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Introduction

This chapter presents a basic guide to troubleshooting procedures for the Series Five Programmable Logic Controller. The Series Five PLC is designed to provide many years of trouble free operation. If a failure should occur, it can usually be quickly isolated and the defective assembly replaced with minimum downtime. It is important to quickly identify the source of the problem, and whether it is hardware or software related. The maintenance concept for the Series Five PLC is to replace failed assemblies (modules), rather than individual components.

Troubleshooting Aids

The CPU has many internal bits and diagnostic registers which can be used in the user program or external CCM compatible computer to implement a custom diagnostic package. Many of these internal bits and registers are used by Logicmaster 5 to report errors. Most typical problems are isolated through interpretation of the LEDs on individual modules or through error codes or messages on the programming device's screen. These troubleshooting aids help diagnose not only the Series Five PLC, but also the total control system. The main diagnostic tool is the programming device, which can be a Workmaster II portable computer, a Workmaster, or Cimstar I industrial computer, or an IBM PC, XT, AT, PS/2 or compatible personal computer with Logicmaster 5 software.

Many hardware related faults can be attributed to incorrect switch settings, loose cables or screw connections - all major faults can be corrected by replacing modules. There are usually no special tools required other than a screwdriver and a voltmeter.

Series Five Diagnostic Aids

The diagnostic features of the Series Five PLC provide the user with a powerful, easy to use troubleshooting tool. These diagnostic features not only tell you that an error has occurred, they also lead you to the location of the problem. These diagnostic features are: status indicators on the CPU and all other modules, special purpose internal coils that turn on to reflect error conditions, reserved registers that indicate an error code number or other informative information, the CPU ERROR FLAGS display in the Scratch Pad screen in Logicmaster 5, and the error display in the OIU. Logicmaster 5 provides the tools for displaying and interpreting error messages and leading you to the cause of the problem.

When a failure occurs, a bit or bits will be set in the CPU ERROR FLAGS line at the bottom of the Scratch Pad display, and an error message will be displayed. In most cases, the cause of the problem is indicated. If additional information about the problem is needed, by accessing a HELP screen, you are directed to an explanation of the bit or bits that are set, i.e., the nature of the error. You can then display the reference table for the special contacts (I1-000 to I1-512) to see which of the contacts has been set to a logic 1 or access the register display and look at registers 4078, 4079, and 4080. These registers will display an error code number. Then refer to table 5.2 for error code definition and the action to take to clear the problem.

The flow chart on the following page shows the recommended troubleshooting procedure for the Series Five PLC.

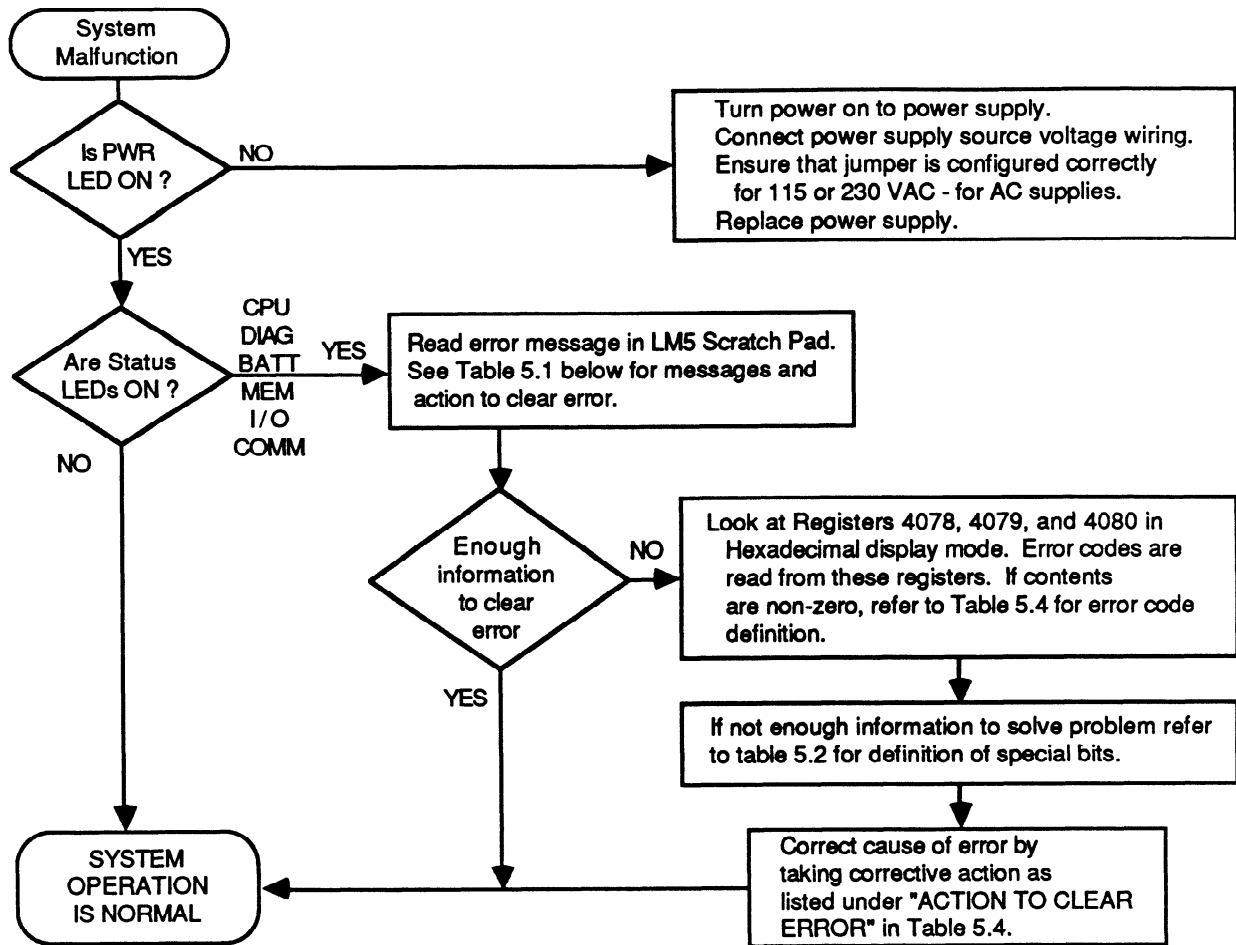


Figure 5-1. Recommended Troubleshooting Sequence Flow Chart

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Table 5-1. Scratch Pad Error Messages and Corrective Action

Scratch Pad Error Message	Corrective Action
Compilation Error	Store program to CPU again.
CPU Battery Low	Replace CPU battery within one week.
Duplicate I/O Address Error	Reassign addresses and do a STORE TO CPU.
I/O Address Range Error	Correct user logic and store program again.
I/O Bus Error	Cycle from STOP to RUN, or reset CPU with reset switch, or Recycle power, or replace base unit or device on bus.
I/O Config Changed	Key-in NEW CONFIG or OLD CONFIG command from LM5 or edit I/O map and do a STORE TO CPU, or return to previous I/O configuration.
I/O Error	See Table 5.2 in this chapter for further information.
I/O Module Removed	With power off, replace module. Or edit I/O map and STORE TO CPU
I/O Parity Error	Cycle from STOP to RUN, or reset CPU with reset switch, or cycle power. Replace base unit, or device on I/O bus.
Memory Battery low	Replace memory cartridge battery within one week.
NO CPU BATTERY	Connect or install back-up battery in CPU.
NO Battery in memory cartridge	Install battery in memory cartridge.
No Memory Cartridge Error	With power off - install memory cartridge.
Program Error	Check user program, correct error and store program again.
Program Parity Error	Store program again. Cycle power.
Watchdog Timer Timed Out	Check user logic or increase Watchdog Timer preset value.

Table 5-2. Special Purpose Contact (Bit) Definition

Reference	Error	Definition
I1-0033	Critical System Error	1 = error, CPU goes to STOP mode.
I1-0034	Non-Critical System Error	1 = error, CPU remains in RUN mode.
I1-0035	Diagnostic Error	1 = error detected
I1-0036	Battery Not Normal	1 = CPU or memory cartridge battery voltage low.
I1-0037	Memory Error	1 = latches if a memory cartridge error occurs.
I1-0038	I/O Error	1 = latches if I/O bus error is detected.
I1-0039	Communications Error	1 = Turned ON by a CPU/CCM error. Next successful communications will turn it off.
I1-0040	I/O Configuration Error	1 = error detected, I/O configuration has changed since last power-up.
I1-0042	Watchdog Timeout	1 = Watchdog timer has timed out.
I1-0043	Internal Program Error	1 = Error
I1-0044	Internal Math Error	1 = Error
I1-0045	Smart Module Comm. Error	1 = Error
I1-0065	I/O Retry Parity Status	1 = Parity error after specified number of retries 0 = OK, no parity error detected
I1-0066	Non-Critical Rack	1 = Non-critical rack. 0 = Critical rack (that reported parity error setting I1-0065)

CPU Status Indicator Definitions

The flow chart for basic troubleshooting procedures indicates that observation of system indicator lights is a good starting point to use for troubleshooting. The following table defines the LED status indicators located on the CPU.

Table 5-3. CPU Status Indicator Definitions

LED	COLOR	DESCRIPTION
PWR	GREEN	ON - Power is applied to the CPU and the +5 Vdc operating voltage is within specified tolerance. OFF - Ac or dc input power source is missing or the +5 Vdc operating voltage is not within specified tolerance.
RUN	GREEN	ON - CPU is in the RUN mode. OFF - CPU operation is halted,
CPU	RED	ON - A malfunction exists in the CPU or the watchdog timer has timed out. OFF - CPU is operating normally and the watchdog timer has not timed out.
DIAG	RED	ON - CPU has detected an internal fault that causes the CPU to halt its scanning operation. OFF - Operation normal, no faults detected.
BATT	AMBER	ON - A memory backup battery voltage is low or has failed. Can be either in the CPU or memory cartridge battery. OFF - Both backup batteries operating normally.
MEM	AMBER	ON - A program memory error has been detected. OFF - All memory operating without error.
I/O	AMBER	ON - An I/O error has been detected. OFF - No I/O errors have been detected.
COMM	AMBER	ON - A communications error has been detected. OFF - Communications operating without error.

For detailed error definitions, refer to the Logicmaster 5 Scratch Pad Display and Register tables (R4078, 4079, 4080).

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Error Definition and Action Required

The LEDs on the CPU are a good troubleshooting aid. When combined with the capabilities of the programmer with Logicmaster 5 or when using the Series Five Operator Interface Unit, you can quickly troubleshoot the majority of system errors that may occur. The following table lists the errors that may be detected by the CPU. Two tables are found in this section - the first lists the error codes, definitions and corrective actions when using Logicmaster 5 software, and the second table lists error codes and messages, cause of error, and corrective actions when using the Operator Interface Unit. The information in the tables is as follows:

ERROR CODE/MESSAGE: Error code number and message (message with OIU)
CAUSE OF ERROR: Action or problem that caused the error.
ACTION TO CLEAR ERROR: Action required to clear the error.

Table 5-4. Error Code Definitions - Logicmaster 5

Error Code	Cause of Error	Action to Clear Error
E003	Scan time exceeds Preset time of Watchdog timer	Check user logic or increase watchdog timer preset.
E004	CPU memory parity error detected	Cycle power. Store program again.
E041	Voltage of CPU back-up battery too low.	Replace CPU battery within one week.
E042	No back-up battery in CPU.	Install back-up battery in CPU.
E043	Voltage of back-up battery installed in memory cartridge too low.	Replace battery in memory cartridge within one week. Contents of memory cartridge must be copied before you change the battery, or data will be lost.
E044	No battery or dead battery in memory cartridge.	Install battery in memory cartridge.
E101	No memory cartridge in CPU.	With power off, install memory cartridge in CPU.
E102	Memory cartridge contains only CPU parameters.	With power off, insert user program MC in the CPU.
E103	Memory cartridge contains only registers.	With power off, insert user program MC in the CPU.
E150	Register reference is greater than maximum register size.	Change register reference.
E151	Memory parity error in user logic.	Store program again.
E152	Rung too complex to execute.	Change user logic program to have fewer stack levels.
E201	Terminal block removed from I/O module.	With power off, install terminal block.
E202	I/O configuration change since last power-up, or I/O module removed from slot.	With power off, install I/O module in correct slot.
E203	Blown fuse or no fuse in an output module. FU indicator on output module will also be on.	With power off, remove output module and install new fuse, or replace module.
E204	Voltage of external 24 V dc power to output module too low.	Adjust voltage of external power supply.
E221	No power applied to Series Three PLC's I/O base unit connected through a Series Three PLC I/O Interface module.	Apply power to the Series Three PLC's I/O base unit.
E222	A problem exists in the Series Three PLC's I/O system.	Troubleshoot the Series Three PLC's I/O system and replace defective module(s).
E250	Error on I/O bus or device connected to I/O bus.	Recycle power, or push CPU reset pushbutton, or replace base unit or device.

Table 5-4. Error Code Definitions - Logicmaster 5 - Continued

Error Code	Cause of Error	Action to Clear Error
E251	I/O bus parity error, noise.	Cycle power. Replace base unit, or device on I/O bus.
E252	Current I/O configuration is different than the one stored in the memory cartridge.	Key-in NEW CONFIG command or OLD CONFIG command from LM5 or edit I/O map and do a STORE TO CPU.
E261	I/O address duplicated when assigned manually.	Reassign addresses with no duplication.
E262	I/O address in user logic exceeds valid address range.	Correct user logic.
E350	Specified target address is not an intelligent module.	Specify correct target address.
E351	Invalid ID specified for intelligent module (target).	Reassign correct target ID.
E352	Syntax error present in command parameters	Use correct syntax/parameters.
E353	Timeout when communicating with target.	Check target source and all interconnects.
E354	No information obtained from target device	Verify target information.
E4XX	Translated program error.	Check and reload program.

Table 5-5. Error Code Definitions - Operator Interface Unit

Error Message	Cause of Error	Action to Clear Error
E003 S/W TIMEOUT	CPU scan time was greater than software watchdog timer.	Set longer software watchdog (sub-menu 54) or change ladder logic.
E041 CPU BATTERY LOW	Low voltage on CPU back-up battery.	Replace CPU battery, Cat. No. IC655ACC550
E042 NO CPU BATTERY	Missing or disconnected CPU battery.	Install or reconnect CPU battery.
E043 CPU MC BATTERY LOW	Low voltage on CMOS RAM memory cartridge battery.	Copy program to another memory cartridge and replace battery (IC655ACC549).
E044 NO MC BATT	Missing CMOS RAM memory cartridge battery.	Install battery in memory cartridge.
E101 NO CPU MC	Attempt to access CPU MC when it is not installed.	Insert memory cartridge into CPU.
E102 MC HOLDS SYS DATA	Attempt to run CPU with MC installed that contains only system parameter data.	Replace with a program memory cartridge.
E103 MC HOLDS REG DATA	Attempt to run CPU with a memory cartridge that contains register data.	Replace with a program memory cartridge.
E104 WRITE FAILED	Copy operation to CPU MC in Menu 7 failed because cartridge is write protected.	Reconfigure the jumper in memory cartridge to the write enable position. If problem still exists - replace memory cartridge.
E150 REG REF TOO LARGE	Register reference larger than maximum register size.	Change register reference.
E151 BAD COMMAND	Parity check detects error in program stored on the CPU memory cartridge.	Rewrite the invalid code to correct the logic.
E152 PROG STACK OVERFLOW	Rung too complex to execute	Change logic to have fewer stack levels.

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Table 5-5. Error Code Definitions - Operator Interface Unit - Continued

Error Message	Cause of Error	Action to Clear Error
E2XX DIAG ERROR MENU 42	An I/O diagnostic error has been reported to the CPU.	Use sub-menu 41 or visual inspection to determine the type of error, and take corrective action. Error can be one or more of errors E201 to E262.
E201 MISSING TERM BLOCK	Loose or missing terminal block on I/O module.	Use sub-menu 41 or visual inspection to find module location. With power off - tighten terminal block or install new terminal block on module.
E202 MISSING I/O MODULE	I/O module loose or missing since last power cycle.	Use sub-menu 41 or visual inspection to determine module type and location of missing module. With power off - install module and secure to base unit.
E203 I/O MDL FUSE BLOWN	Fuse blown on an output module.	Use sub-menu 41 or visually find module type and location. With power off replace fuse or module.
E204 LOW VOLTAGE EXT PS	External 24 Vdc power supply is too low or has failed.	Adjust voltage, correct fault or replace supply.
E208 ILLEGAL MODULE CODE	n/a	n/a
E221 NO SERIES 3 I/O PS	Power supply failed or power-off on Series Three I/O base unit.	Turn on power, repair or replace power supply in Series Three base unit.
E222 S3 I/O ABNORMAL OP	Series Three I/O module or modules functioning abnormally.	Determine which module is defective and replace.
E226 PS OVERLOAD	CPU has detected that I/O loading in a base unit exceeds the power supply capacity.	Use high capacity power supply or adjust I/O module arrangement.
E250 I/O CHAIN	Faulty link in the I/O chain.	Check I/O expander cables, Local I/O Interface module.
E251 I/O BUS PARITY	Parity error on I/O bus due to electrical noise or other type of interference.	Cycle power, if CPU won't enter RUN mode, replace base unit or device on bus.
E252 NEW I/O CONFIG/	Current I/O configuration is different than the one stored in CPU memory cartridge.	Use sub-menu 45 to select the former or the new config, or change I/O config to its previous configuration.
E261 I/O ADDR CONFLICT	Attempt made to force a module to an address already assigned to another module.	Use sub-Menu 46 to change one of the modules address to a avoid duplication.
E262 I/O OUT OF RANGE	Attempt made to force a module address to an invalid address.	Use sub-menu 46 to re-enter a valid address.
E311 COMM ERROR 1	A non-existent operation code was included during a CCM communications session.	Key-in CLR to retry the communications.
E312 COMM ERROR 2	A non-existent operation code included during communications with a programmer.	Key-in CLR to retry the communications.
E313 COMM ERROR 3	A non-existent address was included during communications with a programmer.	Key-in CLR to retry the communications.
E316 COMM ERROR 6	A non-existent mode was included during communications with a programmer.	Key-in CLR to retry the communications.

Table 5-5. Error Code Definitions - Operator Interface Unit - Continued

Error Message	Cause of Error	Action to Clear Error
E320 OIU-CPU TOUT	Communications time out between CPU and OIU.	Cycle power. If problem persists - replace faulty unit (OIU or CPU).
E321 OIU-CPU COMM	No reply or NAK from the CPU to an OIU ENQ.	Check link between the OIU and the CPU. Cycle power. If problem persists - replace the CPU.
E350 MODULE ADDR	A base unit and slot address has been specified that does not contain an intelligent module - when attempting communications between intelligent modules or between OIU to intelligent modules.	Reassign the intelligent module address either in the user logic program or through sub-menu 47 on the OIU.
E351 MODULE ID	Invalid communications ID number specified for an intelligent module during communications between intelligent modules.	Reassign the correct intelligent module ID in user logic program.
E352 BGND SETTING	Syntax error occurred during background communications.	Key-in CLR and retry communications.
E353 BGND TOUT	Communications time out during communications session between two intelligent modules.	Key-in CLR and retry communications.
E360 TIME OUT	During communications between a personal computer and OIU, the personal computer did not respond to an enquiry.	Press the CLR key and retry communications.
E361 COMM ERROR	Communications problems between CPU and OIU.	Retry communications, check cable connections, check OIU mounting to CPU.
E4XX NO PROGRAM	Mode keyswitch turned to RUN with no program in the CPU memory cartridge.	Download program from computer to CPU, or insert memory with program.
E501 BAD ENTRY	Invalid key sequence attempted before ENT, PREV, or NEXT keys.	Rekey correct sequence of keys.
E504 BAD REF/VAL	Reference number or value entered is out of range.	Re-enter correct value.
E520 BAD OP-RUN	Attempt made to perform an operation which is illegal when the CPU is in the RUN mode.	Change CPU mode to allow the operation.
E521 BAD OP-RDIS	Attempt made to perform an operation which is illegal when the CPU is in the RUN w/OUTPUTS DISABLED mode.	Change CPU mode to allow the operation.
E524 BAD OP-STOP	Attempt made to perform an operation which is illegal when the CPU is in the STOP mode.	Change CPU mode to allow the operation.
E525 KEYSWITCH	CPU mode keyswitch not in the OIU position.	Turn key to OIU position.
E526 OIU OFFLINE	Attempt to perform an operation while OIU is off-line.	Use sub-menu 64 to put OIU on-line.
E540 CPU LOCKED	Attempt to perform a password protected operation without logging-on to the locked CPU.	Logon to the locked CPU with sub-menu 81, and repeat operation.
E541 WRONG PWORD	Wrong password entered for the memory cartridge in the OIU.	Re-enter correct password for the memory cartridge in the OIU.

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Table 5-5. Error Code Definitions - Operator Interface Unit - Continued

Error Message	Cause of Error	Action to Clear Error
E601 MEMORY FULL	Attempt to program instruction too large for available memory.	Copy program onto a larger memory cartridge and continue entering program.
E603 DATA MISSING	While searching for data in registers (sub-menu 33), no data that was specified was found in the specified register range.	Press CLR and respecify data value or register range.
E610 BAD I/O TYPE	Attempt made to read/write an intelligent I/O module through sub-menu 47; however, location specified was for a conventional I/O module.	Retry operation - specify correct base unit/slot for the intelligent module.
E611 BAD COMMS ID	Attempt made to communicate with a CCM station ID that does not exist.	Set correct CCM ID.
E620 OUT OF MEM	Copying operation incomplete because of insufficient memory remaining on memory cartridge.	Change to larger memory cartridge, or restructure program.
E621 MC NOT BLANK	(1) Blank check with sub-menu 74 has detected data on the OIU memory cartridge. (2) Attempt to copy to or erase a write protected RAM or EEPROM cartridge. (3) Attempt to copy to UVEPROM cartridge that already contains data.	Clear the memory cartridge using sub-menu 75 or use another memory cartridge. Change jumper in memory cartridge to unprotected position. Erase contents of UVEPROM cartridge with an ultra violet lamp, or use another UVEPROM cartridge.
E622 NO MC IN OIU	Attempt made to transfer data to or from a memory cartridge in the OIU with no memory cartridge installed in the OIU.	Insert an appropriate memory cartridge into the OIU.
E623 SYSTEM MC	Attempt made to transfer user logic from OIU memory cartridge to CPU memory cartridge when OIU memory cartridge contains other than user logic.	Remove memory cartridge from OIU and insert one that contains user logic.
E624 REGS ONLY	Attempt made to transfer user logic from OIU memory cartridge to CPU memory cartridge when OIU memory cartridge contains register data.	Remove memory cartridge from OIU and insert one that contains user logic, or select register option from sub-menu 72.
E625 PROG ONLY	Attempt made to transfer registers from the OIU memory cartridge to the CPU memory cartridge when the OIU memory cartridge contains user logic.	Remove memory cartridge from OIU and insert one that contains register data, or select program option from sub-menu 72.
E626 EPROM MC	Attempt made to copy data onto an EPROM memory cartridge installed in the CPU.	Install a RAM or EEPROM cartridge in the CPU, or insert the EPROM memory cartridge in the OIU to copy data.
E627 BAD WRITE	RAM or EEPROM cartridge in OIU is write protected, or UVEPROM cartridge in OIU has not been erased, or CPU has detected a mismatch of data while copying data with sub-menu 71 or 72.	Reconfigure the memory cartridge jumper to the write enable position.
E640 MISCOMPARE	Data mismatch detected while performing a verification in sub-menu 73 or 79.	Clear the OIU or CPU memory cartridge, as applicable, and retry the copy operation.

Table 5-5. Error Code Definitions - Operator Interface Unit - Continued

Error Message	Cause of Error	Action to Clear Error
E641 VOLUME LEVEL	Cassette recorder volume level set too high or too low when in sub-menu 77, 78, or 79.	Readjust volume level and repeat operation.
E642 CHKSUM ERROR	Checksum error when copying between cassette tape and OIU, or external computer and OIU.	Repeat operation, after clearing the OIU memory cartridge, or other medium where appropriate.
E650 MACHINE CODE	CPU detected an unknown op code value during execution of a program instruction.	Press CLR key. If problem persists, reload program or provide more protection from electrical noise or other interference for CPU.
E651 SYSTEM ROM	Checksum error exists in OIU ROM.	Press CLR key and repeat operation. If problem persists - replace the OIU.
E652 SYSTEM RAM	Checksum error exists in OIU RAM	Press CLR key and repeat operation. If problem persists - replace the OIU.
E653 MC BATT LOW	Battery voltage in OIU memory cartridge low.	Replace battery in memory cartridge, or use another memory cartridge.

General I/O Troubleshooting Procedures

I/O troubleshooting procedures depend upon knowledge of the logic program installed for your application. The following procedures are general in nature, and should be adjusted to fit your specific application. The following steps assume that the CPU is in the RUN mode - operating with outputs enabled.

1. If the Series Five PLC has stopped with some of the outputs energized, locate the signal (timer, coil, input, etc.) that should cause the next operation to happen. The state of that signal can be monitored by Logicmaster 5.
2. If the signal is an input, compare the state of the input monitored with the programmer, with the state of the LED for that input on the input module. If they are different, replace the module.

WARNING

Do not install or remove any I/O module when power is applied to the base unit. Failure to adhere to this warning could cause a module to be damaged.

Voltages from user devices may be present on a module's screw terminals, though power to a base unit is turned off. Care must be taken any time that you are handling the module's terminal board or any wires connected to it.

3. If an input state and the applicable LED on the input module agree, compare the LED status with the actual input device (limit switch, pushbutton, etc.). If they are different, measure the voltage at the input module terminals. Refer to the *Series Five Programmable Controller I/O Specifications Manual, GFK-0123*, for specific module information. If the measured voltage indicates a faulty I/O device - replace it, or the field wiring, or its power source. If this does not solve the problem, replace the input module.

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4. If the signal is a coil wired to a field device, compare its status to the LED on the applicable output module. If they are different, check the power source to ensure that an excitation voltage is available. If field power to the device is not present, check the power source and its wiring. If the correct field power source is available, but the status is wrong at the output module - replace the output module.
5. If the signal is a coil, and either there is no output module or the output is the same as the coil state, examine the logic driving the output using the programming device, and a hard copy of your program. Working from right towards left, locate the first contact that is not passing power available to it from the conditional logic at its immediate left.

Troubleshoot that signal using the procedures in steps **2** and **3** if the signal is an input, or steps **4** and **5** if the signal is a coil.

6. If the signal is a timer that has stopped at a non-zero value below its preset value, replace the CPU module.
7. If the signal is the control over a counter, examine the logic that is controlling the reset first - then the count signal. Follow steps **2** through **5**.

Replacing Components

The following procedures provide information on replacement of various components of a Series Five PLC system.

Replacing a Power Supply

1. Turn off AC or DC power, as applicable, to the supply.
2. Disconnect field wiring from the power supply terminal block.

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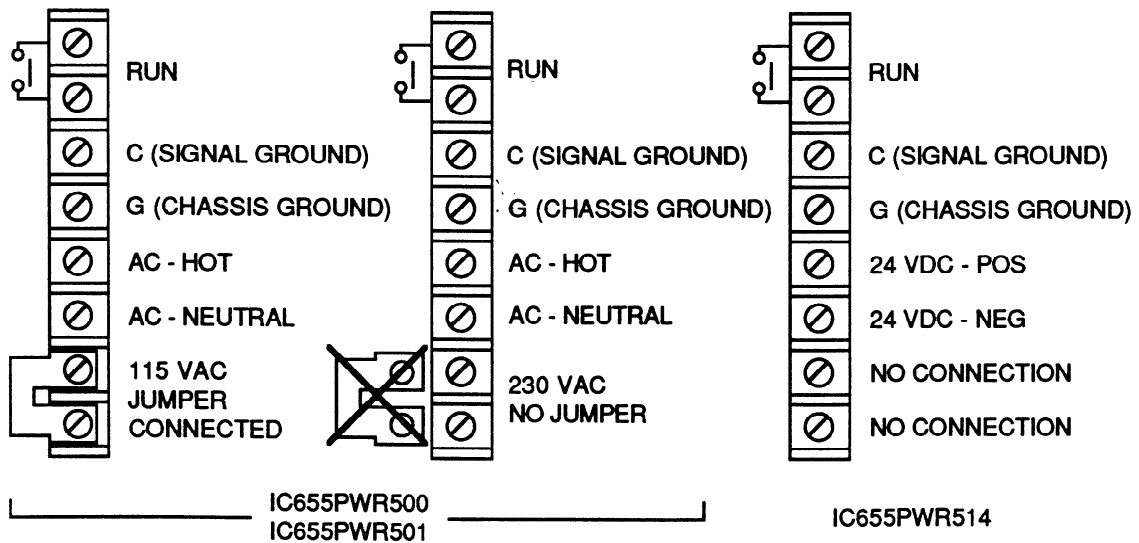


Figure 5-2. Power Supply Terminal Block Connections

3. Remove the power supply by loosening the two captive screw fasteners that are holding the supply in place.
4. Install the new power supply by placing it over the connector on the backplane and pushing down on the module until it is firmly seated.
5. Reconnect field wiring to the power supply terminal block, and verify that the jumper for 115 or 230 V ac is properly configured if the supply is an AC supply.
6. Apply power to the system and check for proper system operation.

Replacing a CPU Module

1. Place the CPU mode switch in the STOP position. Turn off AC or DC power, as applicable, to the power supply.
2. Disconnect any cables that may be attached to the CPU. Remove the memory cartridge installed in the CPU. Write down the DIP switch settings to ensure that the settings on the new CPU are the same.
3. Remove the CPU from its slot by loosening the two captive screws and pulling the module away from its backplane connectors.
4. Install the new CPU module, and tighten the two captive screws.
5. Ensure that the DIP switch settings are correct for your operation and verify that the CPU backup battery is properly installed .
6. Reconnect any cables, you may have removed, to the CCM port connectors on the CPU.
7. Apply power and verify system operation.

Replacing a Memory Cartridge

1. Place the CPU mode switch in the STOP position. Turn off AC or DC power, as applicable, to the power supply.
2. Open the top hinged door on the front of the CPU to gain access to the memory cartridge.
3. Remove the memory cartridge by grasping the top of the plastic strip at the point marked "PULL", then pull it towards you. The cartridge will slide out of its slot.

CAUTION

Do not remove or insert a memory cartridge with power on. Handle RAM memory cartridges with care, since excess charges of static electricity could damage the memory devices in the cartridge.

4. Install the new memory cartridge by orienting the cartridge so that the word "PULL" is towards the top of the CPU, then slide the cartridge carefully into the guides in the slot until it firmly plugs into the connector at the back of the slot.
5. Turn on AC or DC power to the base unit and verify proper system operation.

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Replacing a Memory Cartridge Backup Battery

1. Before replacing a memory cartridge battery, the memory contents should be saved, since the memory in the cartridge will be lost when a battery is changed.
2. Remove the memory cartridge as described previously.
3. Remove the phillips head screw that attaches the top cover to the case containing the memory cartridge.

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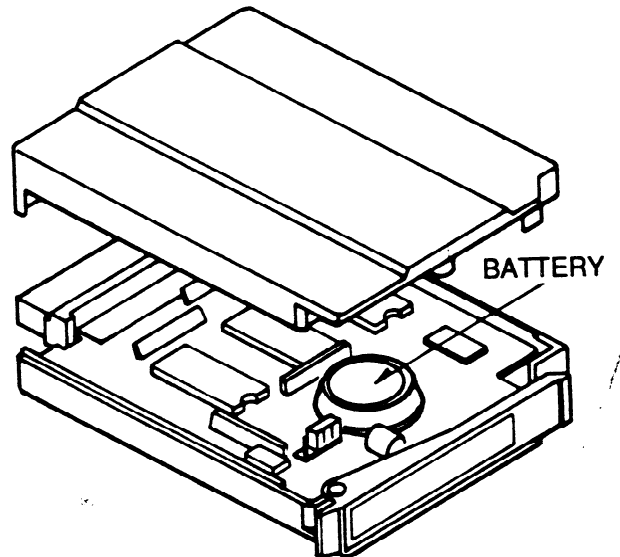


Figure 5-3. Memory Cartridge Battery Location

4. You do not have to remove the circuit board from the case to remove and replace the battery. The battery is mounted on the circuit board and can be removed by very gently pulling up on the bottom of the battery until it is completely free of the socket. It is recommended that you use your fingers or a non-conductive tool for pulling the battery out of the socket.

CAUTION

Be very careful when removing the battery from its mounting holes to ensure that the circuit board is not damaged. Be careful not to short runs or components on the circuit board when using a screwdriver.

5. Notice that the holes into which the battery is inserted are offset to one side, this ensures that proper battery polarity is observed. Insert the new battery into the mounting holes by placing it over the holes, then gently pushing down on the battery case until it is firmly seated in place. Do not bend the two leads on the battery.
6. Replace the cover and replace and tighten the screw. Before turning on power, ensure that the CPU mode keyswitch is in the STOP position.

7. Before turning power on, reinstall the memory cartridge in the CPU. The memory will be blank or have random data in it - you will need to execute an INIT CPU (Initialize CPU) function from the Scratch Pad screen. Reapply power to the system and check the system for proper operation.

Replacing a CPU Backup Battery

1. Ensure that power has been applied to the system at least one minute before changing the battery. Remove AC or DC power, as applicable, from the CPU base unit.
2. Access the battery by opening the large hinged door on the front of the CPU module. The battery is mounted on the inside of the door.
3. Remove the battery connector from the socket in the CPU by grasping it and pulling it straight out until it is free of the socket. To ensure that the wires in the battery do not pull out of the connector, it may be necessary to use a pair of needle nose pliers to grasp and remove the connector.
4. Pull the battery out of the mounting clips on the door.
5. Replacement batteries come with the connector prewired to the battery. To install the new battery, insert it into the mounting clips, and push the battery connector firmly into the socket on the CPU until it is securely in place.
6. Turn on power to the base unit.
7. Reinitialize the CPU. This will cause the CPU system parameters to be reset to their default conditions, and will clear Logicmaster 5 memory and Series Five CPU memory.
8. Verify that system operation is correct.

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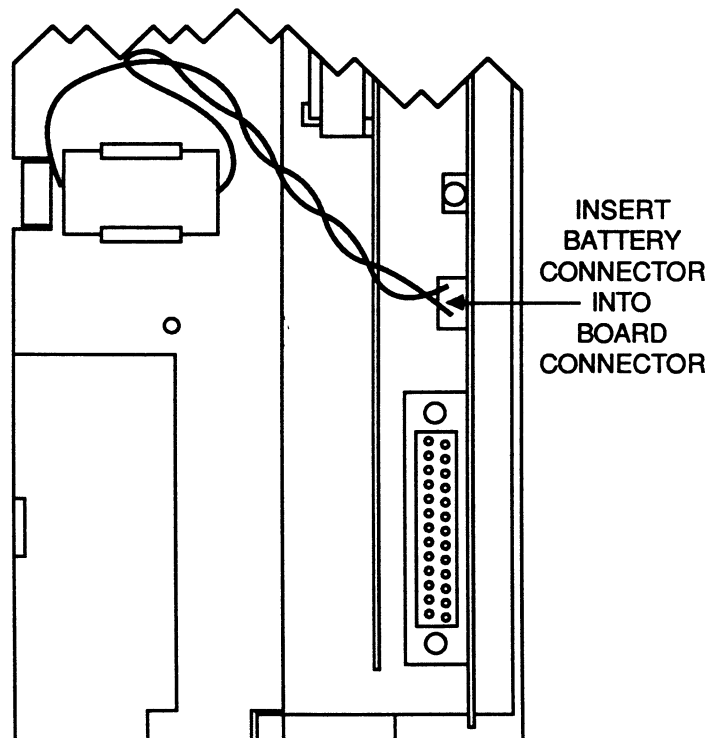


Figure 5-4. CPU Battery Mounting and Connection

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Replacing I/O Modules

1. Turn off AC or DC power, as applicable, to the base unit in which the I/O module to be replaced is contained, and from the I/O system.
2. Remove the faceplate from the module to be replaced. There is no need to remove field wiring from the terminal block, since the block is removable. Disconnect the removable terminal block from the module by removing the two captive screws holding the terminal block to the module's circuit board assembly.

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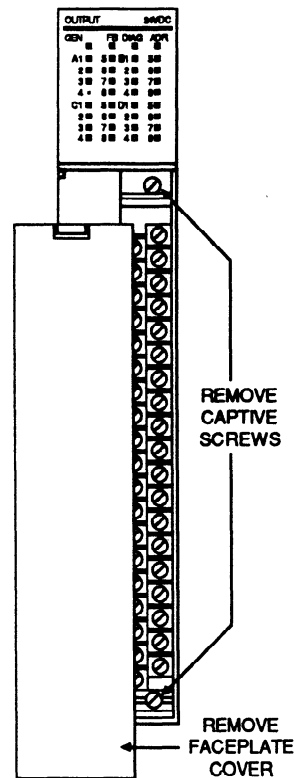


Figure 5-5. Removal of Terminal Block From Module

3. Loosen the two captive screws holding the module in place, and remove the module from its slot by pulling it towards you.
4. Install the new module in the slot by lining it up with the backplane connector for its slot and firmly pushing the module into the connectors until it is securely seated, then tighten the two captive screws.
5. Place the terminal block over the edge connector on the circuit board and firmly push down. Tighten the two screws on the terminal block, then replace the plastic faceplate cover.
6. Reapply power to the base unit and to the field devices, and verify that the system is operating properly.

A list of parts for the Series Five PLC is provided in table 5-6. It is recommended that a spare parts kit be available so that your Series Five PLC system can be returned to service with a minimum amount of downtime if a problem does occur.

Table 5-6. Series Five PLC Parts List

Catalog Number	Description of Item
Base Units/Power Supplies/Cables/Miscellaneous	
IC655CHS506	Base Unit, with 6 I/O slots
IC655CHS508	Base Unit, with 8 I/O slots
IC655CBL500	I/O Expander Cable, 1 feet (.5 m)
IC655CBL501	I/O Expander Cable, 3 feet (1.0 m)
IC655CBL502	I/O Expander Cable, 15 feet (5 meters)
IC655CBL503	I/O Expander Cable, 30 feet (10 meters)
IC655CBL504	I/O Expander Cable, 80 feet (25 meters)
IC655CBL505	I/O Expander Cable, 160 feet (50 meters)
IC655CBL540	OIU to CPU Cable, 5 feet (1.5 m)
IC655CBL541	OIU to CPU Cable, 10 feet (3.0 m)
IC655PWR500	AC Power Supply, 115/230 V ac Input, 6 amps (maximum)
IC655PWR501	AC Power Supply, 115/230 V ac Input, 12 amps (maximum)
IC655PWR514	DC Power Supply, 24 V dc Input, 6 amps (maximum)
IC655CHS590	I/O Rack Terminator Plug
IC655ACC551	Oversized Faceplate
IC655ACC552	Filler Module
IC655ACC553	19 inch Rack Mounting Bracket
IC655ACC554	OIU Mounting Bracket
CPU - Batteries - Memory Cartridges - Interface and Special Modules	
IC655CPU500	CPU module
IC655ACC549	Battery, memory cartridge
IC655ACC550	Battery, CPU
IC655MEM501	4K/24K RAM memory with battery back-up
IC655MEM503	16K RAM memory with battery back-up
IC655MEM512	8K/24K EPROM memory (UV erasable)
IC655MEM513	16K EPROM memory (UV erasable)
IC655MEM521	4K EEPROM memory (electrically erasable)
IC655APU500	ASCII/BASIC Module
IC655APU510	High Speed Counter
IC655APU521	Axis Positioning Module
IC655BEM500	Local I/O Interface module
IC655BEM510	Genius Bus Controller module
IC655BEM530	Series Three I/O Interface module
IC655CBL530	Series Five to Series Three Cable, 3 feet (1m)
IC655CCM500	CCM Communications Module
Input Modules	
IC655ALG516	Analog Input, 1 to 5V, 0 to +10V, -10 to +10V, 4 to 20 mA, 8 Channels
IC655MDL501	12/24 V dc Input, Negative Logic, 16 Circuits
IC655MDL502	12/24 V dc Input, Negative Logic, 32 Circuits
IC655MDL503	24 V dc Input, Positive/Negative Logic, 64 Circuits
IC655MDL511	24/48 V ac/dc, Isolated Input, Positive Logic, 16 Circuits
IC655MDL512	12/24 V ac/dc Input, Positive Logic, 32 Circuits
IC655MDL524	Input Simulator, 16 or 32 Circuits (switchable)
IC655MDL525	115/230 V ac Input, 16 Circuits
IC655MDL526	115 V ac Input, 32 Circuits
IC655MDL527	115/230 V ac, Isolated Input, 16 Circuits
IC655MDL533	5/12 V dc TTL Input, Positive/Negative Logic, 64 Circuits

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Table 5-6. Series Five PLC Parts List - Continued

Catalog Number	Description of Item
Output Modules	
IC655ALG566	Analog Output, 0 to +10V, 4 to 20 mA, 2 Channels
IC655ALG567	Analog Output, -10 to +10V, 2 Channels
IC655MDL551	12/24 V dc Output, Negative Logic, 16 Circuits
IC655MDL552	12/24 V dc Output, Negative Logic, 32 Circuits
IC655MDL555	12/24 V dc Output, Positive Logic, 16 Circuits
IC655MDL556	12/24 V dc Output, Positive Logic, 32 Circuits
IC655MDL575	115/230 V ac Output, 16 Circuits
IC655MDL576	115/230 V ac Isolated Output, 16 Circuits
IC655MDL577	115/230 V ac Output, 32 Circuits
IC655MDL580	Relay Output, 16 Circuits
IC655MDL581	Relay Output, 32 Circuits
IC655MDL586	Isolated Relay Output, 16 Circuits
IC655MDL593	5/12 V dc TTL Output, Positive Logic, 64 Circuits

List of Fuses

The following table contains a list of fuses that are used in Series Five Output modules.

Table 5-7. Fuses Used in Output Modules

Module Name	Catalog Number	Fuse Type *	Current Rating	Slow/Fast Blow	Qty On Module	User Replaceable
24 V dc Out, Neg Logic	IC655MDL551	MF51SH8	8 amp	Fast	4	Yes
24 V dc Out, Neg Logic	IC655MDL552	MF51SH3	3 amp	Fast	4	Yes
24 V dc Out, Pos Logic	IC655MDL555	MF51SH8	8 amp	Fast	4	Yes
24 V dc Out, Pos Logic	IC655MDL556	MF51SH3	3 amp	Fast	4	Yes
115/230 V ac Out	IC655MDL575	MF51SH8	8 amp	Fast	2	Yes
115/230 V ac Isol Out	IC655MDL576	MC3	3 amp	Fast	16	No
115/230 v ac Out	IC655MDL577	MC5	5 amp	Fast	4	No
Relay Out	IC655MDL580	MF51SH8	8 amp	Fast	4	Yes

* MF51SH3, MF51SH8 - 20 mm x 5.2 mm - cartridge type
 MC3, MC5 - 9 mm x 2.7 mm - pigtail type, soldered-in place

Accessory Kit for the Series Five PLC

An accessory kit (IC655ACC520) is available to support the Series Five PLC. This kit contains many of the most commonly used components that may get damaged or lost during normal operation, such as fuses, screws, terminal covers, etc. Rather than attempting to order all of these parts separately, this kit provides a convenient means of ordering and storing these parts. Each kit should be sufficient to support several PLCs, depending on their I/O count. Items included in the kit are listed below.

Table 5-8. Accessory Kit

Item	Quantity in Kit
CPU keys	2 sets (2 keys per set)
CPU door, with CCM hinged door and OIU port cover	1
I/O wiring labels for inside faceplate, 16/32 pt	50 of each type
Plastic bead chain (I/O faceplate to module)	20
Screws/washers, all sizes	10 of each
Dust covers for I/O bus port connector	4
Dust covers for I/O expansion port connector	2
Fuses, fast blow - 2A, 3A, 3.15A, 5A, 8A	5 of each
Faceplate for I/O module	3
Faceplate for power supply	1
Module access side cover	3
Jumper bar for power supply	2
Jumper for register size configuration	2
Keying inserts for terminal block, 16 and 32 point	10 of each
Memory cartridge labels (CMOS RAM, EPROM, EEPROM)	36 labels, each type

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Figure 5.6 is an illustration of the accessory kit location guide, GFJ-011, which is packed with each accessory kit. This guide shows the location and lists the quantity of each item in the kit.

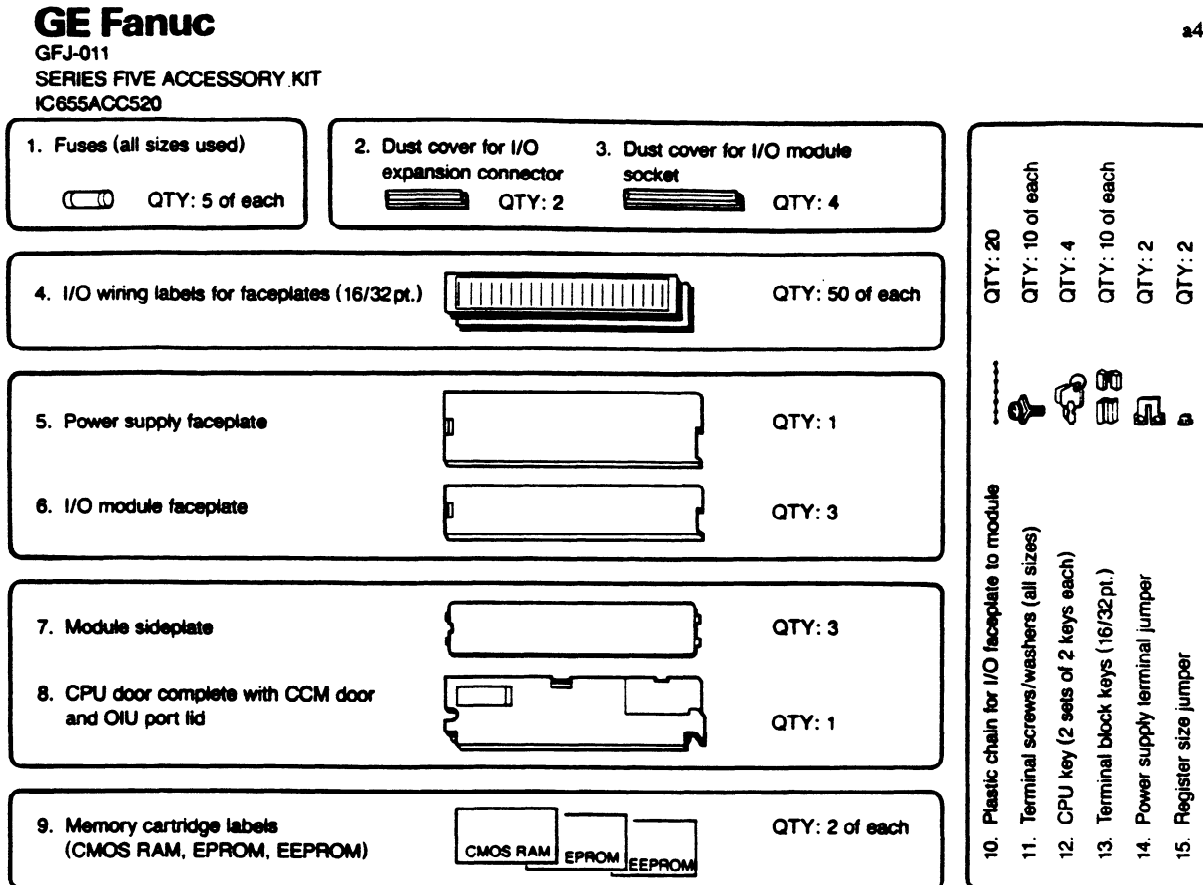


Figure 5-6. Accessory Kit Location Guide

Ring and Spade Lugs

The following list of ring and spade lugs have been tested and can be used for connecting field wiring to the terminal blocks on Series Five I/O modules. Most ring or spade lugs will fit the terminals.

Table 5-9. Recommended Lugs for Field Wiring Connections

Type of Lug	Wire Size Awg # (mm ²)	AMP Catalog Number
spade	22 - 16 (0.38 - 1.2 mm ²)	52929
spade	16 - 14 (1.2 - 1.9 mm ²)	52935
spade	12 - 10 (3.0 - 5.2 mm ²)	52941
ring	16 - 14 (1.2 - 1.9 mm ²)	32422
ring	22 - 18 (0.38 - 1.0 mm ²)	31822