and Figure 3). Replace the plastic cover.

13. Verify that the DC input lines are of the correct polarity before applying power. An inadvertant reversal of input polarity will cause the supply to draw excessive currents and may blow the internal fuse (2A slo-blow) which must then be replaced before proper operation can be resumed.

14. Restore system power. Turn on the CPU unit. Check to see if the POWER light is on. If it is, turn on the rest of the system and resume normal operation.

15. If the POWER light does not come on, the power supply may be bad, source voltage may not be turned on, or there may be other problems within the rack. Please call your local authorized GE Fanuc Automation Distributor or Sales off ice for assistance.

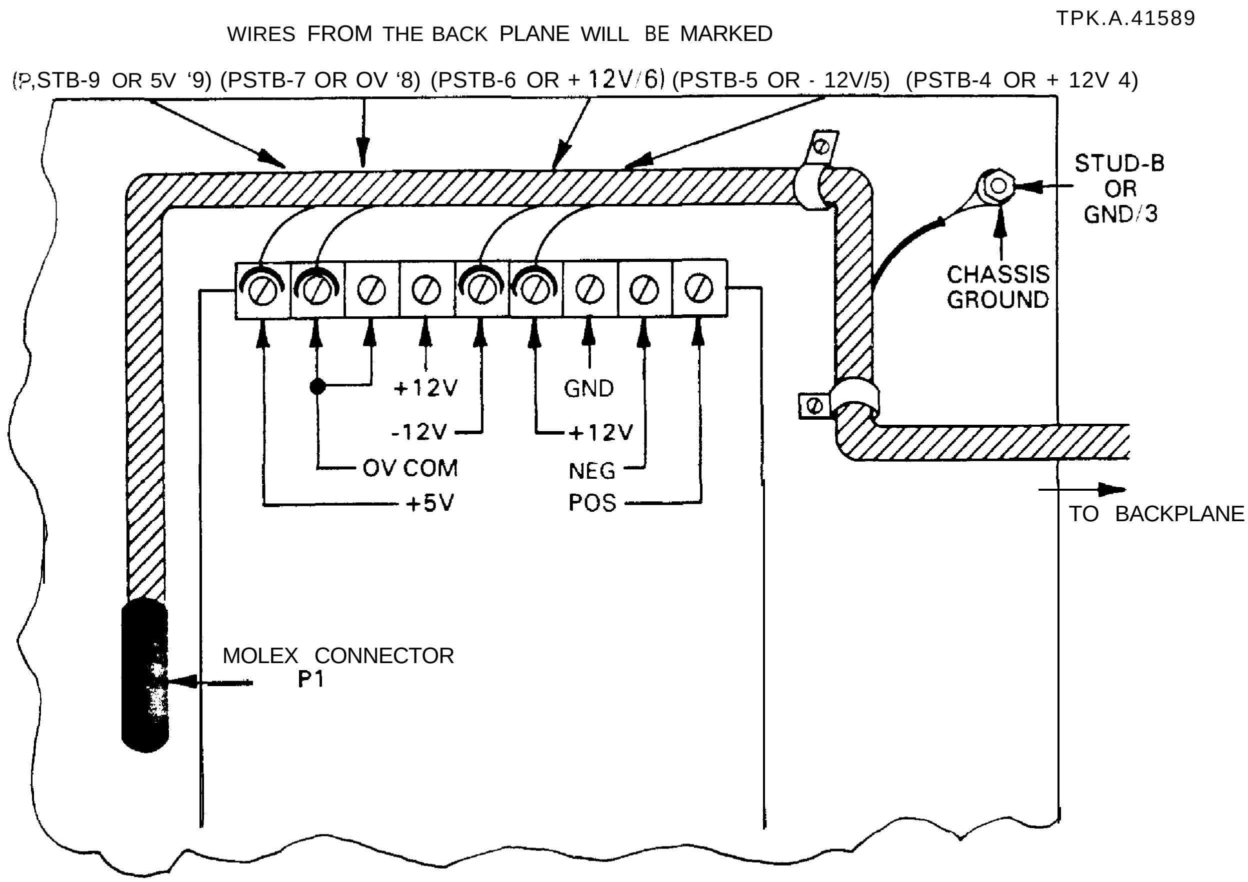


FIGURE 2. POWER SUPPLY EXTERNAL WIRING DIAGRAM

CAUTION

If a memory auxiliary battery is used, the circuit connecting it to this module should be isolated from the rest of the system. If this CAUTION is not observed, the battery could be short-circuited.

The alarm contacts consist of two sets of normally-opened and normal iy-closed contacts. The terminals marked "1 NO" and "1 NC" are associated with Alarm Type No. 1; the terminals marked "2 NO" and "2 NC" with Alarm type No. 2. (Refer to Series Six Plus User's Manual, GEK-96602, for further information on Alarm Nos. 1 and 2.)

CAUTION

The user devices connected to each set of Alarm terminals on this module should present a resistive load drawing no more than one amp of current at no greater than 115 V ac/28 V dc. Failure to observe this CAUTION may result in damage to the circuit board.

NOTE

During normal operation the alarm relays are energized. During an alarm condition the contacts marked IN0 and 2NO, open, and those marked 1NC and 2NC, close.

Ref. PC-S6-84-0246

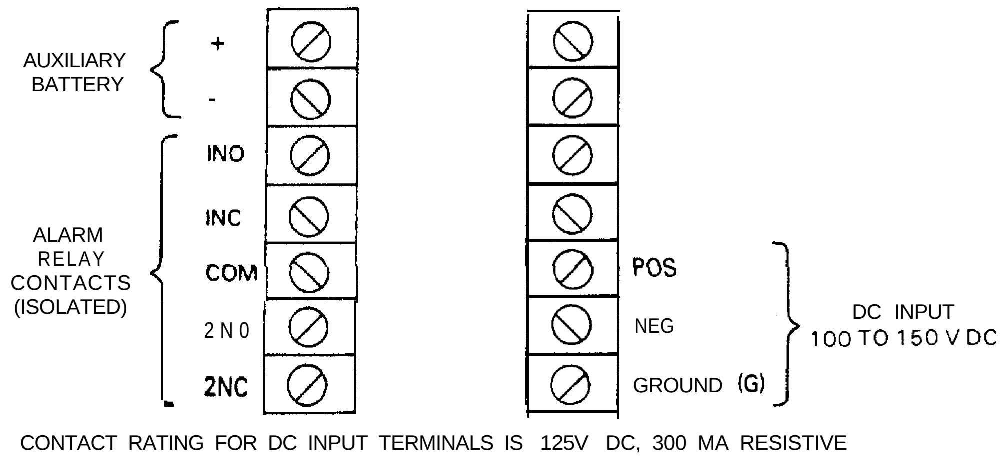


FIGURE 3. FRONT-PANEL TERMINAL BLOCK

ORDERING INFORMATION

Module	Part Number
125 V dc Input CPU Power Supply Module	IC600PM546

The UL symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment .)

For further information, contact your local GE Fanuc Automation Sales office.

GE FANUC AUTOMATION NORTH AMERICA, INC., CHARLOTTESVILLE, VIRGINIA

MARCH, 1987

GE FANUC

Series Six
Programmable Controller

GFK-0077A
April 1988

I/O Communications Control Module Type 4
IC600BF950

- Interface to Allen-Bradley Data Highway
- PLC-2 communication compatability
- DF1 full duplex operation
- Configurable data rate

The I/O Communications Control Module Type 4 (I/O CCM4) is a microprocessor based module consisting of two boards in a mother-daughter board configuration.

The module is designed to operate with a Series Six Central Processor Unit (CPU). The module may be installed in the Series Six CPU I/O slot or a High Capacity I/O rack. It connects to an external Allen-Bradley Communication Controller Module (Cat. No's. 1771 -KE, KF) and permits Series Six access to the Allen-Bradley Data Highway.

Under control of the Series Six application program, the I/O CCM4 module can transfer information to and from any remote device on the Data Highway. Conversely, any remote Data Highway device can also transfer information to and from the Series Six CPU. The I/O CCM4 appears much like a PLC-2 Programmable Controller in the way that it communicates over the Allen-Bradley Data Highway.

The I/O CCM4 full-duplex DFI protocol conforms closely to the ANSI X3.28 standard. DF1 protocol combines the features of D1 (data transparency) and F1 (two way simultaneous transmission with embedded responses).

The I/O CCM4 features six on-board, light-emitting diodes (LEDs) that display port activity and module status indications.

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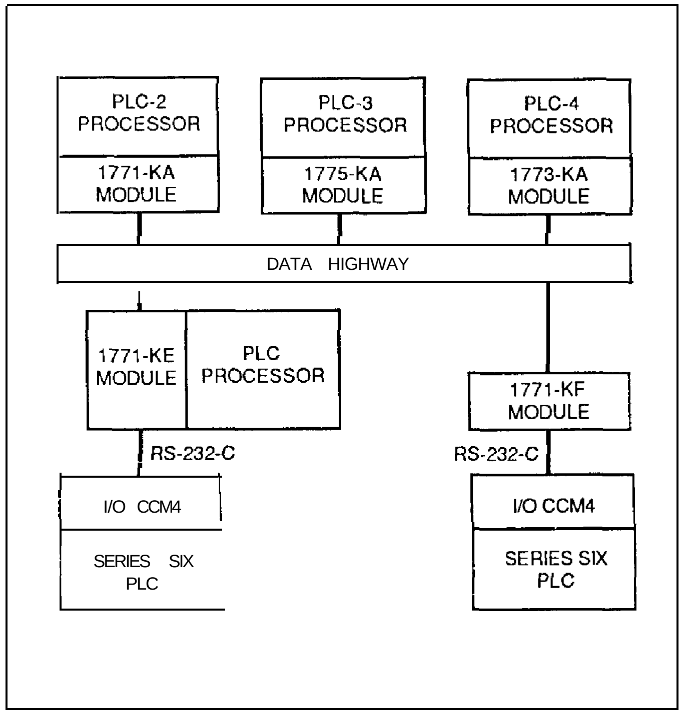

Figure 1
DATA HIGHWAY INTERFACE

If the power-up diagnostics detect a failure, the BOARD OK LED will not turn ON and the remaining five LEDs will provide an error code.

The CPU COMM LED blinks to indicate communications between the I/O CCM4 module and the Series Six CPU. If this LED stays off there is no communication.

The remaining four LEDs provide port activity indication for the respective transmitters and receivers. They will blink when the port is communicating and stay off when there is no activity on the port.

A Series Six CPU with software version V104, or later, is required. The Series Six application (ladder logic) program must include a DPREQ instruction for any I/O to take place through the I/O CCM4. This is true for both locally and remotely initiated I/O instructions.

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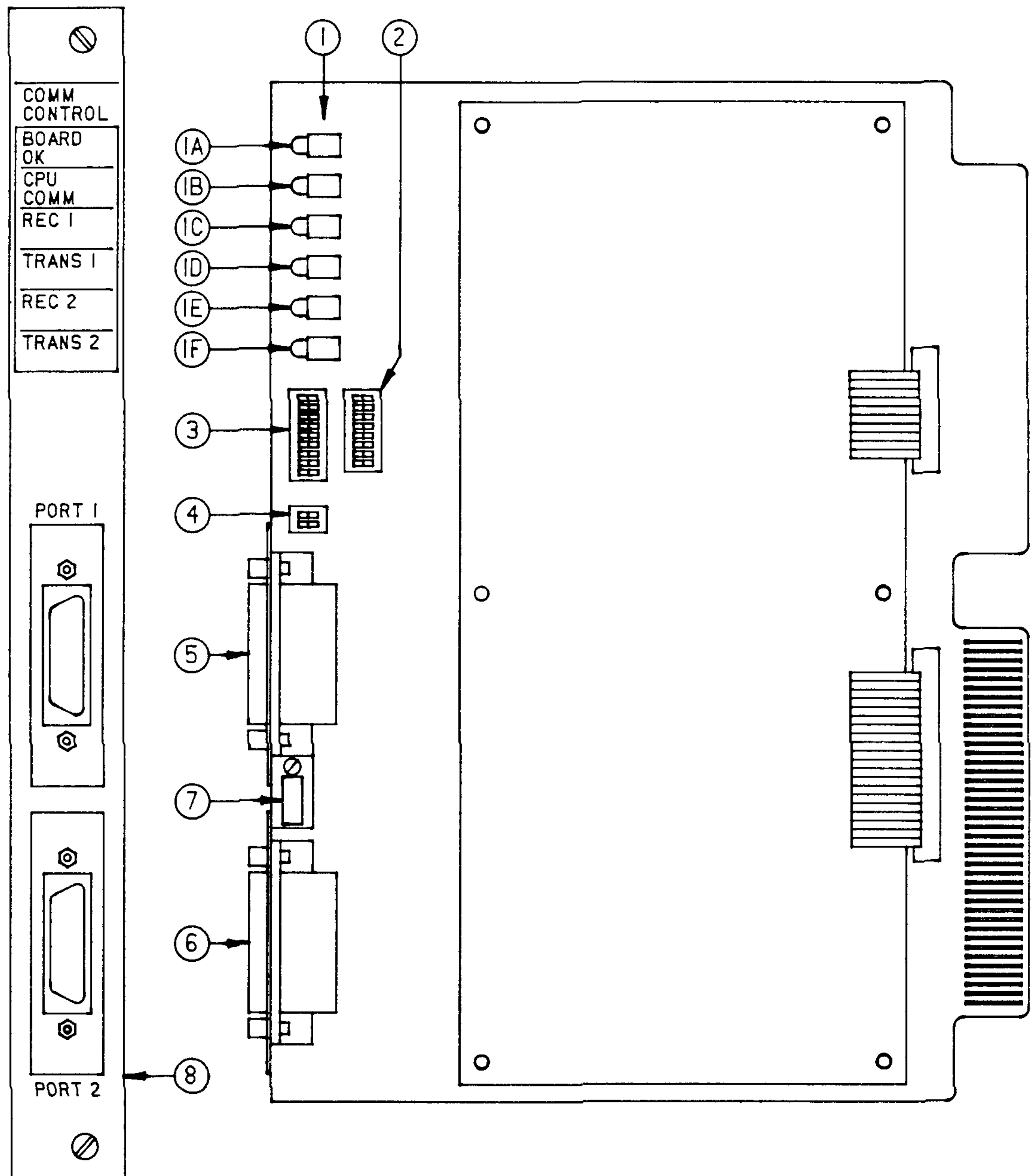


Figure 2 USER ITEMS (I/O CCM4)

1. LED Status Indicators (Refer to Table 3)
2. Bank A DIP switches
3. Bank B DIP switches
4. Bank C DIP switches
5. J1 connector: 25-pin D-type female connector (unused)
6. J2 connector: 25-pin D-type female connector (DF1 full duplex)
7. Hybrid DIP package: RS-232 package orientation
8. Faceplate

INSTALLATION

The I/O CCM4 module may be installed in any one of the Series Six CPU rack I/O locations or in a High-Capacity I/O rack. Installation of the I/O CCM4 module consists of the following:

I/O CCM4 module configuration

Series Six backplane I/O configuration

RS-232 cable fabrication

I/O CCM4 Module Installation

Diagnostic power-up

I/O CCM4 CONFIGURATION

Configure the I/O CCM4 before installing the module into the logic rack. (Refer to Figure 2, User Items I/O CCM4)

1. Set the I/O CCM4 dual-in-line (DIP) switches banks (A, B and C) for the required configuration. They specify the characteristics of the interface module. (Refer to Page 4, Switch bank setting for A, B and C)

2. Verify that the I/O CCM4 hybrid DIP package is oriented for RS-232 communications on the lower port (Port 2). This package is marked "232" on one end and "422" on the other and is mounted in a socket. Position the package so that "232" appears right-side up on the surface of the package.
   A small screwdriver is needed to turn the screw which releases the hybrid package from the socket.
   (Refer to Figure 3 for package configuration)

BACKPLANE I/O CONFIGURATION

Set the backplane dual-in-line (DIP) switch package before installing the I/O CCM4 into the rack. The switch package is located on the backplane to the right of each I/O card location.

The DIP switch setting establishes a group of eight consecutive input points in the CPU input table and one register in the register table for use by the I/O CCM4 module.

If more than one module is installed in the same I/O rack, each must have its own unique card address. (Refer to Table 2. DIP switch setting for I/O point selection, and Figure 4. backplane switch configuration.)

CABLE FABRICATION

A cable assembly is required for communication between the I/O CCM4, RS-232 serial port and the port labeled "computer RS232-C" on the Allen-Bradley CCM. (Refer to Page 7, for cable specifications, and Table 1. for Port 2 pin-out.)

I/O CCM4 INSTALLATION

Position the I/O CCM4 module in any one of the Series Six or High-Capacity I/O rack locations.

Refer to Page 8 of this document for module installation.

DIAGNOSTIC POWER-UP

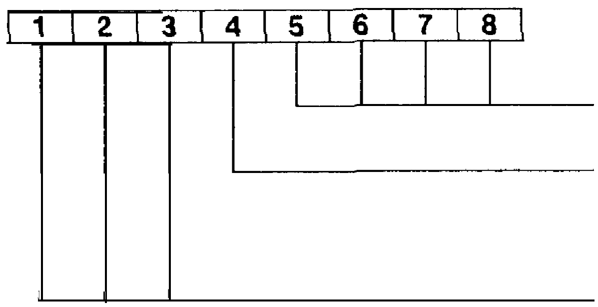
Power-up the system and verify communications of the I/O CCM4 module. (Refer to Page 8 of this document for Diagnostic Power-up Instructions.

I/O CCM4 SWITCH CONFIGURATION

Position the I/O CCM4 DIP switch banks (A, B, and C) as indicated. Switch notations apply to al l three switches.

OFF is equivalent to OPEN
ON is equivalent to CLOSED
* Indicates the factory-set default position.

BANK A DIP SWITCH SETTING



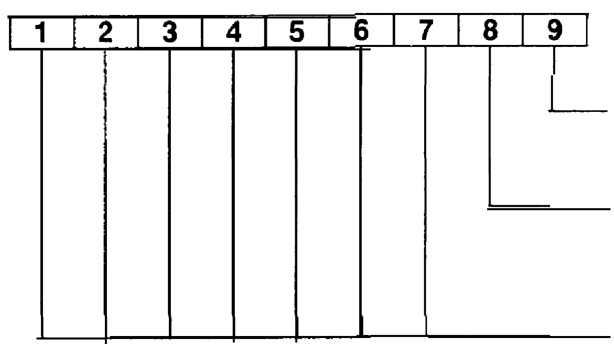
Reserved for future use
* ON

Parity
* ON - no parity
OFF - even parity

Data Rate Selection on Port 2

	SW1	SW2	SW3	Data Rate
	OFF	OFF	OFF	110 b/sec
	ON	OFF	OFF	300 b/sec
	OFF	ON	OFF	600 b/sec
	ON	ON	OFF	7200 b/sec
	OFF	OFF	ON	2400 b/sec
	ON	OFF	ON	4800 b/sec
	OFF	ON	ON	9600 b/sec
*	ON	ON	ON	19200 b/sec

BANK B DIP SWITCH SETTING

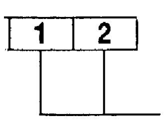


Hardware reset
* OFF - normal operation

Factory diagnostic
ON - enable
* OFF - disable

Reserved for future use
* OFF

BANK C DIP SWITCH SETTING



Hardware switch (must be ON)
* ON

HYBRID PACKAGE ORIENTATION

Verify that the hybrid DIP package is oriented for RS-232 communication. Position the hybrid DIP package so that "232" appears right-side up on the I/O CCM4 module.

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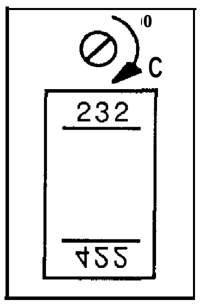

Figure 3 HYBRID PACKAGE

BACKPLANE I/O CONFIGURATION

Before installing the I/O CCM4 in the logic rack, set the backplane dual-in-line (DIP) switch package. The switch package is located to the right of each I/O card locat ion.

To set the backplane switch package refer to Table 1 l

CABLE SPECIFICATIONS

A cable assembly is required to connect the I/O CCM4 to the Data Highway. This cable connects the I/O CCM4, RS-232, serial port to the port labeled "Computer RS232-C" on the Allen-Bradley Communication Controller Module.

Only the RS-232, Port 2, (also referenced as J2) is used for the I/O CCM4 interface. Port 2, pin-out is shown below.

Table **1**
RS-232-C PORT 2 PIN-OUT

PIN	COMMUNICATIONS PORT (J2)
2	**Data Out**
3	Data In
7	Ground

Refer to Table 3, cable specifications and Figure 5, cable configuration, for construction of the RS232 cable assembly.

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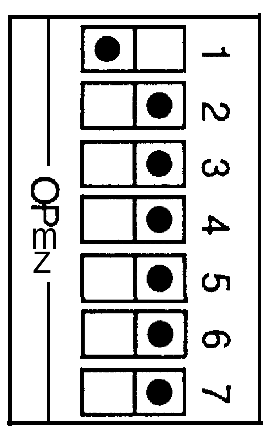


Figure 4 BACKPLANE I/O SWITCH

Table 2 BACKPLANE DIP SWITCH SETTING FOR I/O CCM4 CARD ADDRESS

b40478

DPREQ REGISTER CONTENTS DECIMAL (HEX) *	I/O POINT	DIP SWITCH POSITION 7	6	5	4	3	2	1	DPREQ REGISTER CONTENTS DECIMAL (HEX) *	I/O POINT	DIP SWITCH POSITION 7	6	5	4	3	2	1
1001 (03E9)	1- 8								1505 (05E1)	505- 512		X	X	X	X	X	X
1009 (03F1)	9- 16							X	1513 (05E9)	513- 520	X						
1017 (03F9)	17- 24						X		1521 (05F1)	521- 528	X						X
1025 (0401)	25- 32						X	X	1529 (05F9)	529- 536	X					X	
1033 (0409)	33- 40					X			1537 (0601)	537- 544	X					X	X
1041 (0411)	41- 48					X		X	1545 (0609)	545- 552	X				X		
1049 (0419)	49- 56					X	X		1553 (0611)	553- 560	X				X		X
1057 (0421)	57- 64					X	X	X	1561 (0619)	561- 568	X				X	X	
1065 (0429)	65- 72				X				1569 (0621)	569- 576	X				X	X	X
1073 (0431)	73- 80				X			X	1577 (0629)	577- 584	X			X			
1081 (0439)	81- 88				X		X		1585 (0631)	585- 592	X			X			X
1089 (0441)	89- 96				X		X	X	1593 (0639)	593- 600	X			X		X	
1097 (0449)	97- 104				X	X			1601 (0641)	601- 608	X			X		X	X
1105 (0451)	105- 112				X	X		X	1609 (0649)	609- 616	X			X	X		
1113 (0459)	113- 120				X	X	X		1617 (0651)	617- 624	X			X	X		X
1121 (0461)	121- 128				X	X	X	X	1625 (0659)	625- 632	X			X	X	X	
1129 (0469)	129- 136			X					1633 (0661)	633- 640	X			X	X	X	X
1137 (0471)	137- 144			X				X	1641 (0669)	641- 648	X		X				
1145 (0479)	145- 152			X			X		1649 (0671)	649- 656	X		X				X
1153 (0481)	153- 160			X			X	X	1657 (0679)	657- 664	X		X			X	
1161 (0489)	161- 168			X		X			1665 (0681)	665- 672	X		X			X	X
1169 (0491)	169- 176			X		X		X	1673 (0689)	673- 680	X		X		X		
1177 (0499)	177- 184			X		X	X		1681 (0691)	681- 688	X		X		X		X
1185 (04A1)	185- 192			X		X	X	X	1689 (0699)	689- 696	X		X		X	X	
1193 (04A9)	193- 200			X	X				1697 (06A1)	697- 704	X		X		X	X	X
1201 (04B1)	201- 208			X	X			X	1705 (06A9)	705- 712	X		X	X			
1209 (04B9)	209- 216			X	X		X		1713 (06B1)	713- 720	X		X	X			X
1217 (04C1)	217- 224			X	X		X	X	1721 (06B9)	721- 728	X		X	X		X	
1225 (04C9)	225- 232			X	X	X			1729 (06C1)	729- 736	X		X	X		X	X
1233 (04D1)	233- 240			X	X	X		X	1737 (06C9)	737- 744	X		X	X	X		
1241 (04D9)	241- 248			X	X	X	X		1745 (06D1)	745- 752	X		X	X	X		X
1249 (04E1)	249- 256			X	X	X	X	X	1753 (06D9)	753- 760	X		X	X	X	X	
1257 (04E9)	257- 264		X						1761 (06E1)	761- 768	X		X	X	X	X	X
1265 (04F1)	265- 272		X					X	1769 (06E9)	769- 776	X	X					
1273 (04F9)	273- 280		X				X		1777 (06F1)	777- 784	X	X					X
1281 (0501)	281- 288		X				X	X	1785 (06F9)	785- 792	X	X				X	
1289 (0509)	289- 296		X			X			1793 (0701)	793- 800	X	X				X	X
1297 (0511)	297- 304		X			X		X	1801 (0709)	801- 808	X	X			X		
1305 (0519)	305- 312		X			X	X		1809 (0711)	809- 816	X	X			X		X
1313 (0521)	313- 320		X			X	X	X	1817 (0719)	817- 824	X	X			X	X	
1321 (0529)	321- 328		X		X				1825 (0721)	825- 832	X	X			X	X	X
1329 (0531)	329- 336		X		X			X	1833 (0729)	833- 840	X	X		X			
1337 (0539)	337- 344		X		X		X		1841 (0731)	841- 848	X	X		X			X
1345 (0541)	345- 352		X		X		X	X	1849 (0739)	849- 856	X	X		X		X	
1353 (0549)	353- 360		X		X	X			1857 (0741)	857- 864	X	X		X		X	X
1361 (0551)	361- 368		X		X	X		X	1865 (0749)	865- 872	X	X		X	X		
1369 (0559)	369- 376		X		X	X	X		1873 (0751)	873- 880	X	X		X	X		X
1377 (0561)	377- 384		X		X	X	X	X	1881 (0759)	881- 888	X	X		X	X	X	
1385 (0569)	385- 392		X	X					1889 (0761)	889- 896	X	X		X	X	X	X
1393 (0571)	393- 400		X	X				X	1897 (0769)	897- 904	X	X	X				
1401 (0579)	401- 408		X	X			X		1905 (0771)	905- 912	X	X	X				X
1409 (0581)	409- 416		X	X			X	X	1913 (0779)	913- 920	X	X	X			X	
1417 (0589)	417- 424		X	X		X			1921 (0781)	921- 928	X	X	X			X	X
1425 (0591)	425- 432		X	X		X		X	1929 (0789)	929- 936	X	X	X		X		
1433 (0599)	433- 440		X	X		X	X		1937 (0791)	937- 944	X	X	X		X		X
1441 (05A1)	441- 448		X	X		X	X	X	1945 (0799)	945- 952	X	X	X		X	X	
1449 (05A9)	449- 456		X	X	X				1953 (07A1)	953- 960	X	X	X		X	X	X
1457 (05B1)	457- 464		X	X	X			X	1961 (07A9)	961- 968	X	X	X	X			
1465 (05B9)	465- 472		X	X	X		X		1969 (07B1)	969- 976	X	X	X	X			X
1473 (05C1)	473- 480		X	X	X		X	X	1977 (07B9)	977- 984	X	X	X	X		X	
1481 (05C9)	481- 488		X	X	X	X			1985 (07C1)	985- 992	X	X	X	X		X	X
1489 (05D1)	489- 496		X	X	X	X		X	1993 (07C9)	993- 1000	X	X	X	X	X		
1497 (05D9)	497- 504		X	X	X	X	X										

* For programming use only: add 1000 to I/O points.

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left).

Table 3 RS-232C CABLE SPECIFICATIONS

Length, Maximum: 50 feet (15 meters)
Overall Shield Recommended
24 AWG Minimum
Mating connector to Port 2 is a Male, D-Subminiature Type. Cannon DB25P (Solder Pot) with DB110963-3 Hood or Equivalent. (Standard RS-232C male connector.>
Mating connector to Allen-Bradley RS-232 Port is a Male, D-Subminiature Type. Cannon DB1SP (Solder Pot) with DA110963-2 Hood or Equivalent.
Almost any shielded cable is adequate. The shield is connected to pin 1 of the 15 pin connector only.

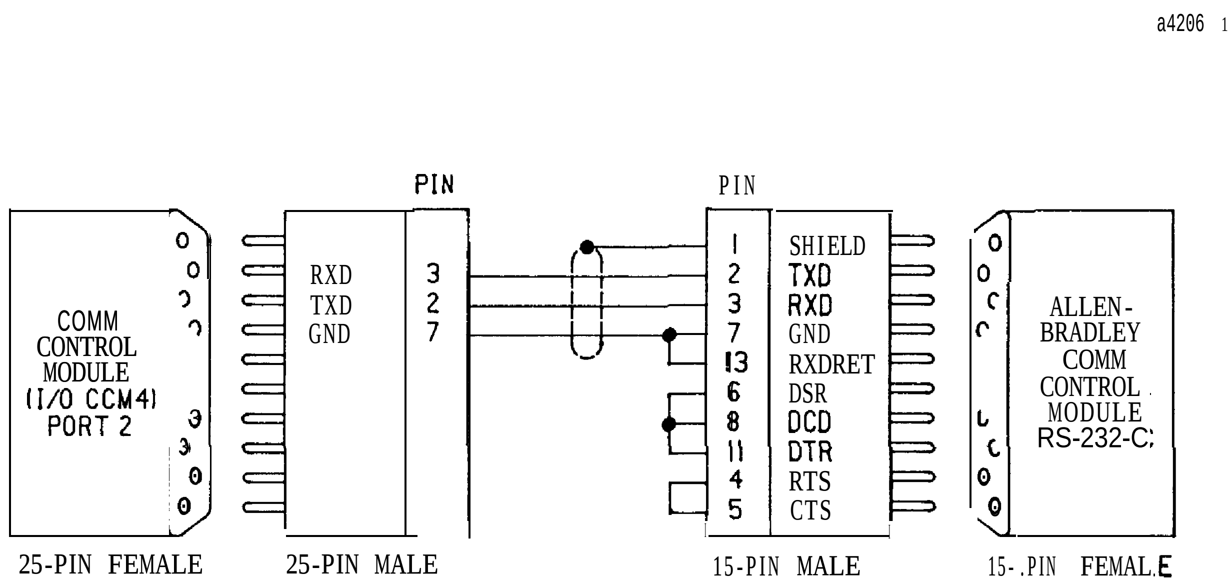


Figure 5 **RS-232-C** CABLE COMMUNICATION LINK

MODULE INSTALLATION

Use the extraction/insertion tool furnished with the Series Six PLC rack to remove or install the module. Position the I/O CCM4 board in any one of the Series Six I/O locations, or High Capacity I/O rack.

Guide the faceplate over the circuit board so that the proper contact is made. Then secure the faceplate to the rack using the thumbscrews at the top and the bottom. Refer to Figure 2, item 8

DIAGNOSTIC POWER-UP

Apply power to the I/O CCM4 module and external communication controller module. The CPU provides a window to the I/O CCM4 using the DPREQ instruction as shown below. When properly entered the CPU COMM LED will start blinking to indicate that the windows are occuring.

```
        Ixxxx        Rnnnn          Oyyyy
--------] [-------[DPREQ]----------(   )
                     HHHH
```

Table 4 I/O CCM4 LED DIAGNOSTICS

LED		DESCRIPTION
(1A) BOARD OK	ON:	Board has passed self-diagnostics and is operating properly.
	OFF :	Indicates a failure.
(1B) CPU COMM	ON:	Board is communicating with the Series Six CPU.
	OFF :	No communication between the Series Six and the board.
(IC) REC 1	ON:	Serial data present at receiver 1 input.
	OFF:	Receiver 1 input inactive. (Unused)
(lD) TRANS 1	ON:	Serial data present at transmitter 1 output.
	OFF :	Transmitter 1 output inactive. (Unused)
(lE) REC 2	ON:	Serial data present at receiver 2 input.
	OFF:	Receiver 2 input inactive.
(lF) TRANS 2	ON:	Serial data present at transmitter 2 output.
	OFF:	Transmitter 2 output inactive.

I/O CCM4 POWER-UP ERROR CODES

If the BOARD OK light remains OFF after the self-diagnostics routine, the indicator lights will create one of the patterns as follows: (• = ON)

Table 5 I/O CCM4 POWER-UP ERROR CODES

LED		CODE 1	CODE 2	CODE 3	CODE 4	CODE 5	CODE 6
(6)	BOARD OK	o	o	o	o	o	•
(5)	CPU COMM	o	o	o	o	o	o
(4)	REC 1	o	o	o	o	•	o
(3)	TRANS 1	o	o	o	•	•	o
(2)	REC 2	o	o	•	•	•	o
(1)	TRANS 2	o	•	•	•	•	o

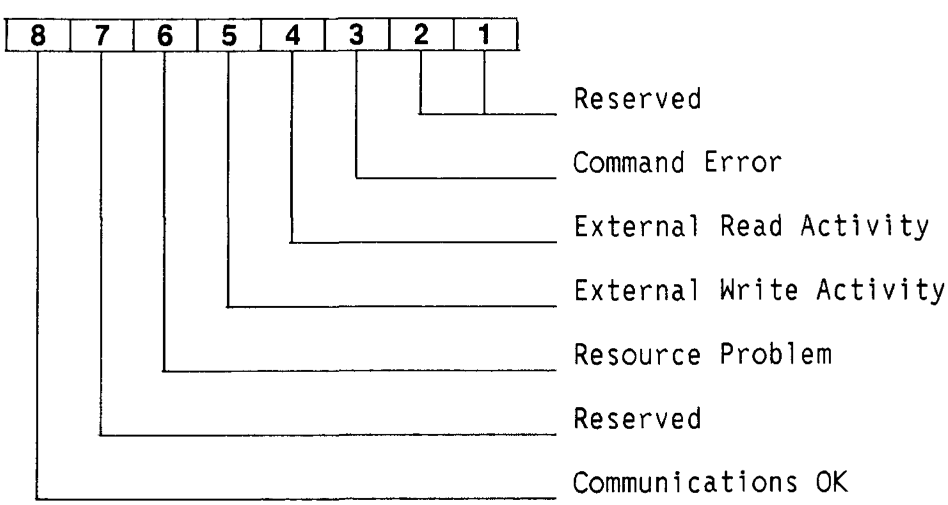
<u>Code</u> <u>Description</u>

1 Processor test failed (Defective board)
2 Timer test failed
3 EPROM checksum test or EPROM test failed
4 RAM test failed
5 S/W initilization failure
6 Power-up complete and successful

I/O CCM4 MODULE - SERIES SIX INTERFACE

The I/O CCM4 maintains a status byte holding the latest status of the I/O CCM4 operation. The byte is comprised of 8 consecutive Input Points. The Input Points assigned to the I/O CCM4 depend on the backplane address of the I/O CCM4 card. Refer to GFK-0076 User's Manual, Chapter 3, for more information concerning status byte.

SERIES SIX I/O CCM4 INPUT STATUS BYTE



SPECIFICATIONS

Space Requirements: One Series Six I/O slot in either a Model 60 or High-Capacity I/O rack

Circuit Board:	8.15 x 11.0 (inches)	208 x 280 (mm)
Faceplate:	12.46 x 1.175 (inches)	317 x 30 (mm)

Rated Voltage: 240 Vdc or RMS ac, 50/60 Hz.

Power Requirements: +5 Vdc, +12 Vdc (Supplied by rack power supply)
5 Vdc-20 unit loads

Storage Temperature: 0 to 70°C

Operating Temperature: 0 to 60°C

Humidity: 5% - 95% (non-condensing)

Altitude: Up to 10,000 feet (3,000 meters) above sea level (operating)

Isolation: (Port to Port and either Port to Series Six common).

Noise & Transient: Immunity: Meets following specifications:
Showering arcs per NEMA ICS 2,230.40
Surges per ANSI C37.90.9
5 W R.F. transmitter 27-450 Mhz

ORDERING INFORMATION

Circuit Board and Faceplate	Faceplate
IC6OOBF950	IC6OOFP948

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

The UL® symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment .)

Series Six PLC

GEnet Factory LAN

GFK-0142B

December, 1989

Broadband Network Interface

IC650ESS103, IC650ESS303

IC650ESS101, IC650ESS301

- Direct LAN attachment to MAP Broadband network
- Works with Series Six Plus PLC
- Three concurrent data transfer services: MAP, DATAGRAM, and GLOBAL DATA
- Software (sold separately) is easily loaded or upgraded via RAM load
- Software is retained through power outages up to *72* hours
- Comprehensive station management and diagnostic tools

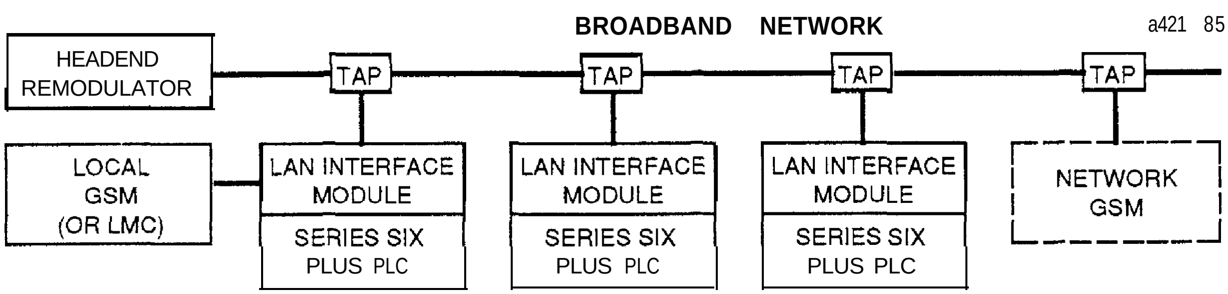


Figure 1. LAN Interface Module Connects the Series Six PLC to a Broadband Network

The LAN Interface module for the Series Six programmable controller is a member of the family of GEnet Factory LAN communication products. These products provide a range of options for interconnecting automation controllers and for integrating them into multi-vendor networks.

The Series Six LAN Interface module fulfills its role in the family by providing a direct connection for a Series Six Plus programmable controller to a broadband network.

The GEnet Factory LAN architecture is based on standards set forth in the Manufacturing Automation Protocol (MAP) specification.

MAP has been an evolving standard. Series Six LAN Interface modules support the MAP specification versions 3.0 and 2.2. The version of MAP protocol is simply loaded into Random Access Memory (RAM) on the appropriate LAN Interface module. This allows upgrade to a new revision of software without modification to the hardware.

Features of the LAN Interface Module

The features of the GEnet Factory LAN Interface module are described briefly here. For a more complete description see the appropriate GEnet ***Series Six PLC Network Interface User's Manual.*** Other related publications are listed on page 7.

Direct LAN Attachment to the Broadband Network

The LAN Interface module consists of two boards (controller board and modem board) which plug directly into the Series Six Plus CPU rack. Figure I illustrates the LAN Interface module as part of the net work.

The LAN Interface module connects directly to the Broadband Network through the 10 Mbps modem board. Intermediate devices such as bridges or gateways are not required, The direct connection provides the high performance required for real-time control applications.

The communications software is down-loaded to the LAN Interface and stored in Random Access Memory (RAM). This makes it easy to reconfigure or upg-rade the communications software simply by downloading it again. An on-board capacitor provides 72-hour memory retention which will prevent loss of the communication software due to most power loss situations.

Broadband Networks: Broadband networks are designed to handle medium to large-size applications with hundreds of stations as a typical number which might be attached. Broadband networks can extend over cable distances as far as 1Okm.

Broadband cable plant design and installation must be in accordance with IEEE 802.7 and requires special expertise. GE Fanuc Automation recommends that you contract professional specialists for these services. Consult your local GE Fanuc salesperson for further information.

Communication Services

There are three different communication protocols for transferring data on the network: MAP, Datagram, and Global Data. The LAN Interface software for these protocols is offered as two separate software packages, one for MAP 3.0, and the other for MAP *2.2.*

Regardless of which MAP version you choose; MAP, Datagram, and Global Data operate simultaneously on the network and within each station.

MAP Protocol (7-layer)

MAP protocol is defmed by the Manufacturing Automation Protocol (MAP) specification, MAP is an approved standard. MAP-compatible products are available from a variety of manufacturers, and their interoperability has been established.

The primary service offered by the MAP protocol is reliable message transfer between two interconnected stations. MAP protocol provides automatic error recovery for most kinds of errors. MAP is ideal for transferring large amounts of data between two specific stations, such as PLC program downloads.

A feature of MAP is that the two communicating stations need not be on the same LAN, so long as the different LAN's are connected by an appropriate intermediate station.

MAP commands are directed from an initiating station to a single specific responding station. Each message exchange is explicitly initiated.

Datagram Protocol (3-layer, miniMAP, EPA)

GEnet Datagram protocol is a subset of the MAP/EPA standard specified in MAP Version 3.0.

MAP/EPA represents an optional enhancement of the basic MAP standard, toward improved real-time performance for direct control applications. These applications, in contrast to MAP applications, send short messages but demand very quick response.

GEnet Datagrarn protocol provides basic read and write data transfers between two stations on the same LAN. Like MAP, automatic error recovery is provided.

GEnet Datagram commands are directed from an initiating station to a single specific responding station. Each message exchange is explicitly initiated.

Global Data Protocol

GEnet Global Data protocol is a proprietary innovation of GE Fanuc - NA.

Global Data provides periodic data transfers from a source station to unspecified receiving station(s). Receiving stations elect to receive specific data according to symbolic variable-names, but from unspecified source station(s). The receiving ladder logic program is notified only if the data is not updated in a timely fashion.

GEnet Global Data provides highly efficient transfer of periodic data to one or many stations on the same LAN. Symbolic data references permit independent progamming of the stations.

A single command initiates the transfer, which then proceeds periodically without further attention by the ladder logic program unless an exception condition occurs.

Station Management and Diagnostics Tools

The station management and diagnostic tools featured are:

- GEnet System Manager (GSM) (called Local Management Console or LMC with the MAP 2.2 software)
- The Local Station Manager (LSM)

GEnet System Manager (GSM)

GEnet System Manager (GSM) is a software package which runs on an IBM PC or IBM compatible (e.g., Workmaster computer.

GSM is used to perform the following functions:

- Create and store configuration files to be downloaded as the communication software to a Series Six PLC LAN Interface.
- A terminal mode of operation provides access to the local Station Manager of Series Six LAN Interfaces.

GSM Software Versions

The GEnet System Manager (GSM) comes in two versions: local and Network.

Local GSM comes as part of the MAP software and allows connection from the computer COMMl port to the 9-pin port on the Series Six LAN Interface.

Network GSM is an optional software package (purchased separately) which allows GSM to work over the network. The appropriate MAP Interface card is required for the personal computer on which GSM is to be installed. A download server is included with network GSM to load configuration files to Series Six LAN Interfaces over the network.

Local Station Manager

The Local Station Manager (LSM) is a part of the basic Series Six LAN Interface communication software. The LSM executes as a background activity on the LAN Interface module to provide online supervisory access to it.

The LSM can be accessed in three ways:

- Via the 9-pin serial port to a locally connected user-provided terminal.
- Via the network from GEnet System Manager.
- Limited access is also provided directly to the ladder logic program of the associated Series Six PLC.

The LSM provides all the following services via the local serial port or over the network to GSM. A subset is available directly to the ladder logic program.

- An interactive set of commands for interrogating and controlling the LAN Interface module.
- An online "help" facility.
- Unrestricted access to observe internal statistics, an error log, and configuration parameters.
- Password security for commands that change the LAN Interface states or configuration.

Installation

The LAN Interface Module consists of two boards:

- The digital controller board
- The modem board

These boards are interconnected by a ribbon cable. Each board is also shipped with a faceplate.

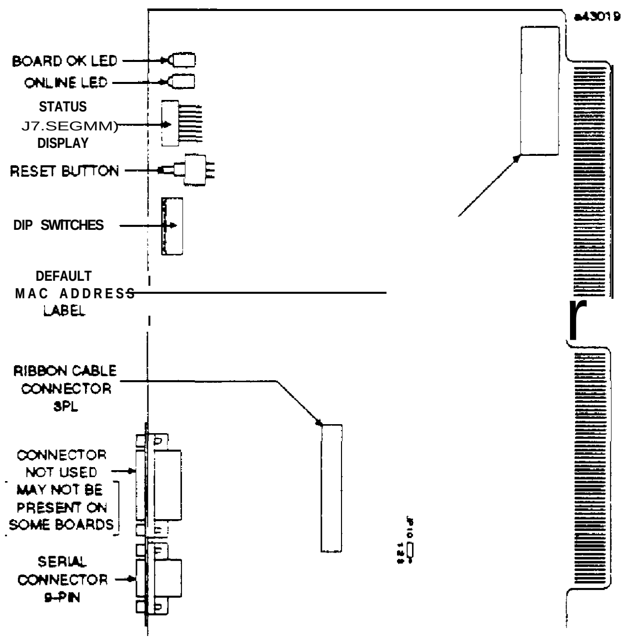


Figure 2. User Items - Controller Board

Digital Controller Board

The digital controller board (see Figure 2) connects the LAN Interface to the backplane of the Series Six Plus PLC, allowing data to flow to and from the Series Six Plus PLC. It contains LAN communication software which is downloaded to the board using GSM.

The controller board has the following user-accessible elements:

1. BOARD OK LED
   This LED is ON if the LAN Interface hardware has passed diagnostics and is operating properly. It is OFF if either the board fails diagnostics or if a hardware problem occurs on an operating board.

2. ONLINE LED
   The ONLINE LED is ON when the LAN Interface module is periodically receiving the right to transmit on the network.

   It is BLINKING when the module is transferring data to or from the network.

   It is OFF when no other stations are connected and communicating, when the network is not communicating due to a disruption of the cable, or when the local station has malfunctions.

3. STATUS DISPLAY
   The Status Display is a seven-segment display used to show a diagnostic code during the power-up diagnostics. It is also used to show the status of the Station after it is operating. See *GEnet Series Six PLC Network Interface User's Manual*, Appendix E for the meaning of codes which may be displayed.

4. RESTART BUTTON
   Pressing the Restart button forces a reset of the LAN Interface module. This causes the power-up diagnostics to be run and the software on the module to be reset. Any data being transferred by the LAN Interface module at the time of the restart will be lost. The button is used to restart the LAN Interface module after changes have been made to the option DIP switches.

   The Restart button is inaccessible when the Digital Controller faceplate is installed.

   NOTE

   Depending on the ladder logic program in the Series Six PLC, depressing the Restart button when the Series Six RUN/STOP keyswitch is in RUN may result in failure of the LAN Interface backplane diagnostic.

5. OPTION SWITCHES
   On the exposed edge of the digital controller board is a set of 8 DIP switches which are used to enable various maintenance options. For a complete description of these switches, refer to GEnet Series Six *PLC Network Interface User's Manual*, Appendix C. Normally, all these switches should be positioned to the right (OPEN).

   The option switches are inaccessible when the Digital Controller faceplate is installed

6. SERIAL PORT
   The GSM terminal is connected to this 9-pin port and communication software may be loaded to the module through this port. For pinouts of this port, refer to Table 2.

GFK-0142B

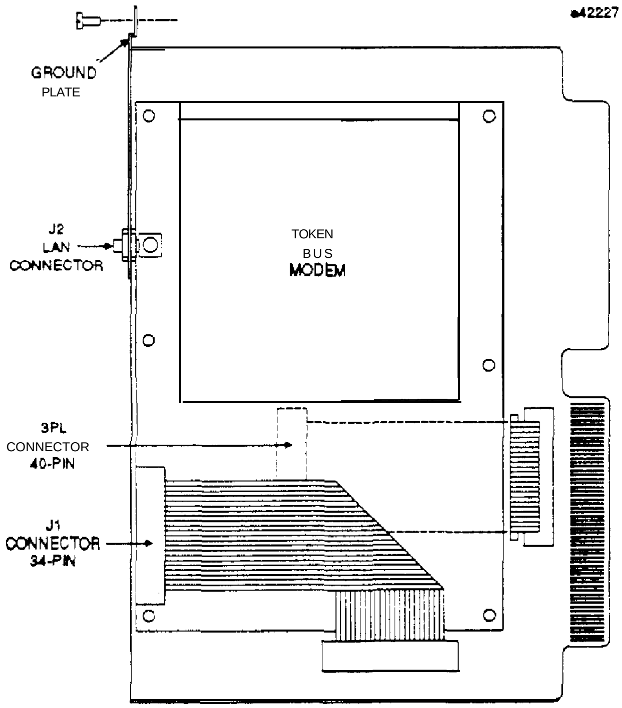


Figure **3. User Items • Modem Board**

Modem Board

The modem board (see Figure 3) connects to the digital controller board through the ribbon cable, but does not connect directly to the Series Six PLC's backplane; the modem board's backplane connection provides mechanical support only. The LAN Interface module is connected to the network through the coaxial LAN connector on the modem board.

WARNING

The ground plate must be securely fastened to the chassis of the Series Six Plus PLC rack using the screw provided. Failure to do so may cause personal injury or **improper operation of the equipment.**

The modem board has the following user accessible elements:

1. GROUND PLATE
   Grounds modem and coaxial cable shield to the chassis of the Series Six Plus PLC rack.

2. LAN CONNECTOR
   The connector for attaching the drop cable of the LAN cable plant.

Installing and Powering-Up the LAN Interface Module

1. Set the Series Six PLC's backplane DIP-switches for the COM I./O slot (slot 6) all to the OPEN position.
2. Examine JP10 on controller board (see Figure 2.) and insure that the jumper connects pins 1 and 2.
3. Plug the Modem board cable connector (3PL) into the Controller board (3PL) connector. The cable is keyed to aid in doing this.
4. Locate the COM CON slot (slot 5) of the PLC rack. Carefully remove the COM CON label and remaining adhesive from the PLC rack. This will expose the screw hole that will receive the safety screw from the Modem board ground plate.
5. Slide the Controller and Modem boards into the Series Six Plus PLC rack as a unit. Refer to Figure 4.
   - Controller in COM I/O (slot 6)
   - Modem board into COM CON (slot 5)

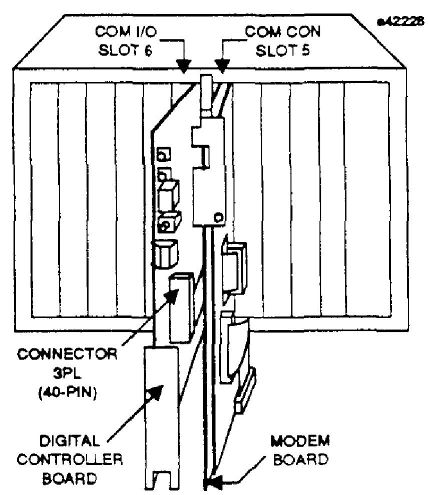


Figure 4. Series Six **Plus Rack Layout**

6. Back out the screw in the Modem board ground plate part way, and seat both boards using the extraction/insertion tool.

7. Tighten the g-round plate screw, securing the ground plate to the chassis of the rack.
8. Make sure alI option switches on the edge of the controller board are positioned to the right (OPEN).
9. If available, connect the drop cable from the cable plant to the LAN Interface connector of the modem board, first threading it through the hole in the unattached faceplate. Tighten to a snug fit using a small wrench.
10. Set the Series Six RUN/STOP keyswitch to STOP. This will prevent the local application program (if any) from initiating any command that may affect the operation of the module.
13. Power up the PLC rack The controller board executes self diagnostics and its progress is shown by a sequence of characters which appear on the 7-segment Status display. Refer to ***GEnet Series Six PLC Network Interface User's Man***ual, Appendix E, for details. After diagnostics are complete, the status of the LEDs and display should be as shown in Table 1 below.

NOTE

The first time the Controller board is powered after several days without power, the self diagnostics may not commence for a period of up to one minute. This is normal. This is the time required to recharge the capacitor used for memory retention.

12. Attach the faceplate(s) to both the Controller and Modem.

Correct Results of Installation Procedure

After performing steps 1 through 12 above, the status of the LEDs and Status Display should be as shown in the Table 1 below.

Table 1. LED and Status Display

LED	RESULTS
BOARD OK	LED must be ON.
ON LINE	LED should be OFF (could be ON only if the communication software has been loaded previously and if modem is connected to operating network).
STATUS DISPLAY	Should display an "L" (Indicating a request for Load) or a "0" (indicating that the board has been loaded successfully at a previous time). If an "L" appears, the module is ready to receive a load via the local 9-pin serial port- If an "l" (lower case L) appears, the module is ready to receive a load via the LAN. If a "0" appears, but you wish to reload the LAN Interface module, you must first manually force a reload ***(see instructions in GEnet Series Six PLC Network Interface User's Manual) The*** LAN Interface does not require a reload if you are sure the currently loaded communication software and configuration parameters are correct for this LAN Interface.

Corrective Actions

If the BOARD OK LED is ON, but the STATUS display is other than 'L" or "O", this may indicate a problem with the configuration which was loaded previously. Refer to the Loading instructions in ***GEnet Series Six PLC Network Interface User's Manual,*** for more information.

If the BOARD OK LED is OFF, then something is wrong with the LAN Interface or its installation.

Turn off power, remove the controller and modem boards, and examine the backplane and ribbon cable connectors for bent or broken pins. Repeat the installation procedure. If you still do not get the results in the Table 1, refer to ***GEnet Series Six PLC Network Interface User's*** Manual., Appendix E for further instructions.

Configuring and Loading the LAN Interface Module,

Each station on the network must have its own unique configuration file which is downloaded with the communication executive soft ware.

See GEnet Series Six PLC Network Interface User's Manual, for instructions on configuring and loading the LAN Interface module. These operations are necessary before the LAN Interface can be brought on line.

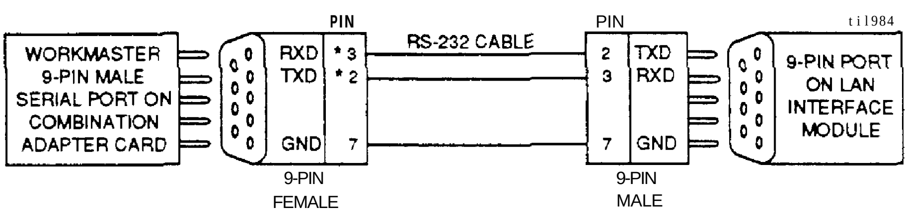
Serial Port Characteristics

The 9-pin serial port (RS-232C interface) is used to connect the local version of GSM to the LAN lnterface module. The pinouts of the port are shown in the Table 2. The LAN Interface module is a Data Terminal Equipment (DTE) device.

Table 2. RS-232 Port Pinouts

PIN	SIGNAL	DESCRIPTION NUMBER
1		Reserved
2	TX	Transmit data (out)
3	RX	Receive data (in)
4		Reserved
5		Reserved
6		Reserved
	GND	Signal Ground
8		Reserved
9		Reserved

A cable is needed to connect the GSM to the LAN Interface. Figure 5 shows how to construct this cable.



\+ THE PINS AND CONNECTOR MAY BE DIFFERENT FOR THE IBM PC OR ASCII TERMINAL, BUT THE SIGNAL NAMES WILL BE THE SAME. CONSULT THE MANUAL FOR YOUR TERMINAL OR ASCII TERMNAL FOR THE CORRECT SIZE AND PIN NUMBERS.

Figure 5. Cable to Connect the GSM to the LAN Interface

Related Publications (GEnet Factory LAN)

Series Six Network Interface User's Manual (MAP3.0)	GFK-0364
Series Six Network Interface User's Manual (MAP22)	GFK-0013
Carrierband Cable Plant Design and Installation Manual	GFK-0014
GEnet System Manager User's Manual	GFK-0413
GEnet Factory LAN System User's Manual	GEK-96608

Table 3. Module Specifications

Power Consumption (Typical):	Power consumption for the Digital Controller Board includes external RS-232 loads. The Broadband Modem Board is powered by the Controller Board through the ribbon cable.
	+5 Vdc / +12 Vdc / -12 Vdc
Power Requirements:	2.70 A / 0.55 A / 0.40 A
Units of Load:	45 / 22 / 16
Memory Retention:	An on-board capacitor provides backup power (up to 72 hours) when power is removed from the CPU rack containing the LAN Interface module. Maintenance free; no batteries are required.
Physical Dimensions:	
Each Circuit Board:	8.15 x 11.0 inches (207 x 279 mm)
Faceplate:	12.46 x 1.175 inches (317 x 30 mm)
Environment:	Operating Temperature 0° to 60° C Storage Temperature -40° to 70° C Humidity (non-condensing) 5% to 95%
Mounting:	The two-board set plugs into the Series Six Plus CPU rack in specific card slots and are interconnected by a 40-conductor flat ribbon cable. - Controller Board in the COM I/O slot (6th slot from the right) - Modem Board in the COM CON slot (5th slot from the right) Reset and Option Switches (front edge of controller board behind faceplate) BOARD OK LED, ONLINE LED STATUS (7-segment) Display
Connectors:	LAN (to Local Area Network) Type F female connector - J2, Female 9-pin D-connector
Interface Specifications:	LAN (to Local Area Network) IEEE 802.2 Logical Link Control Class III IEEE 802.4 Token Bus Medium Access Control - 48-bit Address Option - Priority Option - Immediate Response Option IEEE 802.4 Chapter 14, Broadband Bus Physical layer - Data Rate: 10 Mbps - Minimum network slot time: 128 octet times (102 microsec) - Worst-case station delay: 1024 octet times (820 microsec) - Supports Optional Receive Signal Source and Transmitter Enable/Disable selection J2, RS-232 DTE, 9600 bps
Certification:	Conforms to FCC (part 15, Subpart J) for Class A computing equipment. The product is listed by Underwriters Laboratories, Inc.

Table 4. Ordering Instructions

Complete Interface	Controller and Modem boards, Ribbon Cable and Faceplates for MAP 3.0	
	- RF Channel A 3'/4'/P/Q	IC650ESS103
	- RF Channel C 6'/FM1'/T/U	IC650ESS303
Complete Interface	Controller and Modem boards, Ribbon Cable and Faceplates for MAP 2.2	
	- RF Channel A 3'/4'/P/Q	IC650ESS101*
	- RF Channel C 6'/FM1'/T/U	IC650ESS301*
Configuration Software	MAP 3.0 Software and Documentation (Includes Local GSM)	IC651ESS003
GSM Network Version	GSM Software and User Documentation (PC with MAP I/F Required)	IC651MMZ300

Replacement Parts

Controller Board	Board and Faceplate (MAP 3.0)	IC650AEL003
	Board and Faceplate (MAP 2.2)	IC650AEL002
	Faceplate only (Controller)	IC650AMP010
Modem Board	Channel A Board, Faceplate and Cable	IC650AEM100
	Channel C Board, Faceplate and Cable	IC650AEM300
	Faceplate only (Modem)	IC650AMP030

* Obsolete 1st Qtr 1990.

GFK-0144

Arithmetic ControI Module

November 1987

GENERAL DESCRIPTION

The Arithmetic Control module performs arithmetic and logical operations for the Series Six Central Processor Unit (CPU). The features and benefits of this module are summarized in Table 1.

Four, AM2903, bit-slice, integrated circuits contained on this module constitute a 16-bit microprocessor that works in conjunction with the Logic Control module to generate system control and timing signals. The Arithmetic Control module is linked to the Logic Control through a ribbon cable connector.

Visible through a lens on the faceplate are two Light Emitting Diode (LED) indicators: One, marked "CHECK", remains lit to indicate that a self-test has been completed successfully once per I/O sweep; this LED also indicates that no abnormal conditions prevail in the CPU, such as system clock stopped, scan time longer than 300 milliseconds. The other LED, marked "RUN' indicates that the CPU is performing execution sequences and is in the RUN mode. The LEDs operate only when the module is installed in a properly powered CPU rack.

Refer to Table 2 for Arithmetic Control module specifications

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Contains 2 LED indicators: *CHECK *RUN	Indicates status of CPU to simply troubleshooting.
Usable in Model 60, 600, 6000 and Series Six Plus CPUs.	Reduces spare-parts inventory.
Bit-slice architecture.	High-speed processing.
Supports all Series Six Instructions sets including Expanded II	Increased functionality and backwards compatability.

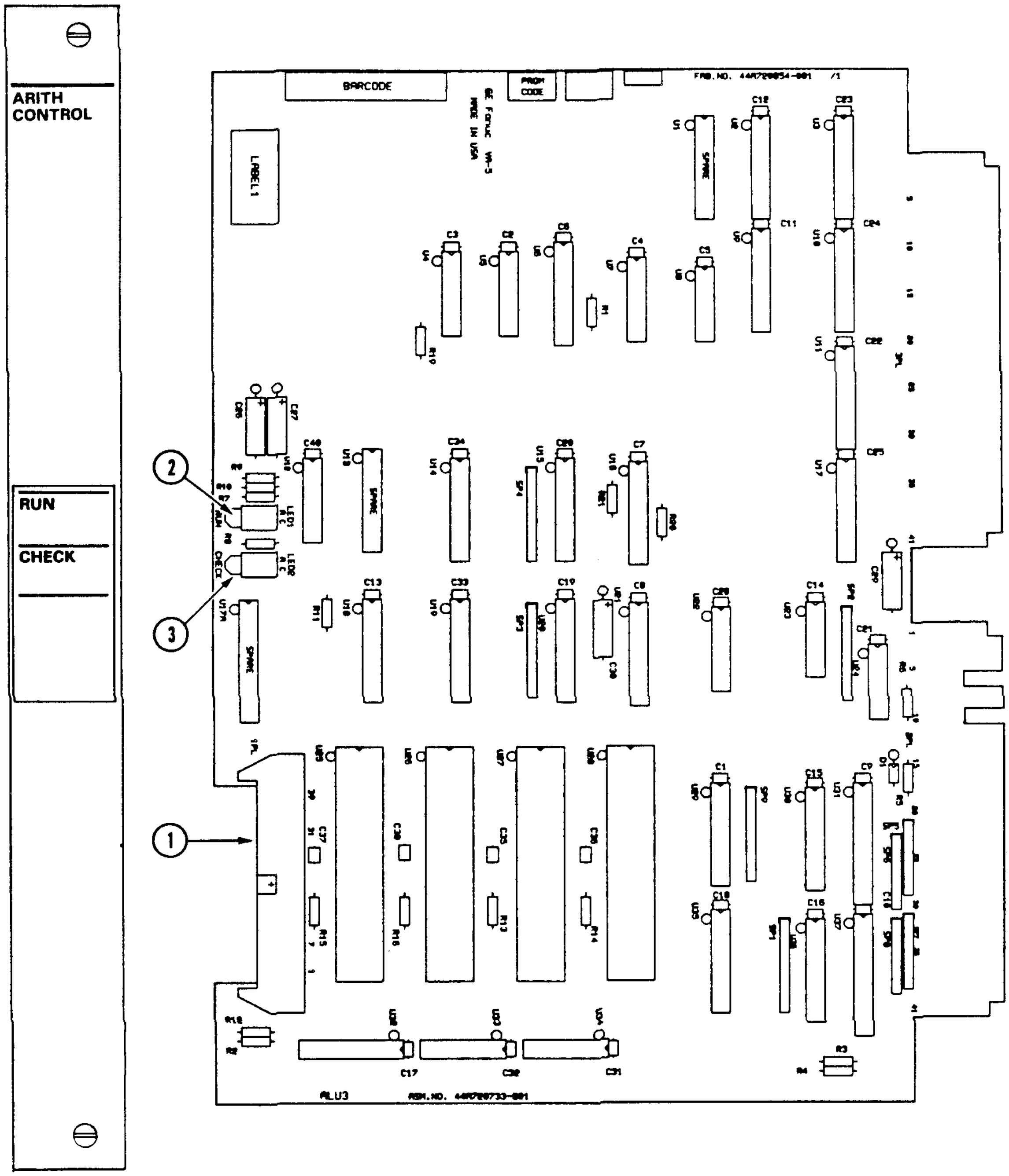


Figure 1. USER ITEMS

1. Socket for ribbon-cable connection to Logic Control module. See the "Installation" section of this sheet.

2. RUN Light

On: CPU execution sequence is proceeding; the self test is passed and the I/O scan is completed at least once each 300 (+/-50 ms). CPU is in RUN mode.

Off: CPU is in STOP mode.

3. CHECK Light

On: CPU execution sequence is proceeding; the self-test is passed at least once each 300 ms (+/-50 ms). CPU could be in RUN or STOP mode.

Off: CPU self-test has not been passed within 300 ms (+/-50 ms) or user program execution takes longer than 300 ms. CPU goes to STOP mode; I/O chain is reset.

INSTALLATION

The Arithmetic Control module can be installed in a Model 60, 600, 6000 or Series Six Plus CPU. Follow these steps for all models:

1. Use the extraction/insertion tool supplies with the CPU to insert (or remove) this module into the appropriate slot.

2. Connect a short length of ribbon cable (also supplied with the CPU) between this module and the Logic Control module.

3. Fasten the faceplate to the rack using the screws at the top and bottom.

NOTE

Attempting to operate the system without the ribbon cable connected between the Arithmetic Control module and the Logic Control module will cause the CPU to operate unpredictablv.

Table 2. SPECIFICATIONS

Dimensions:	
Circuit Board:	8.15 x 11.0 (inches) 208 x 280 (mm)
Faceplate:	12.46 x 1.175 (inches) 317 x 30 (mm)
Power Requirements:	5V DC, 1.7A (Supplied by CPU power supply)
Storage Temperature:	-20 to 70°C (-4 to 158°F)
Operating Temperature:	0 to 60°C (32 to 140' F) (outside rack) Humidity: 5% - 95% (non-condensing)

Table 3. ORDERING INSTRUCTIONS

DESCRIPTION	CATALOG NUMBER
Circuit Board and Faceplate	IC6OOCB524K
Faceplate	IC600FT'500A

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

For further information, contact your local **GE** Fanuc sales office.

Series Six Plus
Programmable Controller

Logic Control Module

GFK-0145c
October 1988

GENERAL DESCRIPTION

The Logic Control module is available in three versions: Advanced, Expanded and Expanded II. The module contains the system clock, a microprogram sequencer, and Programmable Read-Only Memory (PROM). The module provides control and timing signals to the CPU backplane for use by other modules, and microprogram instructions to the Arithmetic Control module through a ribbon cable. The Logic Control module features and benefits are summarized in Table 1.

Refer to Table **3** for Logic Control module specifications.

NOTE

Operation of the system without the ribbon cable connected between the Arithmetic control Module results in unpredictable execution by the CPU.

NOTE

Use of the Expanded II Logic Control Module requires use of Logicmaster 6, Release 4 or later to ensure proper operation.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Compatible with most Series Six and Series Six Plus CPUS.	Reduced spare parts inventory cost.
Three Versions Available:	Provides a wide range of firnctions.
Advanced Functions	Includes Basic functions plus logic and signed arithmetic operations, data handling, user I/O control and access to R1025-R8192 via Extended Table Moves.
Expanded Functions	Includes Advanced Functions plus expanded I/O and register addressing, *floating* point arithmetic operations, GENIUS I/O diagnostic functions, and additional communications control functions.
Expanded II Functions	Includes all Advanced Functions plus: Auxiliary I/O oven-ides, dynamic checksum of user logic for changes, active override detection, support of 64K Logic memory, faster solution of Relay Ladder Logic+

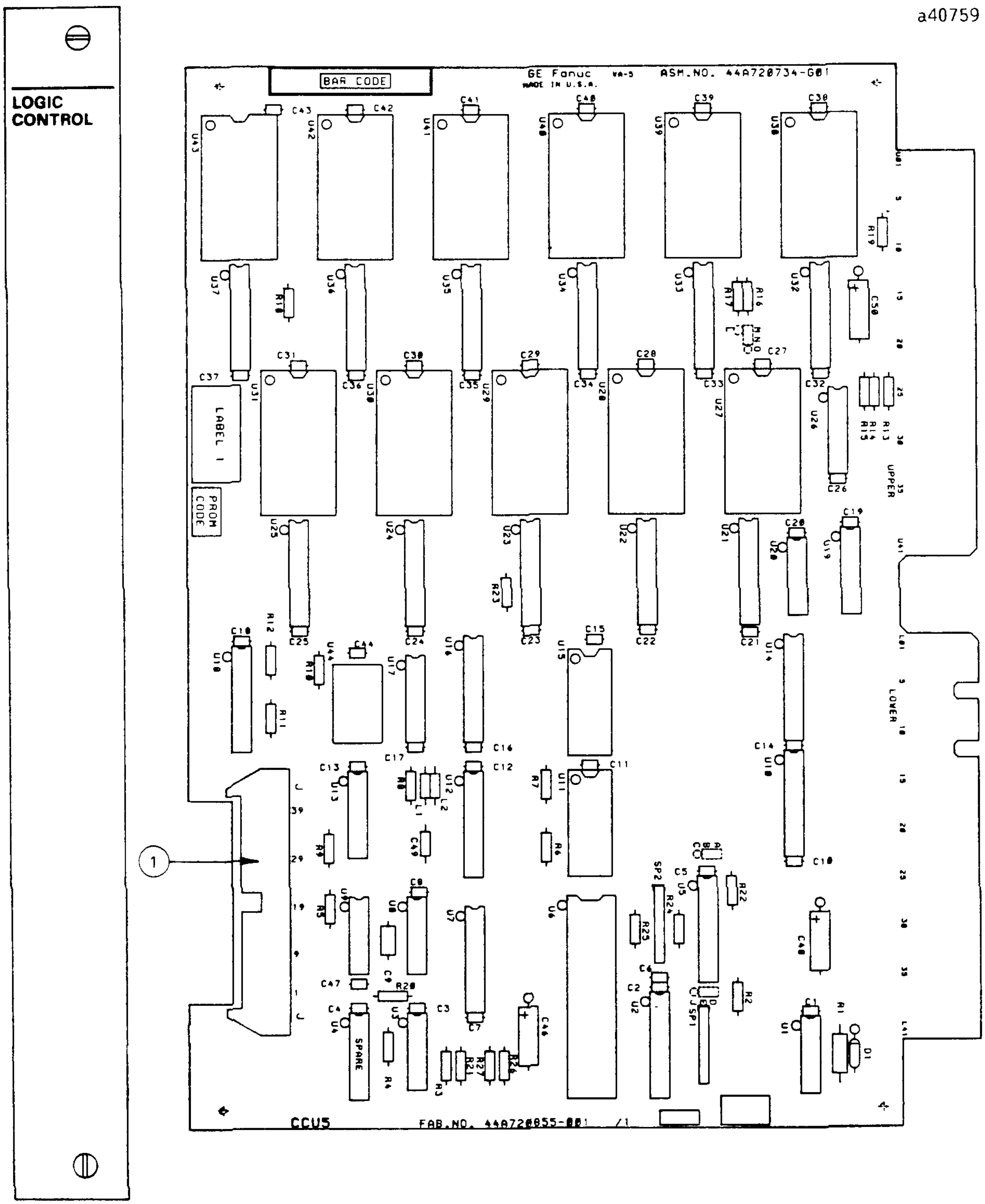


Figure 1. USER ITEMS

Table 2. SYSTEM COMPATIBILITY

VERSION	SYSTEM USE
Advanced	All CPU racks
Expanded	All CPU racks
Expanded II	Requires:
	1. IC6OOCB524K or later Arithmetic Control Module.
	3. IC6OOLX---K or later Logic Memory Modules.
	3. IC6OOCP630, CP62-, or CP61- CPU rack
	4. Logicmaster 6 Release 4 or later.

INSTALLATION

The Logic control Module is installed in the CPU Rack, one slot to the right of the Arithmetic control Module. To ensure proper installation and removal of the Logic control Module, always use the insertion/extraction tool packaged with the CPU.

When replacing a defective module, the ribbon connector must be disconnected before removing the module.

After inserting a replacement module, the ribbon connector must be reconnected.

NOTE

To prevent unpredictable operation by your Series Six or Series Six Plus CPU, power-down prior to removing or installing the Logic Control module and its ribbon connector.

Table 3. SPECIFICATIONS

Dimensions:	
Circuit Board:	8.15 x 11.0 x 1.20 (inches), 208 x 280 x 31 (mm)
Faceplate:	12.46 x 1.175 (inches), 317 x 30 (mm)
Power Requirements:	5 V DC, .65A, 12 units of load (Supplied by CPU power supply).
Storage Temperature:	-20 to 70C (-4 to 158F)
Operating Temperature:	0 to 60C (32 to 140F)
Humidity:	5% - 95% (non-condensing)

Table 4. ORDERING INFORMATION

DESCRIPTION	CATALOG NUMBER
Advanced Logic Control Module	JC600CB502L or CB525
Expanded Logic Control Module	IC600CB512L or CB526
Expanded II Logic Control Module	IC600CB515K

CATALOG NUMBER REVISION SUFFIX

The equipment listed above having the catalog numbers shown and the same equipment having a higher alpha suffix is designed for listing by UL for use as auxiliary control devices. The equipment is a direct replacement for equipment having the same catalog number but a lower alpha suffix.

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc sales office.

GFK-0146

Memory Modules

November 1987

GENERAL DESCRIPTION

The Combined Memory modules contain the entire Series Six Plus Central Processor Unit (CPU) memory configuration, including Internal, Register and Logic (user) memory. Also included is parity memory for each of these six memory types. The modules are available in six versions. They are: 5K, 12K, 16K, 24K, 48K and 80K. The features and benefits of the Combined Memory modules are summarized in table 1.

The Logic memory section contains the user program, comprised of ladder diagram logic and/or mnemonic instructions; modules containing 4K, 8K, 16K, 32K or 64K 16-bit words of Logic memory are available. The Register memory stores 1K user-defined 16-bit words in the 8K version; 8K words in the 12K, 16K or 24K versions; 16K words in the 48K or 64K versions. The Internal Memory section contains data stored in Table and Scratchpad formats.

The Combined Memory module uses CMOS-RAM for its memory storage devices. When power is removed, intentionally or not, the contents of these devices are maintained by a Lithium-Manganese Dioxide battery. This battery is located on the circuit board along with circuitry to monitor the battery voltage level.

Two LED's are visible through a lens on the module faceplate. An LED marked, 'BATTERY', indicates that the on-board Lithium battery has enough charge to preserve memory contents. Another, marked, "PARITY", indicates there are no parity errors resulting from a Logic Memory access, a Register Memory access or an Internal Memory access.

Refer to table 2 for Combined Memory module specifications.

NOTE

The faceplate packaged with the Combined Memory module is labeled. LOGIC MEMORY.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
-Six Versions Available: 4K of User Memory; 1K Words of Register Memory 4K of User Memory; 8K Words of Register Memory 8K of User Memory; 8K Words of Register Memory 16K of User Memory; 8K Words of Register Memory 32K of User Memory; 16K Words of Register Memory 64K of User Memory; 16K Words of Register Memory	Expandable Memory Capacities
Battery back-up of CMOS Memory through on board battery of auxiliary battery.	All data maintained when power is removed ALlows system **to restart** after power is restored.
Parity-error indicator.	Simplifies troubleshooting. Preserves data integrity.
Battery-Status indicator.	Wams user of need for battery replacement.

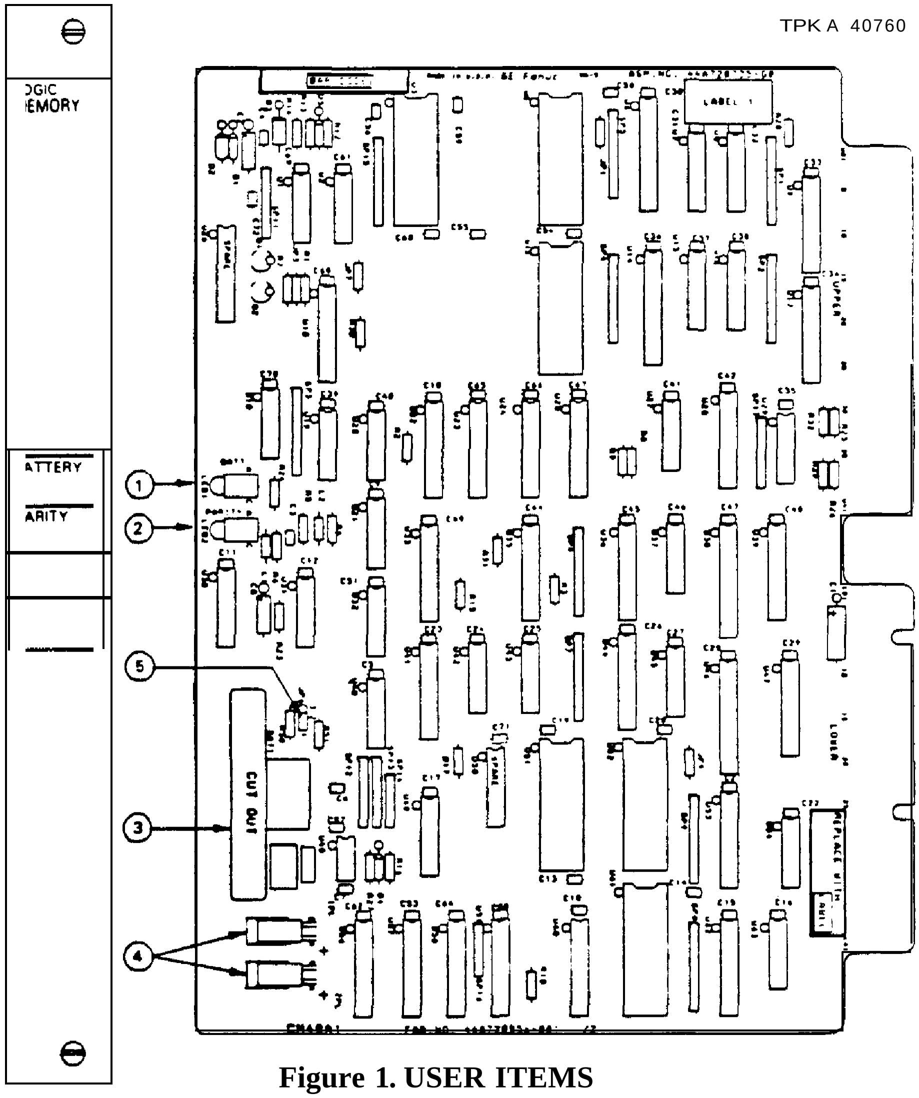


Figure 1. USER ITEMS

I. BATTERY Light

Steady On: Battery Normal

Flashing: Battery Low: The CPU continues running. No. 2 (advisory) alarm is activated. To protect the memory contents, replace the battery before it fails. When the light begins to flash, battery failure will occur in approximately 30 days.

Steady Off: Battery Failed: CPU continues running, but will not restart if stopped. No. 2 alarm remains activated. Memory contents will be lost when power is switched off or lost.

2. PARITY Light

on: Internal Memory, Register Memory and Logic Memory Parity are OK.

off: Internal Memory and/or Register Memory or Logic Memory parity error occurred when reading memory. An error message appears on the Workmaster Computer display or in the work area of the Program Development Terminal display. Causes CPU to stop.

3. Lithium-Manganese Dioxide Battery

4. Battery Connectors

5, External Auxiliary Battery Select

NOTE

For battery replacement information, consult the Series Six Plus Installation and Maintenance Manual, GEK-96602.

INSTALLATION

The Combined Memory module (LOGIC MEMORY) is installed in the card slot to the immediate left of the Arithmetic Control module in the CPU rack. Follow **these** steps for installation:

1. Connect 2-pin lithum battery connector to either male jack beneath battery if not using auxiliary battery inputs on power supply terminal strip.
2. If auxiliary battery is used, the battery does not have to be on the board.
3. Use extraction/insertion tool furnished with CPU to insert (or remove) module into rack.
4. Secure faceplate to rack using screws at top and bottom.
5. Clear parity errors detected at initial power-up of the CPU. Refer to Chapter 11, of the Logicmaster 6 User's Manual, GEK-25379.

CAUTION

Do not allow the bottom of this circuit board to come into contact with a conductive (metal) surface when the board cover has been removed. Failure to observe this caution could result in the discharge of the non-rechargeable lithium battery and the loss of the memory contents.

Relatively small amounts of excess charge can cause very intense electrostatic fields in metal-oxide-semiconductor (MOS) devices, **damaging** their gate structure. Avoid handling this circuit board in a manner which might cause electrostatic charges. Failure to observe this caution could result in the destruction of the CMOS-RAM devices in this module.

WARNING

Do not discard the lithium-manganese dioxide battery in either fire or water. Do not place a short circuit between the contacts at the ends of the battery. Do not attempt to recharge the battery. Failure to observe any of these warnings map cause the battery to burst or burn or release hazardous materials.

Table 2. SPECIFICATIONS

Dimensions:	
Circuit Board:	8.15 x 11.0 (inches), 208 x 280 (mm)
Faceplate:	12.46 x 1.175 (inches), 317 x 30 (mm)
Power Requirements: (Supplied by CPU power supply)	5 V dc, 1.5 A (max), -12 V dc, 10 mA (max)
***Register Memory Capacity:**	1K l6-Bit words; 5K version 8K 16-Bit words; 12K, 16K or 24K versions 16K 16-Bit words; 48K and 80K versions
***Logic (user) Memory Capacity:**	4,096 (4K) 16-Bit words 8,192 (8K) 16-Bit words 16,384 (16K) 16-Bit words 32,768 (32K) 16-Bit words 65,536 (64K) l6-Bit words
Operating Temperature:	0 to 60° C (32 to 140F) (outside of rack)
Storage Temperature:	-20 to 70C (-4 TO 158F')
Humidity:	5%-95% {non-condensing)

*with battery back-up

Table 3. ORDERING INFORMATION

DESCRIPTION	CATALOG NUMBER
4K/lK Logic/Register Memory	IC600LX 5K
4K/8K Logic/Register Memory	IC600LX612K
8K/8K Logic/Register Memory	IC600LX616K
16K/16K Logic//Register Memory	IC600LX624K
32K./16K Logic/Register Memory	IC600LX648K
64K/16K Logic/Register Memory	IC600LX68OK

For further information, contact your local GE Fanuc sales office.

Series Six Plus Programmable Controller

Gl?K-0147B

June 1989

Central Processor Unit

8-Slot Rack

1l-Slot Rack

General Description

The Central Processor Unit (CPU) for the Series Six Plus Programmable Logic Controller (PLC) contains a power supply, three control modules and a memory module, connected to a common backplane and enclosed within a mountable rack. The Series Six CPU rack is available in 2 sizes: 8 slots and 11 slots. The 8 slot rack contains an I/O backplane capable of supporting up to four I/O modules. The 11 slot rack contains an I/O backplane capable of supporting up to seven I/O modules. Three items must be ordered to make up a complete Series Six Plus CPU: (1) a basic unit which includes a rack with power supply, I/O Control module, Arithmetic Control module, ribbon cable, and field wiring trough, (2) Logic Control module, (3) Combined Memory module. The features and benefits of the Series Six Plus PLC are summarized in table 1.

Two of the three control modules, the Arithmetic Control and Logic Control modules, perform the central processing operations of the Series Six Plus Programmable Logic Controller. The Arithmetic Control module contains a 16-bit processor that performs all PLC arithmetic and logical operations. The Logic Control module provides Advanced, Expanded, and Expanded II functions to the processor as well as control and timing signals throughout the CPU.

The third control module, the I/O Control module, provides an interface between the CPU and an input/output (I/O) chain (containing up to 8000 inputs and 8000 outputs), and the Workmaster computer.

With an optional Auxiliary I/O module, an additional 8000 inputs and 8000 outputs can be included on the Auxiliary I/O chain.

The entire Series Six Plus PLC memory system is contained on a single, battery-backed, CMOS memory board, which is the Logic Memory module. This module contains three types of memory: Internal memory, Register memory and Logic memory. The Internal memory consists of various internal data stored in Table and Scratchpad formats; the Register memory contains storage for up to 16K of l6-bit registers. The user program, which is developed in the Workmaster computer and consists of ladder diagram logic and/or mnemonic functions, is stored in the Logic memory. A Series Six Plus PLC can contain up to 64K of Logic memory.

The CPU can operate in one of two modes: STOP or RUN. In the STOP mode, the CPU performs a series of execution sequences during which the CPU communicates with various system peripherals and executes housekeeping routines.

In the RUN mode, the Series Six Plus CPU solves the user program in logic memory, scans the inputs and updates the outputs, and performs the operations executed in the STOP mode.

A Series Six Plus PLC option, the Communications Control module, allows the Series Six Plus to communicate with intelligent devices (host computer, programmable terminal, etc.) as well as the STR-LINK IIA and STR-LINK III recorders, and Series One, Series Three and Series Six PLCs.

Programs are entered, edited and monitored with the Workmaster computer using Logicmaster 6 programming software.

An IBM PC, PC-XT, or PC-AT personal computer using the unbundled version of Logicmaster 6 software can also be used for the programming functions.

Refer to table 2 for Series Six Plus PLC specifications.

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@Registered Trademark of International Business Machines, Inc.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Battery-backed CMOS memory: 4K, SK, 16K, 32K or 64K of Logic Memory 1K to 16K (16-bit words) of Register Memory Table and Scratchpad Memory	Provides ample program storage; allows user to monitor and control I/O and Series Six Plus PLC. All logic memory is available to the user ladder program.
I/O Control module. Auxiliary I/O module	Supports up to 16K input and 16K output (8K I/O in Main chain, 8K I/O in Auxiliary chain) points with I/O Transmitter modules and optional Auxiliary I/O module.
Communications Control modules (option@: CCM2, CCM3, I/O CCM RS-232C Current Loop RS-422	Provides ease and flexibility in operation of Series Six Plus PLC, Two independent ports. Can be Master/Slave without other hardware.
Interface to Workmaster computer.	Expandability in programming capabilities.
Available in three versions to cover 95 to 260 V ac, 50/60 Hz, 24 V dc or 125 V dc source input power without modification,	Can be used in a variety of installations. No jumpers or rewiring required.
Compact size for 64K Logic memory, 16K register memory and up to 224 I/O points in one 19 inch rack.	Easy one rack installation for I/O and CPU capabilities.
GEnetTM Factory LAN for broader communications capabilities than with the Communications Control Modules.	Provides a 10 M bps token passing bus for high speed communications between GE Fanuc automation equipment. Uses the International Standards Organizations's Open System Interconnection model as its communication architecture and complies with the General Motors' Manufacturing Automation Protocol (MAP) specification which includes the IEEE 802.4 token bus standard.

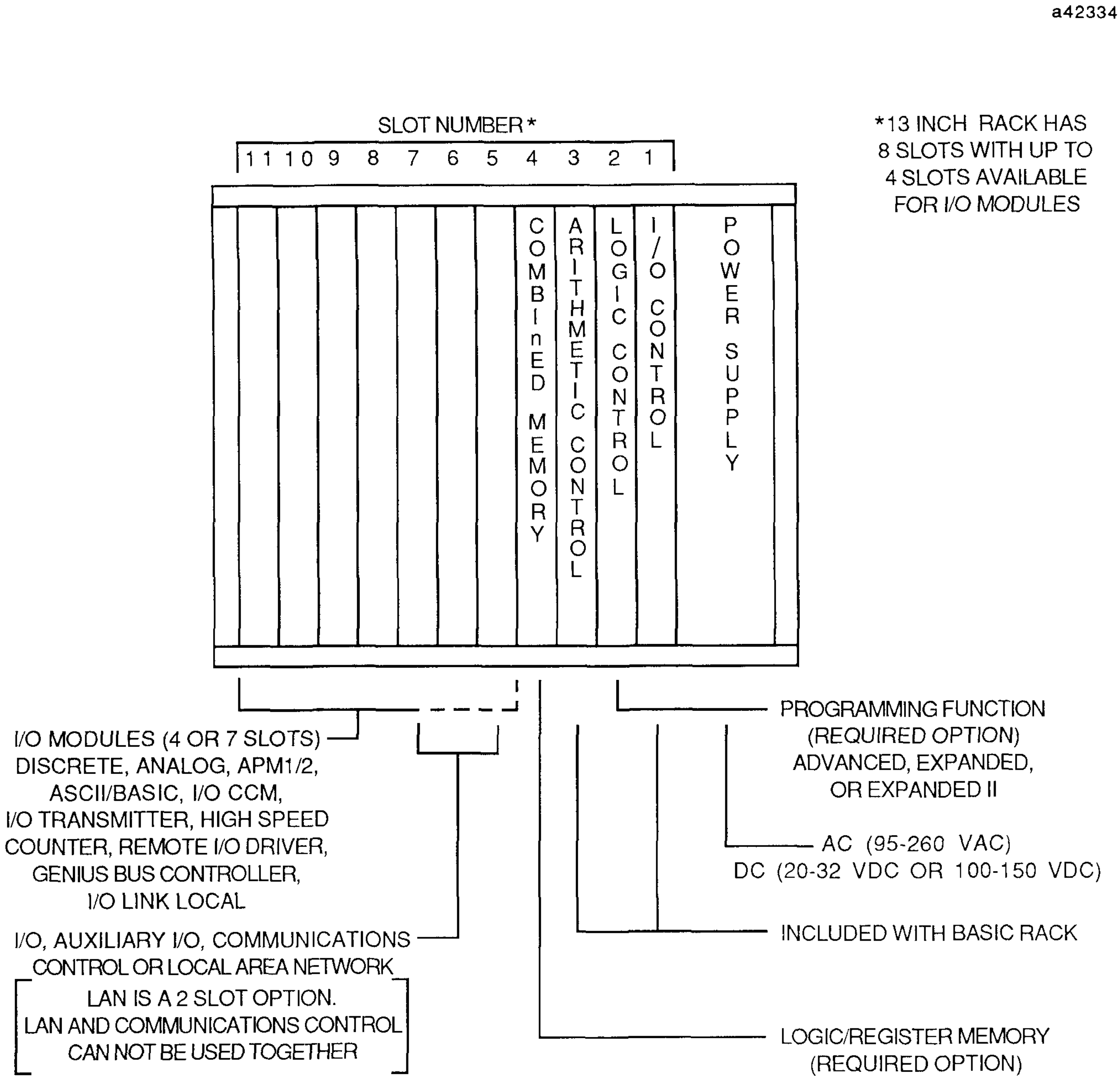


Figure 1. CPU RACK CONFIGURATION

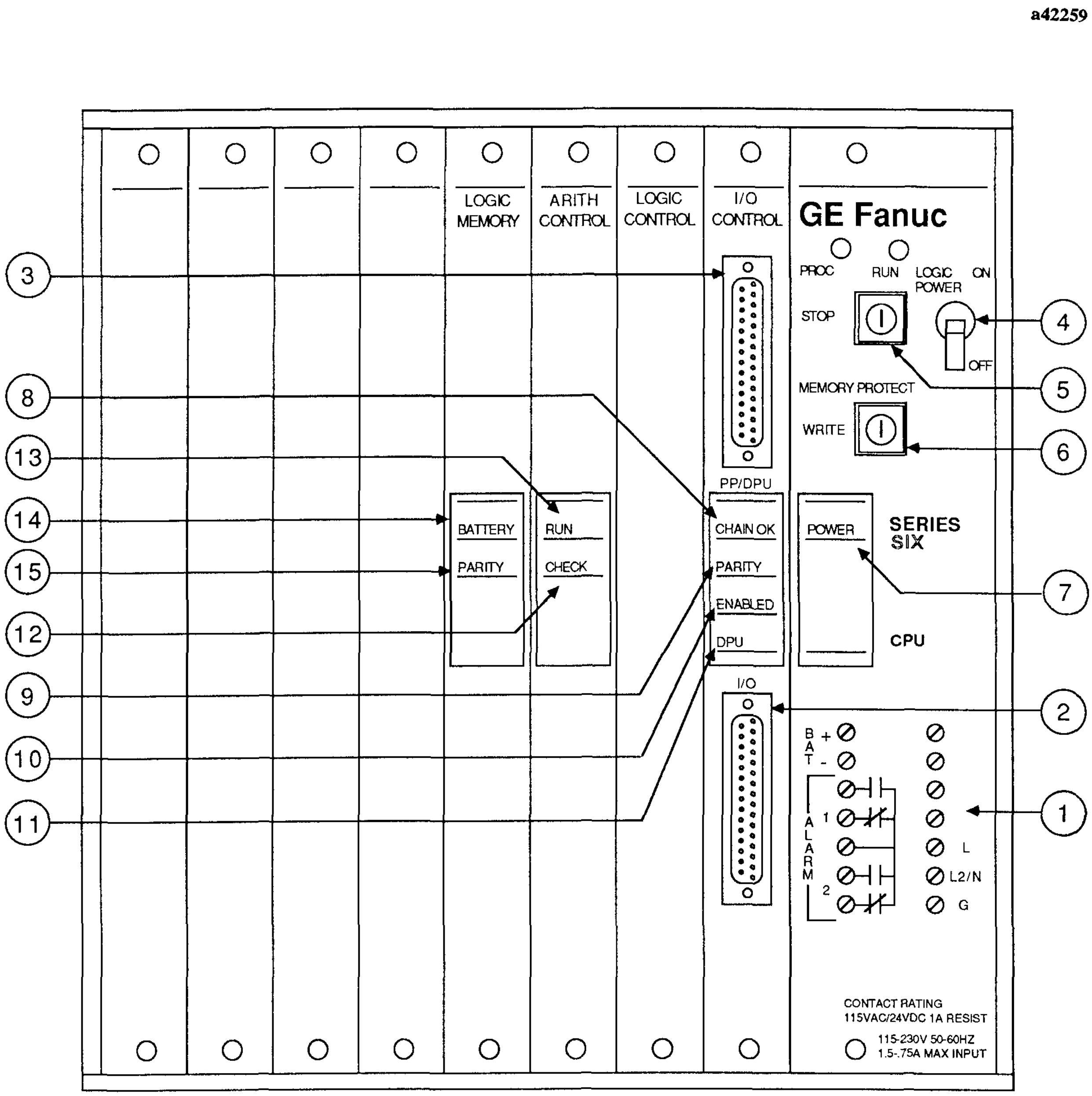


Figure 2. SERIES SIX PLUS CPU RACK USER ITEMS

1. Power-Supply Front-Panel Connector Block.

2. D-Type 36-Pin Connector to I/O Chain.
   Connects to I/O Receiver or Advanced I/O Receiver module in nearest I/O rack in chain.

3. D-Type 36-Pin Connector to Workmaster computer.

4. Power Switch

5. CPU RUN/STOP Key Switch
   STOP: CPU is unconditionally in the STOP mode.
   RUN: CPU is in the RUN mode, unless this condition has been altered by commands from the Workmaster computer, or by the state of various control signals. When this switch is turned from STOP to RUN, the system starts when the outputs are enabled.

6. MEMORY PROTECT Key Switch
   PROTECT: The contents of the Logic Memory and the Override Table are protected from being changed.
   WRITE: The user program in the Logic Memory Can be changed, and an override condition can be added to or removed from inputs or outputs through the Override Table.

7. POWER Light
   On: The voltage levels of all three DC outputs (+12V, -12V, +5V) are within tolerance.
   Off: At least one of these voltage levels is out of tolerance.

8. CHAIN OK Light
   On: Continuity, power, and output data parity are OK at all I/O stations in the chain.
   Off: A continuity, or power problem, or output data parity error exists at one of more I/O stations(s).

9. PARITY Light
   On: Input data parity is OK at the I/O Control module.
   Off: Input data parity error exists.

10. ENABLED Light
    On: Outputs are enabled. CPU is operating in the RUN ENABLED mode.
    Off: Outputs are disabled. CPU is in the RUN DISABLED or the STOP mode.

11. DPU Light
    On: Data Processor is OK.
    Off: A continuity error or other type of problem exists with the DPU. Also off if no DPU is connected.

12. CHECK Light
    On: CPU execution sequence is proceeding and the self-test has passed at least once each 300ms (+/- 5O ms). CPU can be in RUN or STOP mode.
    Off: CPU self-test has not been passed within 300 ms (+/- 50 ms). CPU goes to STOP mode: I/O chain is reset.

13. RUN Light
    On: CPU execution sequence is proceeding and the self-test has passed at least once each 300ms (+/- 50 ms). CPU is in RUN mode.
    Off: CPU is in STOP mode.

14. BATTERY Light
    Steady On: Battery Normal
    Flashing: Battery Low - CPU continues running. No. 2 alarm is activated. To protect the memory contents, the battery should be replaced before it fails.
    Steady Off: Battery Failed - CPU continues running, but will not restart if stopped. No. 2 alarm remains activated. Memory contents will be lost when power is switched off or lost.

15. PARITY Light
    On: Table, Register and Logic memory parity is OK.
    Off: Parity error exists in either Table, Register or Logic memory. An error message identifying location of the error will appear in the scratchpad display area on the Workmaster computer screen.

Installation

This section provides a summary of the procedures described in Chapter 3 of the Series Six Pius User's Manual (GEK-96602). Do not attempt to install the Series Six Plus PLC without consulting that manual.

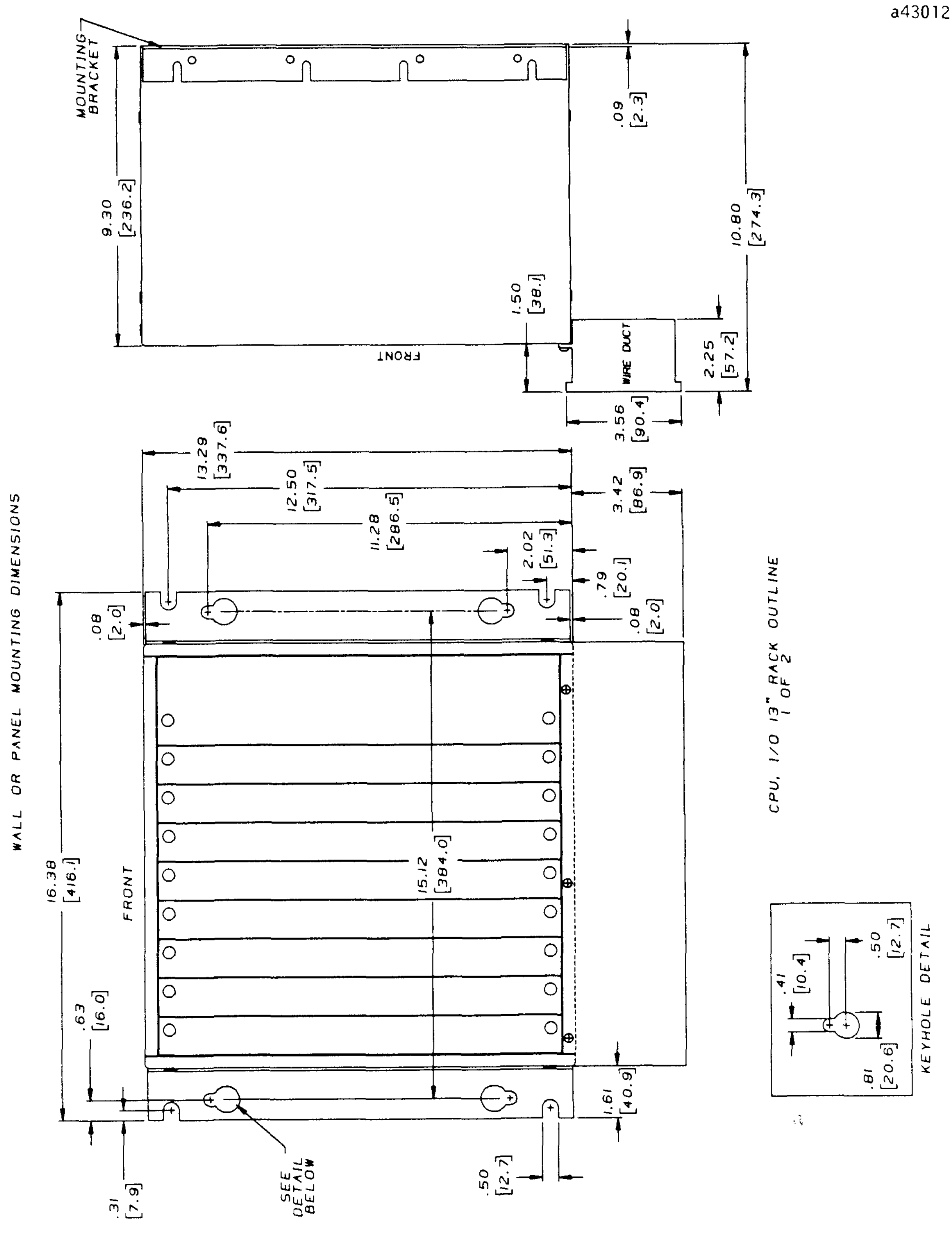
1. The Series Six Plus PLC can be rack, panel or wall mounted, depending on the position of the mounting brackets. IMPORTANT: Proper safety ground and signal ground connections must be made as described in the Series Six Plus User's Manual.
2. Connect the Lithium-Manganese Dioxide battery to either of the male jacks beneath the battery on the Logic Memory module.
3. Install the Logic Control module in slot 2, which is to the left of the I/O Control module. Use the extraction/insertion tool supplied with the basic CPU unit to insert (or remove) this module (or any other module) into the Series Six Plus rack.
4. Install the Logic Memory module in slot 4, which is to the irnmediate left of the Arithmetic Control module. Use the extraction/insertion tool supplied with the CPU to insert this module into the Series Six Plus rack.
5. Set the jumpers on the I/O Control module according to system requirements.
6. Make the following connections to the terminal block on the Series Six Plus PLC power supply:
   - 3-wire (grounding) AC power cord for AC power supply
   - DC source connections to POS and NEG terminal for DC power supply.
   - Alarm relay contacts (optional)
   - Auxiliary battery (optional)
   - Install the protective cover plate after making these connections.
   - Connect the cable from the primary I/O chain to the lower faceplate connector on the 1/O Control module. Connect the cable from the Workmaster computer or Program Development Terminal to the upper connector (Workmaster required with Expanded functions). If neither the Workmaster computer nor the PDT is to be connected, the upper connector can be left empty.

NOTE

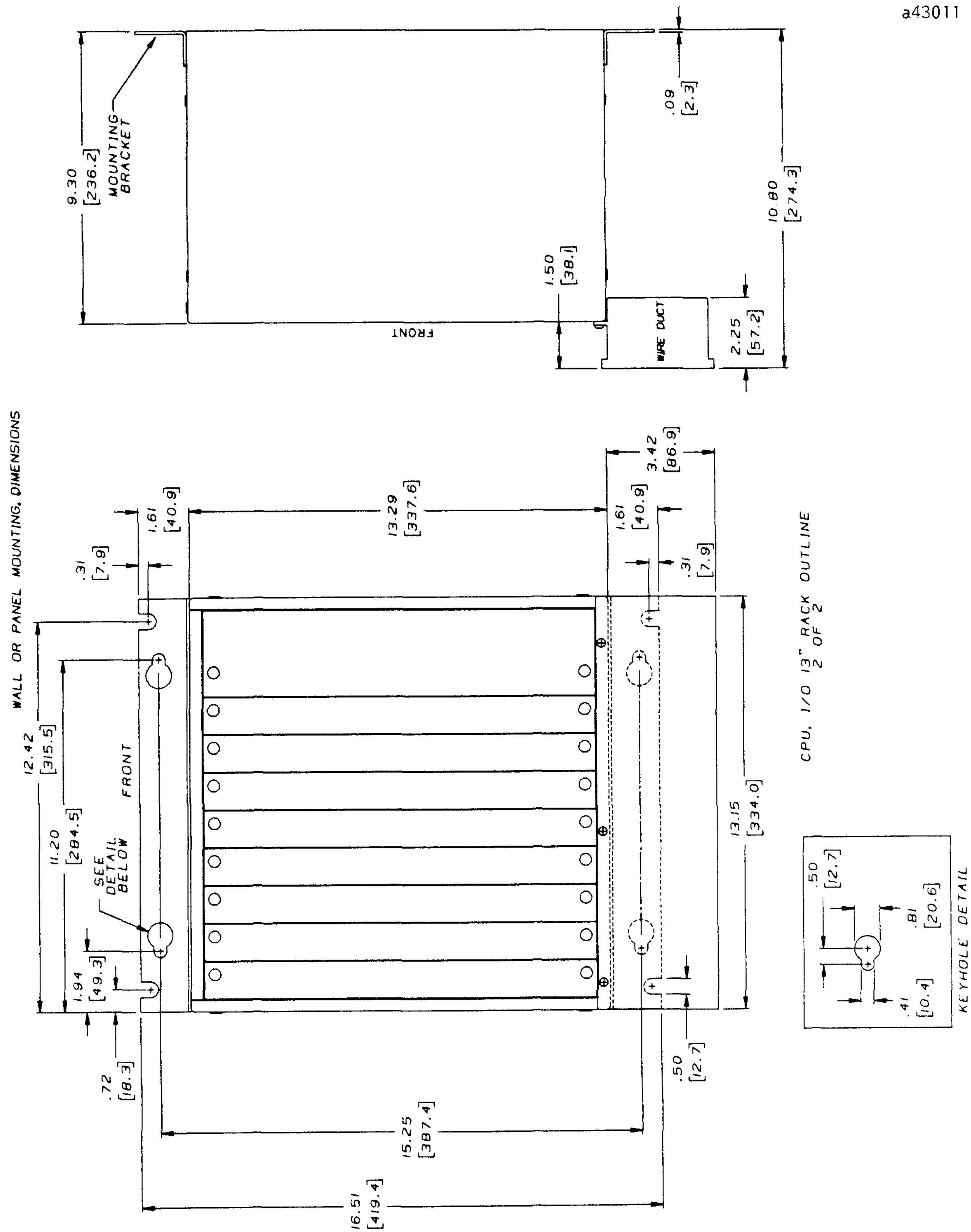
After a power fault, the system comes back in the mode (STOP, RUN ENABLED, or RUN DISABLED) in which it was operating before power was lost.

Both the RUN and the CHECK indicator can flash momentarily when power is turned on in the CPU. A valid RUN or CHECK state, however, is indicated by a steady glow of the LED.

See outline drawings of racks on pages 7-10.


a43012
MOUNTING BRACKET
9.30 [236.2]
.09 [2.3]
10.80 [274.3]
1.50 [38.1]
FRONT
WIRE DUCT
2.25 [57.2]
3.56 [90.4]
WALL OR PANEL MOUNTING DIMENSIONS
13.29 [337.6]
12.50 [317.5]
11.28 [286.5]
3.42 [86.9]
2.02 [51.3]
.79 [20.1]
.08 [2.0]
.08 [2.0]
16.38 [416.1]
FRONT
15.12 [384.0]
.63 [16.0]
1.61 [40.9]
.31 [7.9]
SEE DETAIL BELOW
.50 [12.7]
CPU, I/O 13" RACK OUTLINE 1 OF 2
.41 [10.4]
.50 [12.7]
.81 [20.6]
KEYHOLE DETAIL

a43011


MOUNTING BRACKET
FRONT
WIRE DUCT
WALL OR PANEL MOUNTING, DIMENSIONS
SEE DETAIL BELOW
CPU, I/O 13" RACK OUTLINE 2 OF 2
KEYHOLE DETAIL
9.30 [236.2]
10.80 [274.3]
.09 [2.3]
1.50 [38.1]
2.25 [57.2]
13.29 [337.6]
3.42 [86.9]
1.61 [40.9]
.31 [7.9]
12.42 [315.5]
11.20 [284.5]
1.94 [49.3]
.72 [18.3]
13.15 [334.0]
.50 [12.7]
15.25 [387.4]
16.51 [419.4]
.81 [20.6]
.41 [10.4]

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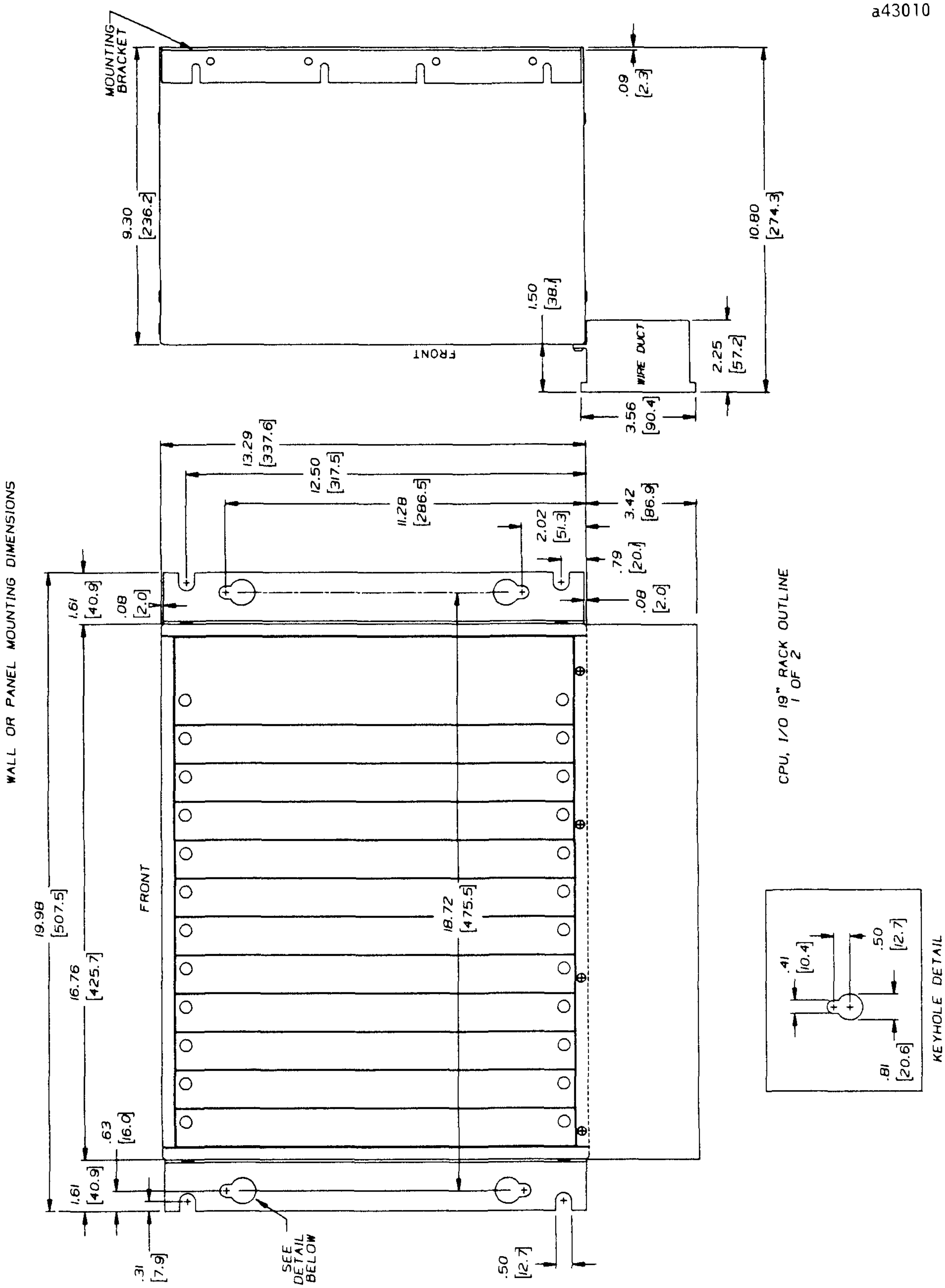

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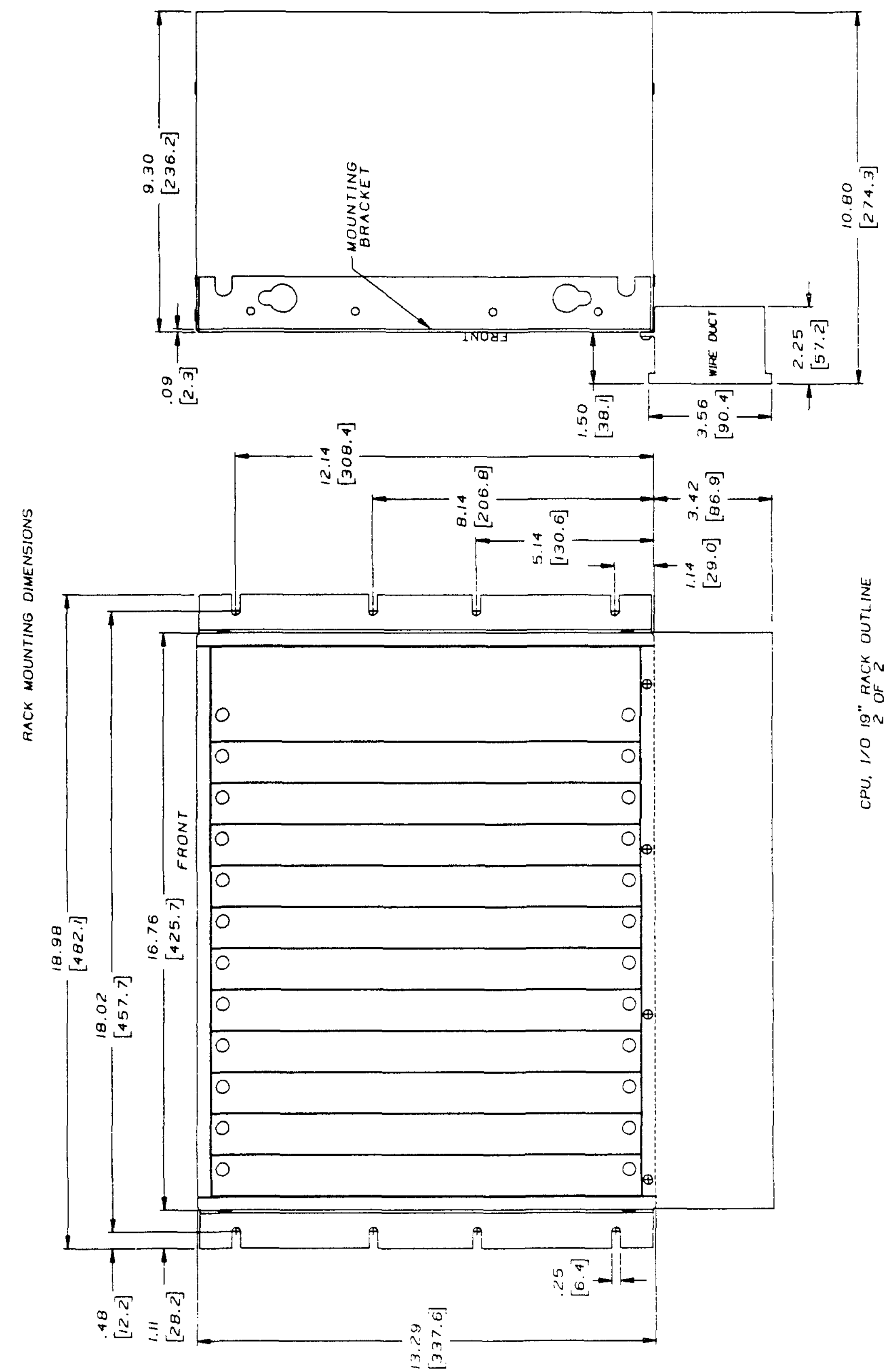

MOUNTING BRACKET
FRONT
WIRE DUCT
9.30 [236.2]
10.80 [274.3]
.09 [2.3]
2.25 [57.2]
1.50 [38.1]
3.56 [90.4]
12.14 [308.4]
8.14 [206.8]
5.14 [130.6]
3.42 [86.9]
1.14 [29.0]
RACK MOUNTING DIMENSIONS
CPU, I/O 19" RACK OUTLINE 2 OF 2
18.98 [482.1]
18.02 [457.7]
16.76 [425.7]
.48 [12.2]
1.11 [28.2]
.25 [6.4]
13.29 [337.6]

Table 2. SPECIFICATIONS

Dimensions (19", 11 slots):	
Rack-Mount	19.0(W) x 13.4(H) x 9.3(D) inches (483 x 340 x 236 millimeters)
Panel Mount	20,0(W) x 13.4(H) x 9.3(D) inches (508 x 340 x 236 millimeters)
Dimensions (I3", 8 slots):	
Rack-Mount	16.0(W) x 13.4(H) x 9.3(D) inches (406 x 340 x 236 millimeters)
Panel Mount (Brackets on sides)	16.0(W) x 13.4(H) x 9.3(D) inches (406 x 340 x 236 millimeters)
Panel Mount (Brackets on Top and Bottom, Side by Side Mount)	13.25(W) x 16,15(H) x 9.3(D) inches (340 x 410 x 236 millimeters)
Weight (filled), 11 slot	37 pounds (17 kg)
Storage Temperature	-20 to +70C (-4 to +158F)
Operating Temperature	0 to +6OC (+32 to +140F) outside of rack
Humidity	5% to 95% (non-condensing)
Power Requirements	Three power supplies are available: 1. 95-260 V ac 47-63 Hz 250VA Max. 2. 20-32 V dc 180 watts Max. 3. 100-150 V dc 200 watts Max.
Allowable Power Interruptions	33 ms minimum at 115 V ac line 10 ms minimum at 20 V dc 4 ms minimum at 100 V dc
Noise Immunity	Meets requirements of NEMA ICS 2-230 and ANSI C 37.90A
Memory Configuration (16.bit words)	5K total: 4K Logic Memory and 1K register Memory 12K total: 4K Logic Memory and 8K Register Memory 16K total: 8K Logic Memory and 8K Register Memory 24K total: 16K Logic Memory and 8K Register Memory 48K total: 32K Logic Memory and 16K Register Memory 80K total: 64K Logic Memory and 16K Register Memory
Input Capacity maximum	16000 points when in Expanded I/O mode
Output Capacity maximum	16000 points when in Expanded I/O mode

Basic unit includes rack, power supply, I/O Control module, Arithmetic Control module, ribbon cable (connects Arithmetic Control to Logic Control), module extraction/insertion tool, mounting brackets, I/O termination plug, and field wiring trough.

Table 3. ORDERING INSTRUCTIONS

DESCRIPTION			CATALOG NUMBER
Series Six Plus CPU			
with 95 to 260 V ac Power Supply, 11 slot			IC6OOCP630
with 24 V dc Power Supply, 11 slot			IC6OOCP634
with 125 V dc Power Supply, 11 slot			IC6OOCP635
with 95 to 260 V ac Power Supply, 8 slot			IC6OOCP610
with 24 V dc Power Supply, 8 slot			IC6OOCP612
with 125 V dc Power Supply, 8 slot			IC6OOCP615
Logic Control Module (select one)			
Advanced Functions			IC6OOCB525
Expanded Functions			IC6OOCB526
Expanded II Functions			IC600CB5 15
Memory Options			
Total User Memory	Logic Memory	Register Memory	
5 K	4 K	1K	IC6OOLX605
12K	4 K	8K	ICBOOLX612
1 6 K	8K	8 K	IC6OOLX616
24K	1 6 K	8 K	IC6OOLX624
48K	32K	1 6 K	IC6OOLX648
80K	64K	16K	IC6OOLX680
Renewal Part			
Series Six Plus CPU 8-slot rack without power supply			IC6OOCR610
Series Six Plus CPU 11-slot rack without power supply			IC600CR620

This symbol on the nameplate means the product is listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc North America Distributor or sales office.

Series Six Plus
Programmable Controller

GFK-0148A

Input/Output Racks
8 and 11 Slots

June 1989

General Description

The Series Six Input/Output (I/O) rack provides the regulated DC power, backplane and enclosure for the Series Six I/O modules; and is available in two sizes: 8 slots and 11 slots. Two power supply types are also available: Standard Capacity and High Capacity. The Standard rack satisfies most I/O applications of the Series Six Programmable Controller. The High Capacity rack provides adequate current for applications utilizing I/O modules that demand collectively more than 6.1 amps. The I/O rack features and benefits are summarized in Table 1.

The left card slot of each I/O rack *is* intended for an I/O Receiver module (Local I/O Receiver or Remote I/O Receiver). The remaining slots are available for Series Six I/O modules. Refer to the list on page 6. On the backplane adjacent to each of the I/O module card slots (inside the rack enclosure) are Dual-In-line-Package (DIP) switches which allow the user to set the addresses for the corresponding I/O modules.

The Standard Capacity I/O Rack provides +5 Vdc to its backplane and operates from 115 Vac or 230 Vac sources (at 47 to 63 Hz). The input voltage is jumper-selectable by the user.

The High-Capacity I/O rack provides +5, +12, and -12 Vdc to its backplane. Three power supplies are available: 95-260 Vac, 20-32 Vdc and 100-150 Vdc.

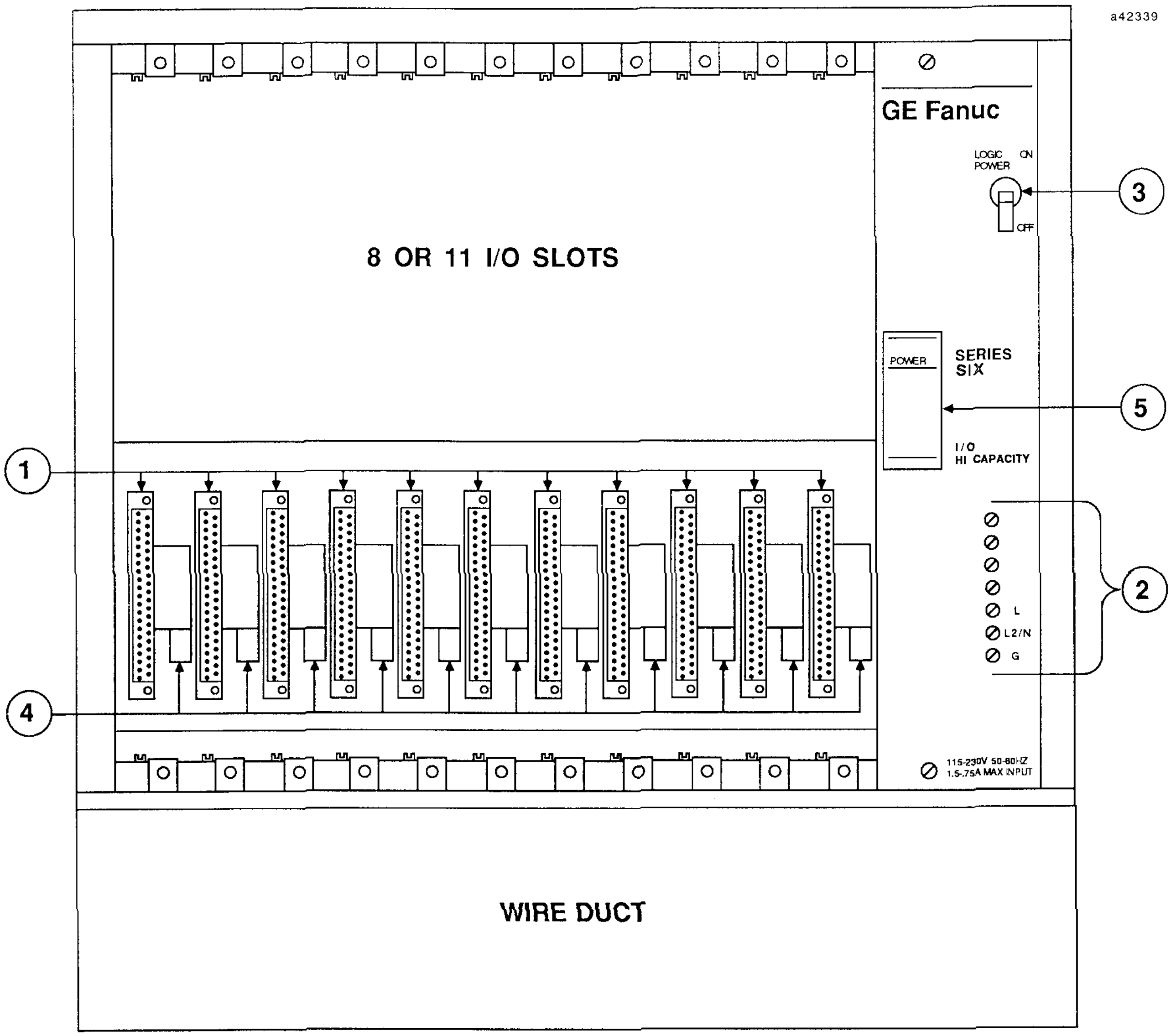
The Standard I/O rack may be upgraded to a High-Capacity I/O rack by replacing the power supply with a High-Capacity power supply.

A Light-Emitting Diode (LED) on the faceplate of the I/O rack power supply indicates that the DC power supplied by the rack **is** wihin tolerance.

Refer to Table 3 for I/O Rack specifications.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Available with Interchangeable Standard or High-Capacity Power Supply modules.	Can accommodate numerous types of I/O modules.
Compatible with all Series Six CPUs. Used in all I/O locations.	Reduces spare-parts inventory cost.
Equipped with dual-purpose mounting brackets.	Can be rack-mounted or panel-mounted
Removeable power supply module.	Reduced downtime and inventory cost.
Addressing switches on backplane	Easy installation of I/O modules.



1. 41P-PIN BACKPLANE CONNECTOR MATES WITH CONNECTOR ON A PLUG-IN MODULE.
2. POWER-SUPPLY FRONT-PANEL TERMINAL BLOCK. SEE "INSTALLATION" SECTION AND FIGURE 3 OF THIS DATA SHEET.
3. LOGIC-POWER SWITCH
4. DIP SWITCHES TO SET I/O MODULE ADDRESS
5. POWER LIGHT
   - A. ON: THE DC VOLTAGE OUTPUT OF THE POWER SUPPLY IS WITHIN TOLERANCE
   - B. OFF: DC VOLTAGE IS OUT OF TOLERANCE

Figure 1. USER ITEMS

Installation

The following procedures summarize the proper installation of the I/O rack. Further details on each step can be found in the Series Six Plus Users Manual GEK-96602.

1. The I/O rack can be rack-mounted or panel-mounted. The location and orientation of the mounting brackets depends on the mount. Refer to Figure 3.

WARNING

Extreme care should be taken when making connections to the terminal block - - - High voltage AC or DC may be present.

2. Refer to Figure 3. Connect a power cord capable of carrying the current drawn by the power supply to the terminal block on the front panel. Safety ground and signal ground connections must be made as described in the Series Six Plus Users Manual. Ensure that the input voltage jumper is positioned correctly and secured (Standard I/O rack only). After the connections have been made, mount the protective cover over the terminal block with the screws provided; make sure that the wires are routed through the opening in the cover.

3. Install an I/O Receiver module (or Remote I/O Receiver) in the card slot at the extreme left in the rack if this **is** the first rack in a Remote station.

4. Any combination of Input, Output, I/O Transmitter **and/or** Remote I/O Driver modules can be installed in the other card slots in the rack, after the DIP switches (Figure 4) for each have been set to the appropriate address as indicated in Figure 5. Note that an optional wiring trough is available to facilitate field-wiring to the various modules.

NOTE

If the POWER LED does not light at power-up, or intermittent errors occur in the course of operation, the current-rating of the I/O rack could be exceeded. Refer to Table 2 to determine the total current requirements within a rack.

NOTE

See outline drawings on pages 5-8.

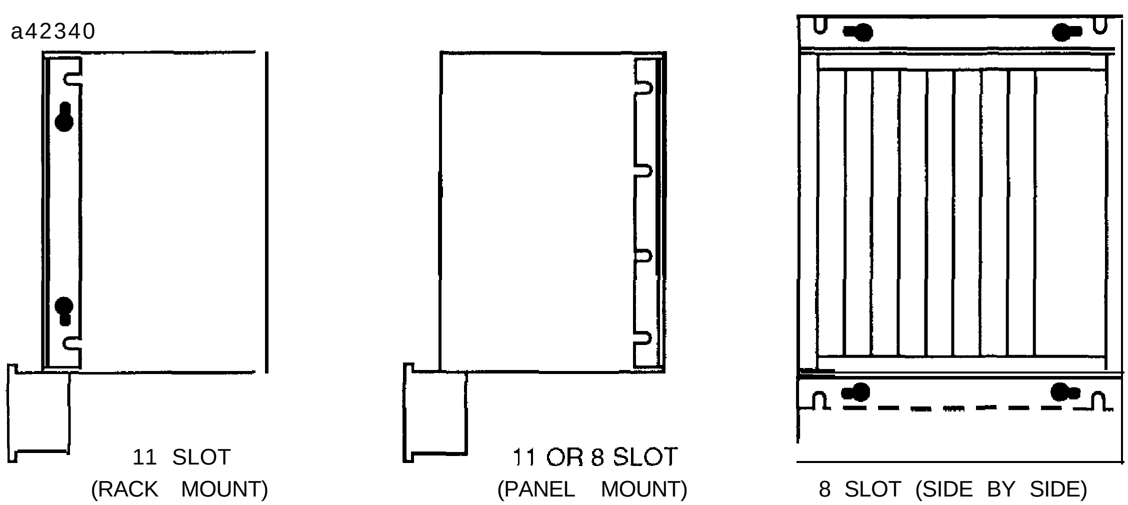


Figure 2. USE OF MOUNTING BRACKETS

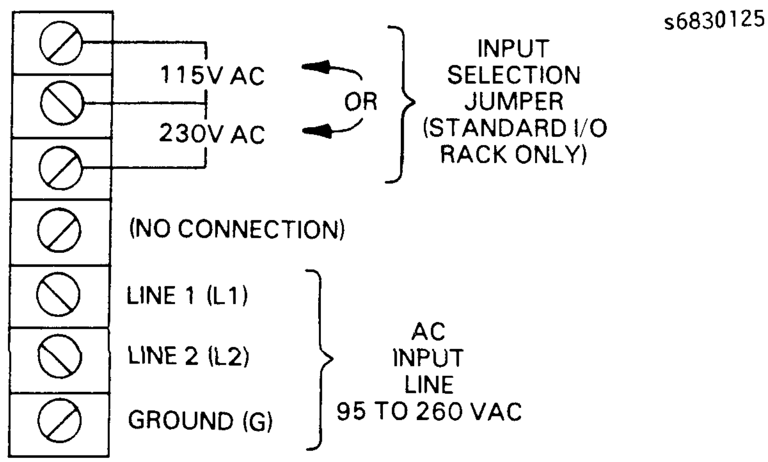


Figure 3. I/O RACK FRONT-PANEL TERMINAL BLOCK

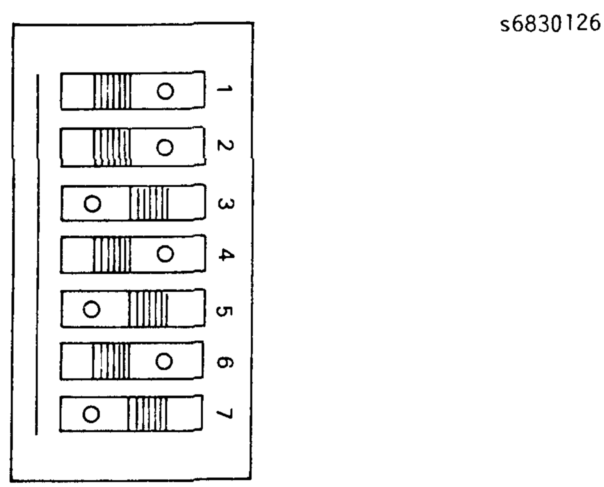
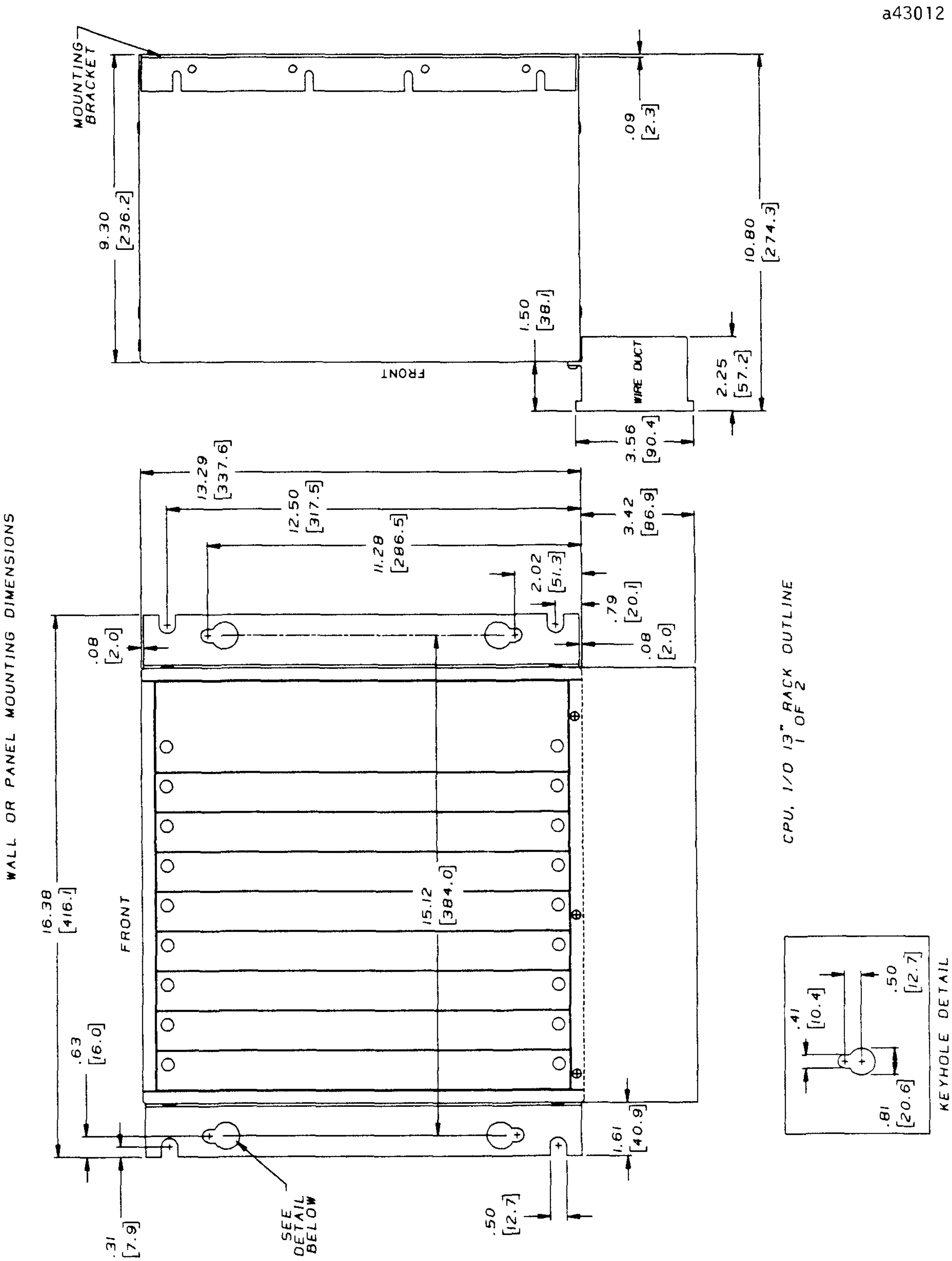


Figure 4. DIP SWITCH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MOUNTING BRACKET
FRONT
WIRE DUCT
9.30 [236.2]
.09 [2.3]
10.80 [274.3]
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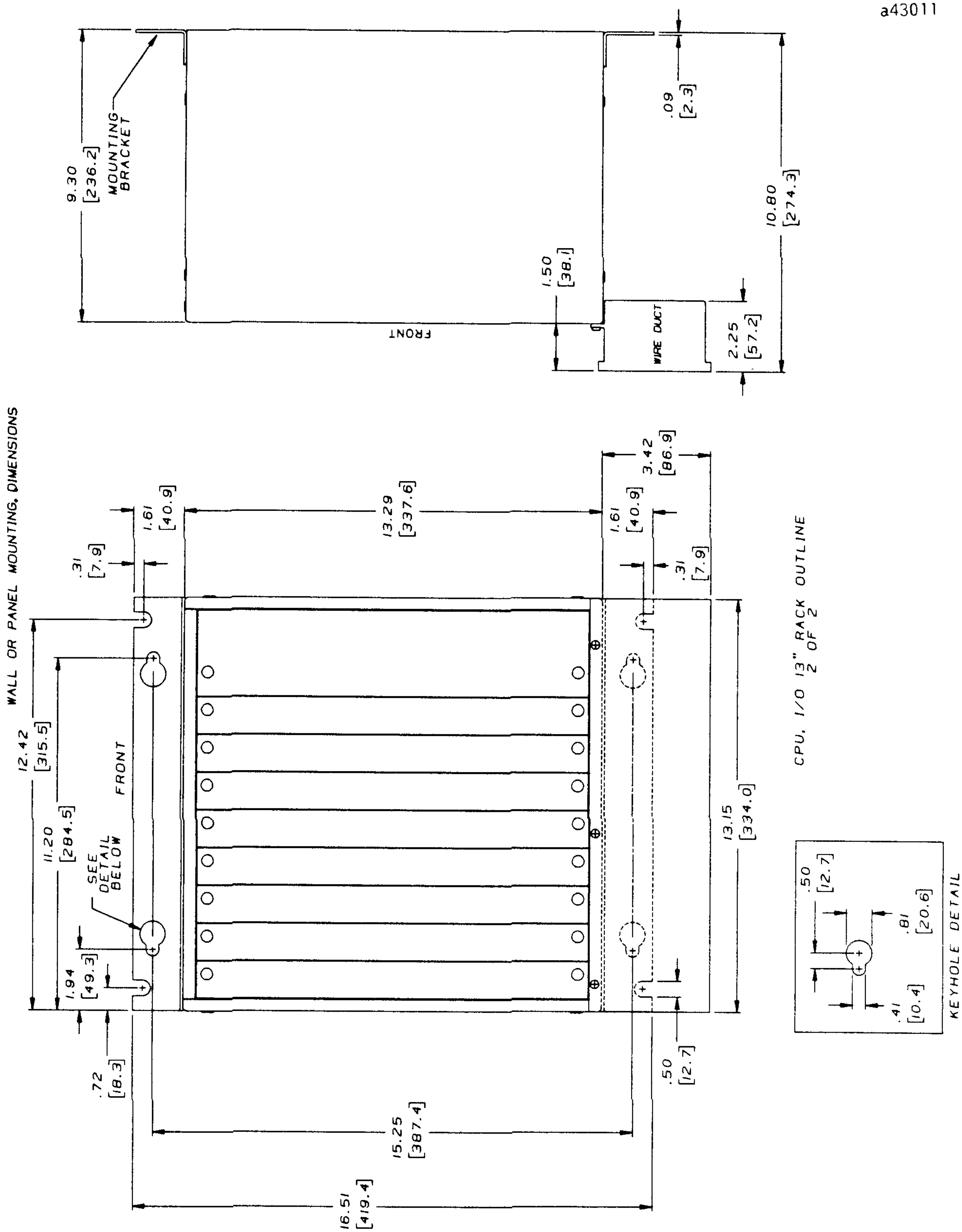
16.38 [416.1]
15.12 [384.0]
.63 [16.0]
.31 [7.9]
.50 [12.7]
1.61 [40.9]
SEE DETAIL BELOW
WALL OR PANEL MOUNTING DIMENSIONS
CPU, I/O 13" RACK OUTLINE
1 OF 2
.41 [10.4]
.81 [20.6]
KEYHOLE DETAIL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MOUNTING BRACKET
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WIRE DUCT
2.25 [57.2]
WALL OR PANEL MOUNTING, DIMENSIONS
.31 [7.9]
1.61 [40.9]
13.29 [337.6]
3.42 [86.9]
12.42 [315.5]
11.20 [284.5]
SEE DETAIL BELOW
1.94 [49.3]
.72 [18.3]
13.15 [334.0]
.50 [12.7]
15.25 [387.4]
16.51 [419.4]
CPU, I/O 13" RACK OUTLINE 2 OF 2
.81 [20.6]
.41 [10.4]
KEYHOLE DETAIL

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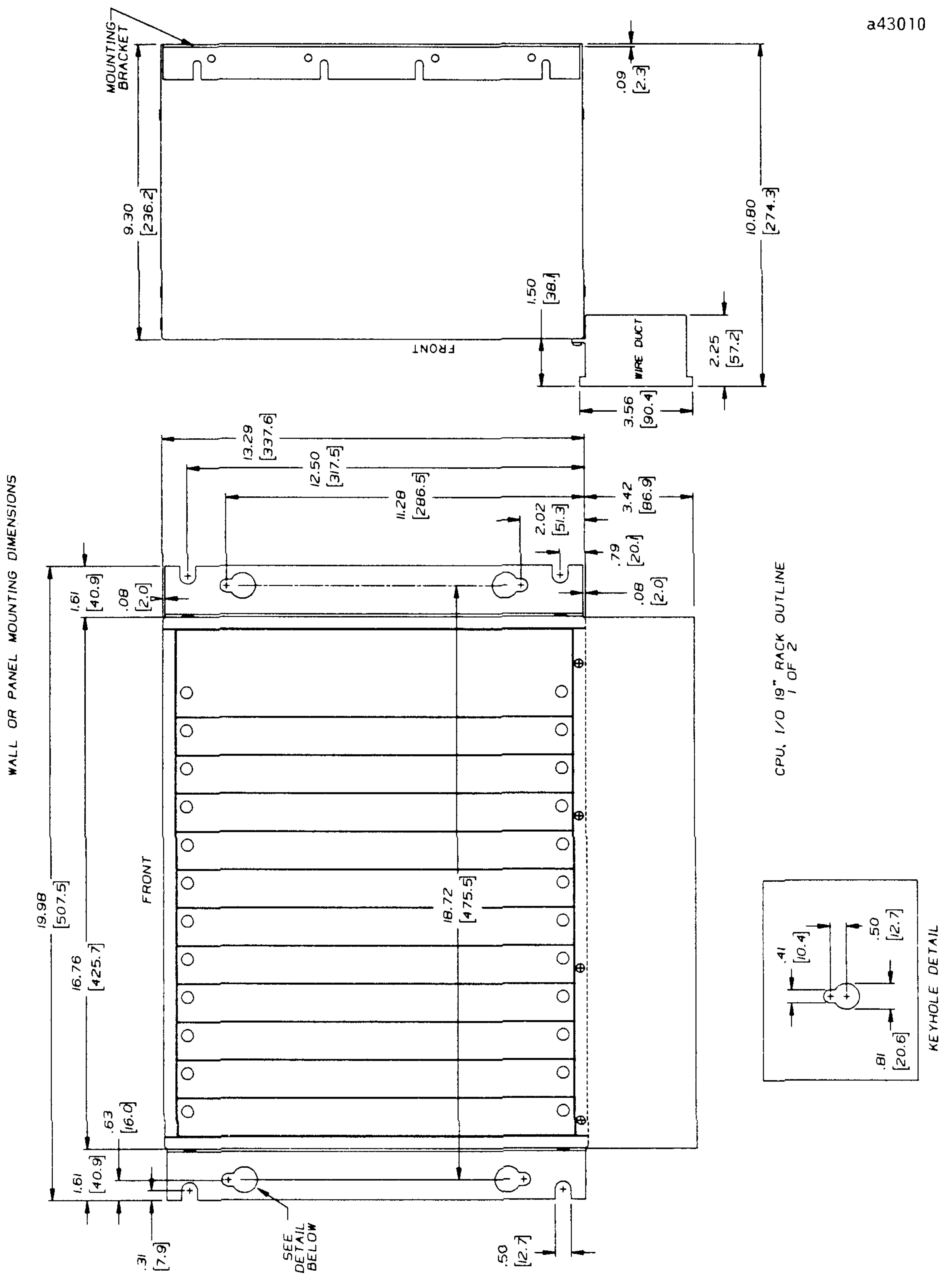
a43010



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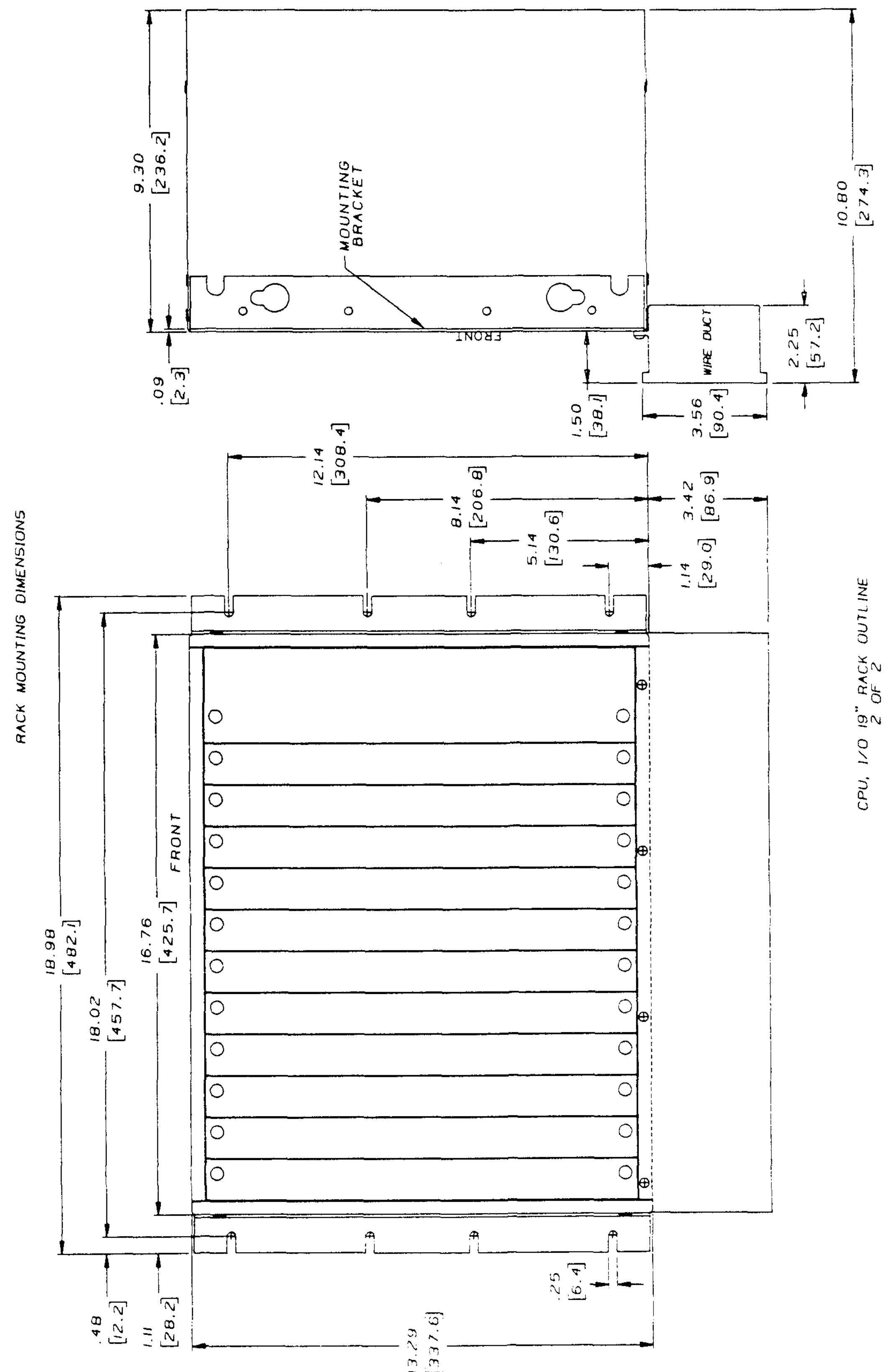

RACK MOUNTING DIMENSIONS
CPU, I/O 19" RACK OUTLINE
2 OF 2
MOUNTING BRACKET
FRONT
WIRE DUCT
FRONT
9.30 [236.2]
10.80 [274.3]
.09 [2.3]
1.50 [38.1]
3.56 [90.4]
2.25 [57.2]
12.14 [308.4]
8.14 [206.8]
5.14 [130.6]
3.42 [86.9]
1.14 [29.0]
18.98 [482.1]
18.02 [457.7]
16.76 [425.7]
.48 [12.2]
1.11 [28.2]
.25 [6.4]
13.29 [337.6]

I/O POINT	DIP SWITCH POSITION							I/O POINT	DIP SWITCH POSITION							I/O POINT	DIP SWITCH POSITION						
	7	6	5	4	3	2	1		7	6	5	4	3	2	1		7	6	5	4	3	2	1
1- 8								337-344		X		X		X		673-680	X		X		X		
9- 16							X	345-352		X		X		X	X	681-688	X		X		X		X
17- 24						X		353-360		X		X	X			689-696	X		X		X	X	
25- 32						X	X	361-368		X		X	X		X	697-704	X		X		X	X	X
33- 40					X			369-376		X		X	X	X		705-712	X		X	X			
41- 48					X		X	377-384		X		X	X	X	X	713-720	X		X	X			X
49- 56					X	X		385-392		X	X					721-728	X		X	X		X	
57- 64					X	X	X	393-400		X	X				X	729-736	X		X	X		X	X
65- 72				X				401-408		X	X			X		737-744	X		X	X	X		
73- 80				X			X	409-416		X	X			X	X	745-752	X		X	X	X		X
81- 88				X		X		417-424		X	X		X			753-760	X		X	X	X	X	
89- 96				X		X	X	425-432		X	X		X		X	761-768	X		X	X	X	X	X
97-104				X	X			433-440		X	X		X	X		769-776	X	X					
105-106				X	X		X	441-448		X	X		X	X	X	777-784	X	X					X
113-120				X	X	X		449-456		X	X	X				785-792	X	X				X	
121-128				X	X	X	X	457-464		X	X	X			X	793-800	X	X				X	X
129-136			X					465-472		X	X	X		X		801-808	X	X			X		
137-144			X				X	473-480		X	X	X		X	X	809-816	X	X			X		X
145-152			X			X		481-488		X	X	X	X			817-824	X	X			X	X	
153-160			X			X	X	489-496		X	X	X	X		X	825-832	X	X			X	X	X
161-168			X		X			497-504		X	X	X	X	X		833-840	X	X		X			
169-176			X		X		X	505-512		X	X	X	X	X	X	841-848	X	X		X			X
177-184			X		X	X		513-520	X							849-856	X	X		X		X	
185-192			X		X	X	X	521-528	X						X	857-864	X	X		X		X	X
193-200			X	X				529-536	X					X		865-872	X	X		X	X		
201-208			X	X			X	537-544	X					X	X	873-880	X	X		X	X		X
209-216			X	X		X		545-552	X				X			881-888	X	X		X	X	X	
217-224			X	X		X	X	553-560	X				X		X	889-896	X	X		X	X	X	X
225-232			X	X	X			561-568	X				X	X		897-904	X	X	X				
233-240			X	X	X		X	569-576	X				X	X	X	905-912	X	X	X				X
241-248			X	X	X	X		577-584	X			X				913-920	X	X	X			X	
249-256			X	X	X	X	X	585-592	X			X			X	921-928	X	X	X			X	X
257-264		X						593-600	X			X		X		929-936	X	X	X		X		
265-272		X					X	601-608	X			X		X	X	937-944	X	X	X		X		X
273-280		X				X		609-616	X			X	X			945-952	X	X	X		X	X	
281-288		X				X	X	617-624	X			X	X		X	953-960	X	X	X		X	X	X
289-296		X			X			625-632	X			X	X	X		961-968	X	X	X	X			
297-304		X			X		X	633-640	X			X	X	X	X	969-976	X	X	X	X			X
305-312		X			X	X		641-648	X		X					977-984	X	X	X	X		X	
313-320		X			X	X	X	649-656	X		X				X	985-992	X	X	X	X		X	X
321-328		X		X				657-664	X		X			X		993-1000	X	X	X	X	X		
329-336		X		X			X	665-672	X		X			X	X								

PC-S6-83-0127

$\boxed{X}$ = Switch in OPEN Position (Depressed to the Left).

Figure 5. DIP SWITCH SETTINGS FOR I/O POINT SELECTION FOR EIGHT-CIRCUIT MODULES

Table 2. SUMMARY OF UNITS OF LOAD FOR I/O MODULES

CATALOG NUMBER	MODULE DESCRIPTION	UNITS OF LOAD (1)		
		+5 v	+12 v	-12 v
LC600BF800	I/O Receiver	9		
[C600BF801	Remote I/O Receiver	42	10	1O(2)
IC600BF802	24 to 48 V dc Input	2		
1C6OOBF804	115 V ac/dc Input	2		
[C6OOBF805	230 V ac/dc Input	2	c	
IC600BF806	12 V ac/dc Input	2	I	
1CBOOBF808	Interrupt Input	3		e
IC600BF810	115 V ac/dc Isolated Input	2		
IC6OOBF813	Type 3 Thermocouple Input	29		
IC6OOBFS 14	Type K+ thermocouple Input	29		
tC600BF8 15	Type S Thermocouple Input	29	B	
IC600BF8 16	Type T Thermocouple Input	29	-	
1C600BF8 17	Type B Thermocouple Input	29		
tC600BF818	Type E Thermocouple Input	29		
IC600BF8 19	Type R Thermocouple Input	29		
IC600BF827	High Speed Counter	19	m	c
IC6OOBF830	Advanced I/O Receiver	12		s
IC6OOBF83 1	High Density Input	4		
IC600BF841	0 to 10 V dc Analog Input	29		
IC600BF842	+-l0 V dc Analog Input	29		
IC600BF843	4 to 20 mA analog Input	29		
IC6OOBF900	I/O Transmitter	34		I
IC600BF90 1	Remote I/O Driver	38	10	1O(2)
IC600BF902	24 V dc Sink Output	7		
IC600BF903	48 V dc Sink Output	7		
IC600BF.904	115 V ac Output	9		
IC600BF905	230 V ac Output	9		c
IC6OOBF906	12 V dc Sink Output	7		s
IC600BF907	12 V dc Source Output	7		l
IC6OOBF908	24 V dc Source Output	7		
IC6OOBF909	48 V dc Source Output	7		
IC600BF910	115 V ac Isolated Output	8		
IC600BF912	230 V ac Isolated Output	8		
IC600BF914	Reed Relay Output	13		
IC6OOBF915	Axis Positioning Module, Type 1	42	7	3
IC600BF9 17	Axis Positioning Module, Type 2	42	11	6
IC600BF921	5 v TTL output	3		
IC6OOBF923	10 to 50 V dc Sink Output	3		
IC600BF924	120 V dc Output	5	I	
IC6OOBF929	10 to 50 V dc Source Output	3		
IC60OBF930	115 V ac Protected Output	8		
IC600BF941	0 to 10 V dc Analog Output	29		
IC600BF942	+-10 V dc Analog Output	29		
IC600BF943	4 to 20 mA Analog Output	29		
IC600BF944	ASCII Basic Module (12 K)	20	12	c
IC600BF949	ASCII Basic Module (28 K)	20	12	*

Table 2. SUMMARY OF UNITS OF LOAD FOR I/O MODULES - Continued

CATALOG NUMBER	MODULE DESCRIPTION	UNITS OF LOAD (1)		
		+5 v	+12 v	-12 v
IC600BF946	Loop Management Module	20	12	
IC6OOBF947	I/O Link Local	20	12	
IC6OOBF948	I/O CCM	20	12	
IC6OOBF950	I/O CCM4	20	12	
IC600AEL000	LAN Interface Controller Board	20	2	1
IC600AEMO 10	LAN Interface Modem Board	17	16	2
IC600CBB902	Genius Bus Controller (with Diagnostics)	20	2	-
IC600CBB 903	Genius Bus Controller (without Diagnostics)	20	2	w

Table 3. SPECIFICATIONS

Dimensions (19", I1 slots):	
Rack-Mount	19.0(W) x 13.4(H) x 9.3(D) inches (483 x 340 x 236 millimeters)
Panel Mount	20.0(W) x 13.4(H) x 9.3(D) inches (508 x 340 x 236 millimeters)
Dimensions (13", 8 slots):	
Rack-Mount	16.0(W) x 13.4(H) x 9.3(D) inches 406 x 340 x 236 millimeters)
Panel Mount (Brackets on sides)	16.0(W) x.4(H) x 9.3(D) inches (406 x 340 x 236 millimeters)
Panel Mount (Brackets On Top and bottom, Side by Side Mount)	13.25(W) x 16.15(H) x 9.3(D) **inches (340 x** 410 x 236 millimeters)
Weight (Empty)	30 pow-ids (15kg)
Power Supply Input	High Capacity: 90-260 **Vac** Standard: 95-130 Vac 190-240 Vac 80 **VA** (maximum)
Noise Immunity	Meets requirements of NEMA ICS2-230 and ANSI C37.90A.
Power Requirements	Three power supplies are available: 1. 95-260 V ac 47-63 Hz 250VA Max. 2, 20-32 V **dc** 180 **watts** Max. 3. l00-150 V dc 200 watts Max.
Allowable Power Interruptions	33 ms minimum at 115 Vac line. (AC supply) 10 ms minimum at 20 **Vdc** (24 Vdc supply) 4 ms minimum at 100 Vdc (125 **Vdc** supply)
Power-Supply Output	High Capacity: +5 Vdc, 16.5 A max. +12Vdc, 1.5 A max. -12 Vdc, 1.0 A max. Standard: +5 Vdc, 6.1 A max.
Module Capacity	Seven or ten addressable card slots, plus one non-addressable slot for an I/O Receiver or Advanced I/O Receiver module.
Operating Temperature	0° to 60°C (32° to 140°F) (outside of the rack)
Storage Temperature	-20°C to +80°C (-4° to 158°F)
Humidity	5% to 95% (non-condensing)

GFK-0148A

Table 4. ORDERING INFORMATION

DESCRIPTION	CATALOG NUMBER
8-slot, 90-260 Vac High Capacity	IC6OOYR55OL
8-slot, 24 Vdc	IC6OOYR554K
8-slot, 125 Vdc	IC600YR555K
8-slot, 115/230 Vac, Standard	IC6OOYR55 1K
1 l-slot, 90-260 Vac, High Capacity	IC6OOYR560K
11 -slot, 24 Vdc	IC600YR564K
N-slot, 125 Vdc	IC600YR565K
11-slot, 115/230 Vac, Standard	IC6OOYR56l.K

This symbol on the namplate means the product is Listed by Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection electronic power Conversion Equipment.)

For ordering information regarding all Series Six Plus PLC products, contact your local GE Fanuc sales office.

Series Six Plus
Programmable Controller

GFK-0174

March 1988

115 VAC Input Module
32 Inputs per Module

General Description

The 115 VAC Input module detects bipolar AC voltage supplied by, and controlled by, the user. The features and benefits of this module are summarized in Table 1.

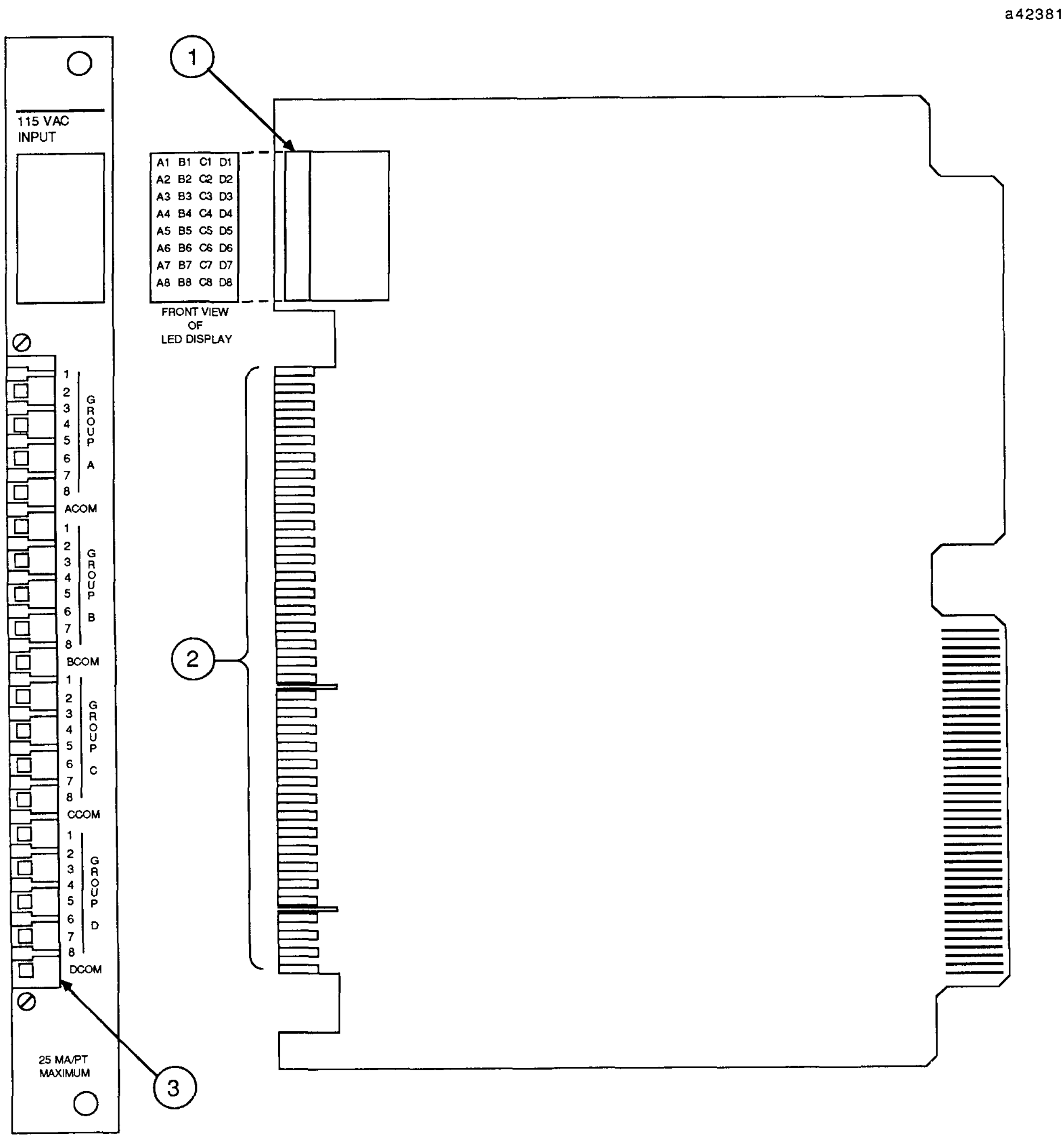
A module contains thirty two inputs, divided into four groups (A, B, C, D), each group sharing a neutral circuit (A corn, B corn, C corn or D corn).

An input circuit contains an AC divider, a noise filter to reduce common mode transients, an opto-isolator, and a Schmitt trigger (one-shot), which fires **to** indicate that an AC **voltage** in a specified range has been detected. An active input circuit is indicated by a Light-Emitting Diode (LED), visible through a lens on the faceplate.

Refer to Table 2 for the I15 VAC Input module specifications.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
High Density Input: 115 VAC 47 Hz.- 63 Hz.	Useful in a variety of applications.
Alpha numeric LED for each input (on logic side)/Color-coded faceplate.	Allows visual inspection of I/O operations.
Thirty two inputs per module in four isolated groups of eight.	Efficient use of I/O rack space with flexibility in multiple common applications.
Optically-coupled inputs.	Provides electrical isolation between user power supplies and Series Six Plus Programmable Controller.
APPLICATIONS *Monitor: *Limit Switches *Proximity Switches *CamSwitches *Toggle Switches *Relays	



1. LED PACKAGE CONTAINS LEDS AND ASSOCIATED CIRCUITRY.
   LED ON: THE ASSOCIATED INPUT IS IN THE ON STATE.
   LED OFF: THE ASSOCIATED LED IS IN THE OFF STATE.
   AN ON LED BACKLIGHTS THE GROUP DESIGNATION AND CIRCUIT NUMBER FOR EACH INPUT,e.g. A1 THROUGH A8. THIS ALLOWS THE CIRCUIT NUMBERS TO BE READ DIRECTLY THROUGH THE FACEPLATE LENS.
2. CIRCUIT BOARD CONNECTIONS MATE WITH USER TERMINAL BLOCK.
3. USER TERMINAL BLOCK:
   ACCEPTS CONNECTIONS FROM USER INPUT DEVICES. SEE THE INSTALLATION SECTION OF THIS DATA SHEET.

Figure 1. USER ITEMS

GFK-0174

Installation

The 115 VAC Input module can be installed in an I/O rack or the I/O rack section of the Series Six Plus Central Processor Unit (CPU). Follow these steps:

1. Set the Dual-In-Line-Package (DIP) switches directly behind the card slot on the rack backplane to establish the correct correspondence between the first group of 8 input terminals on this module and the first of four consecutive groups of eight input numbers in the user program. For further information on I/O DIP-switch settings, refer to the Installation Section of the Series *Six Plus Programmable Controller User's Manual* (GEK-96602).
2. Use the extraction/insertion tool furnished with the Series Six Plus CPU to insert (or remove) this module in the card slot.
3. Guide the faceplate over the circuit board so that the terminals near the bottom of each are mated; secure the faceplate to the rack using the thumbscrews at the top and bottom.
4. Refer to Figure 2. Connect one side of the user circuit to the appropriate input terminal (1 through 8). Circuits connected to inputs 1 through 8 of a group must have their opposite sides connected to the common for that group.

Each input terminal can accommodate one No. 12 AWG wire.

WARNING

Voltages from user field devices may be present on the faceplate terminals, even if the power supply in the I/O rack is off. Care should be taken when handling the faceplate of this module or any wires connected to it.

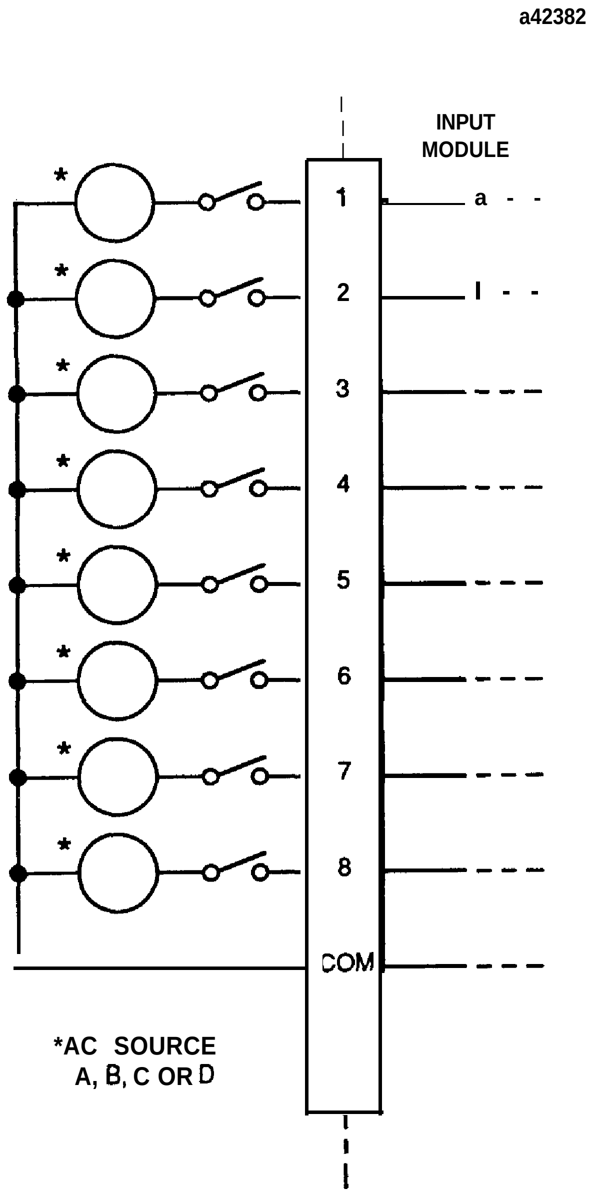


Figure 2. TYPICAL USER INPUT CONNECTIONS

Table 2. SPECIFICATIONS

Dimensions:	
Circuit Board:	8.15 x 11.0 (inches) 208 x 280 (mm)
Faceplate:	12.46 x 1.175 (inches) 317 x 30 (mm)
Power Requirements:	5V DC, 104 ma maximum
Supplied by I/O power supply. The user must supply power for the input devices.	
Number of Inputs:	Thirty-two (32) in four groups (A, B, C, D) of 8 inputs (l-8) with independent common, neutral connections.
Operating Temperature:	0° to 60° (At the outside of rack)
Storage Temperature:	-20 to +80°C
Humidity:	5 to 95% (non-condensing)
On Range:	80-132VAC
Off Range:	0-30VAC
Input Current:	9.8 ma @ 115 VAC, 50 Hz.
(Typical)	11.7 ma @ 115 VAC, 60 Hz.
ON Delay:	l0-20 ms
OFF Delay:	20-40 ms
Isolation (any group common to Series Six Plus common - also between input groups when two or more independent user power supplies are used for one module):	
Continuous:	240 VDC or 50/60 Hz. AC
Transient:	1,500 V peak, non-repetitive
Noise Immunity to:	Showering arcs per NEMA ICS 2.230.40 Surges per ANSI C37.90.9 5W transmitter, 27-450 MHz
Radiated Interference:	**Complies** with FCC Rule 15 for Class A computing devices

Table 3, ORDERING INFORMATION

DESCRIPTION	**CATALOG NUMBER**
Circuit Board **and** Faceplate	IC600BF832K
Faceplate	IC600FP832K

The equipment listed above having the catalog number shown is designed for listing **by** UL for **use** as an auxiliary control device.

The UL symbol on the nameplate means the product is listed **by** Underwriters Laboratories Inc. (UL Standard No. 508, Industrial Control Equipment, subsection Electronic Power Conversion Equipment.)

For further information, contact your local GE Fanuc North America Distributor or sales office.

Series S i x
Programmable Controller

GFK-0238A
November 1988

Communications Control Module Type 2 and Type 3

IC600CB536
IC600CB537

General Description

The Communications Control Module Type 2 (CCM2) and Type 3 (CCM3) are modules for the Series S i x PLC containing two communications ports, two switches, and four indicator Light Emitting Diodes (LEDs) for connection, control, and status of the module.

The primary purpose of these modules is to provide a serial interface between the Series Six Central Processing Unit (CPU) and any intelligent device which can initiate communications based on CCM2 and/or CCM3 supported protocols and electrical interface requirements. Examples of intelligent devices which can be interfaced are:

- CCM2, CCM3, or I/O CCM Series Six modules
- Host computer or microprocessor based device
- Process control system
- Color-graphics terminal

The Series Six Plus PLC with expanded microcode increases the number of user addressable I/O points.

This feature allows addressing of channeled I/O points with the Series Six expanded instruction set. The I/O points can be accessed by both the CCM and the Remote Terminal Unit (RTU) protocol for CCM3, and the CCM protocol only for CCM2. CCM also supports addressing of the Auxiliary I/O Override table.

Expanded user memory reference allows memory addressing up to 64k of the user logic memory. The expanded user logic memory is supported by both the CCM and the RTU protocol.

Table 1. FEATURES AND BENEFITS

FEATURES	BENEFITS
Contains two programmable communications interfaces.	Permits a data link between Series Six and host computer, programmable terminals, and other intelligent devices.
Accepts requests for Serial Communications from CPU user program. (If peer or master mode is selected.)	Allow CPU logic to initiate and control the communication and data flow.
On-board diagnostics and board fault indicator lights.	Simplifies troubleshooting arid indicates correct data transfer.
Direct interface with Operator Interface Unit (OIU).	Allows for simplified operator inputs into process under control.
QAB (Quick Access 1024 byte general purpose Buffer)	Buffer data to minimize access time from an external device.
Expanded memory	Permits addressing of channeled I/O points, up to 64K user logic memory.

CCM2/CCM3 System Configurations

The CCM2/CCM3 supports two types of system con- **figurations,** point-to-point and multidrop.

In the point-to-point configuration only two devices can be connected to the same communication line. The communication line can be directly connected using RS-232 (50 feet, 15 meters maximum) or RS-422 (4000 feet, 1200 meters maximum). Modems can be used for longer distances.

In the multidrop configuration more than two devices can be connected to the same communication line. One CCM2 or host device is configured as the master and one or more CCM2s/CCM3s are configured as slaves. A master is capable of initiating communica- tions; a slave is not. There are three ways to connect CCM2s/CCM3s in the multidrop configuration: RS-422 direct, RS-232 using modems, and RS-232 using modems and microwave or radio transmitters.

RS-422 Direct: This method can be used when the maximum distance between the master and the last **slave** does **not** exceed 4000 feet (1200 meters). This distance assumes good quality cables and a moder- ately "noisy" environment. A maximum of eight slaves can be connected using RS-422 in a daisy chain or multidrop configuration. The RS-422 line may be of the 2-wire or 4-wire type.

RS-232 Using Modems: This configuration is used for long distance communications, primarily over telephone lines. The number of slaves possible is determined by the modem capabilities.

RS-232 Using Modems and Microwave or Radio Transmitters: This configuration **is** used where cables cannot be used between modems. The FCC normally requires the use of single frequency trans- mitters with short transmitter-on times. Therefore, a warm-up delay for the radio transmitter must be added before each transmission. The CCM2/CCM3 keys the radio transmitter to warm-up and wait a short time before actually transmitting the data. The vari- ous time-out values for the communication protocol are increased to include the added delay.

Table 2. RS232C/RS-422 CABLE SPECIFICATIONS

Length, Maximum - 50 feet (15 meters) for RS-232C; 4000 ft. (1.2Km) for RS-422
Overall Shield
24 AWG, Minimum
Connector to CCM Port J 1 - D-Subminiature Type, Cannon DB25P (solder pot) with DB 110963-3 Hood or Equivalent (Standard RS-232C Connector)
Connector to CCM Port J2 - D-Subminiature Type, Cannon DE9P (solder pot) with DE110963-1 Hood or Equivalent
Connector to Intelligent Device (Determined by intelligent device)
RS-422 Cable Selection The following cables provide acceptable operation at data rates up to I9.2K BPS and distances up to 4000 feet. Belden -9184 Belden -9302 NEC -222PISLCBT At shorter distances, almost any twisted pair or shielded twisted pair cable will work. It should be noted that RS-422 requires that the transmitter and receiver ground be within a few volts of each other or damage to the transmitter and receiver may result. It is also noted that the twisted pairs should be matched so that both transmit signals make up one twisted pair and both receive signals make up the other twisted pair, If this is ignored, then cross-talk can result from the mis-matching which will affect the performance of the communication system.

Module Function Options

The options listed below for the CCM2/CCM3 are hardware selectable using switches and jumpers, or software selectable using configuration registers.

Data Rate (bits per second)	300, 600, 1200,2400,4800, 9600, 19.2K 38.4K
Protocol	Peer-to-peer Master, slave RTU slave (CCM3 only)
Line Interface	RS-232C RS-422 RS-422 with clocks (CCM2 **only)**
Turn-Around Delay	0ms, 10ms, 500ms, 500ms with time-outs disabled
Character Format	8 data bits 1 stop bit Optional parity bit
Parity	Odd **None** Even CCM3 RTU mode, (Port 32 only)
Operator Interface Unit (OIU)	Enable Disable Connect, disconnect power to OIU from CCM
• Terminating Resistors (RS-422)	Resistors IN receiver circuit if module is at the end of an RS-422 multidrop or point-to-point link. Removed from receiver circuit if module is in an intermediate drop in a multidrop link.

Table 3. SPECIFICATION AND SERIAL DATA FORMAT

Serial Data Format										
BIT0	BIT 1	BIT2	BIT3	BIT4	Em5	BIT6	BIT 7	BIT 8	BIT 9	BIT10
	LSB							MSB	*	
START				ACTIVE	DATA	BITS			PARITY	STOP
0				1	or	0				1

* Parity can be disabled on either port.

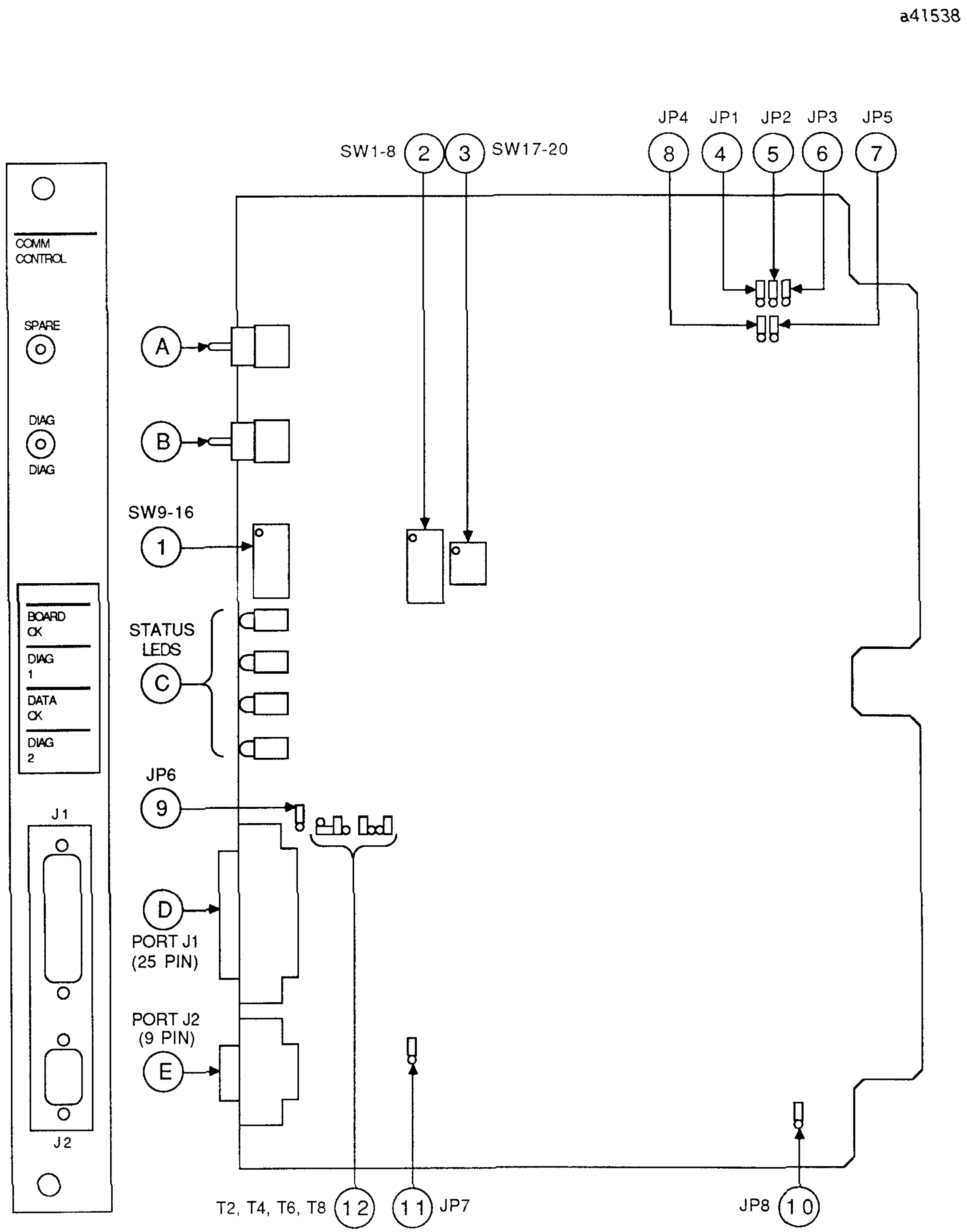


Figure 1. USER ITEMS

Description of User Items

A Single Pole/Double Throw/Center Off switch (momentary contact)

B Single Pole/Double Throw/Center Off switch (momentary contact)

Both switches (A and B) perform the same function in either the Up or DOWN position.

Switches A and B are used for CCM error diagnostics.

C LED Indicators 1 **to 4 (see** below).

D Jl Connector: 25pin "D" type female connector for RS-232 and RS-422.

E J2 Connector: 9-pin "D" type female connector for RS-422 and RS-232.

1 DIP Switches 9 to 16: Configuration selection for port Jl (see Table 5).

2 DIP Switches 1 to 8: Configuration selection for port J2 (see Table 6).

3 DIP Switches 18 to 20: Miscellaneous selection for **both** ports (see Table 5).

4 Jumper JPI: Always set in 1-2 position,

5 Jumper JP2: Always set in l-2 position.

6 Jumper JP3: Always set in 1-2 **position.**

7 Jumper JP5: Always set in l-2 position.

8 Jumper JP4: 1-2 position, OIU DISABLE.

Jumper JP4: 2-3 position, OIU ENABLE.

9 Jumper JP6: 1-2 position disconnects **+5V** from pin 20 of Port Jl.

2-3 position, connects **+5V** to pin 20 of port Jl.

10 Jumper JP8: Always set in 1-2 position.

11 Jumper JP7: Always set in l-2 **position.**

12 See installation of RS-422 interfaces for terminating resistor configuration.

Jumper T2: J2, RS-422 receiver circuit

Jumper T4: RS-422 clock input

Jumper T6: Jl, RS-422 receiver circuit

Jumper T8: Always set in storage position

Table 4. LED INDICATORS POWERUP ERROR CODES

	CAUSE OF ERROR (° Light on, ✍✍ Light off)				
	LIGHT	**CCM POWER-UP RAM TEST FAILED**	**CCM USART FAILED TO INITIALIZE**	**CCM PROM TEST FAILED**	**CPU/CCM COMMUNICA-TIONS FAILED**
1	BOARD OK	a	0	•	0
2	DIAG 1	0	a	•	0
3	DATA OK	0	0	0	✍
4	DIAG 2	0	0	O	0

LED Descriptions

BOARD OK (Module Status)

STATUS	DESCRIPTION
ON:	Board has passed the self-check test and is operating properly.
FLASHING:	Invalid configuration or invalid CPU number, 0 or greater than 90 for CCM slave mode, 0 or greater than 247 for RTU mode (CCM3 only). The configuration or the CPU ID must be changed and the module powered up again to recover.
OFF:	Board has failed power-up test indicating a hardware failure or the CCM failed to communicate with the Series Six CPU. If the BOARD OK LED goes off as a result of a major CCM error, further information about the specific cause of the error can be obtained by toggling the front panel switch. When this is done, the 4 indicator lights will create **one** of the patterns shown in Table 3. - If it is a hardware failure **then** the CCM is inoperable and the LED will turn on again only after successful completion of the power-up test. s If at some time after a successful power-up there is a CCM/CPU communications failure, both the BOARD OK and the DATA OK LED will turn off. In this case additional information from the front panel LEDs cannot be obtained. Both LEDs will turn on again upon successful communications with the CPU.

DIAG 1

STATUS	DESCRIPTION
ON:	Passed powerup diagnostics. ON during normal operation.
	Cycles on and off during powerup then remains on.
OFF:	May change states when toggling Switch A or B.

DATA OK (Serial Data Transmission Link)

STATUS	DESCRIPTION
ON:	Data transmission normal.
FLASHING:	The LED will flash as serial data is actually transmitted.
OFF:	Data transmission is incorrect for one or more of the following reasons. - Parity, overrun or framing errors. - Invalid header, data block, control character, or checksum. In these cases the LED will turn on again after a successful session has been completed between the Series Six and the external device, or if the module power is cycled. A CCM./CPU communications failure will cause this LED and the BOARD OK LED to turn OFF.

DIAG 2

STATUS	DESCRIPTION
ON:	Passed powerup diagnostics. ON during normal operation.
	Cycles on and off during powerup then remains on.
OFF:	May change states when toggling Switch A or B.

Installation

General

Before installing the CCM2/CCM3 in a CPU rack verify the position of the factory set jumpers (see Figures 1 and 2). Select the appropriate module function options by setting the on-board DIP switches (as required) per the coding shown in Tables 5, 6, 7 and 8.

The CCM2/CCM3 module can be installed in a model Six Plus, 60, 600, or 6000 PLC.

- *In the **Series Six 60,600, or 6000*** PLC the second slot to the left of the CPU power supply is reserved for this module, and is the only position where the CCM2/CCM3 can be installed.
- In the Series Six Plus PLC, slot 5 or 6 is reserved for the CCM2/CCM3 module. When slot 6 is used, set the backplane DIP switch package to all positions OPEN.

NOTE

The normal powerup operation with all backplane DIP switch positions set to OPEN is: All four LEDS powerup ON, next a BLINKING sequence, then all LEDS remain ON.

An unpredictable LED powerup sequence results when the backplane DIP switch package is set otherwise. The ALU Module LEDS remain OFF. And, if a Workmaster is connected, a message "No communications with the Series Six" is displayed.

Use the extraction/insertion tool furnished with the Series Six CPU to install or remove the circuit board. With the circuit board in place in the rack, guide the faceplate over the circuit board so that proper contact is made; then secure the faceplate to the rack using the thumbscrews at the top and bottom.

The CCM2/CCM3 module obtains its ID Number from the Series Six PLC. Use the Logicmaster software to set the correct ID Number in the Series Six CPU scratchpad.

Since there are many combinations of devices this module can interface with and many ways to wire up these combinations only a few of the more common wiring connections are shown as follows:

- The pinout definitions for ports J1 and J2 are shown in Figure 3.
- Direct connect from one CCM2 module to another CCM2 is shown in Figures 4 and 6.
- Direct connect from a CCM2/CCM3 module to a computer or process control system is shown in Figure 5.
- Wiring from a CCM2/CCM3 to a GEnet Factory LAN BIU is shown in Figures 8 and 9.
- Wiring for CCM 4-wire multidrop network is shown in Figure 10.
- Wiring for a CCM 2-wire multidrop network is shown in Figure 1 I.
- Wiring from a CCM2/CCM3 to an Operator Interface Unit (OIU) is shown in Figure 7.

Troubleshooting Checklist:

- Verify CPU Id Number
- Verify CCM configuration setup
- Verify wiring
- Verify SCREQ commands (if used)

a41537

HARDWARE JUMPERS						
	PINS JUMPERED	JUMPER	TERMINATING RESISTORS RS422	JUMPER POSITION RESISTOR IN	JUMPER POSITION RESISTOR OUT	JUMPER
REQUIRED SETTINGS	1 - 2	JP1	J2 RS422 RECEIVER			T2
	1 - 2	JP2				
	1 - 2	JP3	J1 RS422 CLOCK INPUT			T4
	1 - 2	JP5				
	1 - 2	JP7				
	1 - 2	JP8				
OIU ENABLED	2 - 3	JP4	J1 RS422 RECEIVER			T6
OIU DISABLED	1 - 2	JP4				
OIU POWER ON PIN 5 J1	2 - 3	JP6				
OIU POWER DISCONNECTED	1 - 2	JP6	REQUIRED SETTING			T8

Figure 2. CCM2/CCM3 CONFIGURATION JUMPERS

Table 5. CCM PROTOCOL HARDWARE CONFIGURATION TABLE - PORT J1

FUNCTION PORT J1	O-Open C-CLOSED X-Don't Care	SWITCHES *										
		9 (1)	10 (2)	11 (3)	12 (4)	13 (5)	14 (6)	15 (7)	16 (8)	18 (2)	19 (3)	20 (4)
										X	X	O
Data Rate	300	O	O	O								
	600	C	O	O								
	1200	O	C	O								
	2400	C	C	O								
	4800	O	O	C								
	9600	C	O	C								
	19.2K	O	C	C								
	38.4K	C	C	C								
Protocol	Master RS-232				O	O	O					
	Master RS-422				C	O	O					
	Slave RS-232				O	C	O					
	Slave RS-422				C	C	O					
	Peer RS-232				O	O	C					
	Peer RS-422				C	O	C					
	Peer RS-422 With CLK (CCM2 Only)				O	C	C					
	Software Configuration **				C	C	C					
Turn Around Delay	0 ms full duplex							O	O			
	10 ms half duplex							C	O			
	500 ms half duplex							O	C			
	500 ms with time-outs disabled							C	C			
Parity Selection	(Always odd when using hardware configuration. To select no parity for port J1, see CCM2 Software Configuration.)											

* The numbers without parentheses are the actual switch numbers as indicated by the board silk screen. The numbers in parentheses are located on the dip switch package itself and are included as an aid in configuring the module.

X Don't Care

** Switch 17 must be CLOSED (C) for software configuration.

Table 6. CCM PROTOCOL HARDWARE CONFIGURATION TABLE - PORT J2

		SWITCHES *								
FUNCTION PORT J2	**O-Open C-Closed**	**1 (1)**	**2 (2)**	**3 (3)**	**4 (4)**	**5 (5)**	**6 (6)**	**7 (7)**	**8 (8)**	**17 (1)**
Data Rate	300	O	O	O						
	600	C	O	O						
	1200	O	C	O						
	2400	C	C	O						
	4800	O	O	C						
	9600	C	O	C						
	19.2K	O	C	C						
	38.4K	C	C	C						
Protocol	Master RS-232				O	O	O			
	Master RS-422				C	O	O			
	Slave RS-232				O	C	O			
	Slave RS-422				C	C	O			
	Peer RS-232				O	O	C			
	Peer RS-422				C	O	C			
	Test 1(CCM2 only)				O	C	C			
Turn Around Delay	0 ms full duplex							O	O	
	10 ms half duplex							C	O	
	500 ms half duplex							O	C	
	500 ms with time-outs disabled							C	C	
Parity Selection	Odd									C
	None									O

* The numbers without parentheses are the actual switch numbers as indicated by the board silk screen. The numbers in parentheses are located on the dip switch package itself and are included as an aid in configuring the module.

Table 7. RTU PROTOCOL (CCM3) HARDWARE CONFIGURATION TABLE - PORT J1

FUNCTION PORT J1	O-Open C-Closed	SWITCHES * 9 (1)	10 (2)	11 (3)	12 (4)	13 (5)	14 (6)	15 (7)	16 (8)
Data Rate	300	O	O	O					
	600	C	O	O					
	1200	O	C	O					
	2400	C	C	O					
	4800	O	O	C					
	9600	C	O	C					
	19.2K	O	C	C					
	38.4K	C	C	C					
Protocol	RTU(CCM3 Only)				O	C	C		
	Software Configuration				C	C	C	NOTE: Switch 17 must be C for Software Configuration	
Line Interface	RS-232							O	
	RS-422							C	
Parity Selection	Odd								O
	None								C

Table 8. RTU PROTOCOL (CCM3) HARDWARE CONFIGURATION TABLE - PORT J2

FUNCTION PORT J2	O-Open C-Closed	SWITCHES * 1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	17 (1)
Data Rate	300	O	O	O						
	600	C	O	O						
	1200	O	C	O						
	2400	C	C	O						
	4800	0	O	C						
	9600	C	O	C						
	19.2K	O	C	C						
	38.4K	C	C	C						
Protocol	CCM3(RTU)				O	C	C			
Line Interface	RS-232							O		
	RS-422							C		
Parity Selection	Odd								O	C
	Even								C	C
	None								O	O
	None								C	O

Faceplate Connections

The pinouts for the 25 pin (Jl) and **9** pin (52) ports (both female connectors) are shown below.

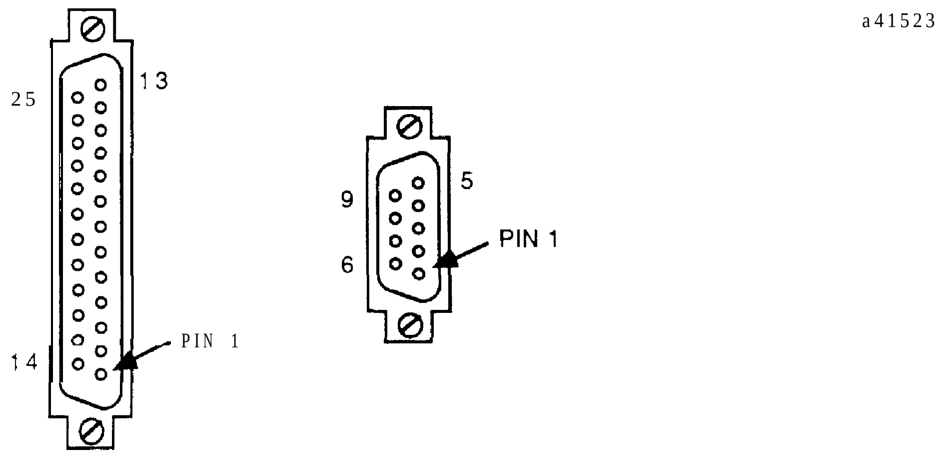


Figure 3. PORT CHARACTERISTICS (J1, J2)

Table 9. PORTS (Jl, J2) PIN-OUT DEFINITIONS

Jl Port				**J2 Port**	
Pin No.	**Description**	**Pin No.**	**Description**	**Pin No.**	**Description**
1	*	**14**	RS-422	1	RS-422 data out (+)
2	RS-232 data out	15	*	2	RS-232 data out
3	RS-232 data in	16	*	3	RS-232 data in
4	RS-232 request to send	17	RS-422 data out (-)	4	RS-232 request to send
5	RS-232 clear to send	18	RS-422 data out (+)	5	RS-232 clear to send
6	*	19	OIU ground	6	RS-422 data out (-)
7	signal ground	20	OIU +5 volts (fused at 5 A)	7	signal ground
8	*	21	RS-422 clock in (+)	8	RS-422 data **in (+)**
9	*	22	-12 volts resistive	9	RS-422 data in (-)
10	*	23	RS-422 clock in (-)		
II	keyout I/O	24	RS-422 clock out (+)		
12	+12 volts	25	RS-422 clock out f-)		
13	RS-422 data in (+)				

* Do not connect

Grounding

Both RS-232 and RS-422 require that the transmitter and receiver circuits be at the same ground potential (within a few hundred millivolts). On the CCM2 or CCM3, none of the circuits are isolated from the Series Six chassis ground, which is also the “local” power company ground. In many cases this is not a problem. However, the user should insure that the ground voltages are within a few hundred millivolts of each other before connecting the devices together.

A problem will exist only if the local power ground is exceptionally noisy, or if the Series Six PLC rack or other device is floating with respect to this ground (which indicates an incorrect or very unusual configuration). If the user’s configuration is such that the grounds do not meet the above condition, then isolating modems will be required instead of a direct twisted pair hookup.

Installation of RS-422 Interfaces

- The maximum number of slaves on a multidrop line may be between 4 and 8, depending on the local electrical noise, the type of cable, distance between devices on the line, and the overall length of the cable.
- The maximum distance between the farthest 2 points in a multidrop system with 8 slave units on the line that has been tested is 10,000 feet. However, this may not represent a worst case in terms of noisy environments.
  - 4000 feet seems to be a good rule of thumb for maximum cable length. This assumes a twisted pair cable of AWG 24 copper with a shunt capacitance of 16 pf/foot. (Refer to the RS-422 specification).
  - In general, distance may be increased by using cables which have less resistance and capacitance per foot, than the 24 AWG cable illustrated above.
  - For example: If a cable with half the resistance per foot and only 8 pf/foot were used, operation at 8000 feet is probably attainable.
- **Terminating resistors:** The CCM2/CCM3 is supplied with 150 ohm terminating resistors in each RS-422 receiver circuit. (These resistors have no effect on RS-232 operation.)
  - These resistors should be left in the circuit if the CCM is at either end of a multidrop or point-to-point link.
  - If the module is used as an intermediate device in a multidrop network, the resistor should be removed by placing Jumper T6 for the Jl port and T2 for the J2 port in the storage position as shown in Table 2.
  - Jumper T8 <u>must</u> be in the storage position.

Physical layout: The following rules should be followed:

- All connections on the multidrop bus should be made inside the CCM serial port connectors. No intervening terminal strips, splices, or other devices should be used. Although it is difficult to get more than one (1) wire on the D connectors, this is the only way to insure that the network will function properly.
- For a multidrop network, the layout of the cable between devices should be as a daisy chain bus; NOT AS A STAR. Even if the physical proximity of the communicating devices **is** such that a radial star would be nice, it will not work.
- Pairing of twisted pairs within the cable: It is critical that the two transmit signals remain physically paired, and the two receive signals remain physically paired in the twisted pair cable.
  - It is not enough that electrically there is continuity between the correct points. If a transmit wire gets paired with a receive wire (twisted together) there may be crosstalk which will limit the maximum dependable distance to about 3 feet instead of 4000.
  - In the case of a 2-wire network where the transmit and receive signals are connected together; this is not a problem.

Cable Configuration

The CCM2/CCM3 module can interface many devices and there are many ways to wire these combinations. A few of the more common applications are shown in the following figures.

General guidelines for cable construction is provided below:

- At short distances (under 1000 feet) almost any twisted shielded pair will work. The specified cables will provide reliable operation at data rates up to 19.2 Kbps and distances up to 4000 feet. Good wiring practices must **be** observed. Twisted pairs must be matched.
- When routing communication cables outdoors, transient suppression devices should be used to reduce the possibility of damage due to lightning or static discharge. Best results have been obtained with General Semiconductor Industries Transzorb SA series wired from each signal line to earth ground at both ends of the cable.

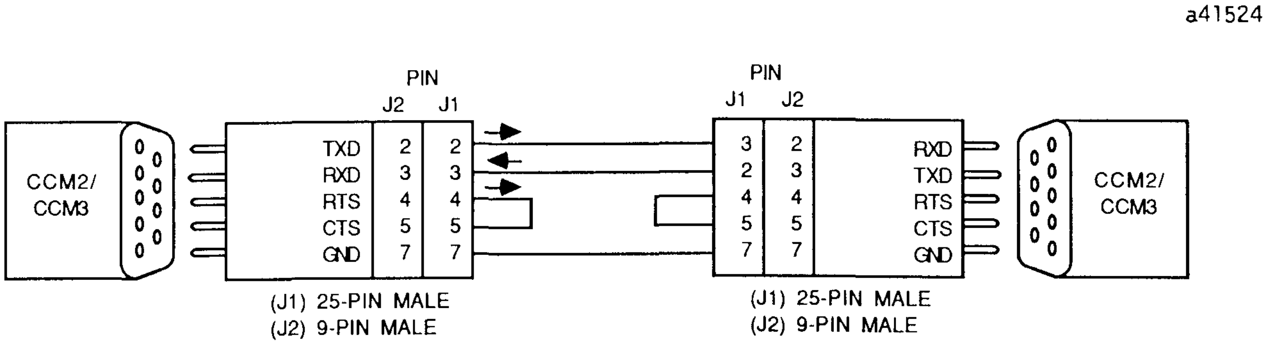


Figure 4. RS-232 TO ANOTHER SERIES SIX PLC CONNECTION

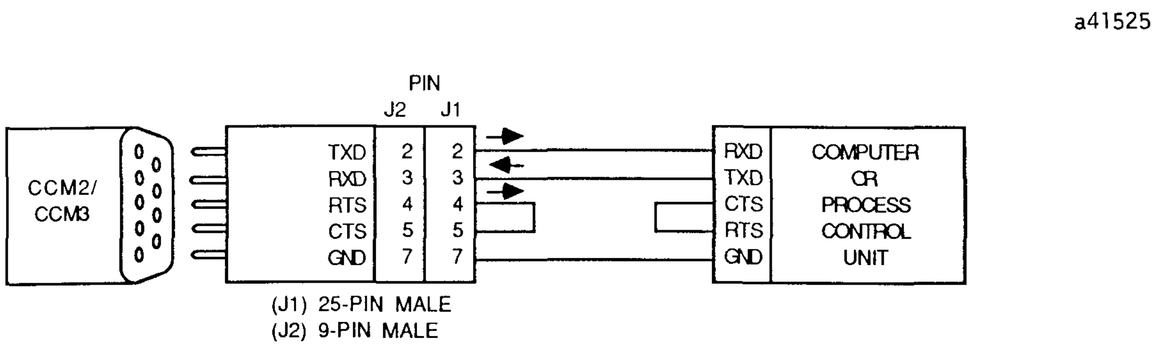


Figure 5. RS-232 TO A HOST COMPUTER CONNECTION

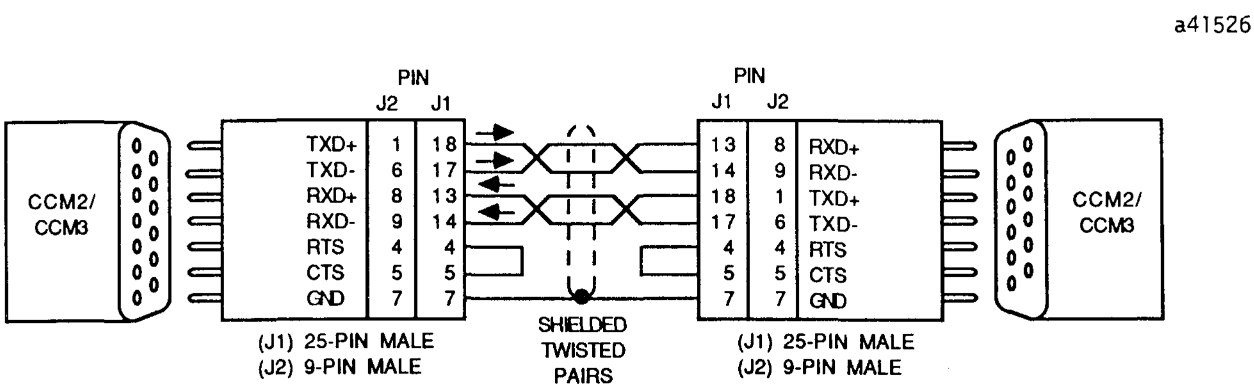


Figure 6. RS-422 TO ANOTHER SERIES SIX PLC CONNECTION

Operator Interface Unit (OIU) Connections

The Operator Interface Unit (OIU) connects to the J1 port of the CCM2/CCM3 module. The CCM communicates to the OIU via RS-422 receive and transmit signals at a data rate of 19.2K BPS. The J1 port also provides power to the OIU.

The CCM needs to be configured properly in order to interface to the OIU. The CCM should be set up for RS-422, 19.2 Kbps, OIU ENABLED, and OIU operating power connected. The connection between the CCM and the OIU is shown in Figure 7.

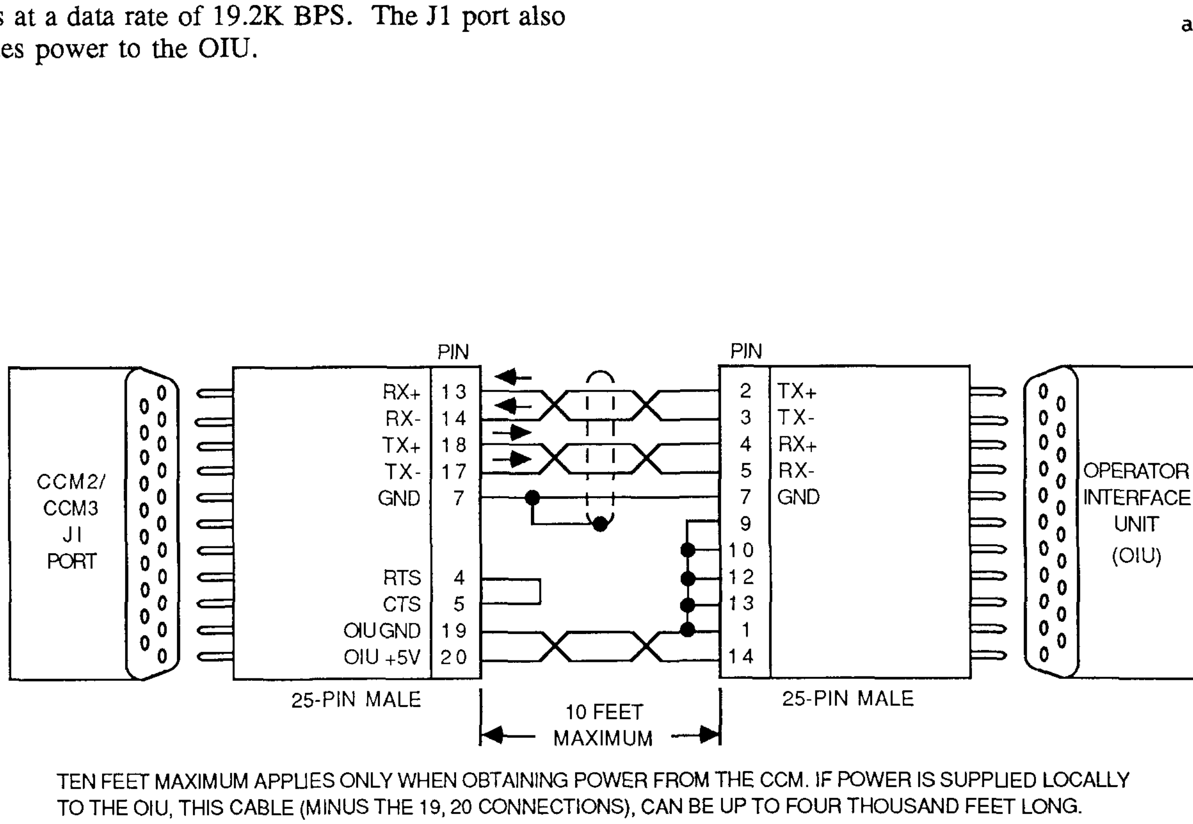


Figure 7. DIRECT CCM TO OIU CONNECTION DIAGRAM

GEnet™ Factory LAN BIU Connections

The Series Six PLC may communicate with many other devices by connection to the GEnet LAN network via the Bus Interface Unit (BIU). The connection can be made on J1 or J2 by using the appropriate 9-pin or 25-pin connectors. Figure 8 shows the pin assignments for an RS-232 connection between the CCM2 and the GEnet BIU.

a41199

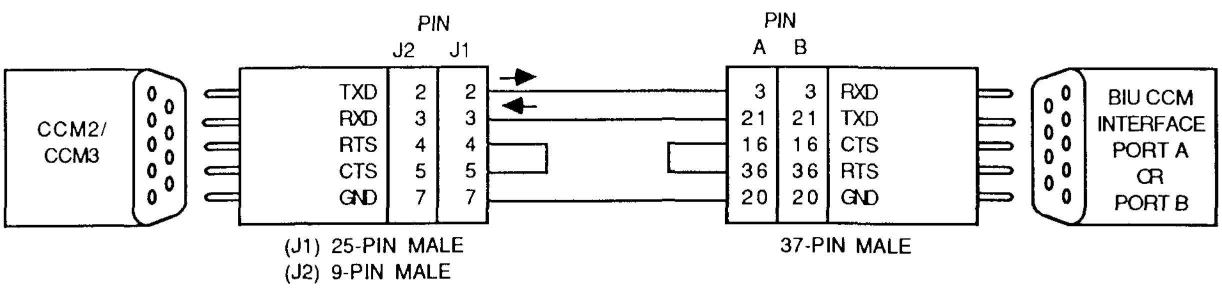


Figure 8. RS-232, CCM TO GEnet BIU, 2-WIRE CONNECTION

a41200

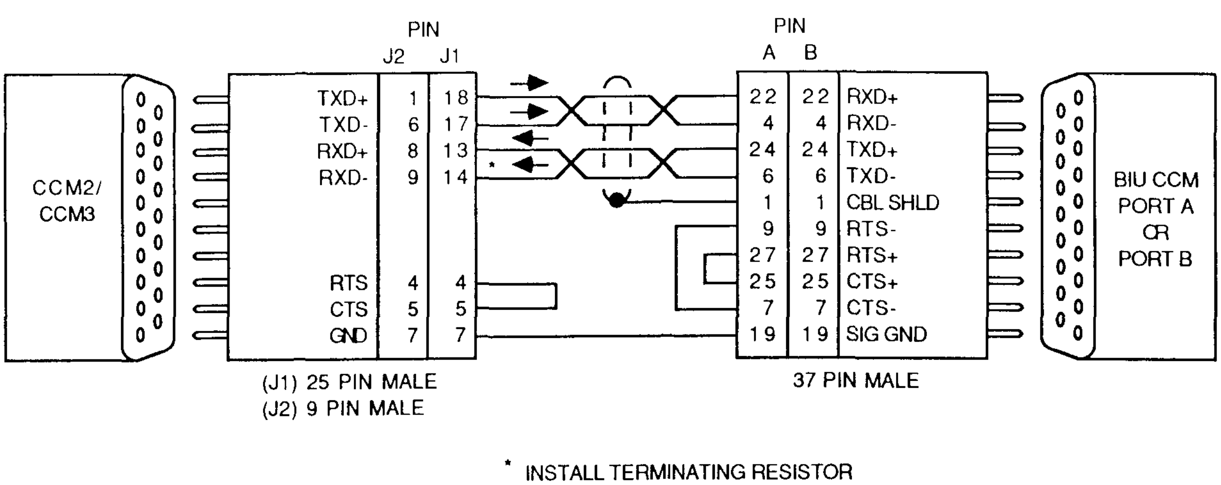


Figure 9. CCM TO GEnet BIU RS-422, 4-WIRE CONNECTION

CCM Multidrop Connections

The diagrams shown as follows show generally how devices are connected in a multidrip configuration. Examples of the 4-wire and 2-wire, RS-422 multidrop connections for the CCM are included.

Master-slave protocol must be used for multidrop connections.

Modems may also be used to set up a multidrop configuration.

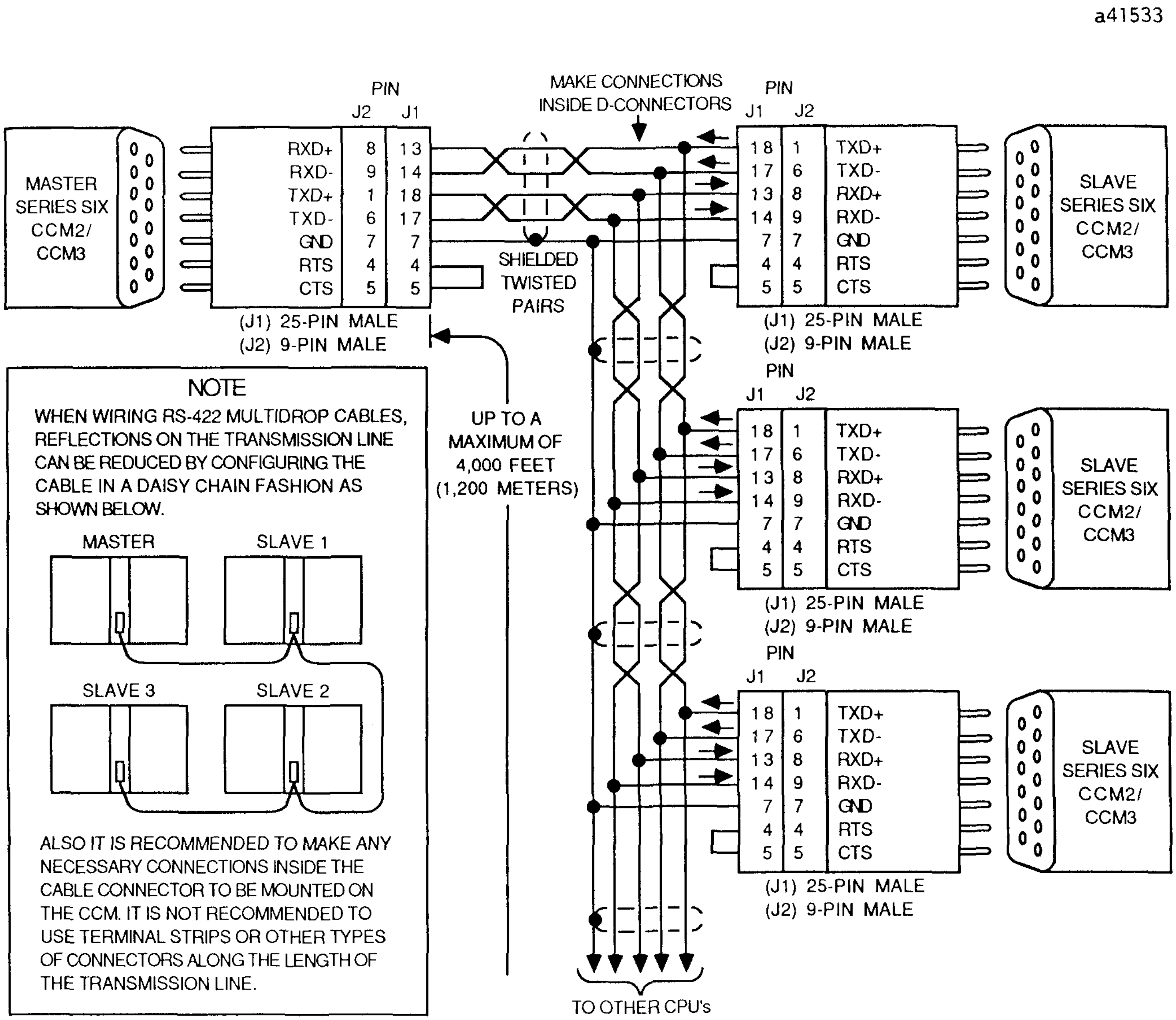


Figure 10. RS-422, 4-WIRE MULTIDROP CONNECTIONS

CCM Multidrop Connections (continued)

A 2-wire RS-422 multidrop link can be implemented. To accomplish this, tie Rxd+ and Txd+ together and tie Rxd- and Txd- together at the CCM. This results in one signal path for a 2-wire RS-422 differential signal.

When implementing a 2-wire RS-422 link with a host as a master, the host must have a tri-state transmitter which maintains idle lines in a high impedance state. Also, some host equipment may not allow tying Rxd and Txd together. In this case the user must use the 4-wire multidrop.

a41534

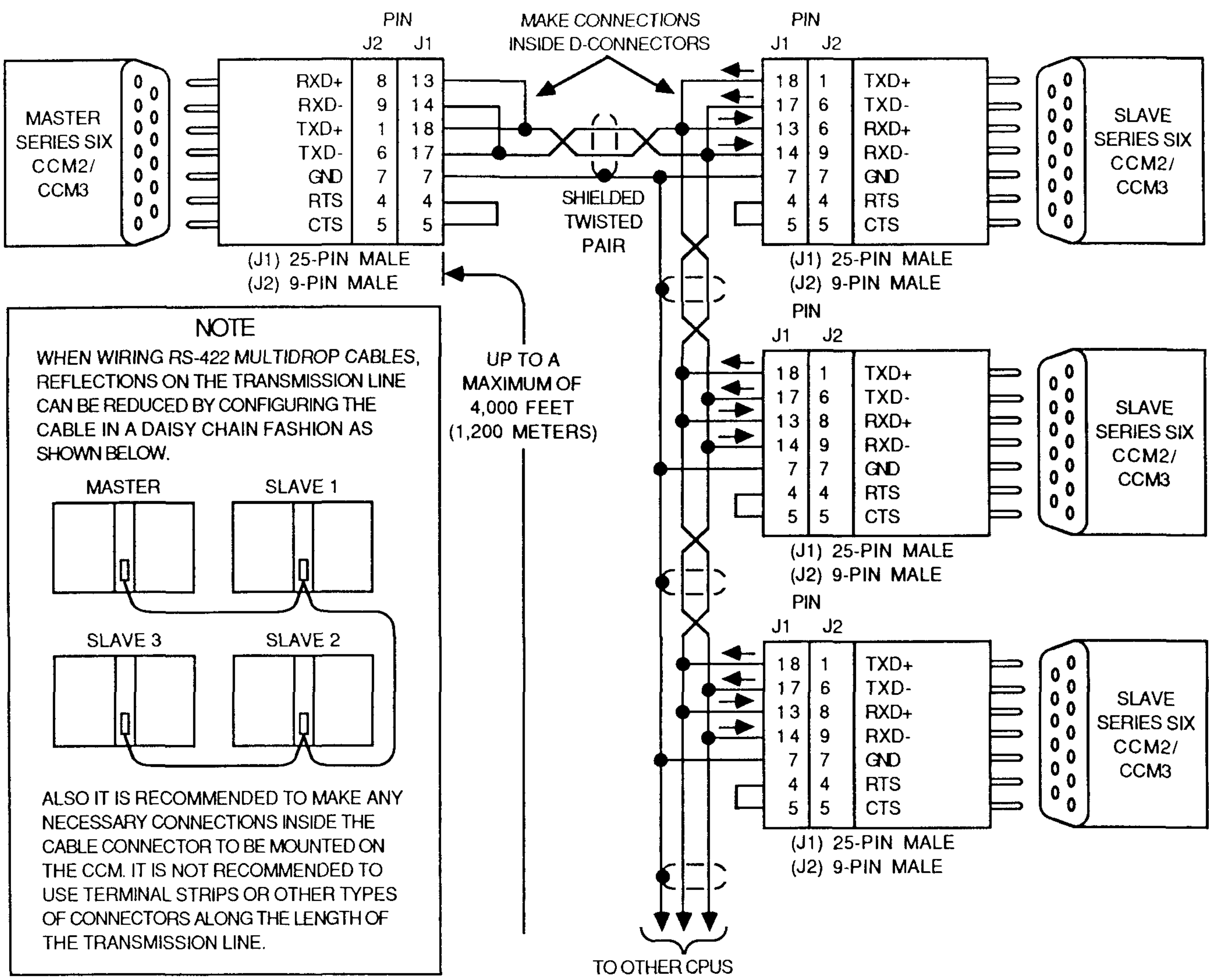


Figure 11. RS-422, 2-WIRE MULTIDROP CONNECTIONS

Table 10. MODULE SPECIFICATIONS

Dimensions - Circuit Board:	8.15 x 11.0 (inches), 208 x 280 (mm)
Dimensions - Faceplate:	12.46 x 1.175 (inches), 317 x 30 (mm)
Power Requirements:	(Supplied by CPU Power Supply) +5 Vdc +12 Vdc -12 Vdc
Units of Load (CCM2)	17 4 4
Units of Load (CCM3)	17 4 4
Storage Temperature:	0 to 70 C
Operating Temperature:	0° to 60° C (outside of rack)
Humidity:	5% - 95% (non-condensing)

Table 11. ORDERING INFORMATION

DESCRIPTION	CATALOG NUMBER
Circuit Board & Faceplate (CCM2)	IC600CB536
Circuit Board & Faceplate (CCM3)	IC60OCB537
Faceplate (CCM2/CCM3)	IC6OOFP536

For further information, contact your local GE Fanuc - NA sales representative.

Series Six PLC
GEnet Factory LAN

GF'K-0267C
December, 1989

Single-Slot Carrierband Network Interface
IC65OESS004
IC65OESS002

- Direct PLC attachment to MAP Carrierband network.
- Works with Series Six PLC, Models 60,600,6000, as well as with the Series Six Plus.
- Three concurrent data transfer services: MAP, DATAGRAM, and GLOBAL DATA
- Software (sold separately) is easily loaded or upgraded via RAM load.
- Software is retained through power outages up to 72 hours.
- Comprehensive station management and diagnostic tools

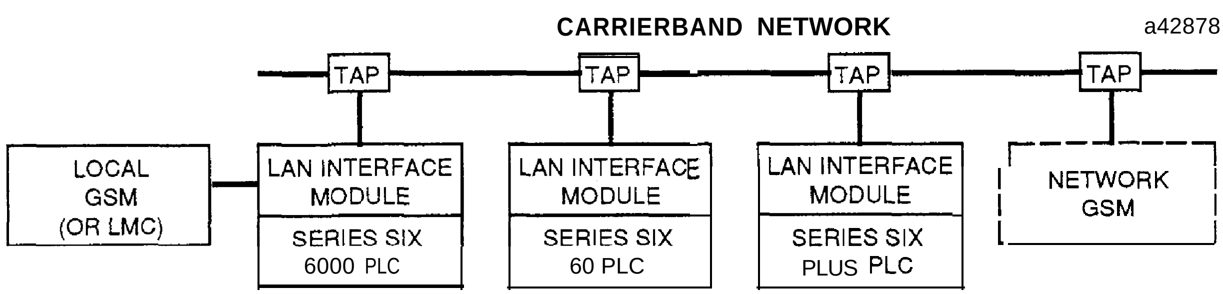


Figure 1. LAN Interface Module Connects the Series Six PLC to a Carrierband Network

The Single-Slot LAN Interface for the Series Six programmable controller is a member of the family of GEnet Factory LAN communication products. These products provide a range of options for interconnecting automation controllers and for integrating them into multi-vendor networks.

The Series Six Single-Slot LAN Interface module fulfills its role in the family by providing a direct connection for a Series Six programmable controller to a carrierband network.

The GEnet Factory LAN architecture is based on standards set forth in the Manufacturing Automation Protocol (MAP) specification.

MAP has been an evolving standard. Series Six LAN Interface modules support the MAP specification versions 3.0 and 2.2. The version of MAP protocol is simply loaded into Random Access Memory (RAM) on the appropriate LAN Interface module. *This* allows upgrade to a new revision of software without modification to the hardware.

Features of the LAN Interface Module

The features of the GEnet Factory LAN Interface module are described briefly here. For a more complete description see the appropriate *GEnet Series Six* PLC *Network Interface User's Manual.* Other related publications are listed on page 7.

Direct LAN Attachment to the Carrierband Network

This Single-Slot carrierband LAN Interface module is composed of a factory assembled digital controller (motherboard) and modem (daughterboard). The unit plugs directly into the COM CON slot in any Series Six CPU rack. Figure 1 illustrates the LAN Interface module as part of the network.

The LAN Interface module connects directly to the 5 Mbps Carrierband Network through the modem daughterboard. Intermediate devices such as bridges or gateways are not required. The direct connection provides the high performance required for real-time control applications.

The communications software is down-loaded to the LAN Interface and stored in Random Access Memory (RAM). This makes it easy to reconfigure or upgrade the communications software simply by downloading it again. An on-board capacitor provides 72-hour memory retention which will prevent loss of the communication software due to most power loss situations.

Carrierband Networks: Networks of up to 72 stations or up to 2000 feet cable span can be constructed using simple do-it-yourself carrierband technology. The 75 ohm coaxial cable plant contains no active (powered) components. Received signal strength limits network size and depends on the number of intervening stations and the cable distance over which the signal must travel.

For carrierband cable design, refer to GFK-0014, *Carrierband Cable Plant Design and Installation Manual* for step-by-step instructions. GEnet carrierband complies with the IEEE 802.4 Phase Coherent standard, operating at 5 M-bps.

Communication Services

There are three different communication protocols for transferring data on the network: MAP, Datagram, and Global Data. The LAN Interface software for these protocols is offered as two separate software packages, one for MAP 3.0, and the other for MAP 2.2.

Regardless of which MAP version you choose; MA-P, Datagram, and Global Data operate simultaneously on the network and within each station.

MAP Protocol (T-layer)

MAP protocol is defined by the Manufacturing Automation Protocol (MAP) specification. MAP is an approved standard. MAP-compatible products are available from a variety of manufacturers, and their interoperability has been established.

The primary service offered by the MAP protocol is reliable message transfer between two interconnected stations. MAP protocol provides automatic error recovery for most kinds of errors. MAP is ideal for transferring large amounts of data between two specific stations, such as PLC program downloads.

A feature of MAP is that the two communicating stations need not be on the same LAN, so long as the different LAN's are connected by an appropriate intermediate station.

MAP commands are directed from an initiating station to a single specific responding station. Each message exchange is explicitly initiated.

Datagram Protocol (3-layer, miniMAP, EPA)

GEnet Datagram protocol is a subset of the MAP/EPA standard specified in MAP Version 3.0.

MAP/EPA represents an optional enhancement of the basic MAP standard, toward improved real-time performance for direct control applications. These applications, in contrast to MAP applications, send short messages but demand very quick response.

GEnet Datagram protocol provides basic read and write data transfers between two stations on the same LAN. Like MAP, automatic error recovery is provided.

GEnet Datagram commands are directed from an initiating station to a single specific responding station. Each message exchange is explicitly initiated.

Global Data Protocol

GEnet Global Data protocol is a proprietary innovation of GE Fanuc - NA.

Global Data provides periodic data transfers from a source station to unspecified receiving station(s). Receiving stations elect to receive specific data according to symbolic variable-names, but from unspecified source station(s). The receiving ladder logic program is notified only if the data is not updated in a timely fashion.

GEnet Global Data provides highly efficient transfer of periodic data to one or many stations on the same LAN. Symbolic data references permit independent programming of the stations.

A single command initiates the transfer, which then proceeds periodically without further attention by the ladder logic program unless an exception condition occurs.

Station Management and Diagnostics Tools

The station management and diagnostic tools featured are:

GEnet System Manager (GSM)
(called Local Management Console or LMC with the MAP 2.2 software)

The Local Station Manager (LSM)

GEnet System Manager (GSM)

GEnet System Manager (GSM) is a software package which runs on an IBM PC or IBM-compatible (e.g., Workmaster computer.

GSM is used to perform the following functions:

- Create and store configuration files to be downloaded as the communication software **to** a Series Six PLC LAN Interface.
- A terminal mode of operation provides access to the local Station Manager of Series Six LAN Interfaces.

GSM Software Versions

The GEnet System Manager (GSM) comes in two versions: Local and Network.

Local GSM comes as part of the MAP software and allows connection from the computer COMMl port to the 9-pin port on the Series Six LAN Interface.

Network GSM is an optional software package (purchased separately) which allows GSM to work over the network. The appropriate MAP Interface card is required for the personal computer on which GSM is to be installed. A download server is included with network GSM to load configuration files to Series Six LAN Interfaces over the network.

Local Station Manager

The Local Station Manager **(LSM)** is a part of the basic Series Six LAN Interface communication software. The LSM executes as a background activity on the LAN Interface module to provide online supervisory access to it.

The LSM can be accessed in three ways:

Via the 9-pin serial port to a locally connected user-provided terminal.

Via the network from GEnet System Manager.

Limited access is also provided directly to the ladder logic program of the associated Series Six PLC.

The LSM provides all the following services via the local serial port or over the network to GSM. A subset is available directly to the ladder logic program.

- An interactive set of commands for interrogating and controlling the LAN Interface module.
- An online "help" facility.
- Unrestricted access to observe internal statistics, an error log, and configuration parameters.
- Password security for commands that change the LAN Interface states or configuration.

Installation

The Carrierband LAN Interface module is an assembly composed of:

The digital controller - motherboard

The carrierband modem - daughterboard

These subassemblies are factory assembled and are not sold separately. The module is shipped with a separate faceplate.

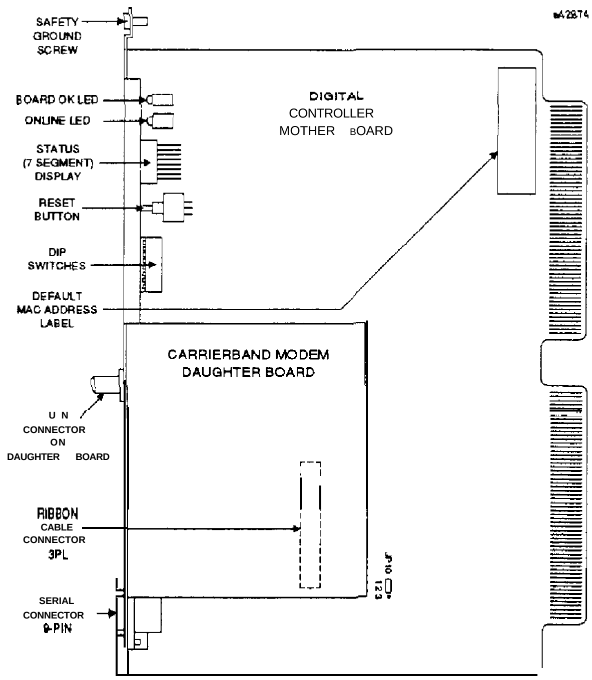


Figure 2. User Items - Single-Slot LAN Interface

Digital Controller Board

The digital controller (see Figure 2) connects the LAN Interface to the backplane of the Series Six PLC, allowing data to flow to and from the PLC. It contains RAM storage for LAN communication software which is downloaded to the board using GEnet System Manager (GSM) software.

The controller board has the following user-accessible elements:

1. BOARD OK LED
   This LED is ON if the LAN Interface hardware has passed diagnostics and is operating properly.

   It is OFF if either the board fails diagnostics or if a hardware problem occurs on an operating board.

2. ONLINE LED
   The ONLINE LED is ON when the LAN Interface module is periodically receiving the right to transmit on the network.

   It is BLINKING when the module is transferring data to or from the network.

   It is OFF when no other stations are connected and communicating, when the network is not communicating due to a disruption of the cable, or when the local station has malfunctioned.

3. STATUS DISPLAY
   The Status Display is a seven-segment display used to show a diagnostic code during the power-up diagnostics. It is also used to show the status of the station after it is operating. See *GEnet Series Six PLC Network Interface User's Manual*, for the meaning of codes which may be displayed.

4. RESTART BUTTON
   Pressing the Restart button forces a reset of the LAN Interface module. This causes the power-up diagnostics to be run and the software on the module to be reset. Any data being transferred by the LAN Interface module at the time of the restart will be lost. The button is used to force a restart of the LAN Interface module after changes have been made to the maintenance switches.

   The Restart button is inaccessible when the module faceplate is installed.

   NOTE

   Depending on the ladder logic program in the Series Six PLC, depressing the Reset button when the Series Six RUN/STOP keyswitch is in RUN may result in failure of the LAN Interface backplane diagnostic.

5. OPTION SWITCHES
   On the exposed edge of the digital controller board is a set of 8 DIP switches which are used to enable various maintenance options. For a complete description of these switches, refer to *GEnet Series Six PLC Network Interface User's Manual*, Appendix C. Normally, all these switches should be positioned to the right (OPEN).

   The option switches are inaccessible when the Digital Controller faceplate is installed.

6. SERIAL PORT
   The GSM terminal is connected to this 9-pin port and communication software may be loaded to the module through this port. For pinouts of this port, refer to Table 2.

Carrierband Modem

The modem daughterboard is factory assembled to the digital controller board and does not require a separate Series Six PLC rack location. The LAN Interface module is connected to the network through the coaxial LAN connector located on the modem daughterboard (see Figure 2) .

WARNING

The ground plate must be securely fastened to the chassis of the Series Six PLC rack using the screw provided. Failure to do so may cause personal injury or improper operation of the equipment.

The carrierband single-board module has the **following** user accessible elements:

1. GROUND PLATE
   Grounds modem and coaxial cable shield to the chassis of the Series Six PLC rack.
2. LAN CONNECTOR
   The connector for attaching the drop cable of the LAN cable plant.

CAUTION

The LAN connector and LAN Interface module may be damaged if other than recommended cable plant components are used. *See GFK-0014 Carrierband Cable Plant Design and Installation Manual* for recommended components. Such damage is not covered by the LAN Interface module equipment warranty.

Installing and Powering-Up the LAN Interface Module

NOTE

When the Single-Slot LAN Interface is to be installed in a Model 6000, 600, or 60 PLC, the CPU power supply must be replaced. On these models, the power module built by Fanuc Ltd is a prerequisite.

1. The Series Six PLC power must be OFF before beginning this procedure,
2. The single-slot LAN Interface module must **be** installed in the COM CON slot of the PLC CPU rack. This will be slot 2 of a Series Six Model 6000, 600, or 60 CPU, or slot 5 of a Series Six Plus CPU.

NOTE

A CCM2 or CCM3 module may not be used if a LAN Interface module is used, However, I/O CCM modules may be used.

3. Examine JPlO on controller board (see Figure 2.) and insure that the jumper connects pins 2 and 3.
4. Locate the COM CON slot of the PLC rack. Carefully remove the COM CON label and remaining adhesive from the PLC rack. This will expose the screw hole that will receive the safety screw from the modem ground plate.
5. Set the Series Six PLC backplane COM CON slot DIP switches all OPEN.

NOTE

Earlier Series Six PLC's (prior to the Series Six Plus PLC) do not have this screw hole. In this case, it will be necessary to carefully drill a hole in the Series Six PLC chassis.

Use the LAN Interface module as a template. Insert the card into the COM CON slot to locate and mark the screw hole position. Remove the card and carefully drill a hole (using a #31 drill bit) in the Series Six PLC chassis, being careful not to drop any metal chips. Also, see Figure 3 for hole location.

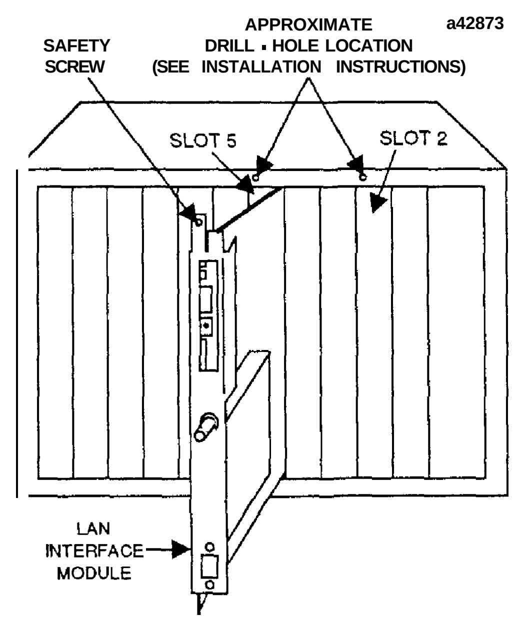


Figure 3. Series Six Rack Layout

6. Remove the faceplate from the card to the left of the COM CON slot. (This is necessary to provide clearance for the card extraction/insertion tool.)

   Slide the **module** into the COM CON slot of the Series Six PLC rack. Seat the module securely in the rack using the extraction/insertion tool.
7. Tighten the ground plate screw to secure the ground plate to the chassis of the rack.
8. Make sure all option switches on the edge of module (controller board) are positioned to the right (OPEN).
9. Attach the LAN Interface module faceplate to the CPU rack, and reinstall the faceplate that was removed in Step 6.
10. If available, connect the drop cable from the cable plant to the LAN Interface connector. Tighten to 15 to 20 inch-pounds torque; this is a snug fit using a small wrench.

CAUTION

The faceplate must be installed before tightening or removing the drop cable. Otherwise, damage to the module may occur due to rotation of the module internal components.

The LAN connector and LAN Interface module may be damaged if other than recommended cable plant components are used. *See GFK-0014 Carrierband Cable Plant Design and Installation Manual* for recommended components. Such damage is not covered by the LAN Interface module equipment warranty.

11. Set the Series Six RUN/STOP keyswitch to STOP. This will prevent the local application program (if any) from initiating any command that may affect the operation of the module.
12. Power up the PLC rack. The controller board executes self diagnostics and its progress is shown by a sequence of characters which appear on the 7-segment Status display. Refer to ***GEnet Series Six PLC Network Interface User's Manual,*** Appendix E for details.

NOTE

The first time the Controller board is powered after several days without power, the self diagnostics may not commence for a period of up to one minute. This is normal. This is the time required to recharge the capacitor used for memory retention.

Correct Results of Installation Procedure

After performing steps 1-12 above, the status of the LEDs and Status Display should be as shown in Table 1.

Table 1. LED and Status Display

LED	RESULTS
BOARD OK	LED must be ON.
ON LINE	LED should be OFF (could be ON only if the communication software has been loaded previously and if modem is connected to operating network).
STATUS (7-segment) DISPLAY	Should display an “L” (Indicating a request **for** Load) or a “0” (indicating that the board has been loaded successfully at a previous time). If an ‘ ‘L” appears, the module is ready to receive a load via the local 9-pin serial port and LMC. If an “I” (lower case L) appears, the module is ready to receive a load via the LAN and NMC. If a “0” appears, but you wish to reload the LAN Interface module, you must first manually force a reload (see instructions in ***GEnet Series Six PLC Network Interface User's Manual.*** The LAN Interface does not require a reload if you are sure the currently loaded comrnunication software and configuration parameters are correct for this LAN Interface module.

Corrective Actions

- If the BOARD OK LED is ON, but the STATUS display is other than shown in Table 2, this may indicate a problem with the software configuration which was loaded previously. Refer to the loading instructions in *GEnet Series Six PLC Network Interface User's Manual*, for more information.
- If the BOARD OK LED is OFF, then something is wrong with the LAN Interface module or its installation. Turn off power, remove the interface module, and examine the backplane for bent or broken pins. Repeat the installation procedure. If you still do not get the results in Table 2, refer to Appendix E in the *GEnet Series Six PLC Network Interface User's Manual* for further instructions.

Configuring and Loading the LAN Interface Module.

Each station on the network must have its own unique configuration file which is down-loaded with the communication executive software.

See *GEnet Series Six PLC Network Interface User's Manual*, for instructions on configuring and loading the LAN Interface module. These operations are necessary before the LAN Interface can be brought on line.

Serial Port Characteristics

The 9-pin serial port (RS-232C interface) is used to connect the local version of GSM to the LAN Interface module. The pinouts of the port are shown in the Table 2. The LAN Interface module is a Data Terminal Equipment (DTE) device.

Table 2. RS-232 Port Pinouts

PIN	SIGNAL	DESCRIPTION NUMBER
1		Reserved
2	TX	Transmit data (out)
3	RX	Receive data (in)
4		Reserved
5		Reserved
6		Reserved
7	GND	Signal Ground
8		Reserved
9		Reserved

A cable is needed to connect the GSM to the LAN Interface. Figure 4 shows how to construct this cable.

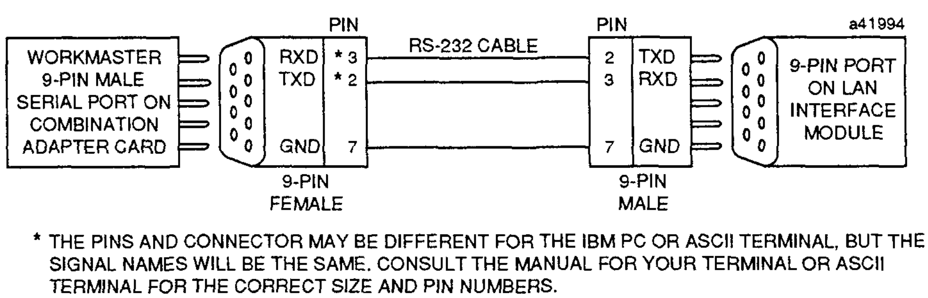


Figure 4. Cable to Connect the GSM to the LAN Interface

Related Publications (GEnet Factory LAN)

Series Six Network Interface User's Manual (MAP3.0)	GFK-0364
Series Six Network Interface User's Manual (MAP2.2)	GFK-0013
Carrierband Cable Plant Design and Installation Manual	GFK-0014
GEnet System Manager User's Manaual	GFK-0413
GEnet Factory LAN System User's Manual	GEK-96608

Table 3. Module Specifications

Power Consumption (Typical):	Power consumption for the carrierband Single-Slot module includes external RS-232 loads. The module is powered by the CPU rack.
Power Requirements:	+5 Vdc: 1.25 A; +12 Vdc: 0.25 A; -12 Vdc: 0.25 A
Units of Load:	+5 Vdc: 21; +12 Vdc: 10; -12 Vdc: 10
Memory Retention:	An on-board capacitor provides backup power (up to 72 hours) when power is removed from the CPU rack containing the LAN Interface module. Maintenance free; no batteries are required.
Physical Dimensions:	
Circuit Board:	8.15 x 11.0 inches (207 x 279 mm)
Faceplate:	12.46 x 1.175 inches (317 x 30 mm)
Environment:	Operating Temperature 0° to 60° C Storage Temperature -40° to 70° C Humidity (non-condensing) 5% to 95%
Mounting:	The module plugs into Series Six CPU rack in the COM CON slot. - Reset and maintenance switches (front edge of controller board behind faceplate) - Indicators on Controller Board: BOARD OK LED, ONLINE LED STATUS (7-segment) Display
Connectors:	LAN (to Local Area Network) FD female connector (special high reliability F-type connector) - J2 1 female 9-pin D-connector
Interface Specifications:	LAN (to Local Area Network) IEEE 802.2 Logical Link Control Class III IEEE 802.4 Token Bus Medium Access Control - 48-bit Address Option - Priority Option - Immediate Response Option IEEE 802.4 Chapter 12, Single-Channel Phase-Coherent-FSK physical layer (modem) - Data Rate: 5 Mbps - Minimum network slot time: 64 octet times (102 microsec) - Worst-case station delay: 512 octet times (820 microsec) - Supports Optional Receive Signal Source and Transmitter Enable/Disable selection J2 RS-232 DTE, 9600 bps
Certification:	Conforms to FCC (part 15, Subpart J) for Class A computing equipment. The product is listed by Underwriters Laboratories, Inc.

Table 4. Ordering Instructions

Complete Interface	Module and faceplate for MAP 3.0 Module and faceplate for MAP 2.2	IC650ESS004 IC650ESS002*
Configuration Software	MAP 3.0 Software and Documentation (Includes Local GSM)	IC651ESS003
GSM Network Version	GSM Software, and User Documentation (PC with MAP I/F Required)	IC651MMZ300

Replacement Parts

Faceplate	Faceplate only	IC650AMP040
Power Supply	CPU Power Supply - prerequisite for Models 6000, 600, or 60 PLCs	IC600PM500

*** Obsolete 1st Quarter 1990**

GE FANUC

Series Six'"
Programmable Controller

GFK-0404A

January, 1990

Work Station Interface (WS6Al)
IC647WMI620

Features

- High Performance Programmer Interface
- Parallel Interface to Series Six Family of PLCs
- Resides in a Workmaster II or an IBM Personal System/2 (PS/2) computer
- Standard Micro-Channel@ bus interface
- Configured to use PS/2 COM2 assignments
- Includes option diskette for use with standard PS/2 computers

Functions

The Work Station Interface provides a parallel interface to the Series Six and Series Six Plus PLCs. It **is** installed in a Workmaster II computer or PS/2 computer, and requires one full PS/2 slot.

Location in System

This Work Station Interface module is used as a parallel interface from the Workmaster II or PS/2 computer to a Series Six or Series Six Plus PLC,

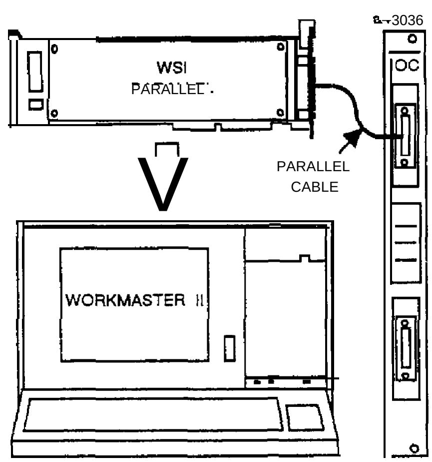
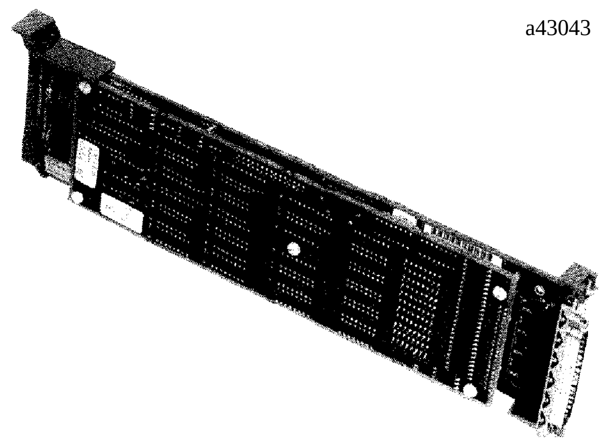


Figure 1. Interconnection of Workmaster II, Parallel Work Station Interface and Series Six PLC

@IBM Personal System/Z, PS/2 and Micro-Channel are registered trademarks of International Business Machines Corporation



Connection to the Series Six or Series Six Plus PLC is to the top connector on the I/O Control module in the CPU rack, or to an I/O Receiver or Advanced I/O Receiver in an I/O rack. Figure I is an example of this connection and Figure 2 is an illustration of the Work Station Interface module.

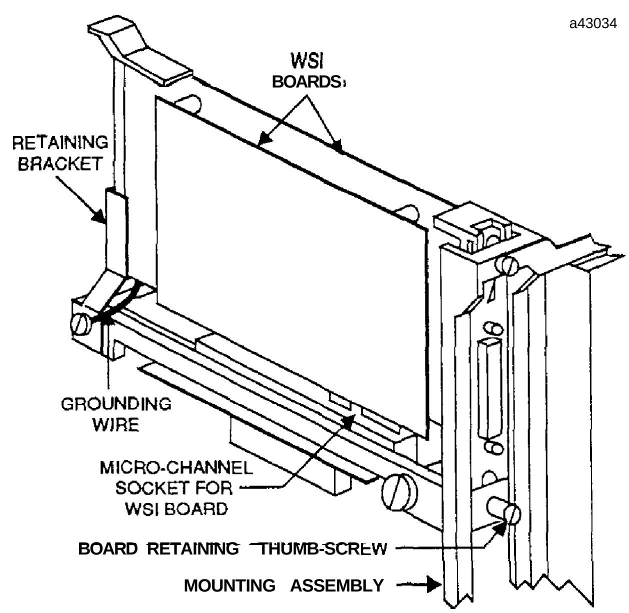


Figure 2. Detail of Work Station Interface Installed in a Workmaster II Computer

Installation - Workmaster II Computer

1. Turn power OFF. (Power OFF Workmaster II computer and attached devices).
2. Unplug all computer power cords from the electrical outlets. Make a note of all cables connected to the rear of the system unit before disconnecting them.
3. Lay the system unit on its keyboard side.
4. Loosen the bottom rear cover screws with a coin or flat blade screwdriver.

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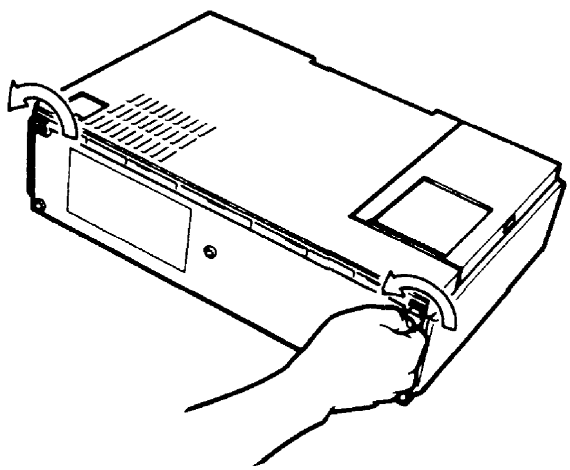

5. Open the connector housing door [1] by moving the side of the door in the direction indicated by 2.

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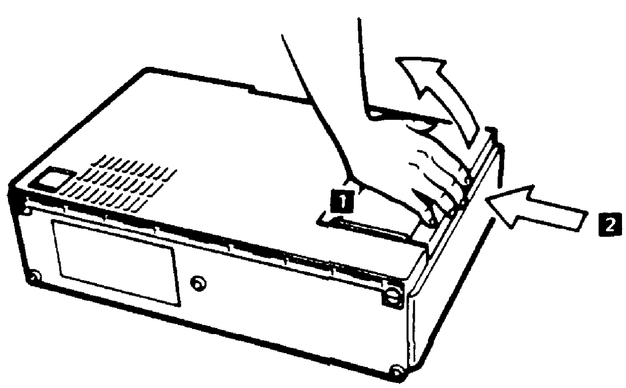

6. Loosen the rear cover screw with a coin.

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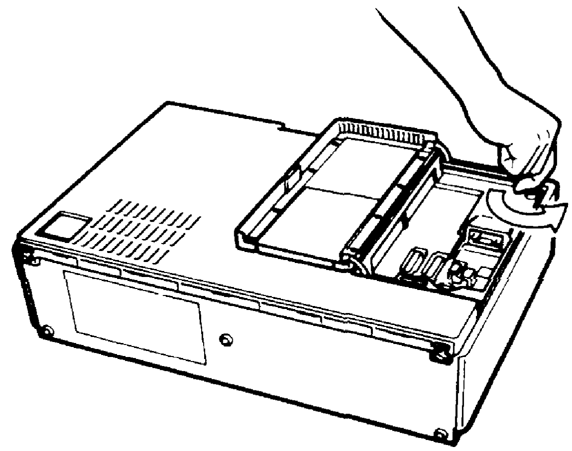

7. Move the handle to the carry position. Hold the rear cover as shown in the next figure, and lift the cover while firmly pushing the bottom at position [3] to release the first latch. Then lift the cover while strongly pushing the bottom at positions [4], [5], [6], [7] to release the other latches.

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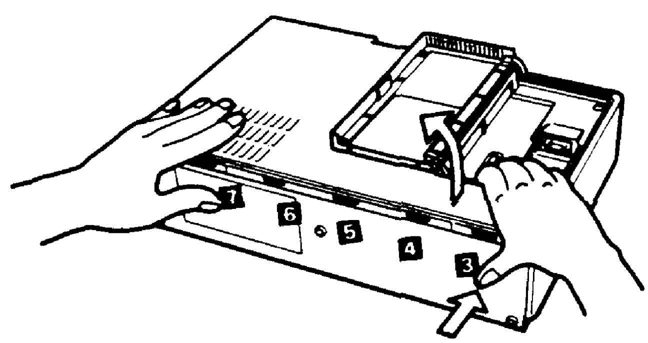

8. Before installing the Work Station Interface board into the upper expansion slot, you must remove the expansion slot cover. To do this, loosen the thumbscrew (a coin may be used). Slide the expansion slot cover $\boxed{2}$ outward, and push it to the left. You may discard the expansion slot cover.

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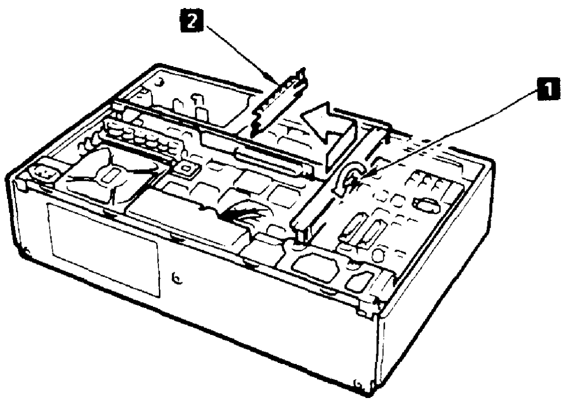

9. Align the Work Station Interface board $\boxed{1}$ with the upper slot as shown in the next figure. Position the adapter support bracket <u>under</u> the holding bracket before pressing the Work Station Interface into the expansion slot connector. $\boxed{2}$ Secure the Work Station Interface in place by using the thumbscrew.

   Connect the grounding wire located at the bottom rear of the Work Station Interface board by attaching it under the retaining bracket screw head (see figure 2) and using a screwdriver, tighten the adapter support bracket.

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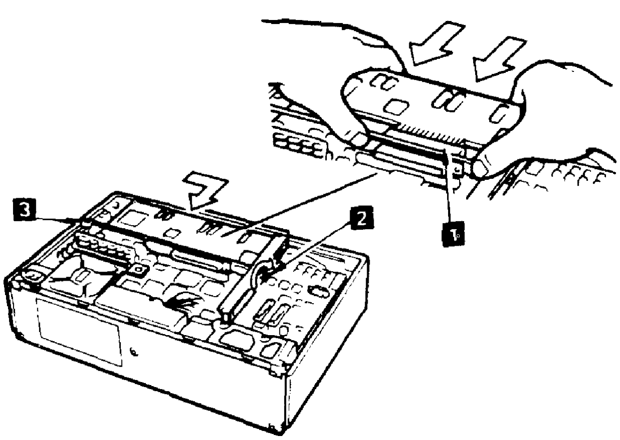

10. Replace the cover by putting its left side on the system unit and pushing its right side down until it clicks in place.

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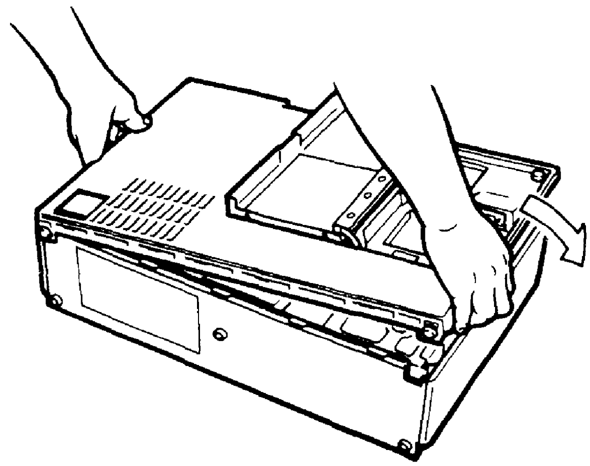

11. Lock the rear cover onto the system unit by turning the rear cover screw with a coin. *Do not overtighten the screw.*

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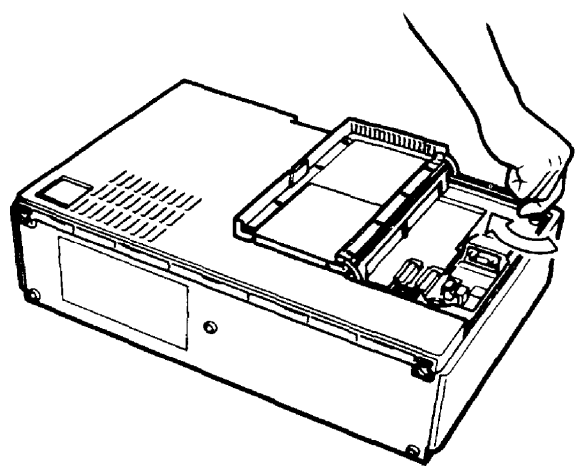

12. Tighten the bottom rear cover screws with a coin. **Again, do not overtighten the screws.**

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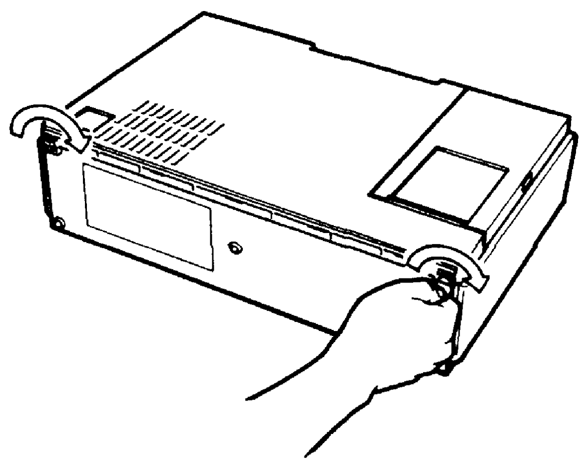

Installation - Personal System/2 Computer

1. The Work Station Interface module requires one full Micro-Channel slot in your Personal System/2 computer.
2. Refer to your computer's quick reference guide for instructions on installing options.

Cable Description

The parallel attachment for this Work Station Interface module is to the top connector on the I/O Control module located in a CPU rack, or to an I/O Receiver or Advanced I/O Receiver located in an I/O rack through a standard I/O cable as shown in Figures 1 and 3. Maximum cable length for this connection is **50** feet.

WARNING

The Series Six or Series Six Plus PLC rack and programmer ground connections must be at the same ground potential. Incorrect wiring will result in damage to the WSI.

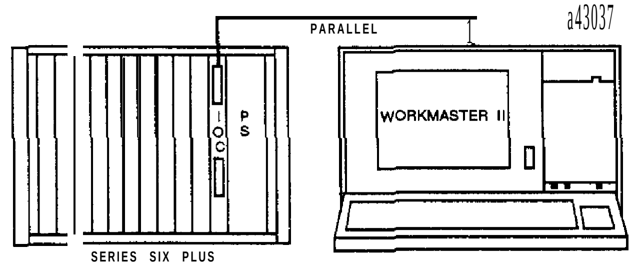

Figure 3. Series Six PLC System Configuration

Table 1. References

Reference	Title	GEK/GFK No.
1	Logicmaster 6 Programming and Documentation Software User's Manual	GEK-25379
2	Series Six Plus PLC User's Manual	GEK-96602
3	Series Six PLC Installation and Maintenance User's Manual	GEK-25361
4	Workmaster 11 PLC Programming Unit Guide to Operation	GFK-0401

Table 2. Specifications

Environmental	
Operating Temperature	0 to 60° C (32 to 140") F
Storage Temperature	-40 to 85° C (-40 to 185°) F
Humidity	5-95% non-condensing
Vibration	0.1 in., 5-10 Hz: 0.5 G, 10-200 Hz 0.2 in., 5-10 Hz: 1.0 G, IO-200 Hz
Parallel Interface Specification	
Effective Data Rate	500 kbytes/sec (parallel)
Time to store 8k word program	1 - 2 seconds
Maximum cable length	50 ft.
Complies with Standards	
IEC	435, 380
DIN	435, 380
UL	508, 1012
CSA	C22.2 No. 142, C22.2
NEMA/ICS	2-230.40
ANSI/IEEE	C-37.9OA-1978
VDE	805, 806, 871-877
FCC	15J Part A

Table 3. Ordering Information

Description	Catalog Number
Work Station Interface Module, Parallel	IC647WMI620
Parallel Interface Cable Assembly	IC600WD0xxA (XX is the cable length which **can be** 2, 5, 10, 25, or 50 feet)