CHAPTER 7
PERIPHERALS

The CPU/Programmer allows operation via the tape port with various peripherals. This chapter describes the operations of these peripherals such as a tape loader, the logic printer, and the PROM writer. To operate these peripherals, the programmer's mode switch must be turned to the LOAD position. The 2.5 foot (0.75 meter) audio cable, gray with red tracer supplied with the CPU is used to connect only the tape loader to the tape port on the programmer. The solid gray cables supplied with the other peripheral device can be used with either the printer or the PROM Writer.

CASSETTE RECORDER OPERATION

Most audio tape recorders with auto-level control can be used with the Series Three. It is recommended that the recorder also be equipped with a counter to allow multiple programs to be recorded on tape. Units such as General Electric models 3-5158A or 3-5153A have been tested and found fully compatible with the Series Three. The tape recorder performs three functions: (1) record a program onto tape, (2) load a CPU from tape, and (3) verify the content of a tape. All of logic memory (4096 words) will be recorded on tape. The operation of each of these functions is described below in a step-by-step manner.

RECORD A PROGRAM

1. Turn the mode select switch on the programmer to LOAD.

2. Apply AC power to the tape recorder. Verify presence of write protect tab on cassette and insert cassette.

3. Adjust tone control to its highest position.

4. Connect Programmer (TAPE port) to the tape recorder (MIC input) with audio cable (Catalog Number IC630CBL151A).

5. Rewind tape to beginning or desired record position if multiple programs are to be recorded on one tape. Programs require a maximum of 9 minutes (4096 words) of tape per program.

6. Push CLR, SHF, and WRITE.

7. For identification of program if desired, enter a four digit number (0000-9999) on the Programmer. When tape is accessed later to load the CPU, this number can be used to verify program prior to altering CPU data. If program number is not as expected, operator can terminate load and obtain correct tape without loss of existing program nor delay incurred by loading wrong program. However, this identification is optional.

8. Begin tape recorder by depressing the RECORD button (and PLAY if required) on the recorder, then push NXT on the Programmer.

9. The record operation now commences and the Programmer display will read P-C. N.N.N.N. (N.N.N.N. is the four digit program number, if no number assigned display will be 0.0.0.0.).

10. When the record is complete, the Programmer will beep and display P-C End. Stop the recorder and note the counter position so that the amount of tape used for that program can be determined.

11. Either turn the mode select keyswitch to RUN 1 to start the CPU or check (verify) the recording.

12. It is recommended that the tape be rewound to where the record began and that the Verify operation described below be performed to ensure data integrity.

VERIFY A PROGRAM

1. Place Programmer in the LOAD mode.

2. Apply AC power to the tape recorder and insert cassette (if not already in the recorder).

3. Adjust volume and tone controls to their maximum setting.

4. Connect Programmer (TAPE port) to the tape recorder (EAR input) with audio cable (gray with red tracer).

5. Rewind tape to beginning of previously recorded program. Tape can also be on blank area prior to program, but not on another program. Enter the program identification number (if previously recorded).

6. Push CLR, SHF, and CHECK. The display will read CΓ1 P.

7.   Begin tape recorder by depressing the PLAY button, then push NXT on the Programmer. The verify operation now commences. The display will read CⁿP-. N.N.N.N. The bar indicates that the volume control setting is correct. It should not be flickering on or off.

8.   Error code E21 indicates the tape has an integral parity error; E25 indicates a mismatch between the content of the tape and the CPU logic memory. E28 indicates the play level is wrong and the verify should be stopped, volume adjusted, and the operation restarted (step 5 above).

9.   The illustration below shows the available area of the volume control for a proper setting.
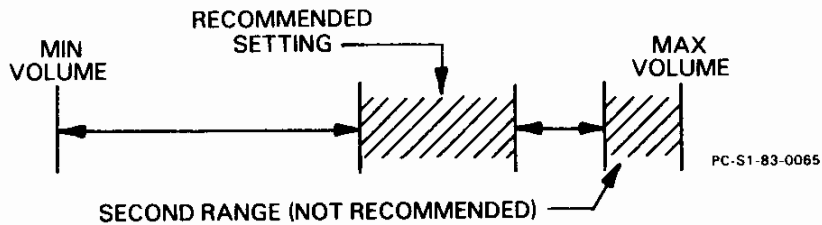
With some recorders, there are two ranges where the signal level appears to be acceptable, one near the middle and one near maximum volume. The setting near maximum volume should not be used. The CPU will indicate that it is acceptable; however, an unacceptable amount of clipping distortion may occur in this area with some recorders.

10. Find the correct position for the mid-range of the acceptable volume control during the beginning or "header" portion of the tape. Some experimenting may be necessary. The duration of time for the header is about 7 seconds. It is important to choose the lower of the two ranges for the volume control setting if they both exist (see 9 above). For the recommended General Electric recorder this is at about 80% of full maximum. Mark the proper setting with paint or other method.

11. During the verify (or load) operation, F.F.F.F. may appear in the display. This is most likely an indication that the tape was started after the beginning of a program. If this happens stop the tape, rewind it and restart the operation.

12. If an error code is displayed during a verify (or load) operation, the CLR key should be pushed two times in order to start over again. The first time CLR is pushed, the program address that did not match is displayed. The second CLR will allow the operation to be restarted.

13. If after following all instructions, reliable operation cannot be obtained, try operating the recorder with batteries.

14. When the verify is complete without error, the Programmer will display C⌐¬P-.   End.

15. Stop the recorder and turn the mode switch to RUN 1 and re-enter the RUN mode.

16. The verify operation will require approximately the same time as the record (maximum of 9 minutes depending upon memory length used).

LOAD A PROGRAM

1. Place Programmer in the LOAD mode.

2. Apply AC power to the tape recorder and insert cassette.

3. Adjust volume control to the setting determined during the verify operation. Adjust tone control to its highest setting.

4. Connect Programmer (TAPE port) to the tape recorder (EAR input) with audio cable (gray with red tracer).

5. Rewind tape to beginning of previously recorded program. Tape can also be on blank area prior to program, but not on another program. Enter the program identification number (if previously recorded).

6. Push CLR, SHF, and READ on the Programmer to establish CPU load operation. Display will read C-P.

7. Begin tape recorder by depressing the PLAY button, then push NXT on the programmer. The load operation now commences. The display reads C-P. When the beginning of the program is reached the display will change to C-P-. If the bar after the P is off or flickering, the volume control should be adjusted until the flickering stops. Return to step 5 and proceed with the operation. The display will also eventually contain the program identification number. If the CPU detects a program number different than the one entered in step 5, the display will beep and show PA'ᴚ'ᴚ.

8. If the incorrect program has been selected, the load operation can be aborted by stopping the recorder or depressing the CLR (Clear) key on the Programmer.

9. Error code E21 indicates the tape has an internal parity error. E28 indicates the play level is wrong and the load should be stopped, volume adjusted, and the operation restarted (step 5 above).

10. When the load is complete without error, the Programmer will beep and display C-P-. End in the Address/Data display. Stop the recorder and depress the CLR (Clear) button on the Programmer to end the load operation.

11. The load operation will require approximately the same time as the record (maximum of about 9 minutes depending upon memory length used).
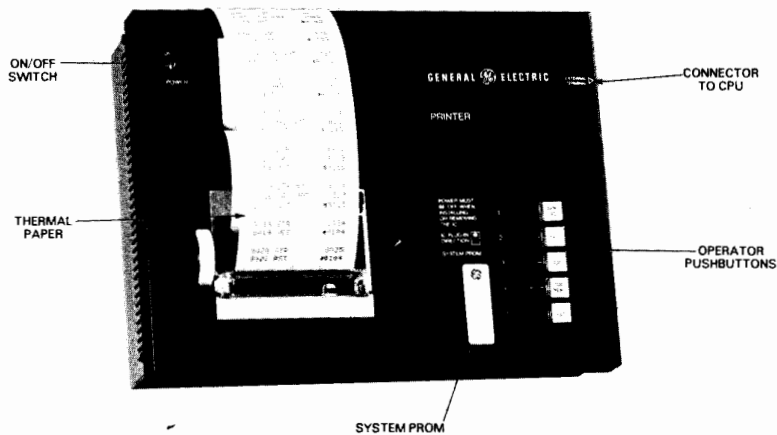

Figure 7.1
LOGIC PRINTER

LOGIC PRINTER OPERATION

In addition to the tape loader, the TAPE port on the Programmer can also support a Printer (Figure 7.1). This Printer is used to document the logic stored within a Series Three utilizing the same language or symbols as used to enter the program. Figure 7.2 is a sample printout; logic is documented from the beginning of memory (lower address) towards the higher addresses exactly as the CPU scans. The paper is heat sensitive and does not require ink or carbon paper. The printer has a buffer that is loaded from the Series Three and generates the print output from that buffer. An entire program can be printed out or just the logic contained in a 1K portion as controlled by the operator. On the lower right of the printer top are eight LED's and five pushbuttons. The function of each is as follows:

LED 1   –   On to indicate printer will document first 1024 words of logic space (addresses 0000-1023).

LED 2   –   On to indicate printer will document second 1024 words of logic space (addresses 1024-2047).

LED 3   –   On to indicate printer will document third 1024 words of logic space (addresses 2048-3071).

LED 4   –   On to indicate printer will document last 1024 words of logic space (addresses 3072-4095).

POWER   –   On when power switch is in the ON position and power supply is providing proper DC voltages for internal operations.

MEM SEL–   Pushbutton used to change selected memory for printing. Each time it is depressed, LED's 1-4 will shift one position (1, 2, 3, 4, none, 1, 2, etc). When all LED's 1-4 are off, all of memory will be documented.

READ   –   Pushbutton used to read CPU data into the Printer's buffer. Its associated LED will be ON when this operation is selected and other lower LED's will be extinguished.

PRNT   –   Pushbutton used to begin print operation based upon data previously loaded into its buffer space. Its associated LED will be ON, and other adjacent LED's will be OFF, when this operation is selected.

CLR MEM- Pushbutton used to clear buffer memory within printer. Its
associated LED will be ON when this operation is selected and
other higher LED's will be extinguished.

RST   - Pushbutton used to reset any printer operation. Functions such
as reading CPU data, printing logic, and clearing memory will be
terminated if this pushbutton is depressed.

To operate the Printer with the Series Three, install the Series Three Printer
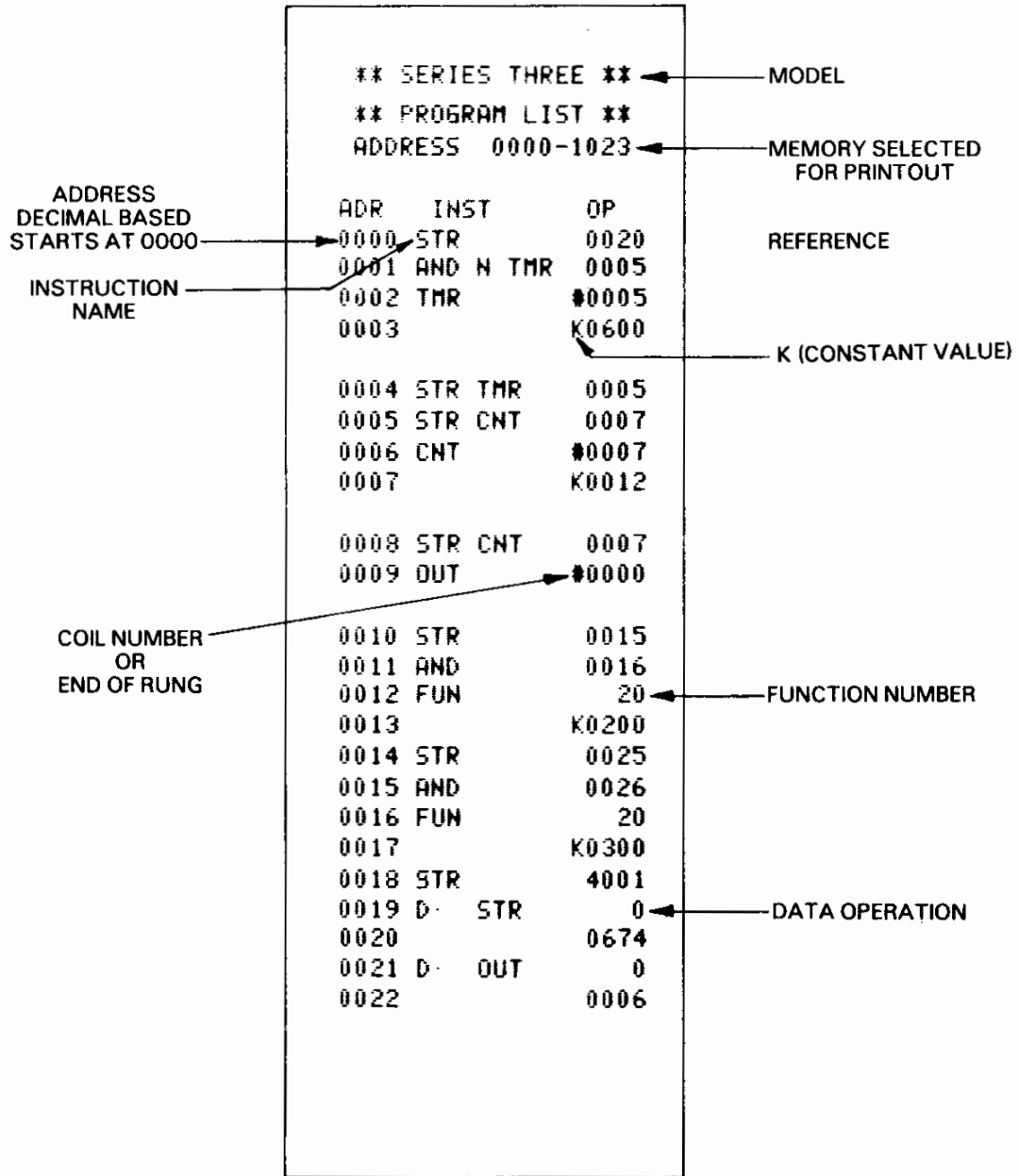PROM (IC630ACC301A) with Printer power switch in the OFF position or AC power
cord disconnected.

{CAUTION}

PROM must be installed with GE logo in the up position.
Failure to correctly orient PROM may cause it to be damaged
when power is applied.

This Printer can also be used to document Series One programs with Printer
PROM IC610ACC101A (see Series One Manual, GEK-25375). Both PROM's are
provided with the Printer. To document a Series Three program, perform the
following actions:

1. Apply AC power to the Printer.

2. Put Printer power switch in the ON position. Verify that the POWER
    LED is On.

3. Depress CLR MEM pushbutton twice to clear memory. The first time the
    pushbutton is depressed the LED will turn ON and a tone will sound,
    the second time the LED will turn OFF.

4. Connect Programmer (TAPE port) to Printer (external terminal - on
    side) with audio cable that is totally gray (no red trace, Catalog
    Number IC630CBL150A).

5. Put Programmer in the LOAD mode.

6. Depress the READ pushbutton, the LED will flash ON and OFF.

7. At the Series Three Programmer, push the CLR, SHF, WRITE, NXT keys to
    cause a write to the printer to begin. The READ LED will turn ON,
    verifying that the printer is in READ mode. The Programmer displays
    P-C. indicating that data is being read.

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8. The loading of the Printer buffer is complete when the Printer READ
    LED goes off and two quick tones sound and the Programmer displays
    P-C. End and generates a single tone. The time required to transfer
    the logic depends upon the amount of memory used. If a transmission
    error occurs, a constant beeping tone will sound.

9. At the Series Three, depress the CLR key to clear the display. The
    CPU can be disconnected from the audio cable and returned to normal
    operation if desired.

10. Select the memory to be documented by successive depressions of the
    MEM SEL pushbutton while observing LEDs 1-4. All LEDs off indicate
    that the total 4K of memory will be documented. Additional printouts
    can be obtained from this memory area or others without refreshing
    data from the CPU.

11. To begin the printing, depress the PRNT pushbutton, the PRNT LED will
    turn ON. The printer will begin to document the logic at the rate of
    one line per word or function. When Printing is complete a tone will
    sound and the PRNT LED will turn OFF.

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                    ** SERIES THREE **  ◄─────── MODEL

                    ** PROGRAM LIST **
                    ADDRESS   0000-1023 ◄────── MEMORY SELECTED
                                                FOR PRINTOUT
ADDRESS
DECIMAL BASED       ADR    INST       OP
STARTS AT 0000 ───► 0000  STR         0020        REFERENCE
                    0001  AND N TMR   0005
INSTRUCTION ─────── 0002  TMR        #0005
NAME                0003              K0600
                                            ◄──── K (CONSTANT VALUE)

                    0004  STR TMR     0005
                    0005  STR CNT     0007
                    0006  CNT        #0007
                    0007              K0012

                    0008  STR CNT     0007
                    0009  OUT      ►#0000

COIL NUMBER         0010  STR         0015
OR                  0011  AND         0016
END OF RUNG         0012  FUN          20  ◄──── FUNCTION NUMBER
                    0013              K0200
                    0014  STR         0025
                    0015  AND         0026
                    0016  FUN          20
                    0017              K0300
                    0018  STR        4001
                    0019  D·  STR       0  ◄──── DATA OPERATION
                    0020              0674
                    0021  D·  OUT       0
                    0022              0006



                                            PC-S3-83-0033
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Figure 7.2
SAMPLE PRINTOUT

PROM WRITER OPERATION

The third peripheral available for use with the Tape port is the PROM writer (Figure 7.3). This device copies logic from the CPU's CMOS memory and writes it into a PROM for subsequent installation into any Series Three CPU. To operate with the Series Three, PROM Writer System PROM IC630ACC302A must be installed with Writer power switch in the OFF position or AC power cord disconnected.
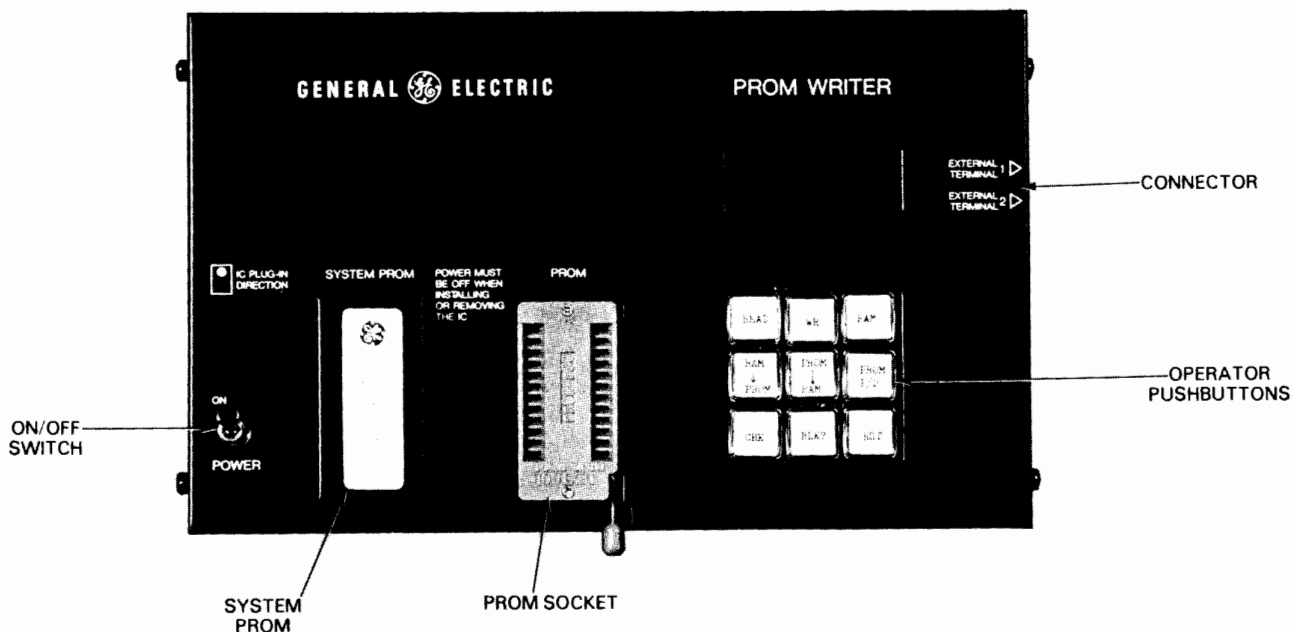
Figure 7.3
PROM WRITER

This Writer can also be used to transfer Series One programs with PROM Writer PROM IC630ACC102A (see Series One Manual GEK-25375). Both PROM's are provided with the PROM Writer. PROM memory can be written once by this Writer and not altered thereafter; their content is not lost when power is removed for long time periods (up to 8-10 years). To reuse a PROM it must be erased by long exposure (10-15 minutes) to an intense ultraviolet light in a special PROM eraser. Normal ambient ultraviolet light (e.g. sunlight) has virtually no effect on its content. There are many commercially available PROM erasers handling single PROM's or many PROM's at a time.

The nine pushbuttons to the lower right have the following functions:

READ   —   Causes the Writer to receive data into its buffer memory from the Series Three.

WR   —   Causes the Writer to write data from its buffer memory to the Series Three.

RAM   —   Refers to the Writer's internal memory.

RAM→PROM – Specifies loading the PROM from Writer's internal memory.

PROM→RAM – Specifies loading the Writer's internal memory from the PROM.

PROM 1/2 – Selects PROM 1 (lower 8 bits) or PROM 2 (upper 8 bits).

CHK   —   Specifies a checking or verifying operation as contrasted to actual transfer of data.

BLK?   —   Specifies testing for blank or erased PROM's.

RST   —   Resets Writer's operation and obtains type of system PROM installed.

There are many functions possible with this Writer. The following steps should be used as appropriate for the functions desired.

1. Verify the following conditions before each function:

    a. Apply AC power to the CPU base unit

    b. Plug Writer's AC power cord into a source of power.

c. Install the Series Three system PROM onto Writer with GE logo at top of PROM.

d. Place Writer's power switch to ON. Depress RST to reset the Writer. The display should read S3 if the Series Three System PROM is properly installed.

e. Place Programmer in the LOAD mode

2. To load the Writer's memory from the Series Three CPU:

a. Connect audio cable (solid gray) from the Programmer's TAPE port to the Writer's External Terminal 1 on its right side. Depress the RAM/RST buttons simultaneously to clear the Writer's RAM memory. The display will read CLR, a tone will sound, then when End is displayed memory has been cleared.

b. Depress the Writer's READ pushbutton. The display should read E-A.

c. On the Programmer push CLR, SHF, WRITE, NXT. The Writer's display will show P-C.

d. At the completion of the transfer, the Writer will display End and beep twice. The Programmer will also display End. If a transmission error occurs, a constant beeping tone will sound.

e. Select the CLR key on the Programmer to clear its operation.

3. Verify Writer memory against Series Three memory.

a. Connect the audio cable (solid gray) from the Programmer's TAPE PORT to the Writer's External Terminal 1 on its right side.

b. Depress the Writer's RAM and CHK pushbuttons at the same time. Display will read E C P.

c. On the Programmer push the CLR, SHF, WRITE and NXT keys. The Programmer display will be P-C. If the verify proves both memories are identical, the Writer's display will show End and beep twice, the Programmer will also display End. The Verify will take about 4 minutes. To indicate an error, it will display (ErrU).

4. Loading PROM from Writer's memory

    a. Place type 2732A-2 or equivalent PROM into blue-green socket. Insert with locking handle up and then lock in place by moving handle 90° to horizontal position. PROM should have notch at top to ensure pin 1 is at top left.

    b. Depress RST pushbutton to reset the Writer. The display should be S 3 if the Series Three system PROM is properly installed.

    c. Depress the RAM——▶PROM pushbutton to initiate the loading of the PROM. The display will read A-P1 for PROM 1 or A-P2 for PROM 2. The Writer will check that the PROM is erased, load it, and then verify the load automatically. The display will show Ers while checking if the PROM is erased or blank. The display ErrE indicates the PROM is not properly erased. The display ⌐⌐⌐ , then End indicates satisfactory completion of the load which should take about 4 minutes.

    d. Remove first PROM from socket, insert second PROM. Depress the 1/2 pushbutton to select PROM2, then repeat step c.

5. Verify Writer memory against PROM

    a. Place type 2732A-2 or equivalent PROM into blue-green socket. Insert with locking handle up and then lock in place by moving handle 90° to horizontal position. PROM should have notch at top to ensure pin 1 is at top left.

    b. Depress RST pushbutton to reset the Writer. The display should be S 3 if the Series Three system PROM is properly installed.

    c. Depress the CHK pushbutton to initiate the checking of the PROM. The display will be ⌐⌐⌐1 or ⌐⌐⌐2. If differences are found, the checking halts at that location and Errc is displayed. Depressing the CHK pushbutton will display the first memory address with a miscompare, successive depressions of CHK will allow successive addresses with miscompares to be displayed. At the end of the check, the display will show End.

    d. Remove PROM 1, insert second PROM, depress PROM 1/2 pushbutton and repeat step c.

6.   Transfer from PROM to Writer's memory to Series Three CPU memory

     a.   Connect the audio cable (solid gray) from the Programmer's TAPE
          port to the Writer's External Terminal 2 on its right side.

     b.   Place type 2732A-2 or equivalent PROM into blue-green socket.
          Insert with locking handle up and then lock in place by moving
          handle 90° to horizontal position. PROM should have notch at
          top to ensure pin 1 is at top left.

     c.   Depress RST pushbutton to reset the Writer. The display should
          be '⌐⌐⌐'if the Series Three system PROM is properly installed.

     d.   Depress the PROM⟶ RAM pushbutton to initiate the loading of the
          Writer's memory. The Writer display will be P1-A, then |⌐⌐|⌐|
          while the transfer is taking place and End when the loading is
          complete.

     e.   On the Programmer, select the CLR, SHF, READ and NXT keys. The
          display will be C-P.

     f.   On the Writer, depress the WR pushbutton. The Writer will display
          A-E and the Programmer display will now be C-P. After a short
          delay 0.0.0.0. will appear under the Data display. When the
          transfer is complete, the Programmer will display C-P-. End and
          the Writer will display End. To terminate its operation, select
          the Programmer's CLR key.

     g.   Remove PROM, insert second PROM, depress PROM 1/2 pushbutton and
          repeat steps d to f.

     h.   To verify the accuracy of the transfer, select CLR, SHF, CHECK,
          NXT at the Programmer (display will be |⌐⌐|⌐.) and depress the WR
          pushbutton on the Writer. The Writer will display A-E and the
          Programmer will display |⌐⌐|⌐-. After a short delay 0.0.0.0. will
          appear under the Data display. When the verify is complete, the
          Programmer will display |⌐⌐|⌐-. End. and the Writer will beep and
          display End.

7.   To verify that a PROM is blank, insert it and depress the BLK?
     pushbutton. The Writer display of End indicates a blank PROM: display
     of ErrE indicates the PROM is not fully erased.

8. To clear the Writer's memory, depress the RAM and RST pushbuttons at the same time. A successful clearing results in the Writer's display of End; if for some reason (hardware failure) the clear is not successful, the display will be ErrM. The display will show CLE while erasing and End when complete.

9. Inserting PROM1 and PROM2 in CPU.

   a. Turn off AC power to the CPU.

   b. Remove cover on back of CPU.

   c. Insert PROM1 in slot on right.

   d. Insert PROM2 in slot on left.

   e. To select PROM memory, move ROM/RAM switch to S (left position).

   f. Replace cover on back of CPU.

   g. Apply power to CPU.