Model 60 Logic Programmer

Operator's Manual

DATA I/O
Corporation

MODEL 60

Operator's Manual

981-0122-008 *May 1988*

Data I/O Corporation warrants to the original purchaser of the product described by this manual that the product was fully functional to the extent of its specification at the time of shipment from the factory. Data I/O further certifies that the equipment used to test the product was calibrated to standards that are traceable to the national bureau of standards as appropriate. Data I/O has made every attempt to ensure that the information in this document is accurate and complete. However, Data I/O assumes no liability for errors, or for any damages that result from use of this document or the equipment which it accompanies.

Data I/O reserves the right to make changes to this document without notice at any time.

ORDERING INFORMATION

When ordering this manual, use Part Number 981-0122-008, which applies to Engineering Part Number 901-0005-019 and up.

SAFETY SUMMARY

General safety information for operating personnel is contained in this summary. In addition, specific WARNINGS and CAUTIONS appear throughout this manual where they apply and are not included in this summary.

DEFINITIONS

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to equipment or other property.

SYMBOLS


This symbol appears on the equipment and it indicates that the user should consult the manual for further detail.

V ∿ This symbol stands for Vac. For example 120V ∿ = 120 Vac.


This symbol stands for fuse ratings.

POWER SOURCE

Check the voltage selector indicator (located on the rear panel) to verify that the product is configured for appropriate line voltage.

GROUNDING THE PRODUCT

The product is grounded through the grounding conductor of the power cord. To avoid electric shock, plug the power cord into a properly wired and grounded receptacle only. Grounding this equipment is essential for its safe operation.

WARNING

Exposure to UV lamp radiation is harmful to eyes and skin.

POWER CORD

Use only the power cord specified for your equipment.

FUSE REPLACEMENT

For continued protection against the possibility of fire, replace only with a fuse of the specified voltage, current and type ratings.

SERVICING

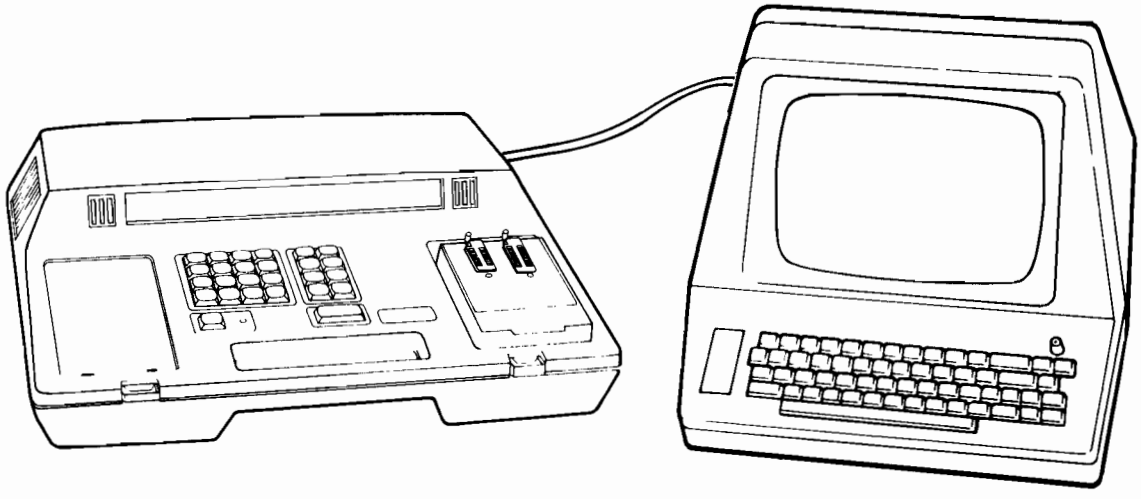
To reduce the risk of electric shock, do not perform any servicing other than that described in this manual.

TABLE OF CONTENTS

INTRODUCTION

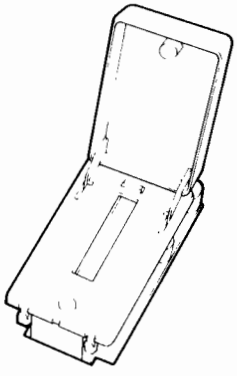
PRODUCT DEFINITION

Data I/O's Model 60 provides the user reliable and versatile programming of Programmable Logic Devices (PLDs) and Erasable Programmable Read Only Memory devices (EPROMs). Individual programming adapters allow you to select the specific device support you need from a wide variety of PLDs and memory devices. In addition, performance boards are available to interface the Model 60 to a device handler. Standard features of the Model 60 include RS-232C port, menu scrolling, approved speed-optimized algorithms, and Computer Remote Control (CRC). The Model 60 offers the Full and Kernel JEDEC translation formats for logic devices and seven other translation formats for memory devices. You may also choose the line voltage and the programming adapters.

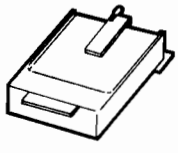


MODEL 60 PROGRAMMER

REMOTE CONTROL*



OPTIONAL UV LAMP ASSY



OPTIONAL PROGRAMMING ADAPTER

*Terminal not included

HOW TO USE THIS MANUAL

This manual contains the operational procedures for the Model 60 Logic Programmer with either a logic or memory programming adapter installed. If you are using a handler, consult the Operator's Manual for the operational procedures for the handler. If you have one of the logic adapters installed, or no adapter installed, the Model 60 will respond in logic device mode. If a memory adapter is installed, the Model 60 will respond in memory device mode. (If you are using a device handler with the Model 60, consult the installation and operation manual for the particular handler you are using.)

Listed below are descriptions of the sections in this manual.

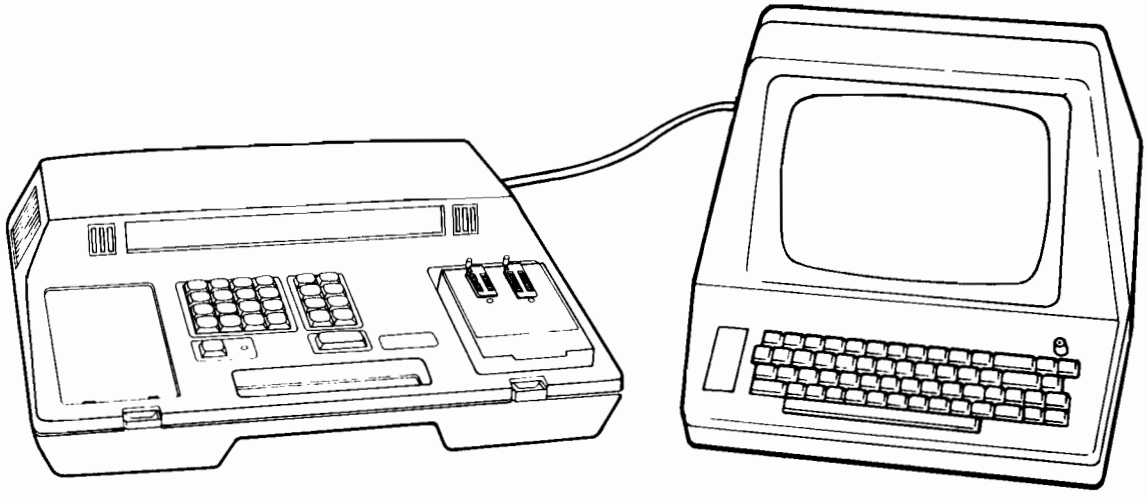
- GETTING STARTED — Sample sessions for operation with a logic adapter and memory adapter installed. Includes instructions on line voltage selection and checking the back panel fuses, powering up the programmer, inserting a device, programming the socketed logic and memory device, and installation of the optional UV lamp.
- PROGRAMMING WITH LOGIC ADAPTER — Information about programming logic devices with a logic adapter installed, including a list of general programming notes applicable to logic and memory operation. Also includes information on editing, verifying data integrity, and serial port data transfer.
- PROGRAMMING WITH MEMORY ADAPTER — Information about programming memory devices with an EPROM adapter installed, including information on editing, verifying data integrity, and serial port data transfer. (This section does not apply to the Model 60H.)
- REMOTE CONTROL — Describes Serial I/O operation with the Model 60 programmer. Includes CRC operation, information on RS-232C hookup, description of the data translation formats, and terminal main menus for logic and memory operation and descriptions for operation in terminal mode.
- SELECT FUNCTIONS — Details on Select Codes for logic and memory devices; two-digit hexadecimal codes that enable special programmer functions such as RAM manipulation and serial port special functions.
- ERROR CODES — Describes the Model 60A's error code displays, and corrective action.
- INDEX — An alphabetical guide to all the major topics covered in the manual.

NOTE

The error codes provided in this manual are not accompanied by any service information. If you would like to receive maintenance data (circuit descriptions, schematics, calibration information and calibration waveform photographs), please contact your nearest Data I/O sales representative by calling one of the numbers listed at the end of this section.

SYSTEM OVERVIEW

The Model 60 is a transportable programmer that provides a fully integrated means of programming, testing, and verifying a variety of logic and memory devices, depending on the adpater that is installed. If you are using the Model 60 programmer with a handler, you will also have one of the available performance boards and cable and the handler itself. Refer to either the MCT/EXATRON Interface Kit Operator's manual or the Model 60H Handler 300 Interace Kit Operator's manual for installation and operation procedures.



MODEL 60 PROGRAMMER

REMOTE CONTROL*

Remote Control*

The standard Computer Remote Control (CRC), controls the Model 60 with a host computer. Terminal mode allows you to send commands to the Model 60 from a terminal. (See the Remote Control section of this manual for descriptions of the terminal menus and terminal mode operation).

*Terminal not included.

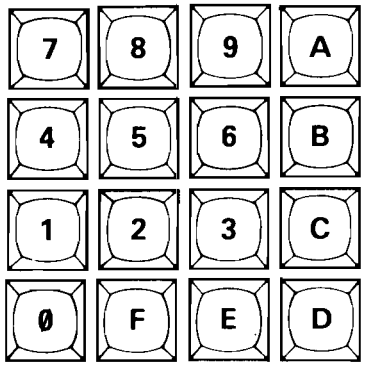
Model 60 Front Panel Description

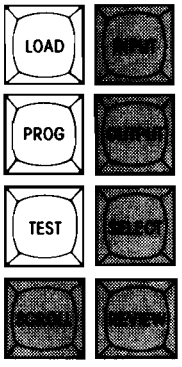
NOTE

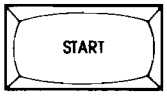
The following describes the front panel keys of the Model 60. The sections in this manual on "Programming With Logic Adapter" and "Programming With Memory Adapter" describe the Model 60A responses when programming with a logic or memory device.

Front panel operation of the Model 60 is provided by a set of three Mode (blue) keys: **LOAD**, **PROG** and **TEST**. These are used in conjunction with several function keys (see figure) and a hexadecimal keyboard. The following diagrams show the basic function of the **LOAD**, **PROG**, **TEST**, **INPUT**, **OUTPUT** and **SELECT** keys.

HEX KEYBOARD
Allows entry of hexadecimal values.







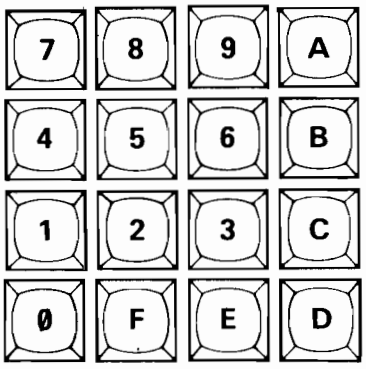
MODE OPERATION KEYS

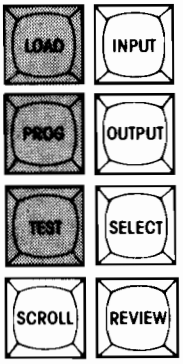
LOAD key:
Used to read device information and store it in the programmer's memory (RAM).

PROG key:
Used to program and selectively test a device installed in the adapter.

TEST key:
Used to compare the device information with the information stored in the programmer's RAM. For logic devices, this may include a functional test of the device if "structured test vectors" are present in RAM and/or if Logic Fingerprint is enabled.

HEX KEYBOARD
Allows entry of hexadecimal values.





START key:
Used to initiate the function selected on any of the other keys or to advance through a multiple step operation.

SCROLL key:
Used to advance through the menus or prompts on the programmer display.

MODE OPERATION KEYS

INPUT key:
Used to receive input from the serial I/O port, translate it, and store it in the programmer's RAM.

OUTPUT key:
Used to transmit data stored in the programmer's RAM, translate it, and send it out the serial I/O port.

SELECT key:
Used in conjunction with the entry of a two-character command code to select any of the programmer functions.

REVIEW key:
Used in conjunction with the SCROLL key to allow reverse scrolling through the menus. This key can also convert the display of manufacturer and part type to family and pinout code.

Specifications

The Model 60's specifications are listed below.

FUNCTIONAL SPECIFICATIONS

- Programming Support: 360A-001, 360A-002, 360A-003, 360A-005, 360A-006 360A-007, 360A-008, and 360A-009 programming adapters
- Keyboard: 16-key hexadecimal, 10-key functional
- Display: 16-character alphanumeric
- Input/Output: Serial RS-232C
- Baud Rates: 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 19,200 (software selectable)
- Remote Control: Computer Remote Control (CRC) Terminal Mode
- Translation Formats: JEDEC Full, JEDEC Kernel, ASCII-Hex Space STX, Motorola EXORciser, Intel Intellec 8/MDS, Tektronix Hexadecimal, Extended Tektronix Hexadecimal, Motorola EXORmax, Intel MCS-86 Hex Object.

POWER REQUIREMENTS

- Operating Voltages: 100, 120, 220 or 240 Vac ± 10%
- Frequency Range: 48-63 Hz
- Power Consumption: 100W maximum, 125 VA maximum
- Fuse Protection: Primary and secondary fuse protection

PHYSICAL AND ENVIRONMENTAL

- Dimensions: 34 x 43 x 11 cm (13.5 x17.0 x4.5 in.)
- Unit Weight: 7.3 kg (16 lbs)
- Operating Temperature: + 5° to 45°C (41° to 113° F)
- Storage Temperature: - 40° to 70°C (- 40° to 140°F)
- Humidity: to 80% noncondensing
- Operational Altitude: to 3 km (10,000 ft.)

SAFETY

The Model 60 is designed to comply with the following safety standards.

- UL 1244 (Underwriters Laboratories)
- CSA C22.2 NO. 151 (Canadian Standard Association)
- IEC 348 (International Electrotechnical Commission)

OPTIONAL FEATURES

The Model 60 offers the following optional features. If you wish to purchase any of these features, contact your nearest Data I/O sales representative. A list of representatives is included at the back of this manual.

- 20/24-pin PLD: 360A-001
- 20/24-pin integrated fuse logic: 360A-002
- 28-pin integrated fuse logic: 360A-003
- 28/32/40-pin memory: 360A-005
- Ultraviolet lamp assembly: 950-0211
- 20/28-pin JEDEC PLCC adapter: 360A-006
- 28/28-pin non-JEDEC PLCC adapter: 360A-007
- 28-pin IFC PLCC adapter: 360A-008
- 20/28-pin IFC PLCC adapter: 360A-009
- MCT/EXATRON Interface Kit
- Handler 300 Interface Kit

ORDERING

Orders made with Data I/O must contain the following information:

- description of the equipment
- quantity of each item ordered
- shipping and billing address of firm, including ZIP code
- name of person ordering equipment
- purchase order number
- desired method of shipment

MODEL 60 AND PROMLINK

If you use PROMlink with Model 60 version 10.0 or later, your PROMlink version must be 2.4 or later. Earlier versions of PROMlink will only work with the Model 60 versions before V10.0.

WARRANTY AND CUSTOMER SUPPORT

Data I/O equipment is warranted against defects in materials and workmanship. The warranty period of one year, unless specified otherwise, begins when you receive the equipment. Refer to the warranty card inside the back cover of this manual for information on the length and conditions of the warranty. For warranty service, contact your nearest Data I/O Customer Support Center.

Data I/O maintains customer support centers throughout the world, each staffed with factory- trained technicians to provide prompt, quality service. This includes repairs, calibration, updates and upgrades of all Data I/O products.

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1. GETTING STARTED

This section explains how to get started using your Model 60 programmer. Included here are complete procedures for powering up and for programming a logic device and a memory device from the programmer's keyboard. For details on operating the programmer using a terminal or computer, see the Remote Control section. Descriptions of the Terminal mode menus are also included in the Remote Control section.

This section includes the following information.

- Removing the Dust Cover
- Power Connection
- Verifying/Changing the Line Voltage and Line Fuse
- Installing a Programming Adapter
- Powering up the Programmer
- Sample Programming Session With Logic Adapter
- Sample Programming Session With Memory Adapter

NOTE

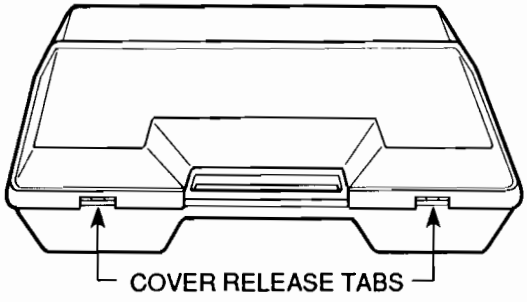
For information on the Model 60H Handler 300, see the Handler 300 installation and operation manual.

For information on the MCT/EXATRON Performance boards and adapters, see the MCT/EXATRON installation and operation manual.

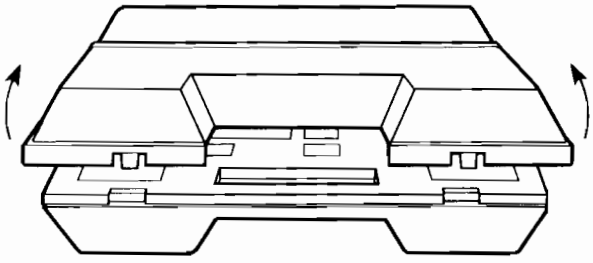
DUST COVER REMOVAL

To gain access to your Model 60 programmer and its component pieces, you must first remove the programmer's protective dust cover. Use the following procedure.

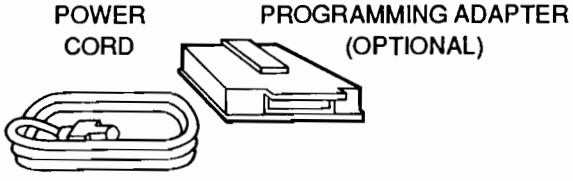
1. Orient the case so that the handle is facing you.
2. With your thumbs, push in on the cover release tabs as shown in the figure.
3. Lift up on the dust cover lid about 2 inches, pulling it toward you, and remove it from the programmer.

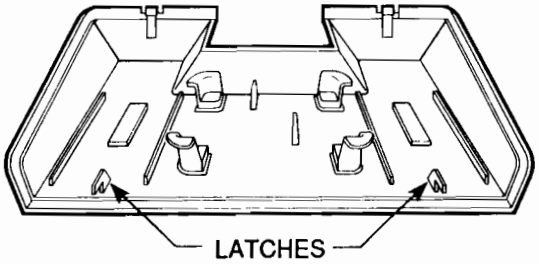


a) Press in on cover release tabs.



b) Lift cover up and pull toward you.





c) Invert the cover to remove or install contents.

POWER CONNECTION

Before applying power to your programmer, make sure that the line voltage selection is correct, that the line fuse is intact, and that the unit is properly grounded. When you have checked that the above are in order, proceed to the next subsection, Installing a Programming Adapter.

Verifying/Changing the Line Voltage

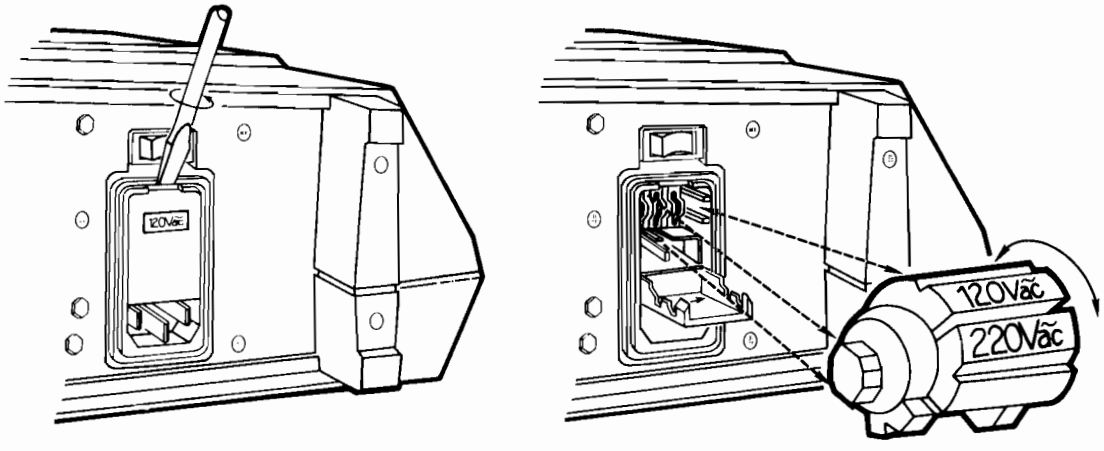
The factory has selected the proper voltage according to your specification. A voltage reading is visible through a window in the door that covers the voltage selector wheel, located on the back panel, as shown in the figure. This voltage should be the same as the line voltage on which the machine will operate. If the voltage that appears in the window is incorrect, change the operating voltage according to the following procedure.

CAUTION

This instrument may be damaged if operated with the wrong line voltage.

The procedures to verify and/or change the operating voltage are described here and illustrated in the figure.

1. Disconnect the power cord.
2. Gently pry open the door that covers the voltage wheel selector with a flat-blade screwdriver.
3. Pull the voltage wheel selector out of its slot.



4. Rotate the selector until the correct operating voltage points toward you.

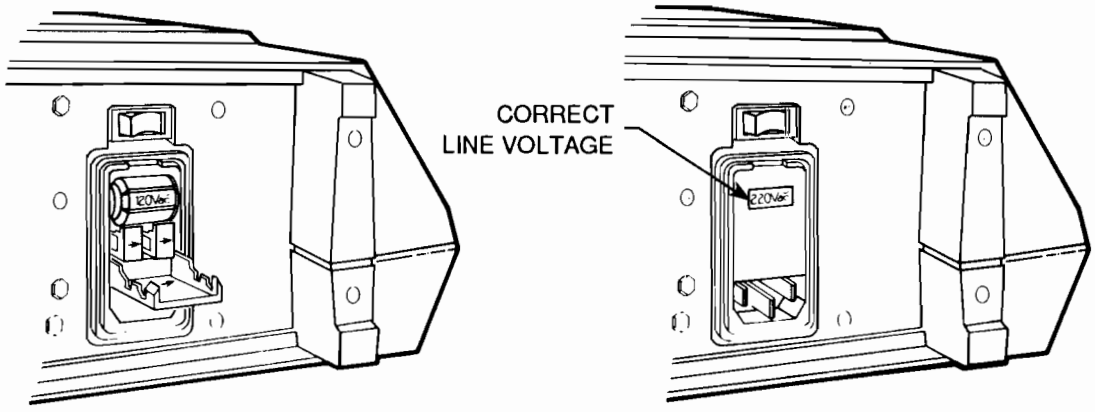
5. Insert the selector back into its slot.

NOTE

If you wish to access the line fuse at this point, proceed to step 2 in the next procedure.

6. Snap the door closed.

7. The correct voltage reading will now appear in the window.



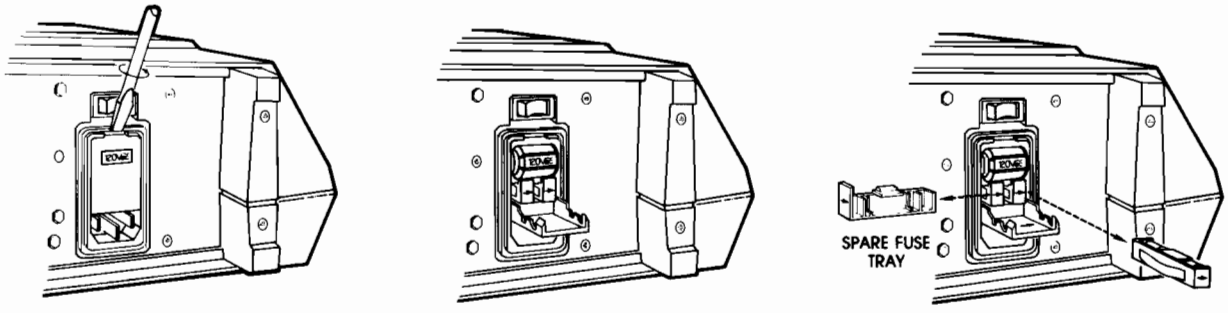
Verifying/Replacing the Line Fuse

The line fuse is located behind the same door that covers the voltage wheel selector. Perform the following procedure to verify that the line fuse is correct and intact. In the event that the fuse is blown, replace it with one of the correct size. Procedure steps are illustrated in the figure.

1. Gently pry open the door that covers the fuse holder using a flat-blade screwdriver.

NOTE

There are two fuse receptacles; only the one on the right is connected to the programmer's circuitry. The left receptacle is a spare fuse tray. See the next subsection for more information on this spare tray.



1 2 3

2. Pull the right fuse holder out of its slot.

3. Check to determine whether the fuse is intact. If it is intact, proceed to step 4. If it is blown, install a new fuse. See the following table for line fuse ratings.

CAUTION

For continued protection against the possibility of fire, replace only with a fuse of specified voltage, current and type ratings.

LINE FUSE RATING

Operating Voltage	Current	Voltage	Type	Data I/O Part Number
100	1.5A	250V	Fast-blow	416-0005
120	1.5A	250V	Fast-blow	416-0005
220	0.8A	250V	Fast-blow	416-1550
240	0.8A	250V	Fast-blow	416-1550

4. Insert the fuse holder into its slot so that the arrow on the fuse holder points in the same direction as the arrows on the door.

5. Snap the door closed.

Spare Line Fuse Tray

All Model 60 programmers are equipped with two line fuse trays (see the previous figure). The white fuse tray accepts 1/4 x 1 1/4 inch fuses; the black tray accepts 5 x 20 millimeter fuses, commonly available in Europe. Only the right fuse receptacle is connected to the programmer's circuitry.

Grounding the Unit

The Model 60 is shipped with a three-wire power cable. This cable connects the chassis of the unit to the earth ground when the cable is connected to a three-wire (grounded) receptacle.

WARNING

Continuity of the grounding circuit is vital for the safe operation of the unit. Never operate this equipment with the grounding conductor disconnected.

INSTALLING A PROGRAMMING ADAPTER

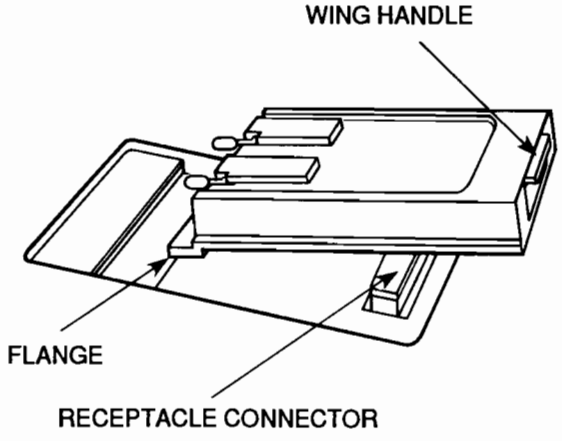
Programming operations require the use of the correct adapter. Any of the adapters may be installed and be removed with the programmer's power on; this feature allows you to retain data in the Model 60 RAM when changing programming adapters.

CAUTION

Voltage transients can cause device damage. Be sure that all sockets are empty when switching power on or off or installing or removing an adapter.

To install an adapter into the Model 60, refer to the figure and follow this installation procedure.

1. Orient the adapter over the front panel socket receptacle.
2. Tilt the adapter down and slide into receptacle and push forward.
3. Push the adapter wing handle down so that the adapter connector mates with the receptacle connector.



POWERING UP

The first step in getting started is powering up your Model 60 programmer. Use the following procedure.

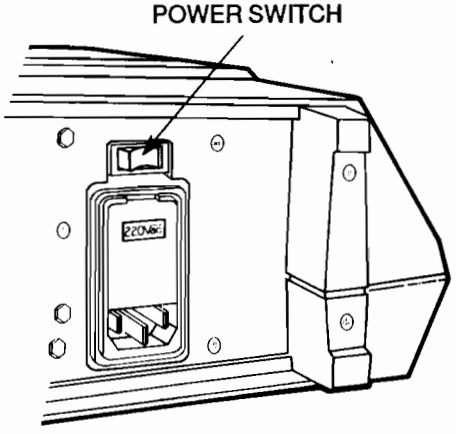
1. Check to make sure the sockets are empty. If a device is in a socket, remove it.

NOTE

If a device is in a socket, lift the socket lever and lift the device out of the socket. Failure to remove the device could result in damage to the device.

2. Check to be sure the voltage selector is in the proper position. Plug the AC power cord into the rear of the programmer and into a power receptacle.

3. Press the power switch at the back of the programmer to the "ON" position (see figure).



When the programmer is powered up, it automatically performs the self-test routine, which initializes the programmer's hardware and checks system memory. While the self-test is being performed, the programmer will display

```
SELF  TEST  ⊗
```

The symbol at the right-most digit of the display is the "action symbol," which "rotates" when the programmer is performing an operation.

When the self-test has been successfully completed, the programmer will display

```
SELF  TEST - OK
```

If an error message is displayed, check the error codes section of this manual.

SAMPLE PROGRAMMING SECTION FOR LOGIC OPERATION

The following steps describe how you would program a logic device using a master device (a part that has been previously programmed and is used as a "master" to program other parts). This procedure assumes that the programming data has already been created (using a development system) and transferred to the master device. For more details on logic device programming, see the "Programming With Logic Adapter" section of this manual. Information about operating in Terminal mode and the associated menus are in the Remote Control section of this manual.

CAUTION

The Model 60A response in the following procedure assumes that the appropriate logic adapter for the device to be programmed is installed.

1. Plug power cord into the programmer and into a power receptacle.

2. Make sure all the device sockets are empty.

3. Power-up the programmer and wait for display

   `SELF TEST - OK`

4. Install the appropriate logic adapter.

5. Press **LOAD**

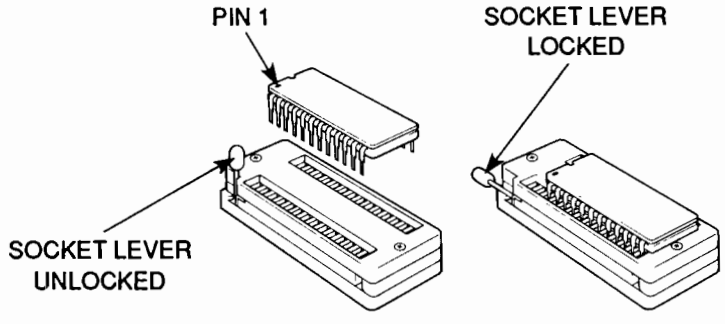
   to prepare the programmer to transfer the master device data to the programmer's data RAM.

   The programmer will display

   `LD (mfg) (dev)`

   or

   `LD FXX PXX`



6. Enter **X X Y Y**

   the family/pinout code for the last device saved or choose a device. Refer to the User Note for correct family and pinout codes. The programmer will then display

   ```
   LD (mfg) FXX ^ PYY
   ```

7. Lift up the lever on the socket that has an illuminated LED below it (see previous figure). Line up pin 1 of the device so that it is nearest the lever and set the device into the socket. Press down on the lever to lock the device in place.

8. Press **START**. During the operation, the programmer will display

   ```
   LOAD ARRAY   ⊗
   ```

   If Logic Fingerprint is enabled, the display will then read

   ```
   LEARN  FPRINT   ⊗
   ```

   When the operation is complete, the programmer will display

   ```
   LOAD DONE   XXXX
   ```

   NOTE

   "XXXX" is the sumcheck of the device.

9. Lift up the socket lever and remove the master device from the socket. The master device data is now transferred to RAM. The next part of the procedure transfers that data to a blank device.

10. Press **PROG**

    to prepare the programmer to transfer the data to the blank device. The programmer will display

    ```
    PG (mfg) (dev)  **
    ```

    NOTE

    The device shown on the display may not match the one being programmed since family and pinout codes are unique. Select proper Family/Pinout for device to be programmed.

11. Line up pin 1 of the blank device so that it is nearest the lever and set the device into the socket. Press down on the lever to lock the device in place.

---

12. Press **START**. The programmer will display

ILLEGAL BIT CHK	⊗	
PROG ARRAY	⊗	
TEST ARRAY	⊗	
TEST FPRINT	⊗	(If Logic Fingerprint is enabled, this line will appear)
PROG DONE	XXXX	

NOTE

"XXXX" in the above display represents the device's sumcheck; the hexadecimal sum of all the bytes in the device. The number displayed should match the sumcheck displayed during step 8 of this procedure.

---

13. Lift up the socket lever and remove the device from the socket. The device is now programmed.

---

14. To program another device of the same type, simply place it in the socket, press down on the socket lever and press **START**.

SAMPLE PROGRAMMING SECTION FOR MEMORY OPERATION

The following steps describe how you would program a memory device using a the Model 60 and a master device (a part that has been previously programmed and is used as a "master" to program other parts). This procedure assumes that the programming data has already been created (using a development system) and transferred to the master device. For more details on memory device programming, see the "Programming With Memory Adapter" section of this manual. Information about operating in Terminal mode and the associated menus are in the Remote Control section of this manual.

1. Plug power cord into the programmer and into a power receptacle.

2. Make sure all the device sockets are empty.

3. Power-up the programmer and wait for display

   ```
   SELF  TEST — OK
   ```

4. Install the memory adapter.

5. Press **LOAD**

   to prepare the programmer to transfer the master device data to the programmer's data RAM.

   The programmer will display

   ```
   DEVICE ^ ADDR/SIZE
   ```

6. Press **START**. The programmer will display

   ```
   'DEVICE  ADDR ^ SIZE
   ```

7. Press **START**. The programmer will display

   ```
   LOAD  RAM ^ ADDR
   ```

8. Press **START**. The programmer will display

   LD FAM ^ XX PIN ^ YY

   or

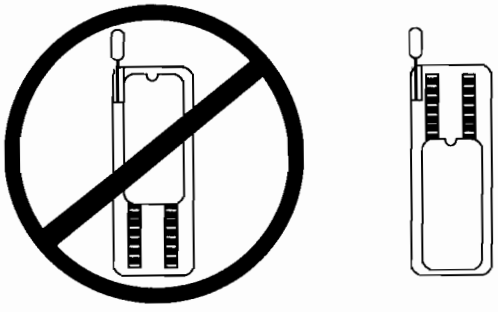
   LD (mfg) (dev)

9. Enter **X X Y Y**

   Either use the default family/pinout code or choose a device. Refer to the User Note for correct family and pinout code. The programmer will then display

   LD FAM XX PIN ^ YY

10. Lift up the lever on the socket. Line the bottom pins of the device so that they are at the bottom of the socket (bottom justified) as shown in the figure. Set the device into the socket and press down on the lever to lock the device in place.



11. Press **START**. The programmer will display

    LOADING DEVICE ⊗
    LOAD DONE XXXXXX

NOTE

"XXXXXX" is the sumcheck of the device.

The load operation could take from a few seconds to more than 60 seconds depending on the size of the device. Any audible sounds resulting from the relays in the memory adapter is normal.

12. Lift up the socket lever and remove the master device from the socket. The master device data is now transferred to RAM. The next part of the procedure transfers that data to the blank device.

---

13. Press **PROG**

    to prepare the programmer to transfer the data to the blank device. The programmer will display

    ```
    DEVICE ^ ADDR/SIZE
    ```

    NOTE

    The device shown on the display may not match the one being programmed since family and pinout codes are unique. Select proper Family/Pinout for device to be programmed.

---

14. Line up the bottom pins of the blank device so that they are at the bottom of the socket. Set the device into the socket and press down on the lever to lock the device in place.

---

15. Press **START** 3 times. The programmer will show the following displays

    ```
    DEVICE  ADDR ^ SIZE
    PROG  RAM ^ ADDR
    PG  FAM ^ XX  PIN YY
    ```

    or

    ```
    PG  (mfg)  (dev)
    ```

---

16. Press **START**. The programmer will display

    ```
    TEST  DEVICE        ⊗
    PROGRAM  DEVICE     ⊗
    VERIFY  DEVICE      ⊗
    PROG DONE    XXXXXX
    ```

17. Lift up the socket lever and remove the device from the socket. The device is now programmed.

    or

    If the device is pre-programmed, then the display will show

    ```
    NON   BLANK      20
    ```

    or

    ```
    ILLEGAL  BIT      21
    ```

    If the display shows `ILLEGAL BIT`, then the device must be erased or try a new device.

    Press **START**. The programmer will display

    ```
    PROGRAM  DEVICE      ⊗
    VERIFY   DEVICE      ⊗
    PROG   DONE      XXXXXX
    ```

    NOTE

    "XXXXXX" is the sumcheck of the device. Programming can take several minutes.

18. Lift up the socket lever and remove the device from the socket. The device is now programmed.

OPTIONAL UV LAMP INSTALLATION PROCEDURES

The Model 60's optional UV lamp assembly provides you with the capability of erasing programmed MOS EPROMS and erasable logic devices. This section explains use of the UV lamp.

Blank UV Cover Removal

This subsection explains how to remove the blank UV cover. This cover will need to be removed if you have purchased and wish to install the optional UV lamp assembly.

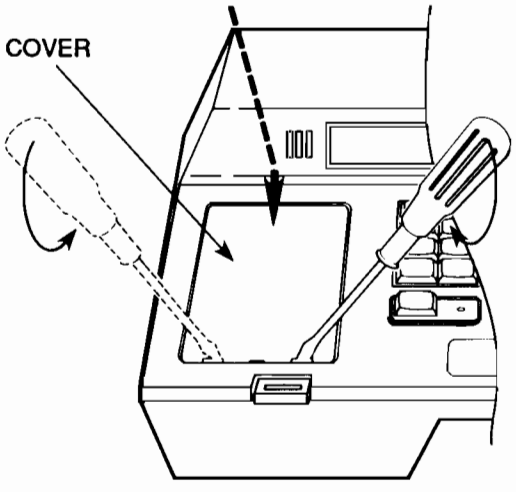
WARNING

To avoid the possibility of electric shock, disconnect the power cord before removing the blank UV cover. Keep the power cord disconnected until installation is completed.

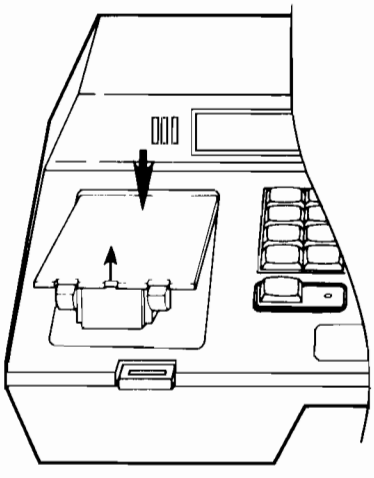
To remove the cover, you will need a flatblade screwdriver or similar instrument. Use the following procedure to remove the cover.

1. Apply a firm downward pressure at the rear portion of the cover as shown in the figure.
2. While continuing the pressure at the rear of the cover, apply a slight rotational motion with the screwdriver inserted into each of the slots in turn (see figure). This releases the cover from the front panel.

a) Press firmly at rear portion of cover.



b) While continuing pressure, insert screwdriver into each slot in turn, and move both tabs forward.

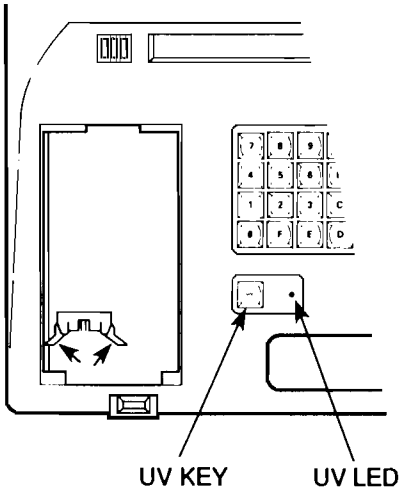


c) When both tabs have been moved forward, the cover will pop up from the front panel.

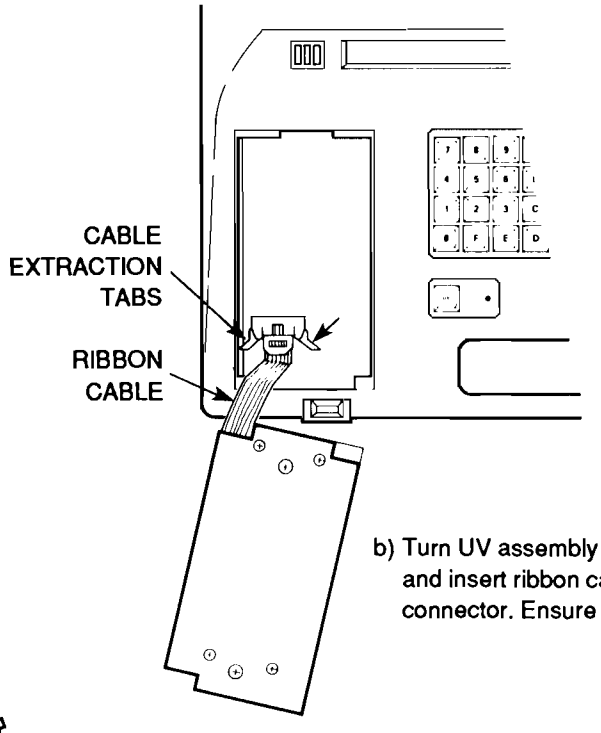
UV Lamp Assembly Installation

To install the optional UV lamp assembly, perform the following procedure.

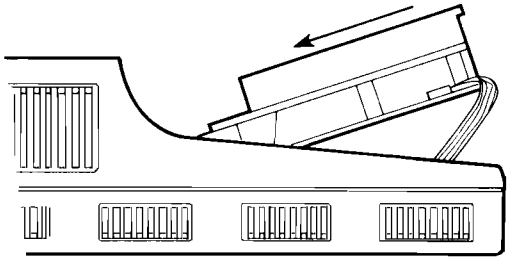
1. Remove the blank UV cover according to the instructions in the previous section.
2. Be sure that the cable extraction tabs on the controller board are snapped out (see figure).
3. Insert the ribbon cable (P204) into the connector (J204) on the controller board (see figure). Ensure that the tabs are now snapped in.
4. Tilt the UV lamp assembly down, placing the front end into the receptacle as shown in the figure.
5. Press the assembly down to lock it into place.



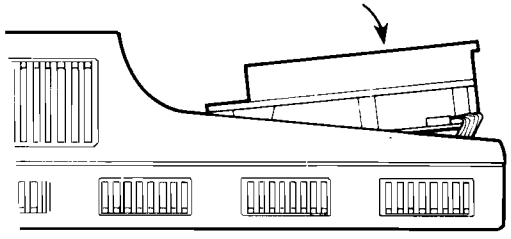
a) Ensure tabs are snapped out.



b) Turn UV assembly upside down and insert ribbon cable into connector. Ensure tabs snap in.



c) Turn assembly right side up and insert underneath front panel receptacle.



d) Press assembly down to lock into place.

Erasing Device With Optional UV Lamp Assembly

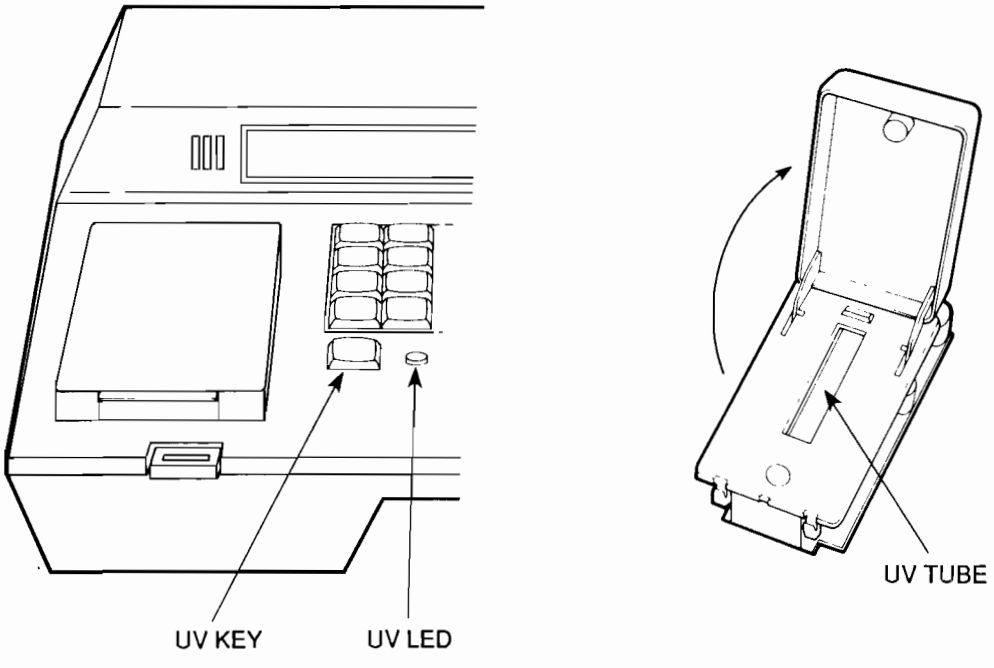
UV LAMP SPECIFICATION

The UV lamp intensity is rated at 7000uW/cm^2. Typically, EPROM device manufacturers recommend an erasure dose of 15W-sec/cm^2. This yields an erasure time of 35 minutes.

PROCEDURE FOR ERASING EPROMS

To erase programmed devices, use the following procedure.

1. Open the UV lamp cover door by lifting the flange on the front edge as shown in the figure.
2. With the device's lens facing down, place the device that you wish to erase on the UV tube (see figure).



3. Select the appropriate erasure time according to the device manufacturer's specifications. Default is 35 minutes. Go to step 5 if (1) you have already set the UV timeout or (2) the default timeout is being used.

4. Enter the erasure time using select code FD (UV timer set). See the Select Code section for the exact sequence.

5. Close the UV lamp cover door. The magnetic catch will hold it closed.

6. Press the UV key, located on the Model 60's front panel. The UV LED should now illuminate, indicating erasure has begun. A lens located above the UV door indicates whether the lamp is on (see figure on previous page).

WARNING

Exposure to UV lamp radiation is harmful to eyes and skin. The UV lamp cover door closes on a sensor. If the door is opened during the erase cycle, the UV lamp will automatically switch off, preventing possible exposure to UV radiation. Do not defeat the purpose of the UV lamp cover door interlock sensor.

Touching the hot UV lamp tube could cause a burn. Avoid contact with the tube after it has been on.

NOTE

Pressing the UV key at any point in the procedure resets the programmer to the beginning of the erasure cycle. The UV lamp's on time is lengthened in conjunction with the other machine operations. The UV lamp cannot be turned on while other operations are in progress.

7. When the UV timeout expires, the UV LED turns off. The devices are now erased.

8. Open the UV lamp cover door and remove the devices.

2. PROGRAMMING WITH LOGIC ADAPTER

This section describes how to load, program and test data from the Model 60 programmer front panel with a logic adapter installed. For descriptions of menus and operation from Terminal mode, see the Remote Control section of this manual. Included in this part of the manual is the following information:

- GENERAL OPERATING NOTES — Explains common symbols and messages encountered during programming operations. Read this subsection first, to familiarize yourself with the displays.
- FREQUENTLY USED OPERATIONS — Describes device operations that are frequently used.
- MENU TREE — Provides a menu structure for each of the logic programming options and shows how to access the functions.
- PROGRAMMING — Describes load and programming operations, which transfer programming data from a source to the Model 60's RAM and then to either the blank device to be programmed or the serial port. To program more logic devices quicker, you might want to use a device handler, like the Model 60H Handler 300.
- EDIT OPERATIONS — Explains how to edit the fuse map stored in the programmer RAM.
- TEST OPERATIONS — Describes how to verify data in two locations; for example, between a programmed device and the data in RAM. A Verify checks that the information in both locations is the same, thereby verifying the integrity of the data transfer. Verify also checks device functionality by performing structured tests (if vectors are present in RAM) and/or Logic Fingerprint if selected. This section also includes the test options available and how to select them.

OVERVIEW

Prior to programming a device, you must first load (also referred to as copy or transfer) the programmer's RAM with data to be programmed into a particular device. This data may be transferred to RAM from either the serial port, a "master" (previously programmed) device or may be keyed in by hand. You can then transfer that data to the socketed device.

After you transfer the data to the programmer's RAM, you may initiate the programming of a device. After data has been programmed into the device, you may check that the data was transferred correctly by using the verify operation. Additional tests include the array test, the structured vector test, and the Logic Fingerprint test.

Besides the load, program and test operations described above, this section includes some general operating notes and menu structure.

GENERAL OPERATING NOTES

The following displays and notes are common to nearly all the Load/Program/Test procedures for the Model 60A.

The Action Symbol ⊗

A special character is displayed by Data I/O programmers while an operation is being executed. This character is called an action symbol, and appears in the right-most character position of the display. For example, during power up, the programmer automatically performs a self-test routine. While this test is being executed, the programmer will display

```
SELF  TEST   ⊗
```

The "hand" of the action symbol rotates several times while an operation is taking place, to indicate that the programmer is executing the operation.

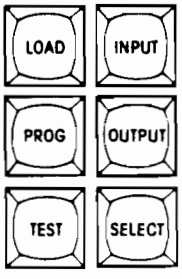
Aborting an Operation

Most operations (except for a few special select functions) may be aborted by pressing one of the keys shown below. If an operation is in progress when one of these keys is pressed, the programmer will momentarily display an abort message. The programmer will then assume and display the mode selected. For example, if you abort an operation by pressing the **SELECT** key, the programmer will display

```
FUNCTION  ABORT
```

and then

```
SELECT OPTION ^
```



FREQUENTLY USED OPERATIONS

Keying in Family and Pinout Codes/Device Selection

At power up and if any of the Mode (blue) keys are pressed, to enter the family and code, all you need to do is enter the correct code from the Model 60 front panel.

XX YY

and then enter

START

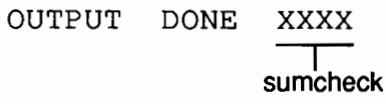
The manufacturer for the device whose pinout code you selected will also appear in the display. To select a device with the SCROLL key, refer to page 2-7 for the procedure.

Caution

Be sure you enter those family/pinout codes listed in the device table. Invalid codes may cause unpredictable results at the device socket, which may damage the device. Data I/O assumes no responsibility or liability for results produced by entry of illegal family/pinout code combinations.

Sumcheck Display

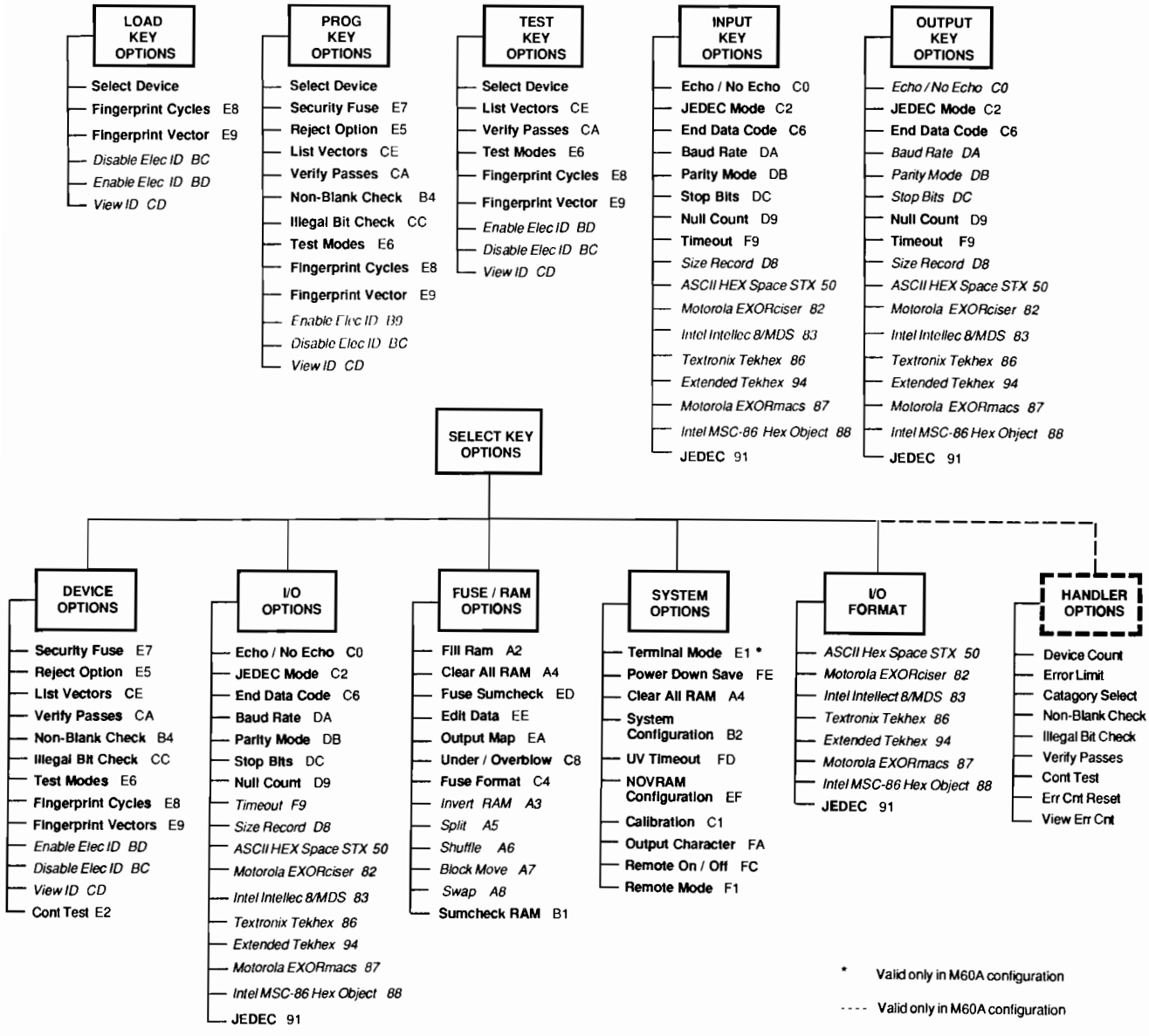
After the Model 60 has performed a Program or Test operation, a four-digit number is always displayed in the right-most display position. This hexadecimal number, called a sumcheck, is used to verify the integrity of a data transfer. For example, if you copy RAM data to the serial port, at the end of the operation the programmer will display



MENU TREE

Refer to the following menu tree as you go through the various program, load, and test operations to find the options available for each function. Refer to the next page to familiarize yourself with moving from one menu level to another. Most functions can be accessed by entering the select code (see the select code section of this manual).

The entries in **BOLD** are the functions that apply when a logic adapter is installed. The other functions will be displayed as you step through the menu options, but will not be active for logic operation. If you try to access a function that does not apply to a logic device, the Model 60 display will show "MEMORY OPTION 3E " in the display.



Interpreting the Menu Tree

- The menu selections for the Mode (blue) keys (**LOAD**, **PROG** and **TEST**) are accessed by pressing

SCROLL, the display will read

```
SELECT  DEVICE
```

use the

SCROLL and **REVIEW** keys to walk through the menu selections, pressing

START after a selection will activate that selection

NOTE

The displays will vary depending on the operation selected.

- The menu selections for the **SELECT** key options are accessed by pressing

SELECT , the display will read

```
SELECT  OPTION ^
```

use the

SCROLL and **REVIEW** keys to walk through these menu options

```
DEVICE  OPTIONS
I/O  OPTIONS
FUSE/RAM  OPTIONS
SYSTEM  OPTIONS
I/O  FORMATS
```

pressing

START after any of these options drops you into that menu tree, then by using the

REVIEW and **SCROLL** keys, you walk through those selections, and pressing

START after a selection will activate that selection. Pressing

SELECT at any time will get you out of the secondary menu tree into the menu tree for

```
SELECT  OPTION ^
```

The Model 60 will display the current I/O format selected.

PROGRAMMING

The following pages explain how to transfer programming data to RAM and transfer that RAM data to the device to be programmed. A list of the programming operations when a logic adapter is installed is given below. The procedures described here are for front panel operation. For programming operations using remote control, see the remote control section of this manual. See the remote control section also for terminal mode menus and descriptions.

Operation	Description
Load RAM With Master Device* Data	Used to transfer data from a master device to the programmer's RAM.
Load RAM From Serial Port	Transfers programming data from a remote system to the programmer's RAM.
Program Device With RAM Data	Copies the programming data from RAM to the device installed in the programming socket. It also verifies the device against RAM data as well as testing the device functionally, if that option was selected.
Output RAM Data to Serial Port	Transfers the RAM data to a remote system via the serial port.
Edit Operations	Allows you to alter the fuse map stored in programmer memory.
Test Operations	Checks that the data was transferred correctly from RAM and provides all Model 60A logic functional tests according to user-selectable options.

*A master device is a previously-programmed device whose data is used as a "source" to program blank devices.

Load RAM With Master Device Data

This operation transfers programming data from a master device to the programmer RAM. When the data transfer is complete, the Model 60 calculates and displays the sumcheck. Use the following procedure to load the Model 60 RAM with data from a master device using the programmer front panel.

Procedure	Keystroke	Model 60 Displays
1. Select the load operation.	**LOAD**	LD (mfg) (dev)
2. Accept	**START**	LOAD ARRAY ⊗ LOAD DONE XXXX
	or	
3. Enter the four hex-digit family/pinout code combination for the device to be copied. Family/pinout codes are listed in the device list included with the User Note.	**X X Y Y**	LOAD FXX ^ PYY
	START	LOAD ARRAY ⊗ LOAD DONE XXXX
If Logic Fingerprint is enabled		LOAD ARRAY LEARN FPRINT LOAD DONE XXXX
where (mfg) is the manufacturer XX is the family code YY is the pinout code		
	or	
	SCROLL	SELECT DEVICE
	START	LD ^ (mfg)

NOTE

"XX" and "YY" are the family and pinout codes associated with the part previously displayed. You may now enter a new family/pinout code.

The **SCROLL** and **REVIEW** keys are now active to walk through all of the manufacturers for logic devices.

Procedure	Keystroke	Model 60 Displays
Review the manufacturers	**SCROLL** or **REVIEW**	LD ^ (mfg)
Select the manufacturer	**START**	LD (mfg) ^ (dev) device name
Review the selected manufacturer's devices	**SCROLL** or **REVIEW**	LD (mfg) ^ (dev)
Select the device	**START**	LD (mfg) (dev)

NOTE

*If another **SCROLL** key is depressed immediately after the initial **SCROLL** the Model 60A goes to a menu of select codes associated with the **LOAD** key.*

4. Insert and lock the master device into the socket. The LED will be illuminated.	**START**	LOAD ARRAY LOAD DONE	⊗ XXXX
If Logic Fingerprint is enabled		LOAD ARRAY (mfg) LEARN FPRINT LOAD DONE	⊗ XXXX
5. Remove the master device from the socket. To repeat the load operation from another device with the same family and pinout codes, return to step 4.			

Load RAM From Serial Port

To transfer data received at the serial port to the programmer RAM, use this operation. When transfer is completed, the programmer calculates and displays the sumcheck of the transferred data and will signal an error if it does not match the one received with the data.

See Remote Control section for serial port setup and cabling. Use the following procedure to load the Model 60 RAM with incoming serial port data, using front panel control.

	Procedure	Keystroke	Model 60 Displays
1.	Select the input operation.	**INPUT**	`INPUT PORT 91` (T = I/O format code)
	Load the program data from the external source into the programmer	**START**	`INPUT PORT 91 ⊗`
		or	
	Use the **SCROLL** and **REVIEW** keys to select any of the required communications parameter.	**SCROLL** or **REVIEW**	
	NOTE *If, after you have entered this sub-menu and do not want to make any changes, press the **INPUT** key to return to the INPUT PORT display.*		
2.	Set up the source to transmit the fuse map data to the programmer. When the downloading operation to the programmer is complete, the Model 60 displays		`INPUT DONE XXXX`
3.	To repeat the input operation, press	**START**	

Program Device With RAM Data

Before programming a device, the system automatically performs illegal bit tests and blank checks at nominal VCC, to verify the ability of the device to accept programming data. Data is then programmed into the device in the socket one byte at a time. This continues until all data bytes have been programmed into the device. After programming is completed, the data in the device is automatically compared (verified) with the RAM data to ensure correct programming. If appropriate options are set, device functionality is verified through Logic Fingerprint and/or structured tests (if vectors are present in RAM).

Procedure	Keystroke	Model 60 Displays
1. Select the program operation.	**PROG**	`PG (mfg) (dev)`

2. Accept or (optionally) change the device that is selected, or view associated select codes.	**START**	`ILLEGAL BIT CHK`
		`PROG ARRAY`
		`TEST ARRAY`
		`APPLY VECTORS`
		`TEST FPRINT`
		`PROG DONE XXXX`

	NOTE *APPLY VECTORS and TEST FPRINT will be displayed only if they were previously selected and vectors are present in RAM.*	
	or	
Enter the four hex-digit family/pinout code combination for the device to be copied. Family/pinout codes are listed in the device list included with the User Note. where (mfg) is the manufacturer XX is the family code YY is the pinout code	**X X Y Y**	`PG FXX ^ PYY`

Procedure	Keystroke	Model 60 Displays
	or	
	SCROLL	SELECT DEVICE
	START	PG ^ (mfg)

The **SCROLL** and **REVIEW** key are now active to walk through all of the manufacturers for logic devices.

When the desired manufacturer is displayed	**START**	PG (mfg) ^ (dev)
Choose the manufacturer's device	**SCROLL** or **REVIEW**	
When the desired device is displayed, select device	**START**	PG (mfg) (dev)

NOTE

*If another **SCROLL** key is depressed the Model 60A goes to a menu of select codes associated with the **PROG** key.*

---

3. Insert and lock the blank device into the socket that has an illuminated LED below it. Select the device.

START

```
ILLEGAL BIT CHK      ⊗
PROG  ARRAY          ⊗
TEST  ARRAY          ⊗
APPLY  VECTORS
TEST  FPRINT
PROG  DONE        XXXX
```

NOTE

APPLY VECTORS and TEST FPRINT will be displayed only if they were previously selected and vectors are present in RAM.

---

4. Remove the programmed device from the socket. To program additional, identical devcies using the data stored in RAM, return to step 3.

Output RAM Data To Serial Port

To transfer data (fuse map, test vectors, logic fingerprint, etc.) to the serial port from the programmer RAM, use this operation.

See Remote Control section for serial port setup and cabling. Use the following procedure to transfer the data from the Model 60 RAM to the serial port using front panel control.

	Procedure	Keystroke	Model 60 Displays
1.	Select the output operation.	**OUTPUT**	`OUTPUT PORT 91`
2.	Send the program data to the external source from the programmer	**START**	`OUTPUT PORT 91 ⊗` `OUTPUT DONE XXXX`
		or	
	Use the **SCROLL** key to select any of the required communications parameters.	**SCROLL**	
3.	To repeat the operation, press	**START**	

Edit Operations

The following pages describe use of the programmer's edit function to alter the fuse map stored in the programmer memory. By using the following procedure, you can access the programmer's edit function. For extensive amounts of fuse map editing, the use of a sophisticated development system such as ABEL is recommended.

The individual fuses that make up the fuse map may be changed from blown to unblown, or vice versa. Before beginning the editing of a fuse map, it may be helpful to output the map to a terminal for visual inspection (see the procedure titled "Transmitting the Fuse Map" that follows this one).

EDITING THE FUSE MAP

Use the following procedure to edit the fuse map.

Procedure	Keystroke	Model 60 Displays
1. Go into the select function menu	**SELECT**	SELECT OPTION ^
2. View the options	**SCROLL** or **REVIEW**	FUSE/RAM OPTIONS
3. View the FUSE/RAM OPTIONS until EDIT DATA appears in the display	**START**	EDIT DATA EE
	SCROLL or **REVIEW**	FILL RAM A2 CLEAR ALL RAM A4 FUSE SUMCHECK ED EDIT DATA EE OUTPUT MAP EA UNDER/OVERBLOW CB FUSE FORMAT C4 INVERT RAM A3 * SPLIT RAM A5 * SHUFFLE RAM A6 * BLOCK MOVE A7 SUMCHECK RAM B1
4. Select the EDIT DATA option	**START**	EDIT FUSE ^ XXXXX

NOTE

The last two characters of each display is the Select Code for the operation. Refer to the Select Code section of this manual for more information.

* These options are not applicable to logic device operations.

Procedure	Keystroke	Model 60 Displays
5. Key in the fuse number to be examined or edited. No leading 0's required.	**X X X X**	EDIT FUSE ^ XXXXX
6. Display the state of the fuses in the device and in the programmer's memory.	**START**	FUSE NNNNN DX ^ RX NNNNN: fuse number DX: fuse state in device RX: fuse state in memory
7. Enter the desired state of the fuse into the programmer memory 0 (fuse blown) 1 (fuse intact)	**1** or **0** **START**	FUSE NNNNN DX ^ RX
8. Increment **(START)** or decrement **(REVIEW)** the fuse number	**START** or **REVIEW**	FUSE NNNNN DX ^ RX
9. To return to the prompt for the entry of a new fuse number	**SCROLL**	EDIT FUSE ^ XXXXX

TRANSMITTING THE FUSE MAP

This procedure transmits the fuse pattern contained in the programmer memory to the serial port. With a terminal connected to the serial port, the fuse pattern can be displayed as shown. The fuse pattern is represented by a series of "1"s and "-"s, or a series of "0"s and "X"s.

The "1" or "-" character represents a blown fuse

The "0" or "X" character represents an intact fuse

```
Command : A - Display fuse pattern

      00          10          20
0000  -------X--  ----------  ----
0024  XXXXXXXXXX  XXXXXXXXXX  XXXX
0048  XXXXXXXXXX  XXXXXXXXXX  XXXX
0072  XXXXXXXXXX  XXXXXXXXXX  XXXX
0096  X-X-------  ----------  ----
0120  XXXXXXXXXX  XXXXXXXXXX  XXXX
0144  ----X-----  ----------  ----
0168  --------X-  ----------  ----
0192  ----------  -X-X------  ----
0216  XXXXXXXXXX  XXXXXXXXXX  XXXX
0240  ----------  ----X--X--  ----
0264  ----------  -----XX---  ----
0288  ----------  ----------  -X--
0312  ----------  ----------  ---X
0336  ----------  ---------X  ----
0360  XXXXXXXXXX  XXXXXXXXXX  XXXX
Sumcheck 1BB9

Command :

NOTE: - = open
      X = intact

Fuse Number = First Fuse Number + Increment
```

The fuse states are arranged in a matrix that corresponds to the logic device diagram on the device.

Procedure	Keystroke	Model 60 Displays
1. Output the fuse map to a terminal from the front panel	**SELECT E A**	OUTPUT MAP EA
2. Initiate the output operation	**START**	OUTPUT MAP ⊗ OUTPUT MAP **

Test Operations

After the Model 60 has executed a Load operation, you may check that the data was transferred correctly from RAM to the device by using the Test key. A Test compares the RAM data with the device data, to make sure they match. The programmer always performs a two-pass verify (low and high voltage). However, Select Code CA will allow the user to select a 1 pass verify at a nominal voltage. If the data does not match on a device-to-RAM verify, the programmer will display a two-digit error code. Refer to the error code section of this manual for explanation. The programmer will perform a functional test of the device with test vectors (if vectors are present in RAM and the option is enabled) and Logic Fingerprint (if enabled).

NOTE

*The **TEST** key is also used to select functional tests; go to the end of this section (Test Options) for an explanation of the test options that may be enabled.*

VERIFY RAM DATA AGAINST DEVICE DATA

Use the following front panel keyboard procedure to verify that the data in the Model 60 RAM is the same as the data in the device.

	Procedure	Keystroke	Model 60 Displays
1.	Select the test operation.	**TEST**	TS MFG DEV
2.	Accept	**START**	TEST ARRAY ⊗ APPLY VECTORS ⊗ TEST FPRINT ⊗ TEST DONE XXXX

NOTE

APPLY VECTORS and TEST FPRINT will be displayed only if they were previously selected.

Procedure	Keystroke	Model 60 Displays
	or	
Enter the four hex-digit family/pinout code combination for the device to be tested. Family/pinout codes are listed in the device list included with the User Note. where (mfg) is the manufacturer XX is the family code YY is the pinout code	**X X Y Y**	TS FXX ^ PYY
	or	
	SCROLL **START**	SELECT DEVICE TS ^ (mfg)

The **SCROLL** and **REVIEW** key are now active to walk through all of the manufacturers for logic devices.

When the desired manufacturer is displayed	**START**	TS (mfg) ^ (dev)
Choose the manufacturer's device	**SCROLL** or **REVIEW**	TS (mfg) ^ (dev)
When the desired device is displayed	**START**	TS (mfg) (dev)

NOTE

*If another **SCROLL** key is depressed the Model 60 goes to a menu of select codes associated with the **TEST** key. Refer to the section on Test Options at the end of this section for the available test options.*

Procedure	Keystroke	Model 60 Displays
3. Insert and lock the part to be tested into the socket that has an illuminated LED below it. Select the device.	**START**	TEST ARRAY ⊗ APPLY VECTORS ⊗ TEST FPRINT ⊗ TEST DONE XXXX

NOTE

APPLY VECTORS and TEST FPRINT will be displayed only if they were previously selected and vectors are present in RAM.

4. Remove the device from the socket. To test additional, identical devices using the data stored in RAM, return to step 3.

TEST OPTIONS

The Model 60 offers a choice of device test options that are enabled or disabled by pressing the TEST key on the Model 60 front panel and then scrolling through the test options. The following procedure allows you to access these test options.

Procedure	Keystroke	Model 60 Displays
1. Select the test operation	**TEST**	`TS (mfg) (dev)`
2. Move to the menu associated with the **TEST** key	**SCROLL**	`SELECT DEVICE`

3. Selects the test option selection routine.
 	
The last two characters each display is the Select Code for the option.
Access test options and most other options by entering the select code directly.
	SCROLL
	
	or
	
	REVIEW
		`LIST VECTORS CE`
		`VERIFY PASSES CA`
		`TEST MODES E6`
		`FPRINT CYCLES E8`
		`FPRINT VECTOR E9`
		`* EABLE ELEC ID BD`
		`* DABLE ELEC ID BC`
		`* VIEW ID CD`

4. If you want to select a test option The Test Option Display varies depending on the test option selected and may require additional keystrokes.	**START**	`Test Display`

5. If you want to perform a test, will initiate one or more tests depending on the options selected and the data in RAM.	**START**	`TEST ARRAY (mfg)`
		`APPLY VECTORS`
		`TEST FPRINT`
		`TEST DONE XXXX`

NOTE

APPLY VECTORS and TEST FPRINT will be displayed only if they were previously selected and vectors are present in RAM.

*These options are not applicable to logic device operations.

SELECTING SPECIFIC TEST OPTIONS

Following are the displays and sequences for each of the test options. All of these options can be accessed directly be entering the select code. See the Select Code section of this manual.

Procedure	Keystroke	Model 60 Displays
1. List Vectors	**TEST**	`TS (mfg) (dev)`
	SCROLL	`SELECT DEVICE`
	SCROLL or **REVIEW**	`LIST VECTORS CE`
	START	`LIST VECTORS ( )` — ( ) = on or off
Pressing the **REVIEW** or **SCROLL** key will toggle between ON (allowing vector failures to be output to the serial port) or OFF.		
Select the option	**START**	`TS (mfg) (dev)`
2. Verify Passes	**TEST**	`TS (mfg) (dev)`
	SCROLL	`SELECT DEVICE`
	SCROLL or **REVIEW**	`VERIFY PASSES CA`
	START	`VERIFY PASSES = ( )` — ( ) = 1 or 2
Pressing the **REVIEW** or **SCROLL** keys will toggle between 2 passes and 1 pass. When you have selected the number of verify passes you want, enter	**START**	`TS (mfg) (dev)`

Procedure	Keystroke	Model 60 Displays
3. Test Modes	**TEST**	TS (mfg) (dev)
	SCROLL	SELECT DEVICE
	SCROLL or **REVIEW**	TEST MODES E6
	START	PERFORM ALL TEST
	SCROLL	ARRAY TEST ONLY
	SCROLL	VECTOR + FPRINT
Pressing the **REVIEW** and **SCROLL** keys walks you through the options from Test Modes. When you have selected the Test Mode option you want, enter		
Select the option	**START**	TS (mfg) (dev)
4. Test Modes	**TEST**	TS (mfg) (dev)
	SCROLL	SELECT DEVICE
	SCROLL or **REVIEW**	FPRINT CYCLES E8
	START	FPRINT CYCLES E8
	START	FPRINT CYCLES ^ XX (Fingerprint cycles)
Select the number of Fingerprint cycles you want. If you selected 99, You may choose Fingerprint cycles from 1-99	**9 9**	FPRINT CYCLES ^ 99

Procedure	Keystroke	Model 60 Displays
Press the Review key to change the number of Fingerprint cycles	**REVIEW**	FPRINT CYCLES ^ 00
Enter new number of Fingerprint cycles	**1 5**	FPRINT CYCLES ^ 15
When you have entered the number of Fingerprint cycles you want, enter	**START**	TS (dev) (mfg)
5. Test Modes	**TEST**	TS (mfg) (dev)
	SCROLL	SELECT DEVICE
	SCROLL or **REVIEW**	FPRINT VECTOR E9
Enter starting vector	**START**	START ^ XXXXXXXX (starting vector)
	XXXXXXXX	
Enter the ending vector	**START**	FPRINT ^ XXXXXXXX (ending vector)
	XXXXXXXX	
Select the option	**START**	TS (mfg) (dev)

3. PROGRAMMING WITH MEMORY ADAPTER

This section describes how to program, edit and verify data from the Model 60 programmer front panel with a memory adapter installed. For descriptions of menus and operation from Terminal mode, see the Remote Control section of this manual. Included in this part of the manual is the following information:

- GENERAL OPERATING NOTES — Explains common symbols and messages encountered during programming operations. Read this subsection first, to familiarize yourself with the displays.
- FREQUENTLY USED OPERATIONS — Describes several device and programming operations that are frequently used.
- MENU TREE — Provides a menu structure for each of the memory programming options and shows how to access the functions.
- PROGRAMMING — Describes load and programming operations, which transfer programming data from a source to the Model 60's RAM and then to either the blank device to be programmed or the serial port.
- EDIT OPERATIONS — Explains use of the editing function, accessed by pressing the **SELECT** key. You can then access and change programming data residing in the Model 60's RAM, before that data is programmed into a device.
- TEST OPERATIONS — Describes how to verify data in two locations; for example, between a programmed device and the data in RAM. A Verify checks that the information in both locations is the same, thereby verifying the integrity of the data transfer. Also includes the test options available and how to select them.

OVERVIEW

Prior to programming a device, you must first load (also referred to as copy or transfer) the programmer's RAM with data to be programmed into a particular device. This data may be transferred to RAM from either the serial port, a "master" (previously programmed) device or may be keyed in by hand. You can then transfer that data to the socketed device.

After you transfer the data to the programmer's RAM, you may make any needed corrections by editing the RAM data. After data has been transferred, you may check that the data was transferred correctly by using the Test operation. This compares the data between a device and a location in RAM to make sure they match.

Besides the program, edit and test operations described above, this section includes some general operating notes, frequently used operation descriptions and menu structure.

GENERAL OPERATING NOTES

The following displays and notes are common to nearly all the Load/Program/Test procedures for the Model 60.

The Action Symbol ⊗

A special character is displayed by Data I/O programmers while an operation is being executed. This character is called an action symbol, and appears in the right-most character position of the display. For example, during power up, the programmer automatically performs a self-test routine. While this test is being executed, the programmer will display

```
SELF  TEST  ⊗
```

The "hand" of the action symbol rotates several times while an operation is taking place, to indicate that the programmer is executing the operation.

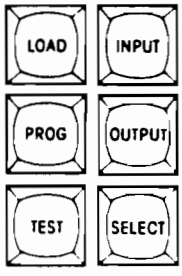
Aborting an Operation

Most operations (except for a few special select functions) may be aborted by pressing one of the keys shown below. If an operation is in process when one of these keys is pressed, the programmer will momentarily display an abort message. The programmer will then assume and display the mode selected. For example, if you abort an operation by pressing the **SELECT** key, the programmer will display

```
FUNCTION  ABORT
```

and then

```
SELECT  OPTION ^
```



FREQUENTLY USED OPERATIONS

Setting the Beginning Address for an Operation

Although setting the beginning address is an optional procedure, you may use it to make transfers when an operation requires use of only a partial amount of a device, RAM or a serial downloaded file. When you have selected the source or destination of the data that you wish to transfer (by pressing the **LOAD**, **INPUT** or **OUTPUT** key), the display will always prompt you for the specific address to begin copying from or to. For example, if you were copying master device data to the programmer's RAM, you would press

LOAD

to instruct the programmer to copy data from the master device. The programmer would display

```
DEV ^ ADDR/SIZE
```

The prompt (^) preceding "ADDR" in the display means that you may change the beginning device address to any address within the range of the device. To change the beginning address, simply key in the hexadecimal address that you want to start copying from. If the hex value that appears in place of "ADDR" is correct, continue to the next step in the procedure. The default address is 00000.

If you enter the incorrect hexadecimal address, press the **REVIEW** key and the display will read

```
DEV ^ 00000/SIZE
```

Enter the correct address.

NOTE

If you set the beginning address, you must also key in the block size (see next paragraph).

Setting the Block Size

You may set the size of the block of data you want to move in the same manner that you could change the beginning address. After you have selected the source of the data you wish to transfer and have pressed the **START** key, the display will always prompt you for the size of the data block that you wish to transfer. For example, if you were copying master device data to the programmer's RAM, you would press

LOAD

START

The programmer would display

```
DEV  XXXXX ^ SIZE
     |
     beginning address
```

The prompt (^) preceding "SIZE" in the above display means that you may change the size of the block of data you wish to transfer. To change the block size, simply key in the hexadecimal number of bytes that you want to transfer. If the hex value that appears in place of "SIZE" is correct, continue to the next step in the procedure. Default value for block size is the device size for device-related operations. For I/O transfers, default is 64K for 16-bit address formats; all of RAM for 8 or 17 bit or more address formats.

NOTE

If you enter an incorrect block size, press the REVIEW key and the display will read

```
DEV  ADDR ^ 00000
```

A zero value will instruct the programmer to use the default value for device-related operations.

Setting the Offset Address

When transferring data through the serial port, you must remember that all of the data that is to be programmed (even if it is only a small part of the data available) must be loaded into the available RAM address space. For translators that support large addresses that could lie above 256K, an offset must be used to relocate the data (during transfer) to usable RAM. Typically, an offset is chosen so that the desired data is loaded beginning at RAM address 00000. As data is received, the offset is subtracted from the address transmitted with the data. (For example, if you set the offset at 00100, port address 00100 would be copied to address 00000 in RAM.)

Keying in Family and Pinout Codes

Each device that Data I/O equipment supports is represented by a hexadecimal two-digit family code and a two-digit pinout code. These codes identify the device to the programmer, to ensure that the proper programming pulses are applied to the part. When you are performing a Program or Test operation, the display will always prompt you to enter this code. For example, if you were programming RAM data into a blank device,

you would press **PROG**

The programmer would then display

```
DEV ^ ADDR/SIZE
```

and then you would press **START**

the programmer would display

```
DEV  ADDR ^ SIZE
```

press **START**

the programmer would display

```
PROG   RAM ^ ADDR
```

press **START**

the programmer would display

```
PG  FAM ^ XX  PIN  YY
```

"XX" and "YY" are the family and pinout codes for the current or default device

or

"PG (mfg) (dev)" if the last part was selected by manufacturer part number.

Now you would enter the two-digit family code and two-digit pinout code for the device being programmed. Family and pinout codes are listed in the device support list included with the User Note accompanying this manual or on the Data I/O wall chart.

CAUTION

Be sure you enter only those family/pinout codes listed in the device table. Invalid codes may cause unpredictable results at the device socket, which may damage the device. Data I/O assumes no responsibility or liability for results produced by entry of illegal family/pinout code combinations.

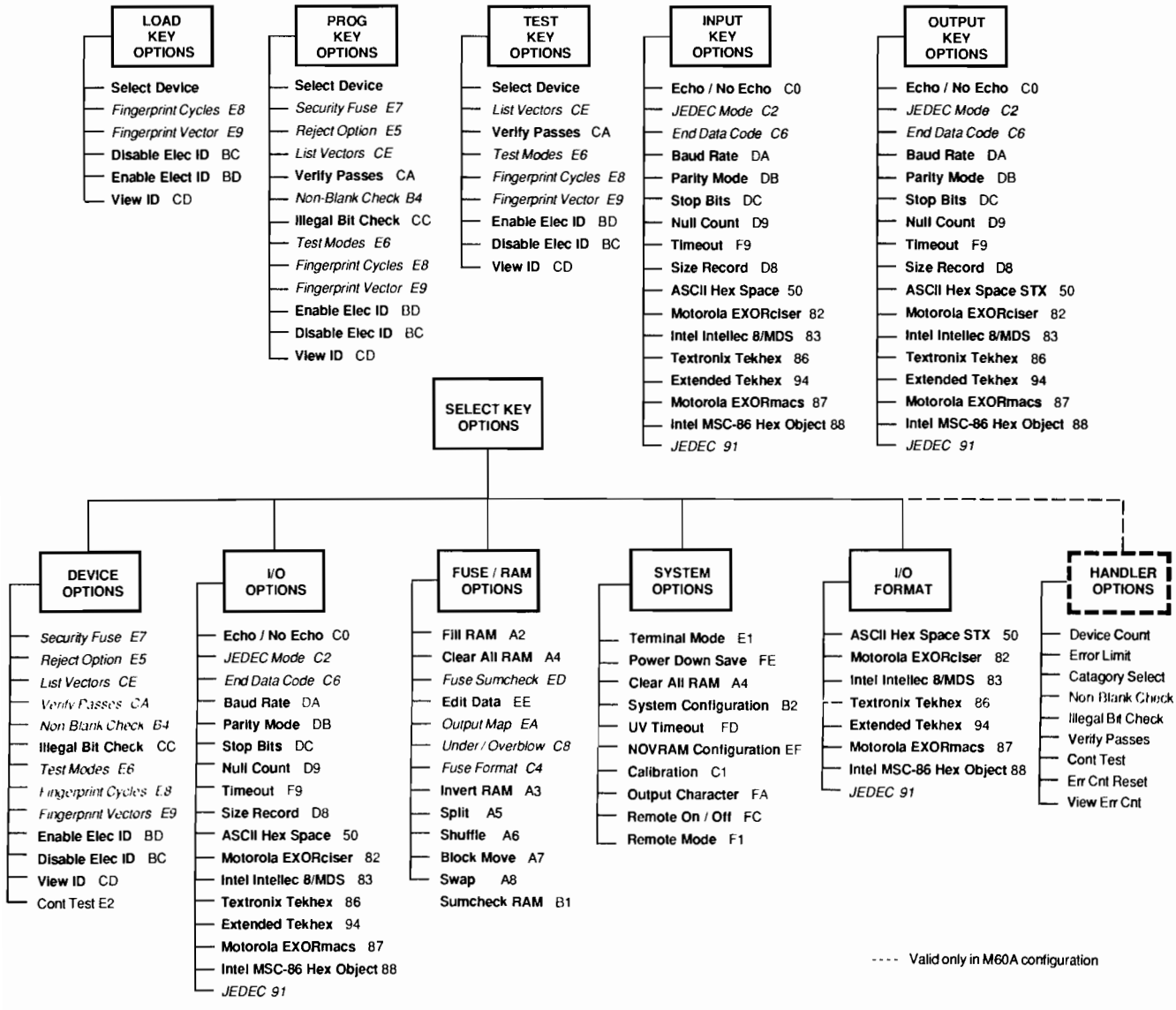
Sumcheck Display

With the EPROM adapter installed and after the Model 60 has performed a Program or Test operation, a six-digit number is always displayed in the right-most display position. This hexadecimal number, called a sumcheck, is used to verify the integrity of a data transfer. For example, if you copy RAM data to the serial port, at the end of the operation the programmer will display

MENU TREE

Refer to the following menu tree as you go through the various program, edit and test operations to find the options available for each function. Refer to the next page to familiarize yourself with moving from one menu level to another. Most functions can be accessed by entering the select code (see the select code section of this manual).

The entries in **BOLD** are the functions that apply when a memory adapter is installed. The other functions will be displayed as you step through the menu options, but will not be active for memory operation. If you try to access a function that does not apply to a memory device, the Model 60 display will show " LOGIC OPTION 3D " in the display.



Interpreting the Menu Tree

- The menu selections for the Mode (blue) keys (**LOAD**, **PROG** and **TEST**) are accessed once you have gone through the selection by pressing the **START** key three times after selecting the current data or changing it. Now press,

SCROLL , the display will read

```
SELECT     DEVICE
```

use the

SCROLL and **REVIEW** keys to walk through the menu selections, pressing

START after a selection will activate that selection

NOTE

The displays will vary depending on the operation selected.

- The menu selections for the **SELECT** key options are accessed by pressing

SELECT , the display will read

```
SELECT     OPTION ^
```

use the

SCROLL and **REVIEW** keys to walk through these menu options

```
DEVICE     OPTIONS
I/O     OPTIONS
FUSE/RAM     OPTIONS
SYSTEM     OPTIONS
I/O     FORMATS
```

pressing

START after any of these options drops you into that menu tree, then by using the

REVIEW and **SCROLL** keys, you walk through those selections, and pressing

START after a selection will activate that selection. Pressing

SELECT at any time will get you out of the secondary menu tree into the menu tree for

```
SELECT OPTION ^
```

PROGRAMMING

The following pages explain how to transfer programming data to RAM and transfer that RAM data to the device to be programmed. A list of the programming operations is given below. The procedures described here are for front panel operation. For programming operations using remote control, see the remote control section of this manual. See the remote control section also for terminal mode menus and descriptions.

Operation	Description
Load RAM With Master Device* Data	Used to transfer data from a master device to the programmer's RAM.
Load RAM From Serial Port	Transfers programming data from a remote system to the programmer's RAM.
Program Device With RAM Data	Copies the programming data from RAM to the device installed in the programming socket.
Block Move	This operation moves a block of RAM data to another location in RAM.
Edit Operations	Allows you to edit data in RAM.
Output RAM Data to Serial Port	Transfers the RAM data to a remote system via the serial port.
Test Operations	Checks the integrity of the device data against RAM data and provides all Model 60 memory operation test options.

*A master device is a previously-programmed device whose data is used as a "source" to program blank devices.

Load RAM With Master Device Data

This operation transfers programming data from a master device to the programmer RAM. When the data transfer is complete, the Model 60 calculates and displays the sumcheck. Use the following procedure to load the Model 60 RAM with data from a master device using the programmer front panel.

Procedure	Keystroke	Model 60 Displays
1. Select the load operation.	**LOAD**	DEV ^ ADDR/SIZE
2. Accept	**START** **START** or	DEV ADDR ^ SIZE LOAD RAM ^ ADDR
(optionally) change the device address and size of block to begin copying from (default is zero)	**X X X X X** **START** **XXXXX** **START**	DEV ^ XXXXX/SIZE beginning address DEV XXXXX ^ SIZE DEV XXXXX ^ XXXXX LOAD RAM ^ ADDR
	NOTE *To specify only block size, press **START** and then key in the size.*	
3. Accept	**START** or	LD FAM ^ PIN YY
(optionally) change the RAM begin address (in hex) to be transferred	**X X X X X** **START**	LOAD RAM ^ XXXXX LD FAM ^ XX PIN YY

Procedure	Keystroke	Model 60 Displays
4. Enter the four hex-digit family/pinout code combination for the device to be copied. Family/pinout codes are listed in the device list included with the User Note.	**X X**	`LD FAM ^ XX PIN YY`
	Y Y	`LD FAM XX PIN ^ YY`
	or	

NOTE

"XX" and "YY" are the family and pinout codes associated with the part previously displayed. You may now enter a new family/pinout code. The display "LD FAM XX PIN XX" appears if the last device was selected by family/pinout code. The display "LD (mfg) (dev)" appears if the last device was selected by manufacturer and part number.

The **SCROLL** and **REVIEW** keys are now active to walk through all of the manufacturers for memory devices.

Review the manufacturers	**SCROLL** **START** **REVIEW** or **SCROLL**	`SELECT DEVICE` `LD (mfg)`
Select the manufacturer	**START**	`LD (mfg) (dev)` device name
Review the selected manufacturers devices	**SCROLL** or **REVIEW**	`LD (mfg) (dev)`
Select the device	**START**	`LD (mfg) (dev)`

Procedure	Keystroke	Model 60 Displays
5. Insert and lock the master device into the socket. The LED will be illuminated during the load operation.	**START**	LOADING DEVICE ⊗ LOAD DONE XXXXXX
6. Remove the master device from the socket. To repeat the load operation from another device with the same family and pinout codes, return to step 5.		

Load RAM From Serial Port

To transfer data received at the serial port to the programmer RAM, use this operation. When transfer is completed, the programmer calculates and displays the sumcheck of the transferred data and will signal an error if it does not match the one received with the data.

After setting up the serial port and selecting the appropriate data translation format (see remote control section), use the following procedure to load the Model 60 RAM with incoming serial port data, using front panel control.

Procedure	Keystroke	Model 60 Displays
1. Select the input operation.	**INPUT**	PO ^ ADDRESS/SIZE
2. Enter port offset, block size, and RAM address parameters	**X X X X X X** **START** **X X X X X X** **START** **X X X X X X** **START** or	PO ^ XXXXXX/SIZE PO XXXXXX ^ SIZE PO XXXXXX ^ XXXXX address block size INPUT RAM ^ ADDR INPUT RAM ^ XXXXX INPUT PORT XX ⊗
Accept	**START** **START** **START**	PO ^ ADDRESS ^ SIZE INPUT RAM ^ ADDR INPUT PORT XX
3. Load the program data from the external source into the programmer	**START**	INPUT PORT XX ⊗ I/O format number

NOTE

The programmer will wait for input from the serial port. A timeout of 25 seconds is invoked but can be disabled by entering the I/O OPTIONS menu and disabling the timeout.

Procedure	Keystroke	Model 60 Displays
4. Set up the source to transmit the data to the programmer. When the downloading operation to the programmer is complete, the Model 60 displays		INPUT DONE XXXXXX
5. To repeat the input operation press	**START**	

Program Device With RAM Data

Before programming a device, the system automatically performs illegal bit tests and blank checks at nominal VCC, to verify the ability of the device to accept programming data. You can bypass the illegal bit check by using Select Code CC and using the **START**, **SCROLL** and **REVIEW** keys to turn Illegal Bit check off. Data is then programmed into the device in the socket one byte at a time. This continues until all data bytes have been programmed into the device. After programming is completed, the data in the device is automatically compared (verified) with the RAM data to ensure correct programming.

Procedure	Keystroke	Model 60 Displays
1. Select the program operation.	**PROG**	DEV ^ ADDR/SIZE
2. Accept	**START**	DEV ADDR ^ SIZE
	or	
(optionally) change the device address to begin copying from (default is zero)	**X X X X X** **START**	DEV ^ XXXXX/SIZE DEV XXXXX ^ SIZE
3. Accept	**START**	PROG RAM ^ ADDR
	or	
(optionally) change the block size (in hex) of data to be transferred.	**X X X X X** **START**	DEVICE XXXXX ^ XXXXX PROG RAM ^ ADDR
4. Accept	**START**	PG FAM ^ XX PIN YY
	or	
(optionally) change the begin RAM address of the block (in hex) to be transferred.	**X X X X X** **START**	PROG RAM ^ XXXXX PG FAM ^ XX PIN YY

Procedure	Keystroke	Model 60 Displays
5. Enter the four hex-digit family/pinout code combination for the device to be copied. Family/pinout codes are listed in the device list included with the User Note.	**X X**	`PG FAM ^ XX PIN YY`
	Y Y	`PG FAM XX PIN ^ YY`
	or	

NOTE

"XX" and "YY" are the family and pinout codes associated with the part previously displayed. You may now enter a new family/pinout code. The display "PG FAM ^ XX PIN XX" appears if the last device was selected by family/pinout code. The display "PG (mfg) (dev)" appears if the last device was selected by manufacturer and part number.

The **SCROLL** and **REVIEW** keys are now active to walk through all of the manufacturers for memory devices.

Review the manufacturers	**SCROLL** **START** **REVIEW** or **SCROLL**	`SELECT DEVICE` `PG (mfg)`
Select the manufacturer	**START**	`PG (mfg) (dev)` device name
Review the selected manufacturers devices	**SCROLL** or **REVIEW**	`PG (mfg) (dev)`
Select the device	**START**	`PG (mfg) (dev)`

Procedure	Keystroke	Model 60 Displays
6. Insert and lock the master device into the socket.	**START**	TEST DEVICE PROGRAM DEVICE VERIFY DEVICE PROG DONE XXXXXX
7. Remove the programmed device from the socket. To repeat the programming operation from another device with the same family and pinout codes, return to step 6.		

Block Move

A block move copies data in one block of RAM locations to another block of RAM locations, beginning at a defined address. Use the following front panel keyboard procedure to copy a block of data from one location in RAM to another location in RAM:

Procedure	Keystroke	Model 60 Displays
1. Select the block move operation	**SELECT A7**	BLOCK MOVE A7
2. Accept	**START** **START** **START** or	SRC ^ADDR/SIZE SRC ADDR ^ SIZE DEST ^XXXXX
(optionally) change the source RAM address to begin copying from (default is zero) and/or the size of the block (in hex) to be transferred.	**START** **X X X X X** **START** **X X X X X** **START**	SRC ^ADDR/SIZE SRC ^XXXXX/SIZE SRC XXXXX ^ SIZE SRC XXXXX ^ XXXXX DEST ^XXXXX
	NOTE *To specify only block size, press **START** twice and then key in the size.*	
3. Accept	START or	BLOCK MOVE **
(optionally) change the destination RAM address to begin copying data to (default is zero)	**X X X X X** **START**	DEST ^XXXXX BLOCK MOVE **

Edit Operations

The following pages describe the programmer's edit function and how to access it. As of Version 11 (V11.0), the Model 60 supports several megabit devices. The programmer display will vary depending on the size of the device you are editing. See the following procedure for editing byte-wide and word-wide parts.

(Hexadecimal is the default value.) When keying in data, you may only key in values allowed in the Hex number base.

NOTE

*If you attempt to edit an address outside the range of the device, two asterisks will appear in the Model 60's display (D**).*

CAUTION

If you start the edit operation with an empty socket, using select code EE, and then insert a device, the Model 60 will display invalid data. Exit the EE mode by pressing any function key and select EE again.

EDITING DATA

Use the following procedure to edit data in a RAM address using the hexadecimal number base. Editing byte-wide and word-wide devices with the Model 60 and the EPROM adapter uses the same procedure, except the Model 60 display after step 4 will be different.

Procedure	Keystroke	Model 60 Displays
1. Go into the select function menu, then press **SCROLL** or **REVIEW** until FUSE/RAM OPTIONS appears in the display	**SELECT** **SCROLL** or **REVIEW** **START**	SELECT OPTION^ FUSE/RAM OPTIONS
2. Choose the EDIT DATA option by pressing **SCROLL** or **REVIEW** until EDIT DATA EE	**SCROLL** or **REVIEW**	EDIT DATA EE
3. Initiate edit	**START**	EDIT ADDR ^ 00000
4. Key in the hex RAM address to be edited. If the address is already correct, go to the next step.	**X X X X X**	EDIT ADDR ^ XXXXX

Procedure	Keystroke	Model 60 Displays
5. Initiate the edit operation. The new data is displayed.	**START**	HHHHH (address) DHH (device data) ^ RHH (RAM data)
6. Press one of the following keys to increment (+ 1), or decrement (- 1) the edit address. Enter new data at desired address.	**START** **REVIEW** **START** increments (+ 1) to edit the next higher RAM location. **REVIEW** decrements (- 1) to edit the next lower RAM location.	
7. Press any of the six keys (LOAD, PROG, TEST, INPUT, OUTPUT, SELECT) to exit from the EDIT operation.		

NOTE

If you are editing a megabit device, the Model 60 will display the following.

5. Initiate the edit operation. The new data is displayed.	**START**	HHHHH (address) FFFF (device data) ^ FFFF (RAM data)
6. Press one of the following keys to increment (+ 1), or decrement (- 1) the edit address. Enter new data at desired address.	**START** **REVIEW** **START** increments (+ 1) to edit the next higher RAM location. **REVIEW** decrements (- 1) to edit the next lower RAM location.	
7. Press any of the six keys (LOAD, PROG, TEST, INPUT, OUTPUT, SELECT) to exit from the EDIT operation.		

Output RAM Data To Serial Port

To transfer data to the serial port from the programmer RAM, use this operation.

After setting up the serial port and selecting the appropriate data translation format (see remote control section), use the following procedure to transfer the data from the Model 60 RAM to the serial port using front panel control.

Procedure	Keystroke	Model 60 Displays
1. Select the output operation.	**OUTPUT**	PO ^ADDRESS/SIZE
2. Accept	**START** **START** **START**	PO ADDRESS ^ SIZE OUTPUT RAM ^ ADDR OUTPUT PORT XX I/O format number
3 Initiate	**START**	OUTPUT PORT XX ⊗ OUTPUT DONE XXXXXX
	or	
Use the **SCROLL** key to select any of the required communications parameters.	**SCROLL**	
4. To repeat the output operation press	**START**	OUTPUT PORT XX OUTPUT DONE XXXXXX

Test Operations

After the Model 60 has executed a Load or Program operation, you may check that the data was transferred correctly between RAM and the device by using the Test key. A Test compares the RAM data with the device data, to make sure they match. The programmer normally performs a two-pass verify (low and high voltage). However, Select Code CA will allow the user to select a 1 pass verify at a nominal voltage. If the data does not match on a device-to-RAM verify, the programmer will display the address location where the error occurs, and also indicate whether the high or low voltage verify failed.

NOTE

*The **TEST** key is also used to select functional tests; go to the end of this section (Test Options) for an explanation of the test options that may be enabled.*

VERIFY RAM DATA AGAINST DEVICE DATA

Procedure	Keystroke	Model 60 Displays
1. Select the test operation.	**TEST**	DEVICE ^ ADDR/SIZE
2. Accept	**START**	DEVICE ADDR ^ SIZE
	or	
(optionally) change the device address to begin copying from (default is zero)	**XXXXX** **START**	DEVICE ^ XXXXX/SIZE DEVICE XXXXX ^ SIZE address

Procedure	Keystroke	Model 60 Displays
3. Accept	**START**	TEST RAM ^ ADDR
	or	
(optionally) change the size of the block (in hex) to be transferred.	**X X X X X** **START**	DEVICE XXXXX ^ XXXXX TEST RAM ^ ADDR
4. Accept	**START**	TS FAM ^ XX PIN YY
	or	
change RAM address to begin testing at	**X X X X X** **START**	TEST RAM ^ XXXXX TS FAM ^ XX PIN YY
5. Enter the four hex-digit family/pinout code combination for the device to be copied.	**X X**	TS FAM XX PIN YY
Family/pinout codes are listed in the device list included with the User Note.	**Y Y**	TS FAM XX PIN ^ YY
	or	

NOTE

"XX" and "YY" are the family and pinout codes associated with the part previously displayed. You may now enter a new family/pinout code. The display "TS FAM XX PIN XX" appears if the last device was selected by family/pinout code. The display "TS (mfg) (dev)" appears if the last device was selected by manufacturer and part number.

The **SCROLL** and **REVIEW** keys are now active to walk through all of the manufacturers for memory devices.

Procedure	Keystroke	Model 60 Display
Review the manufacturers	**SCROLL** **START** **REVIEW** or **SCROLL**	SELECT DEVICE TS (mfg)
Select the manufacturer	**START**	TS (mfg) (dev) device name
Review the selected manufacturers devices	**SCROLL** or **REVIEW**	TS (mfg) (dev)
Select	**START**	TS (mfg) (dev)
6. Initiate test	**START**	VERIFY DEVICE ⊗ TEST DONE XXXXXX

SELECTING SPECIFIC TEST OPTIONS

Following are the displays and sequences for each of the test options. All of these options can be accessed directly by entering the Select Code shown in the display below. See the Select Code section of this manual for further descriptions.

Procedure	Keystroke	Model 60 Displays
1. If you want to select a test option	**SELECT**	`SELECT OPTION^`
Walk through the various test options until DEVICE OPTIONS appears in the display	**SCROLL** or **REVIEW**	`DEVICE OPTIONS`

NOTE

The last two characters of each display is the Select Code for the operation. Refer to the Select Code section of this manual for more information.

These are the test options that will be displayed

```
* SECURITY FUSE    E7
* REJECT OPTION    E5
* LIST VECTORS     CE
  VERIFY PASSES    CA
* NON-BLANK CHK    B4
  ILLEGAL BIT      CC
* TEST MODES       E6
* FPRINT CYCLES    E8
* FPRINT VECTOR    E9
  EABLE ELEC ID    BD
  DABLE ELEC ID    BC
  VIEW ID          CD
  CONT TEST        E2
```

2. Select the test option	**START**	`Test Option Display`

NOTE

The Test Option Display varies depending on the test selected.

*These options are not applicable to memory device operations.

4. REMOTE CONTROL

INTRODUCTION

This section of the manual contains the following information:

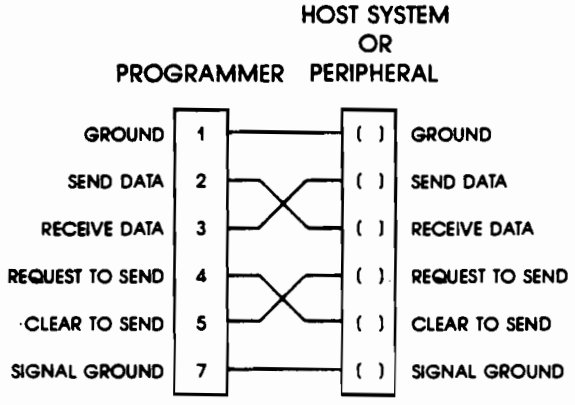
- SYSTEM SETUP — Explains how to set up the Model 60 for remote control operation. Includes information on setting the baud rate, parity and stop bits, and setting up the RS232-C serial port.
- COMPUTER REMOTE CONTROL (CRC) OPERATION — Describes operation of the Model 60 under CRC. Includes a complete command summary.
- TERMINAL OPERATION — Describes how to execute all the Model 60's commands from a local terminal's keyboard. (Terminal operation is only valid in the Model 60A configuration.)
- DATA TRANSLATION FORMATS — Defines the data translation formats compatible with the Model 60A. Includes a complete list of all the formats, with examples of each.
- HANDLER INTERFACE — The Model 60 may be operated with an IC handler. If you are interested in receiving handler interface equipment, contact your nearest Data I/O representative. A list of Data I/O offices may be found at the back of this manual.

SYSTEM SETUP

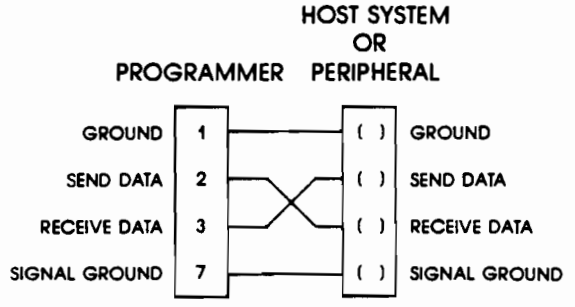
Setting up the Model 60 for use in remote mode consists of the following steps: connecting the RS-232C cable, setting parity, baud rate and stop bits, and verifying that proper communications have been established. This subsection of the manual explains how to set up the Model 60 for remote mode operation.

Serial Port Connection

The figure below shows the pinout for the RS-232C connection between the Model 60 and a host system or peripheral. Both the handshake and no-handshake configurations are shown. In general, you may use a simple three-wire hookup without hardware handshake lines (send, receive, and ground only).



a) RS232C Connection, Half/Full Duplex, with Handshake



b) RS232C Connection, Half/Full Duplex, without Handshake

NOTES:

1 All signals are named with respect to the originating unit
2. All undesignated pins are to be left open
3. For applications that do not require handshaking, the programmer's clear to send line is pulled up internally
4 Host system's pin numbers are left blank so that you can fill in the designators for your terminal or computer

Parity, Baud Rate, and Stop Bits

The Model 60's parity, baud rate, and stop bit settings are all chosen via select codes keyed on the front panel. Select code DA sets baud rate, DB sets parity, and DC sets the number of stop bits. See the select codes section of this manual for more details.

Entering and Exiting Remote Mode

To place the Model 60 into remote mode, press **SELECT F 1 START** . The programmer will then display

```
REMOTE MODE    ⊗
```

To exit from remote mode, press **Z RETURN** from the terminal's keyboard, or press the **LOAD, PROG, TEST, INPUT, OUTPUT,** or **SELECT** keys on the Model 60's keyboard.

Verifying Proper Communication

The first thing that the driver program should do is verify that the computer and the programmer are communicating properly. To do this, use the H (no-op) command. This command causes the Model 60 to return a prompt.

CRC Response Characters

There are three characters transmitted during CRC operation, that indicate the Model 60's response to a command:

> ? F

> means that the command sent was successfully executed.

? A **?** character sent to the terminal means that the programmer either does not understand the command that was typed in, or that the command was invalid.

F Whenever an error occurs, the Model 60 sends an **F** to the computer. (You may then find out more information about the error by sending the **X** command. The **X** command tells the programmer to send a list (up to 16) of the last errors that occurred).

CRC OPERATION

CRC commands are shown in the following table, and described more in detail on the pages that follow. When typing in CRC commands, remember that the Model 60 recognizes only upper-case letters. Commands shown here that contain both upper- and lower-case letters indicate a value that should be typed in. For example, the family/pinout code selection command is shown as ffpp@, meaning that you need to type the family code ("ff"), then the pinout code ("pp"), followed by "@".

CRC Command Summary

Type of Command	Command Description	Command Sent	Logic/ Memory Only	Model 60's Response
CONTROL SYSTEM	No operation			
	(used when enabling CRC)	H		>
	Execute operation	<cr>		>
	Abort operation	<esc>		>
	Abort and reset system	<break>		>
	Exit CRC mode	Z		none
	Save system default	FE]		>
DISPLAY CONFIGURATION	Show software version	G		nnnn>
	Display device characteristics	R		aaaa/b/c>
	Show checksum	S		hhhh>
	Show NOVRAM configuration	EF]		hhhh>
	Show current family/pinout code	[		ffpp>
	Send electronic ID of device	CD]	MO	nn..nn>
SET I/O PARAMETERS	Disable timeout	=	MO	>
	Select odd parity	D		>
	Select even parity	E		>
	Select one stop bit	J		>
	Select two stop bits	K		>
	Select no parity	N		>
	Set nulls	hhU		>
	Set translator format	cnnA		>
	Select type of JEDEC format	C2]	LO	>
	Set I/O address offset	nnnnW		>

NOTE

"LO" (logic only) and "MO" (memory only) indicate whether a particular command is specific to memory or logic device operation.

Type of Command	Command Description	Command Sent	Logic/ Memory Only	Model 60's Response
PERFORM I/O OPERATIONS	Compare RAM with host	C	MO	>
	Input data	I		>
	Output to host	O		>
	Output fuse map	EA]	LO	>
EXECUTE PROGRAMMING COMMANDS	Select family/pinout codes	ffpp@		>
	Load data into RAM	L		>
	Program socketed device	P		>
SELECT DEVICE TESTS	Performs non-blank check	B		>
	Performs illegal-bit check	T		>
	Test socketed device	V		>
	Disable electronic ID check	BC]	MO	>
	Enable electronic ID check	BD]	MO	>
	Enable/disable under/overblow	C8]	LO	>
	Select number of verify passes	CA]		>
	Select reject count	E5]	LO	>
	Select logic test mode	E6]	LO	>
	Enable/disable security fuse	E7]	LO	
	Select number of test cycles	E8]	LO	>
MANIPULATE MEMORY/DEFINE DATA BLOCK	Clear RAM	^		>
	Fill RAM	A2]		>
	Split RAM data	hhhhh?	MO	
	Shuffle RAM data	hhhhh>	MO	>
	Swap bytes	hhhhh>	MO	>
	Set begin RAM address	hhhhh<	MO	>
	Set block size	hhhhh;	MO	>
	Set begin device address	hhhhh:	MO	
	RAM/RAM block move	\	MO	>
MANIPULATE LOGIC DATA	Select fuse representation	C4]	LO	>
	List vectors	CE]	LO	>
	Select starting vector/fingerprint	E9]	LO	>
CHECK ERROR STATUS	Send error code numbers	X		nn..nn>

NOTE

"LO" (logic only) and "MO" (memory only) indicate whether a particular command is specific to memory or logic device operation.

Detailed Command Listing

CONTROL SYSTEM COMMANDS

H — NO OPERATION — Instructs the Model 60 to perform no operation, but just return the prompt character, ">" followed by the carriage return and optional line feed.

<cr> — EXECUTE OPERATION — Tells the Model 60 to execute the command just typed in.

<esc> — ABORT — Halts the command that was being executed.

<break> — ABORT AND RESET — Tells the Model 60 to halt the command that was being executed and return a prompt.

Z — EXIT — Returns control to the Model 60's keyboard.

CONFIGURATION COMMANDS

G — CONFIGURATION INQUIRY — Instructs the Model 60 to return the software configuration information. The programmer will then return "hhhh", the 4-digit hex checksum of the Model 60's data PROMs. This number is used when calling Data I/O Service Centers for update information.

R — DISPLAY DEVICE CHARACTERISTICS — Instructs the Model 60 to return the attributes of the device selected by the current family and pinout code. Data is output in the form "AAAA/B/C" where "AAAA" is the device's word limit in hex, "B" is the word size in decimal and "C" = 1 (VOL) or 0 (VOH). For logic devices, "AAAA" indicates the number of fuses.

S — VIEW CHECKSUM — Instructs the Model 60 to calculate the checksum of the RAM data. For memory devices, the checksum starts at the beginning of user RAM and continues for the word limit (device size) of the selected device. The calculated checksum is returned as a 4-digit hex number, "HHHH".

CD] — SEND ELECTRONIC ID OF DEVICE — Instructs the Model 60 to send to the terminal the electronic ID of the socketed device.

EF] — SHOW NOVRAM CONFIGURATION — Outputs to the terminal the 4-digit NOVRAM configuration, useful when contacting Data I/O Service Centers for update information.

[— VIEW CURRENT FAMILY/PINOUT CODE — Instructs the Model 60 to output the family and pinout code currently in effect. The family and pinout codes are returned in the form "FFPP", where "FF" is the 2-digit family code and "PP" is the 2-digit pinout code.

I/O PARAMETERS COMMANDS

=	DISABLE TIMEOUT — Disables the I/O timeout, which means that when data is downloaded to the Model 60, it will wait indefinitely for the data to arrive (no error condition will be signalled).
cffA	SET TRANSLATION FORMAT — Selects the instrument control code "c" and the data translation format "ff" to be used for I/O data transfers on the remote port. The default is JEDEC, code 91. From 1 to 3 digits must precede the command. If 1 or 2 digits precede the command, they define the data translation format and the instrument control code defaults to 0. If 3 digits precede the command, the first digit designates the instrument control code and the last two digits specify the format code. The data translation formats and the instrument control codes are described later in this section.
D	SET ODD PARITY — Instructs the Model 60 to set odd parity on the remote port for output data and inspect incoming data for odd parity.
E	SET EVEN PARITY — Instructs the Model 60 to set even parity on the remote port for output data and inspect incoming data for even parity.
J	SET 1 STOP BIT — Sets one stop bit for serial data transfers through the remote port.
K	SET 2 STOP BITS — Sets two stop bits for serial data transfers through the remote port.
N	SET NO PARITY — Instructs the Model 60 not to check parity on incoming data and to output data without parity through the remote port.
hhU	SET NULLS — Sets the number of nulls ("hh") after a carriage return on output data transfer operations. This command also enables/disables sending of a line feed after every carriage return sent out (for responses, too). This command must be preceded by 1 or 2 hex digits that determine the number of nulls to be sent. If the null count is set to 80 (hex), no line feeds will be sent after each carriage return. If no parameter precedes the command, the number of nulls defaults to zero and line feeds are enabled.
hhhhhhW	SET I/O OFFSET — Sets the I/O offset address to be used in I/O operations. Depending on the translator selected, up to eight hex digits may precede the command. If "FFFF" precedes the command, the default I/O offset value 0 is used on output and the first incoming address is used on input. If no parameter precedes the command, the I/O offset is set to 0. On input operations, the address where the data is placed in RAM is calculated by taking the incoming address, subtracting the I/O offset and adding the memory begin address. On output, the outgoing address is calculated by adding the I/O offset.
C2]CR nCR	SELECT TYPE OF JEDEC FORMAT — Allows you to choose either the JEDEC "full" ("0"), code 91, or "kernel" ("1") mode, code 92, for translation of logic device data. Type "C2]n", where "n" is the number—either 0 or 1— representing the JEDEC mode you want to use.

I/O OPERATIONS COMMANDS

C — COMPARE RAM WITH HOST — Instructs the Model 60 to compare data in the Model 60's RAM with data received through the remote port using the current data translation format. (JEDEC format cannot be used with this command). This command only works for memory devices. The current memory begin address and I/O offset are used to calculate the RAM address where the data is located to compare against the incoming data.

I or EB] — INPUT FROM PORT — Instructs the Model 60 to accept formatted data from the remote port using the currently selected data translation format and put it into RAM. For memory devices, the current memory begin address and I/O offset are used to calculate the RAM address where the input data is put. For logic devices, all of the fuse map and structured vectors will be received and placed in RAM at the corresponding position. The format will be JEDEC if a logic device is selected.

O or EC] — OUTPUT TO PORT — Instructs the Model 60 to output data using the current translation format to the remote port. For memory devices the current parameter settings for memory block size, memory begin address, and I/O address offset are used. The complete fuse map and structured vectors will be output for logic devices. The format will be JEDEC if a logic device is selected.

EA] — OUTPUT FUSE MAP — Instructs the programmer to output the device's fuse map through the serial port. You may select an end-of-data code to send following the file, using select code C6. Code C6 is only accessible in front panel mode, not in CRC mode.

PROGRAMMING COMMANDS

ffpp@ — SELECT FAMILY/PINOUT CODES — Selects the family and pinout codes for the device to be programmed. Type in the 2-digit hex family and pinout codes, "ffpp", followed by "@".

L — LOAD RAM FROM DEVICE — Instructs the Model 60 to load data from the currently selected device to the Model 60's RAM. For memory devices, the first device address copied from (device begin address), the first RAM address copied to (memory begin address), and the size of the block copied (memory block size) can all be specified prior to executing this command. In the case of logic devices, the entire device is loaded.

P — PROGRAM SOCKETED DEVICE — Instructs the Model 60 to program a device with data in RAM. For memory devices, the first address to program from (memory begin address), the number of bytes to program (memory block size) and the first device address to program (device begin address) can be specified prior to executing this command. For logic devices, the entire device is programmed.

DEVICE TESTS COMMANDS

B	BLANK CHECK — Instructs the Model 60 to search the device to insure that no bits are programmed.
T	ILLEGAL-BIT TEST — Instructs the Model 60 to test the selected device for illegal bits. An illegal bit is defined as a programmed bit in the device that does not exist in RAM.
V	VERIFY DEVICE — Instructs the Model 60 to verify device data with the data in RAM. For memory devices, the memory begin address, device begin address and memory block size can be set prior to the execution of this command. For logic devices, the entire device is verified.
BC]	DISABLE ELECTRONIC ID CHECK — Instructs the Model 60 to disable the electronic ID check, meaning that the socketed device's ID will not be checked with the algorithm in the programmer's software.
BD]	ENABLE ELECTRONIC ID CHECK — Instructs the Model 60 to enable the electronic ID check, meaning that the socketed device's ID will be checked with the algorithm in the programmer's software.
C8]CR nCR	ENABLE/DISABLE UNDER/OVERBLOW — Enables or disables testing for under/overblown fuses in the socketed device. An "underblow" condition means that the socketed device contains an intact fuse, but the data in RAM indicates it should have been blown. An "overblow" means that the device fuse is blown, but should have been left intact. Type "C8]CRnCR" to invoke this feature, where "n" is either "0" or "1": "0" disables and "1" enables under/overblow testing. This information will be displayed during fuse editing.
CA]CR nCR	SELECT NUMBER OF VERIFY PASSES (0,1) — Selects the number of verify passes ("n") to be performed. "0" selects a two-pass verify, at the manufacturer's high and low Vcc levels. "1" selects a one-pass verify, performed at the manufacturer's nominal Vcc level.
E2]CR nCR	CONTINUITY TEST (0,1) — Enables or disables testing for proper insertion of the device, for backward insertion of the device, or for continuity testing. 0 selects off, 1 selects on.
E5]CR nCR	REJECT COUNT (0,1) — Selects the number of times ("n") that the socketed part will be pulsed with programming voltage, before it is rejected as unprogrammable. Choosing "0" selects the commercial (manufacturer's) number of pulses. Choosing "1" (single) selects one-pulse programming. In general, unless you are programming devices to a strict military specification, you may leave this option set at "0". The default value is the manufacturer's number of programming pulses.
E6]CR nCR	SELECT LOGIC TEST MODE — Chooses the type of fuse testing to be performed. "0" selects all tests (fuse array, structured vector and Logic Fingerprint). "1" selects only the fuse array test. "2" selects both the structured vector and Logic Fingerprint tests.

E7]CR nCR — SET/CLEAR ENABLE/DISABLE SECURITY FUSE — Enables/disables security fuse programming and sets the state of the security fuse. The command must be followed by a 1-digit decimal number that is one of the allowable options defined below:

0 — Disables programming and sets the security fuse state in RAM to 0.

1 — Disables programming and sets the security fuse state in RAM to 1.

2 — Enables programming and sets the security fuse state in RAM to 0.

3 — Enables programming and sets the security fuse state in RAM to 1.

E8]CR nnCR — SELECT NUMBER OF TEST CYCLES — Sets the number of cycles to be performed during the Logic Fingerprint test, where "nn" is the decimal number of cycles to be perfomed. Any number between 00 and 99, inclusive, may be entered. Typing "00" disables this function.

MANIPULATE MEMORY/DEFINE DATA BLOCK COMMANDS

A2]CR nCR — FILL FUSE MAP — Specifies the fuse state with which to fill the fuse map. The command must be followed by a 1-digit decimal number ("n") defining the state of the fuse:

0 — Fills the fuse map in RAM with 0's.

1 — Fills the fuse map in RAM with 1's.
For memory devices, the command must be followed by a two-digit hexadecimal number.

hhhhh: — SELECT DEVICE BEGIN ADDRESS — Sets the first device address to be programmed/read. This device begin address is also used as the destination address in a RAM-RAM block move. From 1 to 5 hex digits may precede the command. A default address of 0 is set if no digits precede the command.

hhhhh; — SELECT MEMORY BLOCK SIZE — Sets the number of bytes to be uploaded or programmed. From 1 to 5 hex digits may precede this command. In the Model 60, both the memory block size as well as the device block size are set by this command. A default block size of 00000 is set if no digits precede the command. 00000 sets the block size equal to the selected device's word size for device operation, and sets the block size equal to all of RAM for I/O operations.

hhhhh< — SELECT BEGIN ADDRESS—Sets the first RAM address from which or to which data is to be transferred. This first RAM address is also used as the origination address in a RAM-RAM block move. From 1 to 5 hex digits may precede the command. The default address is 00000.

^ — CLEAR RAM — Instructs the Model 60 to clear every address. The memory begin address and memory block size values should be set prior to execution of this command. If the memory block size is set to 0000, the user memory size value determines the number of bytes to fill. If a value has not been specified, the fill pattern defaults to zeros.

hhhhh? SPLIT RAM DATA — Splits a block of 16-bit-wide word data into two 8-bit- wide blocks around the given midpoint ("hhhhh"), for programming into 8- bit-wide devices. The split places even-addressed bytes into consecutive addresses starting at address 0000, and places odd-addressed bytes into consecutive addresses starting with the specified midpoint. This splits the data into two adjacent blocks occupying the same original block of RAM. The specified midpoint must be a power of two between 2 and the RAM midpoint.

hhhhh> SHUFFLE RAM DATA — Reverses the split operation, converging two adjacent blocks of 8-bit-wide data into one block of 16-bit-wide data occupying the same original block of RAM.

? SWAP BYTES — Swaps odd and even bytes, when enabled, at odd and even address locations during a load, program or verify operation. The organization of bytes in RAM is not altered. Swapping bytes is useful when manipulating 16-bit data, when the target system has a different architecture than the original. For example; Motorola 16-bit data files store the most significant bytes at even-byte locations; Intel stores them at odd-byte locations. The Model 60 maintains its RAM and file data with the convention that the most significant byte of a 16-bit word resides in the even byte of memory.

\ MOVE MEMORY BLOCK — Instructs the Model 60 to move data from one RAM location to another. The memory begin address, device begin address and memory block size should be set prior to execution of this command. The memory begin address is used for the source address. The device begin address is used for the destination address and the memory block size determines the number of bytes to move. If the memory block size had been previously set to 0, the user memory size determines the number of bytes to move.

MANIPULATE LOGIC DATA COMMANDS

C4]CR nCR SELECT FUSE REPRESENTATION — Sets the display format for the fuse map. Selecting "0" will cause fuse data to be represented on the terminal in "X/-" format. "1" selects a "0/1" fuse format. X's and 0's represent intact fuses.

CE]CR nCR LIST VECTORS — Instructs the programmer to either enable or disable the listing of failed device test vectors output from the serial port. If you enable this function, by defining "n" as a "1", test vectors for the device which have failed will be shown on the terminal during device testing.

E9]CR ssssssssCR ffffffffCR SELECT STARTING VECTOR/FINGERPRINT — Allows selection of a starting vector ("s") and the expected Logic Fingerprint ("f"). "s" and "f" must be entered as 8-digit hex numbers.

DEVICE HANDLER COMMANDS

%CR HANDLER WAIT — Puts the programmer into a waiting state until the handler indicates a start condition or the START key is pressed. Once START has been selected, the Model 60 will output a prompt symbol, ">", followed by a line feed. The Model 60 will remain in this state until another command is issued.

n!CR SELECT SORT CATEGORY — Instructs the handler to send sort category signal n to the handler via the control cable. n is an integer from 1 to 5.

TERMINAL OPERATION

Introduction

In addition to the front panel and Computer Remote Control modes, the Model 60 may also be operated in terminal mode. Terminal mode allows you to execute all the Model 60's commands from a local terminal's keyboard. Operation is via a top level menu, which differs depending on whether you have selected a logic or a memory device.

This subsection of the manual explains setup for terminal mode, and the commands available for memory and logic device related operations.

NOTE

Terminal mode is only valid in the Model 60A configuration. Programming in the handler configuration must be done from the front panel or via computer remote control.

SETUP

In order to set up the Model 60 and a terminal, you need to do the following:

1. Connect the terminal to the Model 60 using an RS-232C cable.

2. Set the terminal's and Model 60's communications parameters so the two match. For Model 60, this means using select codes DA, DB and DC to choose the baud rate, parity and number of stop bits to match that of the local terminal.

3. Enable a terminal emulation program, if you are using a personal computer as your local terminal.

4. Place the Model 60 into terminal mode by pressing **SELECT E1 START**. The Model 60 will then display `TERMINAL MODE ⊗`.

The Model 60 will automatically power-up into terminal mode if the configuration was saved, if the local terminal is on, is connected to the programmer and (if needed) the emulation program is enabled.

EXITING TERMINAL MODE

To exit terminal mode using the terminal's keyboard, press **ESC.** The Model 60 will then display `READY ^.`

To exit terminal mode using the Model 60's keypad, press any of the blue keys or **INPUT**, **OUTPUT**, or **START**. The Model 60 will then display `FUNCTION ABORT .`

Terminal Commands for Logic Devices

If you have the logic device adapter installed and the proper family/pinout code selected when you enable terminal mode (E1), the logic device menu will be displayed:

```
                    DATA I/O CORP.
                  -MODEL 60 PROGRAMMER-
               COPYRIGHT  1984, 1985, 1986, 1987

      -GENERAL COMMANDS-                    -I/O COMMANDS-

  0 - Display menu                      B - Input JEDEC data
  1 - Enter family/pinout code          C - Output JEDEC data
  5 - Enter reject option
  6 - Enter test modes option
  7 - Enter security fuse option
  8 - Enter functional test data
  F - System configuration
  G - Select attributes
  H - Power down save

      -DEVICE RELATED COMMANDS-             -FUSE MAP COMMANDS-

  2 - Load device                       A - Display fuse map
  3 - Test device                       D - Display fuse sumcheck
  4 - Program device                    E - Edit fuse map

Command :
```

As shown by the above menu, there are four types of commands: general, device related, I/O and fuse map commands. Each will be explained on the following pages.

*If an invalid device was selected, the terminal will ask for entry of a family and pinout code. When the family/pinout code has been entered, the menu will be displayed.

GENERAL COMMANDS

0 - DISPLAY MENU:	Press "0" if you want to repaint the screen with the top level menu.
1 - ENTER FAMILY/PINOUT CODE:	Type in the family and pinout codes for the device you are going to program. The family and pinout codes must be entered before any of the Device Related commands may be used. A complete list of the family/pinout codes for devices currently supported by Model 60 software is included in the Model 60 User Note, shipped with this manual.
5 - ENTER REJECT OPTION:	Select the number of times you want the socketed device pulsed with programming voltage before it is rejected as unprogrammable. Selecting "0" directs the Model 60 to pulse the device "n" times, where "n" is the device manufacturer's recommended number of times. "1" will cause the device to be pulsed once.
6 - ENTER TEST MODE OPTION:	Select the type of device testing to be performed: 0 - selects array, structured and Logic Fingerprint testing 1 - selects array testing only 2 - selects structured and Logic Fingerprint testing
7 - SECURITY FUSE OPTION:	Use this option if you want the socketed device's security fuse blown during the programming operation. A device whose security fuse is blown may not be read. You may also select the representation for the security fuse. If you want to blow the security fuse during programming, select either option "2" or "3".

8 - ENTER FUNCTIONAL TEST DATA: Use this command to display the Logic Fingerprint data resident in the programmer's RAM. This command also allows you to edit the device's test vectors. You may type **CTRL Z** at any time to exit the editor:

```
Command :  8 - Enter functional test data
Cycles for Fingerprint: 00    (decimal)
Fingerprint starting vector: 0000000000000000000    (binary)
Fingerprint: 00000000     (hexadecimal)

            -DISPLAY-                          -EDITING COMMANDS-

0 ------------- Display menu              D -------- Delete (Kill) current vector
Return -------- Go to next vector         R -------- Repeat current vector
U ------------- Up (previous vector )     CTRL Z --- Exit vector editor
# ------------- Go to vector
Space --------- Move cursor right
BKSP (CTRL H) - Move cursor left
CTRL Z -------- Exit vector editor


   Edit structured vector:  00000
   0001:  --------------------
```

Only certain characters may be used to represent different states for the test vectors:

VECTOR SYMBOL	DEFINITION
0	Drive input pin low
1	Drive input pin high
2-9	Drive input pin to supervoltage
2-9 C	Drive input pin low, then high, then low
K	Drive input pin high, then low, then high
N	Power pins and outputs will not be tested
L	Test output pin low
H	Test output pin high
Z	Test output pin for high impedance
X	Ignore input or output (not defined in JEDEC format)
F	Float input or output pin (tristate)
P	Preload (applied to the clock pin)

F - SYSTEM CONFIGURATION:	Use this command to display the Model 60's software version and RAM size. This information is useful when contacting Data I/O Customer Service personnel.
G - SELECT ATTRIBUTES:	Use this command to control transmission between the terminal and the Model 60. To change any of the attributes, use the space bar (move right) or backspace (move left) to move the cursor to the parameter you want to change, then type in the desired state. For example, depending on whether you want JEDEC "full" or "kernel mode transmission, you could type either "2" or "3".
H - POWER DOWN SAVE:	Use this command to save the attributes you selected during the current programming session, so that next time you power up the Model 60, the attributes need not be re-entered.

DEVICE RELATED COMMANDS

NOTE

Before executing a device related command, you need to type in the family and pinout codes for the part you are going to program.

2 - LOAD DEVICE:	Use this command to copy device data into RAM.
3 - TEST DEVICE:	Use this command to test a socketed device with data residing in the programmer's RAM. Use the "G" (Select Attributes) "6" (test modes) and "8" (functional test data) to choose the type of device testing to be performed.
4 - PROGRAM DEVICE:	Select this command to program a socketed device with data in the programmer's RAM.

I/O COMMANDS

B - INPUT JEDEC DATA:	Use this command to send data through the serial port into the programmer's RAM, in the JEDEC format. Use the select attributes command ("G") to choose the type of JEDEC format ("full" or "kernel") that will be used.
C - OUTPUT JEDEC DATA:	Use this command to send data through the serial port from the programmer's RAM, in the JEDEC format. Use the select attributes command ("G") to choose the type of JEDEC format ("full" or "kernel"), and the end-of-text character, that will be used.

FUSE MAP COMMANDS

A - DISPLAY FUSE MAP:	Use this command to display the fuse map of the device data in RAM. Use the select attributes command ("G") to select the way data will be represented: either as "X" and "-" or as "0" and "1".
D - DISPLAY FUSE SUMCHECK:	Use this command if you want to display the 4-digit hex sumcheck of the fuse data in RAM.
C - EDIT FUSE MAP:	Use this command to edit the device's fuse map resident in RAM. The screen will display the allowable commands. You may exit the editor at any time by pressing CTRL Z. Use the select attributes command ("G") to select the way data will be represented: either as "X" and "-" or as "0" and "1".

Terminal Commands for Memory Devices

If you have the memory adapter installed when you enable terminal mode, the memory device menu will be displayed:

```
                    DATA I/O CORP.
                  -MODEL 60 PROGRAMMER-
               COPYRIGHT  1984, 1985, 1986, 1987

      -GENERAL COMMANDS-                    -I/O COMMANDS-

  0-Display menu                        B-Receive data
  1-Enter family/pinout code            C-Transmit data
  F-System configuration                8-Select I/O format
  G-Select attributes
  H-Power down save

      -DEVICE RELATED COMMANDS-             -RAM DATA COMMANDS-

  2-Load device                         D-Display RAM sumcheck
  3-Test device                         E-Edit RAM data
  4-Program device

 Command :
```

As shown by the above menu, there are four types of commands: general, device related, I/O and device data commands. Each will be explained on the following pages.

*If an invalid device was selected, the terminal will ask for entry of a family and pinout code. When the family/pinout code has been entered, the menu will be displayed.

GENERAL COMMANDS

0 - DISPLAY MENU:	Press "0" if you want to repaint the screen with the top level menu.
1 - ENTER FAMILY/PINOUT CODE:	Type in the family and pinout codes for the device you are going to program. The family and pinout codes must be entered before any of the Device Related commands may be used. A complete list of the family/pinout codes for devices currently supported by Model 60 software is included in the Model 60 User Note, shipped with this manual.
F - SYSTEM CONFIGURATION:	Use this command to display the Model 60's software version and RAM size. This information is useful when contacting Data I/O Customer Service personnel.
G - SELECT ATTRIBUTES:	Use this command to control transmission between the terminal and the Model 60A. To change any of the attributes, use the arrow keys to move the cursor to the parameter you want to change, then type in the desired state. For example, depending on whether you want to enable I/O timeout during transmission, you could type either "2" or "3".
H - POWER DOWN SAVE:	Use this command to save the attributes you selected during the current programming session, so that next time you power up the Model 60, the attributes need not be re-entered.

DEVICE RELATED COMMANDS

NOTE

Before executing a device related command, you need to type in the family and pinout codes for the part you are going to program.

2 - LOAD DEVICE:	Use this command to copy device data into RAM.
3 - TEST DEVICE:	Use this command to test a socketed device with data residing in the programmer's RAM. Use the "G" command (Select Attributes) to choose the type of device testing to be performed.
4 - PROGRAM DEVICE:	Select this command to program a socketed device with data in the programmer's RAM.

I/O COMMANDS

B - RECEIVE DATA:	Use this command to send device data files through the serial port into the programmer's RAM. Data will be sent in the format you select using the "8" command (Select I/O format).
C - TRANSMIT DATA:	Use this command to send device data files from RAM through the serial port. Data will be sent in the format you select using the "8" command (Select I/O format).
8 - SELECT I/O FORMAT:	Type in the two-digit number corresponding to the format in which the data file will be transmitted to or from the programmer's RAM. A list of these format numbers may be found in the Data Translation Formats subsection, which follows this one. There are six memory translators and two logic translation formats (JEDEC "full" and JEDEC "kernel" mode).

DEVICE DATA COMMANDS

D - DISPLAY RAM SUMCHECK:

Use this command to display the 4-digit hex sumcheck of the data in the programmer's RAM. Dots will appear across the screen as the checksum is being calculated.

E - EDIT RAM DATA:

Use this command to edit data in the programmer's RAM. You may exit the editor at any time by pressing **CTRL Z**. You may begin editing at any address: type in the desired edit address and press **RETURN**. The screen will then display the address, followed by the corresponding RAM and device data:

```
Command : E - Edit RAM data

CTRL Z to exit editor

   Edit address : 00001

   00001   D 00  R  00  (byte-wide)

   00000  D 0000  R 0000  (word-wide)
```

If you go past the device range, the Model 60 will display

```
   00001 D **  R 00 (byte-wide)

   00000 D  **** R 0000 (word-wide)
```

DATA TRANSLATION FORMATS

The Model 60 software supports nine data translation formats; two for logic (JEDEC full and JEDEC kernel) and seven for memory devices:

FORMAT	FORMAT NUMBER
ASCII-Hex Space STX	50
Intel MCS-86 Hex Object	88
Intel Intellec 8/MDS	83
JEDEC full/kernel mode	91
Motorola EXORmacs	87
Motorola EXORcisor	82
Tektronix Hexadecimal	86
Extended Tektronix Hexadecimal	94

If you want to download a device data file from a host computer into the Model 60, it must be transmitted in one of the above listed formats. If your system does not generate code into one of the formats listed, you will need to edit the code until it matches one of the formats. For example, if you have written an assembly language program for the devices you are going to program, your system assembler and linker will put the program into machine code. The format of the code generated depends on the system you are using. Check your system manual to see what format your assembler and linker will generate. Sample printouts for each of the supported formats are given in the pages that follow.

In addition to the 2-digit format code associated with each translator listed in the previous table, a 1-digit control code may immediately precede the format code to signal or control the data transfer. The three values of this control code and their functions are shown below.

Control Code	Name	Input Function	Output Function
0	Handshake Off		Data transmission will be halted upon receipt of an "X-OFF" character; transmission will resume upon receipt of an "X-ON" character.
1	Handshake On	Transmit an "X-ON" character when ready to receive data.	Transmit a "PUNCH ON" character prior to transmission. Data transmission will be halted upon receipt of an "X-OFF" character; transmission will resume upon receipt of an "X-ON" character. A "PUNCH OFF" character is sent when the transmission is completed.
2	X-ON/X-OFF		Transmit data only after receiving an "X-ON" character. Data transmission will be halted upon receipt of an "X-OFF" character; transmission will resume upon receipt of an "X-ON" character.

NOTE

"X-ON" character is a CTRL-Q, DC1 or 11 hex
"X-OFF" character is a CTRL-S,DC3 or 13 hex
"PUNCH ON" character is a CTRL-R, DC2 or 12 hex
"PUNCH OFF" character is a CTRL-T, DC4 or 14 hex

ASCII Hex Format, Code 50

The following figure shows 4 data bytes coded in the ASCII Hexadecimal format. Data in this format is organized into sequential bytes separated by the execute character, which is a space. Characters immediately preceding the execute character are interpreted as data. Line feeds, carriage returns and other characters may be included in the data stream as long as a data byte directly precedes each execute character.

Although each data byte has an address, most are implied. Data bytes are addressed sequentially unless an explicit address is included in the data stream. This address is preceded by a "$" and an "A", must contain 2 to 8 hex characters, and must be followed by a comma. Model 60 skips to the new address to store the next data byte; succeeding bytes are again stored sequentially.

The end code terminates input operations. However, if a new start code follows within 16 characters of an end code, input will continue uninterrupted. If no characters come within 2 seconds, input operation is terminated.

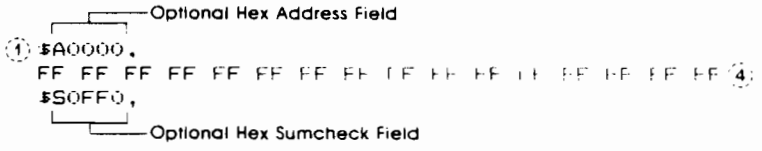
After receiving the final end code following an input operation, the Model 60 calculates a checksum of all incoming data. Optionally, a checksum can also be entered in the input data stream. The Model 60 compares this checksum with its own calculated checksum. If they match, the Model 60 will display the checksum; if not, a checksum error will be displayed.

NOTE

The checksum field consists of 2-4 hex characters, sandwiched between "$" and "," characters. The checksum immediately follows an end code. The checksum is optional in the input mode but is always included in the output mode.

The Model 60 divides the output data into 8-line blocks. Data transmission is begun with the start code and a nonprintable STX character. Data blocks follow, each one prefaced by an address for the first data byte in the block. The end of transmission is signalled by the end code, a nonprintable ETX character. Directly following the end code is a checksum of the transferred data.

FORMAT 50

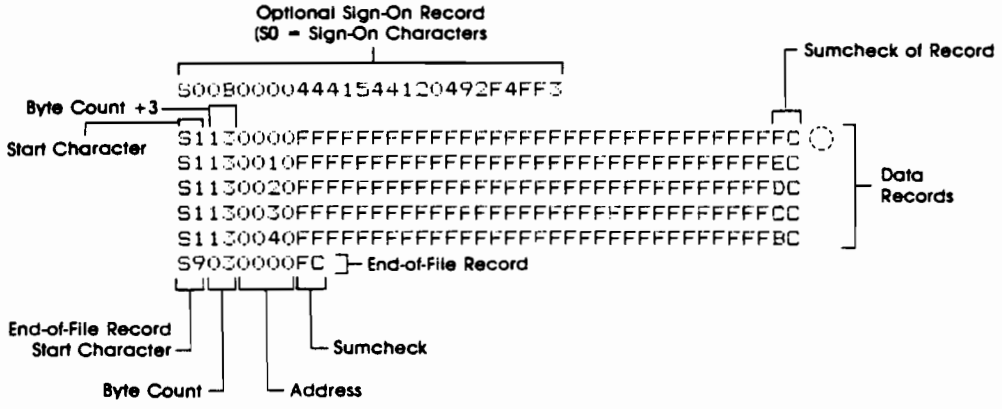


Motorola EXORciser Format, Code 82

Motorola EXORciser data files may begin with an optional sign-on record, which is initiated by the start characters "S0." Valid data records start with an 8-character prefix and end with a 2-character suffix. The figure shows a series of valid Motorola data records.

Each data record begins with the start characters "S1"; the Model 60 will ignore all earlier characters. The third and fourth characters represent the byte count, which expresses the number of data, address and checksum bytes in the record. The address of the first data byte in the record is expressed by the last 4 characters of the prefix. Data bytes follow, each represented by 2 hexadecimal characters. The number of data bytes occurring must be three less than the byte count. The suffix is a 2-character checksum, which equals the one's complement of the binary summation of the byte count, address and data bytes.

The end-of-file record consists of the start characters "S9", the byte count, the address (in hex) and a checksum.



LEGEND

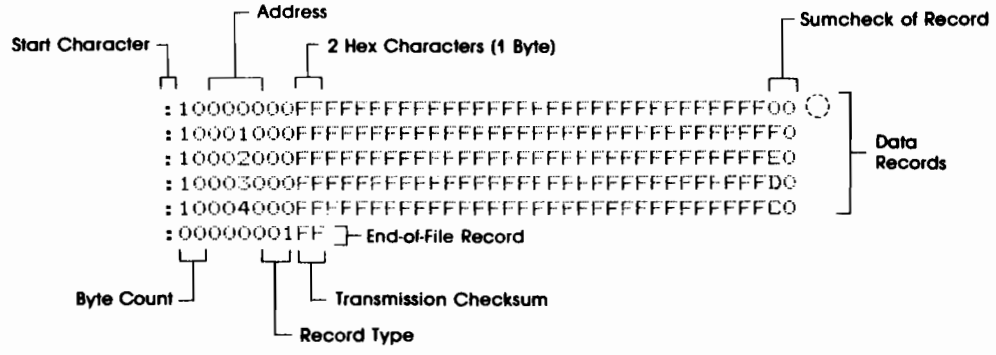
◌ Nonprinting Carriage Return, line feed, and nulls

Intel Intellec 8/MDS Format, Code 83

Intel data records begin with a 9-character prefix and end with a 2-character suffix. The byte count must equal the number of data bytes in the record.

The figure simulates a series of valid data records. Each record begins with a colon, which is followed by a 2-character byte count. The 4 digits following the byte count give the address of the first data byte. Each data byte is represented by 2 hexadecimal digits; the number of data bytes in each record must equal the byte count. Following the data bytes of each record is the checksum, the two's complement (in binary) of the preceding bytes (including the byte count, address and data bytes), expressed in hex.

The end-of-file record consists of the "colon" start character, the byte count (equal to "00"), the address, the record type (equal to "01") and the checksum of the record.



LEGEND

◌ Nonprinting Carriage Return, line feed, and nulls

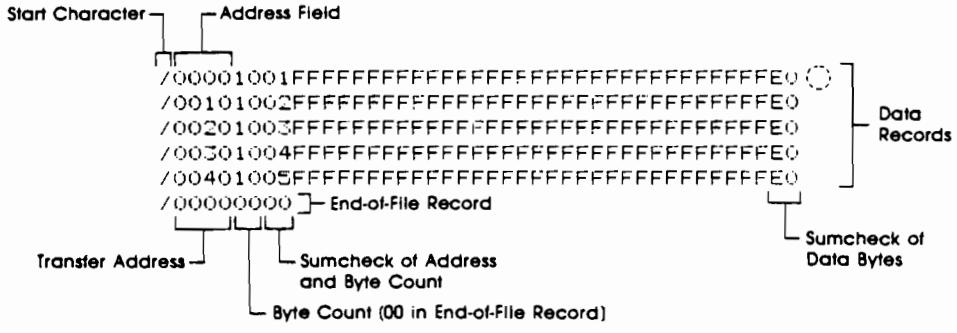
Tektronix Hexadecimal Format, Code 86

The figure illustrates a valid Tektronix data file. The data in each record is sandwiched between the start character (a slash) and a 2-character checksum. Following the start character, the next 4 characters of the prefix express the address of the first data byte. The address is followed by a byte count, which represents the number of data bytes in the record, and by a checksum of the address and byte count. Data bytes follow, represented by pairs of hexadecimal characters. Succeeding the data bytes is their checksum, an 8-bit sum, modulo 256, of the 4-bit hexadecimal values of the digits making up the data bytes. All records are followed by a carriage return.

Data is output from the Model 60 starting at the first RAM address and continuing until the number of bytes in the specified block have been transmitted. The Model 60 divides output data into records prefaced by a start character and an address field for the first byte in the record.

The end-of-file record consists of a start character (slash), followed by the transfer address, the byte count (equal to "00"), and the checksum of the transfer address and byte count.

An optional abort record contains 2 start characters (slashes), followed by an arbitrary string of ASCII characters.



LEGEND

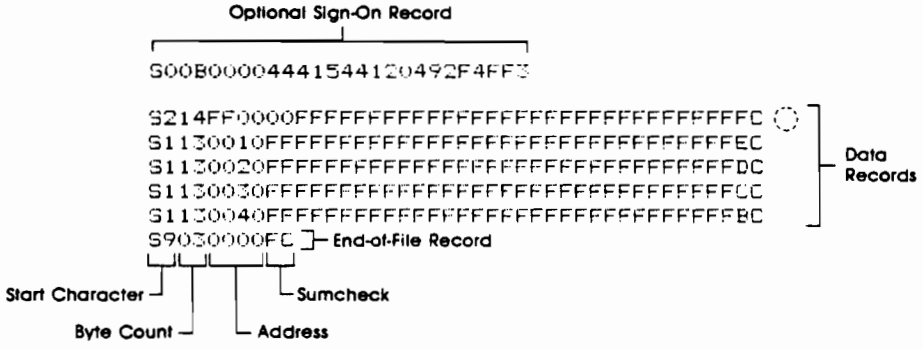
◌ Nonprinting Carriage Return, line feed, and nulls

Motorola EXORmacs Format, Code 87

Motorola data files may begin with an optional sign-on record, initiated by the start characters "S0." Data records start with an 8- or 10-character prefix and end with a 2- character suffix. The figure shows a series of Motorola EXORmacs data records.

Each data record begins with the start characters "S1" or "S2"; "S1" if the following address field has 4 characters, S2 if it has 6 characters. The third and fourth characters represent the byte count, which expresses the number of data, address and checksum bytes in the record. The address of the first data byte in the record is expressed by the last 4 characters of the prefix (6 characters for addresses above hexadecimal FFFF). Data bytes follow, each represented by 2 hexadecimal characters. The number of data bytes occurring must be 3 or 4 less than the byte count. The suffix is a 2-character checksum, the one's complement (in binary) of the preceding bytes in the record, including the byte count, address and data bytes.

The end-of-file record begins with an "S9" start character. Following the start characters are the byte count, the address and a checksum.



LEGEND

◌ Nonprinting Carriage Return, line feed, and nulls

Intel MCS-86 Hexadecimal Object, Code 88

The Intel 16-bit Hexadecimal Object file record format has a 9-character (4-field) prefix that defines the start of record, byte count, load address, and record type and a 2- character checksum suffix. The figure illustrates the sample records of this format.

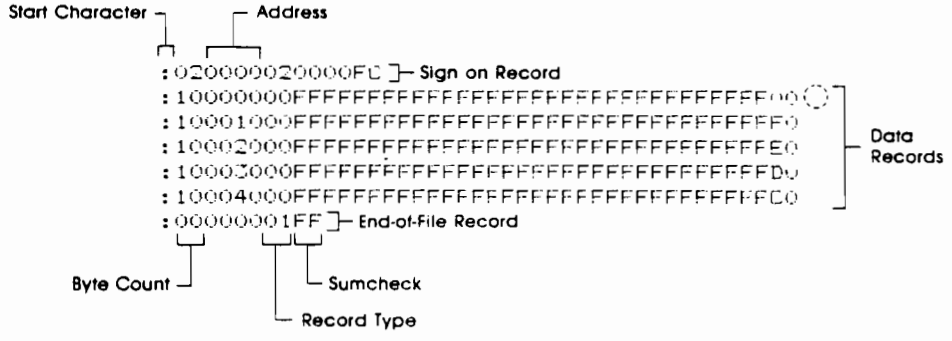
The four record types are:

00= data record
01= end record (signals end of file)
02= extended address record (added to the offset to determine the absolute destination address)
03= start record (ignored during input and not sent during output by Data I/O translator firmware)

Record type 00, the data record, begins with the colon start character. This is followed by the byte count (in hex notation), the address of the first data byte, and the record type (equal to "00"). Following these are the data bytes. The checksum follows the data bytes and is the two's complement (in binary) of the preceding bytes in the record, including the byte count, address and data bytes.

Record type 01, the end-of-file record, also begins with the colon start character. This is followed by the byte count (equal to "00"), the address (equal to "0000"), the record type (equal to "01") and the checksum, "FF".

Record type 02, the extended address record, defines bits 4 to 19 of the segment base address. It can appear randomly anywhere within the object file and in any order; i.e., it can be defined such that the data bytes at high addresses are sent before the bytes at lower addresses. The following example illustrates how the extended address is used to determine a byte address.



LEGEND
( ) Nonprinting Carriage Return, line feed, and nulls

PROBLEM: Find the address for the first data byte for the following file.

```
: 02 0000 02 1230 BA
: 10 0045 00 55AA FF .....BC
```

SOLUTION: Step 1: Find the record address for the byte. The first data byte is 55. Its record address is 0045 from above.

Step 2: Find the offset address. The offset address is 1230 from above.

Step 3: Shift the offset address one place left, then add it to the record address, like this:

offset address	1230	(upper 16 bits)
+ record address	0045	(lower 16 bits)
=	12345	(20-bit address)

The address for the first data byte is therefore 12345.

NOTE

Always specify the address offset when using this format, even when the offset is zero. During output translation, the firmware will force the record size to 16 (decimal) if the record size is specified greater than 16. There is no such limitation for record sizes specified less than 16.

JEDEC Format, Code 91

INTRODUCTION

The JEDEC (Joint Electron Device Engineering Council) format is used to transfer fuse and test vector data between the Model 60 and a host computer. Code 91 is "full" format, and includes all the data fields (such as note and test fields) described on the following pages. Code 92 is the "Kernel", or shorter format. The JEDEC Kernel format includes only the minimum information needed for the transmission: it does not, for example, include fuse information fields or test vector fields.

JEDEC's legal character set consists of all the printable ASCII characters, and four control characters. The four allowable control characters are STX, ETX, CR (RETURN) and LF (line feed). Other control characters, such as ESC or BREAK, should not be used.

NOTE

This is Data I/O Corporation's implementation of JEDEC Standard 3A. For a copy of the strict standard, write:

Electronic Industries Association
Engineering Department
2001 Eye Street NW
Washington, D.C. 20006

Following is an explanation of the data representation used to describe JEDEC output. The syntax used to describe JEDEC format is called the Backus-Naur Form (BNF), named after the people who designed this syntax.

BNF RULES AND STANDARD DEFINITIONS

The Backus-Naur Form (BNF) is used in the description here to define the syntax of the JEDEC format. BNF is a shorthand notation that follows these rules:

":: =" denotes "is defined as."

Characters enclosed by single quotes are literals (required).

Angle brackets enclose identifiers.

Square brackets enclose optional items.

Braces ({ }) enclose a repeated item. The item may appear zero or more times.

Vertical bars indicate a choice between items.

Repeat counts are given by a :n suffix. For example, a six digit number would be defined as "<number>:: = <digit>:6 ."

For example, in words, the definition of a person's name reads:

The full name consists of an optional title followed by a first name, a middle name, and a last name. The person may not have a middle name or may have several middle names. The titles consist of: Mr., Mrs., Ms., Miss, and Dr.

The BNF definition is:

<full name> :: = [<title>] <f. name> {<m.name>} <l. name>
<title> :: = 'Mr.' | 'Mrs.' | 'Ms.' | 'Miss' | 'Dr.'

The following standard definitions are used throughout the rest of this document:

<digit> :: = '0' | '1' | '2' | '3' | '4' | '5' | '6' | '7' | '8' | '9'
<hex-digit> :: =<digit> | 'A' | 'B' | 'C' | 'D' | 'E' | 'F'
<binary-digit> :: = '0' | '1'
<number> :: = <digit> {<digit>}
<del> :: = <space> | <carriage return>
<delimiter> :: = <del>{<del>}
<printable character> :: = < ASCII 20 hex ... 7E hex>
<control character> :: = <ASCII 00 hex ... 1F hex> | <ASCII 7F hex>
<STX>:: = <ASCII 02 hex>
<ETX>:: = <ASCII 03 hex>
<carriage return> :: = <ASCII 0D hex>
<line feed> :: = <ASCII 0A hex>
<space>:: = <ASCII 20 hex> | ' '
<valid character> :: = <printable character> | <carriage return> |<line feed>
<field character> :: = <ASCII 20 hex ... 29 hex> |< ASCII 2B hex ... 7E hex> | <carriage return> |
<line feed>

THE DESIGN SPECIFICATION FIELD

<design spec> ::={<field character>}'*'

The first field sent in a JEDEC transmission is the design specification. Both the "full" and "kernel" JEDEC formats accept the design specification field. This field is mandatory and it does not have an identifier (such as an "*") signalling its beginning. The design specification field consists of general device information. It could, for example, consist of the following information: your name, your company's name, the date, the device name and manufacturer, design revision level, etc. This field is terminated by a "*" character. Examine the sample transmission shown on the next page of this description--the first three lines of the file comprise the design specification field.

NOTE

You do not need to send any information in this field if you do not wish to: a blank field, consisting of the terminating asterisk, is a valid design specification field.

THE TRANSMISSION CHECKSUM

<xmit checksum> ::=<hex digit>:4

The transmission checksum is the last value sent in a JEDEC transmission. the "full" JEDEC formats requires the transmission checksum. The checksum is a 16-bit value, sent as a 4- digit hex number, and is the sum of all the ASCII characters transmitted between (and including) the STX and ETX. The parity bit is excluded in the calculation of the transmission checksum.

Some computer systems do not allow you to control what characters are sent, especially at the end of a line. You should set up the equipment so that it will accept a dummy value of "0000" as a valid checksum. This zero checksum is a way of disabling the transmission checksum, while still keeping within the JEDEC format rules.

JEDEC Full Format, Code 91

The "full" JEDEC format consists of a start-of-text character (STX), various fields, an end-of-text character (ETX) and a transmission checksum. A sample JEDEC transmission sent in the "full" format is shown below. Each of the valid fields is described on the following pages.

JEDEC FIELD SYNTAX

<field>::=[<delimiter>]<field identifier>{<field character>}'*'

<field identifier>::= 'A' | 'C' | 'D' | 'F' | 'G' | 'L' | 'N' | 'P' | 'Q' | 'R' | 'S' | 'T' | 'V' | 'X' |

<reserve identifier>::= 'B' | 'E' | 'H' | 'I' | 'J' | 'K' | 'M' | 'O' | 'U' | 'W' | 'Y' | 'Z' |

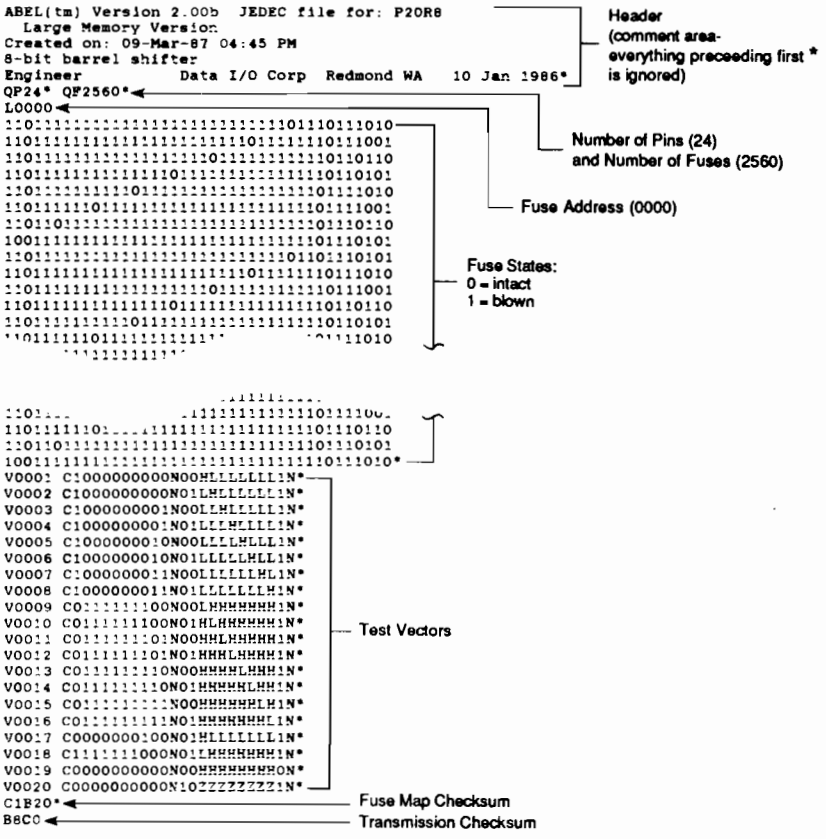
Following the design specification field in a JEDEC transmission can be any number of information fields. Each of the JEDEC fields begins with a character that identifies what type of field it is. Fields are terminated by using a "*" character. Multiple character identifiers can be used to create sub-fields (i.e., "A1", "A$", or "AB3"). Although not required, you may use carriage returns (CR) and line feeds (LF) to improve readability of the data.

Field identifiers which are currently used in JEDEC transmissions are shown above on the "field identifiers" line. The "reserved identifier" line indicates characters not currently used (reserved for future use as field identifiers). JEDEC field identifiers are defined as follows:

FIELD IDENTIFIERS

A -	access time	J -	*	S -	starting vector
B -	*	K -	*	T -	test cycles
C -	checksum field	L -	fuse list field	U-	*
D -	device type♦	M -	*	V -	test vector field
E -	*	N -	note field	W -	*
F -	default fuse state field	O -	*	X-	default test condition field
G -	security fuse field	P -	pin sequence	Y -	*
H -	*	Q -	value field	Z -	*
I -	*	R -	resulting vector field		

"*" next to a field identifier indicates that the character is reserved for future use.
"♦" indicates that the field is not supported with current Model 60 software



DEVICE FIELD (D)

Device selection by this field is not supported by the Model 60. It has been replaced by the QF and QP fields and the manual selection of devices.

FUSE INFORMATION FIELDS (C, F, L)

<fuse information> :: = [<default state>] <fuse list>{<fuse list>} [<fuse checksum>]

<fuse list> :: = 'L' <number><deliminter>{<binary-digit> [<delimiter>]} ' * '

<default state> :: = 'F' <binary-digit> ' * '

<fuse checksum> :: = 'C'< hex-digit>:4 ' * '

Each fuse of a device is assigned a decimal number and has two possible states: a zero, specifying a low resistance link, or a one, specifying a high resistance link. Fuse information describing the state of each fuse in the device is given by three fields: the fuse list (L field), the default state (F field), and the fuse checksum (C field).

Fuse states are explicitly defined by the L field. The character L begins the L field and is followed by the number of the first fuse for which this field defines a state. The first fuse number is followed by a list of binary values (0 or 1) that indicate the fuse states. When more than one binary value is specified, the additional values are assigned to fuses numbered consecutively from the first fuse number. The L field can be any length desired, and any number of L fields can be specified. If the state for a fuse is specified more than once, the last state replaces all previous ones specified for that fuse.

The F field defines the states of fuses that are not explicitly defined in the L fields. If no F field is specified, all fuse states must be defined by L fields.

The fuse information checksum field is used to detect transmitting and receiving errors. The field contains a 16-bit sum (i.e. modulo 65,535) computed by adding 8-bit words containing the fuse states for the entire device. The 8-bit words are formed as shown in the following figure. Unused bits in the final 8-bit word are set to zero before the checksum is calculated.

word 00	msb						lsb	
Fuse No.	7	6	5	4	3	2	1	0
word 01	msb						lsb	
Fuse No.	15	14	13	12	11	10	9	8
word 62	msb						lsb	
Fuse No.	-	-	-	-	499	498	497	496

Following is an example of full specification of the L, C, and F fields:

F0*L0 01010101* L0008 01010111*
L1000 0101*CF3BA*

Another example, where F and C are not specified:

L0200 01101010101010101011
0101110101101000100100100 10*

THE SECURITY FUSE FIELD (G)

<security fuse>::='G'<binary-digit>'*'

The JEDEC G field is used to enable the security fuse of some logic devices. To enable the fuse, send a "one" in the G field:

G1*

THE NOTE FIELD (N)

<note>::='N'<field characters>'*'

The note field is used in JEDEC transmission to insert notes or comments. The Model 60 will "ignore" this field: it will not be interpreted as data. An example of a note field would be:

N Test Preload*

THE VALUE FIELDS (QF,QP AND QV)

JEDEC value fields define values or limits for the data file: number of fuses, for example. The QF subfield defines the number of fuses in the device. All of the value fields must occur before any device programming or testing fields appear in the data file. Files with ONLY testing fields do not require the QF field and fields with ONLY programming data do not require the QP and QV fields.

The QF subfield tells the Model 60A how much memory to reserve for fuse data, the number of fuses to set to the default condition and the number of fuses to include in the fuse checksum. The QP subfield defines the number of pins or test conditions in the test vector, and the QV subfield defines the maximum number of test vectors.

TEST FIELD (V FIELD)

<function test> :: = [<pin list>] <test vector>{<test vector>}

<pin number> :: = <delimiter><number>

N :: = number of pins on device

<test vector> :: = 'V' <number><delimiter><test condition> :N ' * '

<test condition> :: = <digit> 'B' | 'C' | 'F' | 'H' | 'K' | 'L' | 'N' | 'P' | 'X' | 'Z'

<reserve condition> :: = 'A' | 'D' | 'E' | 'G' | 'I' | 'J' | 'M' | 'O' | 'Q' | 'R' | 'S' | 'T' | 'U' | 'V' | 'W' | 'Y' | 'Z'

Functional test information is specified by test vectors containing test conditions for each device pin. Each test vector contains n test conditions where n is the number of pins on the device. The following table lists the conditions that can be specified for device pins.

Test Conditions
0 — Drive input low
1 — Drive input high
2-9 — Drive input to supervoltage #2-9
B — Buried resiter preload (not supported)
C — Drive input low, high, low
F — Float input or output
H — Test output high
K — Test output high, low, high
P — Preload
L — Test output low
Z — High impedance

The C and K driving signals are presented after the other inputs are stable. The L, H, and Z tests are performed after all inputs have stabilized, including C and K.

Test vectors are numbered by following the V character with a number. The vectors are applied in numerical order to the device being tested. If the same numbered vector is specified more than one time, the data in the last vector replaces any data contained in previous vectors with that number.

The following example uses the V field to specify functional test information for a device:

```
V0001 C01010101NHLLLHHLHLN *
V0002 C01011111NHLLHLLLHLN *
V0003 C10010111NZZZZZZZZZN *
V0004 C01010100NFLHHLFFLLN *
```

JEDEC Kernel Mode, Code C2

<kernel>::=<STX><design spec><min. fuse information><EXT><xmit checksum>

<design spec>::={<field character>}*

<min. fuse information>::=<fuse list>{<fuse list>}

You may use the JEDEC "kernel" format if you wish only to send the minimum data necessary to program the logic device—if you do not, for example, want to send any test vectors. If you specify Select Code C2, and then choose the kernel mode, the Model 60A will ignore everything except the design specification field and the fuse information field. The following fields will be ignored if the kernal mode is selected: C, F, G, Q, V, and X. Also, the security fuse will be set to zero and the transmission checksum will be ignored.

An example of a "kernel" JEDEC transmission is shown below:

```
<STX>
Acme Logic Design  Jane Engineer   Feb. 29 1983
Widget Decode  756-AB-3456 Rev C  Device Mullard 12AX7*

L0000 1111111011 1111111111  1111000000 0000000000
      0000000000 0000000000  0000000000 0000000000
      0000000000 0000000101  1111111111 1111111111
      0000000000 0000000000  0000111101 1111111111
      1111111111 1111110111  1111111111 1111111111*

L0200 1110101111 1111110000  0000000000 0000000000
      1111111111 1111011011  1111111111 1111111110
      0111111111 1111111111  1111111110 1111111111
      1111111111 1111101111  1111111111 1111101111
      0000000000 0000000000  0000*

<EXT>0000
```

Extended Tektronix Hexadecimal Format, Code 94

The Extended Tektronix Hexadecimal format has three types of records: data, symbol and termination records. The data record contains the object code. Information about a program section is contained in the symbol record (the Model 60 ignores symbol records) and the termination record signifies the end of a module. The data record (see sample below) contains a header field, a load address and the object code. The header field contains the information listed below.

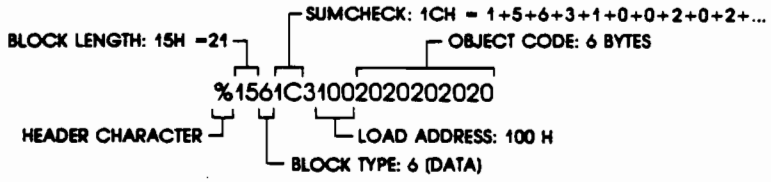
Item	Number of ASCII Characters	Description
%	1	Signifies that the record is the Extended Tek Hex format.
Block length	2	Number of characters in the record, minus the %.
Block type	1	6 = data record 3 = symbol record (ignored by the Model 60) 8 = termination record
Checksum	2	A 2-digit hex sum, modulo 256, of all the values in the record except the % and the checksum.

Character Values for Checksum Computation Characters	Values (decimal)
0 . . 9	0 . . 9
A . . Z	10 . . 35
$	36
%	37
_ (underline)	39
a . . z	40 . . 65

The number of fields in the file will vary, depending on whether a data or a termination block is sent. Both data and termination blocks have a 6-character header and a 2-to-17 character address.

The load address determines where the object code will be located. This is a variable length number that may contain up to 17 characters. The first number determines the address length, with a zero signifying a length of 16. The remaining characters of the data record contain the object code, 2 characters per byte.

When you are copying data to the port or to RAM, make sure to set the high-order address if the low-order is not at the default value.



5. SELECT FUNCTIONS

INTRODUCTION

The Model 60 offers special select functions that allow you to select several operating modes including: RAM data manipulation, utility and inquiry commands and serial I/O commands. The **SELECT** key plus two-character hexadecimal codes which are entered at the front panel keyboard enable the functions. The programmer signals that the select function has been performed by displaying the two-character hex code in the last two display positions. Following is a complete list of the Model 60 select functions. The pages that follow describe these commands.

Some of the Select Codes are particular to either the logic mode or the memory mode. Depending on whether you have a logic adapter or a memory adapter installed, some of the following Select Codes will not apply. If the left-hand column indicates Logic and Memory the Select Code is applicable to memory and logic operation. If either LOGIC or MEMORY is indicated, that Select Code is applicable to only that mode.

SELECT FUNCTION LIST

Command Group	Hex Code	Title
Translation Formats		
Logic	91	JEDEC
Memory	50	ASCII Hex Space STX
Memory	83	Intel Intellec 8/MDS
Memory	88	Intel MSC-86 Hex Object
Memory	82	Motorola EXORciser
Memory	87	Motorola EXORmacs
Memory	86	Tektronix Tekhex
Memory	94	Extended Tekhex
RAM Data Manipulation		
Logic and Memory	A2	Fill RAM
Logic and Memory	A3	Invert RAM
Logic and Memory	A4	Clear All RAM
Memory	A5	Split RAM
Memory	A6	Shuffle RAM
Memory	A7	Block Move
Memory	A8	Swap Bytes

Command Group	Hex Code	Title
Utility and Inquiry		
Logic and Memory	B1	Sumcheck RAM
Logic and Memory	B2	System Configuration
Logic and Memory	C0	Echo/No Echo
Logic and Memory	C1	Calibration
Logic and Memory	CA	Verify Passes
Logic and Memory	CC	Illegal Bit
Logic and Memory	E2	Continuity Test
Logic and Memory	EE	Edit Data
Logic and Memory	EF	NVRAM Configuration
Logic and Memory	FD	Ultra Violet (UV) Timeout
Logic and Memory	FE	Power Down Save
Logic	B4	Non-Blank Check
Logic	C2	JEDEC (Full/Kernel)
Logic	C4	Fuse Format
Logic	C6	End Data Code
Logic	C8	Underblow(UB)/Overblow (OB) display
Logic	CE	List Vectors
Logic	E5	Reject Count
Logic	E6	Test Modes
Logic	E7	Security Fuse
Logic	E8	Fprint Cycles
Logic	E9	Fingerprint Vector
Logic	EA	Output Fuse Map
Logic	ED	Fuse Sumcheck
Memory	BC	Disable Electronic ID
Memory	BD	Enable Electronic ID
Memory	CD	View ID
Serial I/O		
Logic and Memory	D9	Null Count
Logic and Memory	DA	Baud Rate
Logic and Memory	DB	Parity
Logic and Memory	DC	Stop Bits
Logic and Memory	E1	Terminal Remote
Logic and Memory	F9	I/O Timeout Enable/Disable
Logic and Memory	F1	Computer Remote Control (CRC)
Logic and Memory	FA	Character Output
Logic and Memory	FC	Remote On/Off
Memory	D8	Size Record

Power Down/Save Parameters

There are several parameters which will be saved by the power down save select function (FE). They will be written into the 64 X 4 non-volatile RAM space.

Select Code	Parameter
DA	Baud Rate
DB	Parity
DC	Number of Stop Bits
C2	JEDEC Mode
C6	JEDEC End Code
CA	Verify Passes 1 or 2
E5	Reject Count
E6	Test Options
N/A	Family/Pinout Code or Manufacturer and Device
F1	Remote Mode at Power Up
C7	* Illegal Bit Category
C7	* Pass Category
C7	* Program Fail Category
C7	* Fuse Test Fail Category
C7	* Fingerprint Fail Category
C7	* Vector Fail Category
C7	* Non Blank Category
B4	Non Blank On/Off
FC	Remote On/Off
C5	* Handler Device Count
C3	* Handler Error Count
C8	Underblow/Overblow display
C4	Fuse Map Format
CC	Illegal Bit On/Off
CE	List Vectors
C0	Echo/No Echo
E1	Terminal Remote at Power Up
MULTIPLE	Translator Format
F9	I/O Timeout
BC/BD	Electronic ID On/Off
D9	Null Count
D8	Size Record
E7	Security Fuse
CE	List Vectors
E8	FPRINT Cycles
E9	FPRINT Start Vector

*Applies to Model 60H only.

ACCESSING SELECT FUNCTIONS

The select functions may be accessed by either direct entry, stepping or scrolling.

- For direct entry, press **SELECT**. The Model 60 will display " SELECT OPTION^ ". Enter the hex code for the desired function or data translation format and then press **START**. (Some functions require the **START** key to be pressed twice.) The display will prompt any additional entries required, or indicate an invalid entry.

- To access the select functions by scrolling, press **SELECT** and then **SCROLL**. When you have reached the menu of functions you want to view, press **START**. The **SCROLL** and **REVIEW** keys walk you through the functions. When the desired function is displayed press **START**.

The following pages list the key sequences required to perform each of the Model 60's select functions. Most of the functions may be performed by keying in

SELECT H H START

(where "HH" is the two-digit select function). Functions that may be keyed in using this sequence are grouped together; those requiring entry of additional data are listed on the following pages. The select functions are organized according to command group: Format Codes, RAM Data Manipulation, Utility and Inquiry and Serial I/O.

The presentation of the discussion of the Select Functions will be as follows:

- Many of the select functions are applicable to logic and memory operation. These select functions will be discussed first for each code type.

- The select functions applicable to logic only operation are addressed next for each code type.

- The select functions applicable to memory only operation are addressed last for each code type.

FORMAT CODES

Data translation formats allow the Model 60 to send and receive data to and from other systems. You may key in directly the two-digit code for the data translation format you are using. A complete list of formats and their corresponding codes appears in the remote control section.

Selecting the Format Code for Logic Operation

To key in format codes directly, press

	Procedure	Keystroke	Model 60 Displays
1.	Key in format code	**SELECT C 2**	JEDEC MODE C2
		NOTE	
		Fuse data, test vectors, and the Logic Fingerprint test parameters are transmitted between the host computer and the programmer in the JEDEC format only.	
2.	Choose between Full and Kernel transmission	**START** then **SCROLL** or **REVIEW**	
3.	Install JEDEC format selected	**START**	JEDEC MODE **

Selecting the Format Codes for Memory Operation

To key in format codes directly, press

	Procedure	Keystroke	Model 60 Displays
1.	Key in format code	**SELECT 50** (example) **83** **88** **82** **87** **86** **94**	FORMAT NO ^00XX

"XX" is one of the seven data translation select codes.

*The **REVIEW** key can be used to erase the current format code; key in another.*

NOTE

*If an invalid format code is entered, the **START** key will have no effect. Either enter a valid format code or return to the select options by pressing the **SELECT** key.*

2.	View the format code name associated with the chosen format code	**START**	(mfg) (title)

"(mfg)" and "(title)" is the name of the format code.

	Select the format	**START**	FORMAT NO 0XX **

Handshaking

Each format is assigned a 2-digit data translation format code which the operator enters into the programmer to transfer data in that format. In addition to this code, a 1-digit instrument control code may be used to specify control characters for peripheral equipment. These 1-digit codes must be put before the format code. If no codes are entered into the programmer, the current default values will be in effect. See the Remote Control section of this manual for full explanation.

Control Code

0
1
2

For example: 194 or 294

RAM DATA MANIPULATION

Logic and Memory

The select codes listed in the following table apply to logic and memory operation and are all executed using the following key sequence:

SELECT H H START

(where "H H" is the two-digit code given in the Hex Code column of the table). Three others (fill, split and shuffle RAM) require additional data entry and are listed on the following pages.

Hex Code	Command Title	Description
A3	Invert RAM	Performs the ones complement of 4 or 8 bits of each word (determined by the word size in effect). For example, changes all "1's" to "0's".
A4	Clear all RAM	Clear all RAM to zeroes. Useful before downloading port data to RAM.

A2 FILL RAM - MEMORY

The Fill RAM function fills the Model 60's RAM with a specified pattern, from the edit address to the end of RAM (memory mode only). In logic mode, it always fills from the beginning of RAM to the end of RAM. Use the following procedure to fill RAM from the last EDIT address to the end of RAM with variable hex data. The default value is 00.

	Procedure	Keystroke	Model 60 Displays
1.	Select the Fill RAM command operation.	**SELECT A 2** **START**	FILL RAM A2 FILL RAM ^00 A2
2.	Enter the hex data to be placed in RAM	**H H**	FILL RAM ^ HH A2
3.	Write the hex data to RAM.	**START**	FILL RAM HH ⊗ FILL RAM **

A2 FILL RAM - LOGIC

	Procedure	Keystroke	Model 60 Displays
1.	Select the Fill RAM command. .	**SELECT A 2** **START**	FILL RAM A2 FILL RAM ^0
2	Enter fuse state to be placed in RAM. (1=Blown, 0=Un Blown).	**S**	FILL RAM ^S
3.	Write fuse data to RAM	**START**	FILL RAM ⊗ FILL RAM **

A5 SPLIT RAM - MEMORY

The Split RAM function is useful when working with 16-bit data. Split RAM is the inverse of the Shuffle RAM operation. Use the following procedure to split odd- and even-addressed bytes in RAM about a center point, dividing them into two adjacent blocks occupying the same original amount of RAM. The center point must be a power of two between 0 and the RAM midpoint. The default center point is the midpoint of RAM.

	Procedure	Keystroke	Model 60 Displays
1.	Select the Split RAM operation.	**SELECT A 5** **START**	SPLIT RAM A5 SPLIT RAM ^ HHHHH
2.	Set the hex midpoint (if the default or displayed value is correct, press **START**.)	**H H H H H** **START**	SPLIT RAM ^ HHHHH SPLIT RAM SPLIT RAM **

NOTE

The execution time of this function is dependent on the size of the midpoint. The default setting requires the greatest amount of time.

A6 SHUFFLE RAM - MEMORY

As with the Split RAM function, the Shuffle RAM function is useful when working with 16-bit data. Data may be split, then transferred to two PROMs. Use the following procedure to shuffle the block of RAM addresses immediately above the center point with the block below, placing the lower-block bytes at even-numbered addresses starting with 0 and the upper-block addresses at odd-numbered addresses starting with 1. The center point must be a power of two between 0 and the RAM midpoint. The default center point is the total RAM midpoint.

	Procedure	Keystroke	Model 60 Displays
1.	Select the Shuffle RAM command operation.	**SELECT A 6** **START**	SHUFFLE RAM A6 SHUFFLE RAM ^ HHHHH

Procedure	Keystroke	Model 60 Displays
2. Set the hex midpoint (if the default or displayed value is correct, press **START**.)	**H H H H H**	SHUFFLE RAM ^ HHHHH
	START	SHUFFLE RAM SHUFFLE **

NOTE

The execution time of this function is dependent on the size of the midpoint. The default setting requires the greatest amount of time.

A7 BLOCK MOVE - MEMORY

A block move copies data in one block of RAM locations to another block of RAM locations, beginning at a defined address.

Procedure	Keystroke	Model 60 Displays
1. Select the block move operation.	**SELECT A 7**	BLOCK MOVE A7
2. Accept or (optionally) change the device address to begin copying from (default is zero) and/or the size of the block (in hex) to be transferred.	**START** **START** or **START** **X X X X X** **START** **XXXXX**	SRC ^ADDR/SIZE SRC ADDR ^ SIZE SRC ^ ADDR/SIZE SRC ^ XXXXX/SIZE SRC XXXXX ^ SIZE SRC XXXXX ^ XXXXX

NOTE

*To specify only block size, press **START** and then key in the size.*

3. Accept or (optionally) change the hex destination address.	**START** **START** or **START** **X X X X X** **START**	DEST ^ADDR BLOCK MOVE ** DEST ^ ADDR DEST ^ ADDR BLOCK MOVE BLOCK MOVE **

A8 SWAP BYTES - MEMORY

This option, when enabled, allows the most significant bytes (MSB) and the least significant bytes (LSB) of 16-bit words to be swapped when data is transferred from a 16-bit device to memory.

	Procedure	Keystroke	Model 60 Displays
1.	Select the Swap Bytes command operation.	**SELECT A 8** **START**	SWAP BYTES A8 SWAP ^ ADDR/ HHHHH
2.	Set the hex midpoint (if the default or displayed value is correct, press **START**.)	**H H H H H** **START**	SWAP BYTES ^ HHHHH SWAP BYTES SWAP **

NOTE

The execution time of this function is dependent on the size of the midpoint. The default setting requires the greatest amount of time.

UTILITY AND INQUIRY COMMANDS

Logic and Memory

Utility and Inquiry select functions allow you to access and/or display parameters such as the RAM sumcheck, baud rate, verify passes or size record. The select functions listed in the following table are all executed using one of the following key sequences:

SELECT H H START

or

SELECT H H START

SCROLL or **REVIEW** (when there is a choice such as Baud Rate)

START

(where "H H" is the two digit code given in the Hex Code column of the table). The system calibration (C1), UV Timeout (FD) and Edit Data (EE) commands require additional data to be keyed in, and is listed on the following page.

Hex Code	Command Title	Description
B1	Sumcheck RAM	Displays the total RAM sumcheck *.
C0	Echo/No Echo	Sets full or half duplex mode on serial port.
C1	Calibration	Places the programmer in the calibration mode. Tests the Model 60A hardware and examines device programming waveforms.
CA	Verify Passes	Sets 1 or 2 pass functional test.
CC	Illegal Bit	Enables or disables the illegal bit/blank check.

*In logic mode, sumcheck can be different depending on the device selected. Use "ED", fuse sumcheck, for fuse map only.

Hex Code	Command Title	Description
EE	Edit Data	Edit the fuse map (logic) or RAM address (memory)
EF	NVRAM Configuration	Displays the NOVRAM configuration number
FD	UV Timeout	Sets timeout for Ultra Violet
FE	Power Down Save	Saves parameters in NOVRAM

B2 SYSTEM CONFIGURATION

Use the following procedure to display the four-character system configuration code, used when contacting Data I/O Technical Support Personnel for software version determination.

	Procedure	Keystroke	Model 60 Displays
1.	Select the System Configuration command.	**SELECT B 2**	SYSTEM CONFIG B2
2.	Display the System Configuration.	**START**	M60 RRR (RAM size) VHH.H (version number)

Logic

The select functions listed in the following table are all executed using one of the following key sequences:

SELECT H H START

or

SELECT H H START

SCROLL or **REVIEW** (when there is a choice such as Non-Blank Check)

START

Some commands (such as the Fingerprint options) require additional data to be keyed in.

(where "H H" is the two digit code given in the Hex Code column of the table).

Hex Code	Command Title	Description
B4	Non-Blank Check	If enabled (On), the programmer automatically fails non-blank devices. If disabled (Off), the programmer allows the user to bypass a non-blank condition.
C6	End Data Code	Sets CTRL Z or ETX as end upload character (affects display fusemap "EA" only).
C8	UB/OB Display	Enables and disables the underblow/overblow fusemap display (affects display fusemap "EA" only).
CE	List Vectors	Enables the output of the failed vectors.
E2	Continuity Test	Checks for proper contact of the device to the contacts in the PLCC socket adapter.
E5	Reject Count	Selects the number of programming pulses applied to the device.

Hex Code	Command Title	Description
E6	Test Options	Selects the tests to be performed on the device: fuse verify, structured vectors, Logic Fingerprint.
ED	Fusemap Checksum	Display checksum of device size only.
EA	Display Fuse Map	Outputs the fuse map to serial port.
E7	Security Fuse	Enables security fuse programming. Use **SCROLL** and **REVIEW** to select one of the following options.
	0	is the default option. Disables programming and sets the security fuse state in RAM to 0 (unprogrammed).
	1	disables programming and sets security fuse state in RAM to 1 (unprogrammed).
	2	enables programming and sets security fuse state in RAM to 0. (Data downloaded in the JEDEC format can change the security fuse state to 1.)
	3	enables programming and sets security fuse state in RAM to 1. (Data downloaded in the JEDEC format can change the security fuse state back to 0.)
C4	Fuse Display	Sets "X/-" or "0/1" fuse display (affects display fusemap "EA" only).

E2 CONTINUITY TESTING

The continuity test checks that the pins of the device (PLCC or EPROM) are properly inserted into the adapter. When the continuity test is disabled in PLCC mode, the programmer will disable only the continuity testing. When the continuity testing is disabled in EPROM mode, the programmer will also disable the backwards device test and the misjustification test.

	Procedure	Keystroke	Model 60 Displays
1.	Select the option to set	**SELECT E2**	CONT TEST E2
		or	
	Go into the select function menu.	**SELECT**	SELECT OPTION
	View the options until DEVICE OPTIONS appears in the display.	**SCROLL**	DEVICE OPTIONS
	Press **START**	START	NON-BLANK CHK B4 ILLEG BIT CHK CC
	Scroll through the device options until CONT TEST appears.	**REVIEW** **or** **SCROLL**	TEST MODES E6 FPRINT CYCLES E8 FPRINT VECTOR E9 EABLE ELEC ID BD DABLE ELEC ID BC VIEW ID CD CONT TEST E2 SECURITY FUSE E7 REJECT OPTION E5 LIST VECTORS CE VERIFY PASSES CA
	Press **START**	**START**	CONT TEST ON or CONT TEST OFF
2.	Toggle the on/off parameter	**SCROLL** **or** **REVIEW**	CONT TEST OFF or CONT TEST ON
3.	Press **START**.	**START**	CONT TEST **

E8 FINGERPRINT CYCLES

The number of test cycles can be entered by using the following procedure.

	Procedure	Keystroke	Model 60 Displays
1.	Select option to set number of Fingerprint cycles	**SELECT E 8**	FPRINT CYCLES E8
2.	Set number of Finger-print cycles	**START 1-99**	FPRINT CYCLES^XX
	*The **REVIEW** key erases the number entered so you may enter another.*		
3.	Select number of cycles	**START**	FPRINT CYCLES **

E9 FINGERPRINT VECTOR

You can choose the starting vector for Logic Fingerprint testing by using the following procedure.

	Procedure	Keystroke	Model 60 Displays
1.	Select the starting vector function.	**SELECT E 9**	FPRINT VECTOR E9
2.	Enter the eight hexadecimal digits for starting vectors.	**START** **XXXXXXXX** **START**	START ^XXXXXXXX FPRINT ^XXXXXXXX
3.	Set the ending vector.	**XXXXXXXX**	FPRINT ^XXXXXXXX
4.	Install the Fingerprint vector	**START**	FPRINT VECTOR **

*The **REVIEW** key erases the number entered so you may enter another.*

Memory

Hex Code	Command Title	Description
BC	Disable Electronic ID	Disables the Electronic ID
BD	Enable Electronic ID	Enables the Electronic ID

CD VIEW ID

To view the electronic identifier, one byte at a time, use the following procedure.

	Procedure	Keystroke	Model 60 Displays
1.	Select the electronic identifier operation.	**SELECT C D** **START**	VIEW ID CD
2.	Increment through the 16-byte ID code.	**START** **START** or **REVIEW**	0000 XX VIEW ID **

CAUTION

Do not use this function for 40-pin devices.

SERIAL I/O COMMANDS

Logic and Memory

Serial I/O select functions set parameters that are used in serial port operations; for example, to enable CRC mode.

The select codes listed in the following table are all executed using the following key sequence:

SELECT H H START START

(where "H H" is the two digit code given in the Hex Code column of the table). I/O functions requiring additional data entry are listed on the following pages.

Some commands (such as Parity) require additional data to be keyed in.

The commands listed in the following table apply to logic and memory operation.

Hex Code	Command Title	Description
D9	Null Count	Sets the Null Count following a data record on the output. The hex entry selects from 0 (00) to 254 (FE) nulls. An entry of 255 (FF) sends no nulls, depresses the line feed and separates records by using a carriage return. The default entry on power up is 1 (01) null.
DA	Baud Rate	Sets the port baud rate: 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, or 19200. The **SCROLL** or **REVIEW** key allows you to walk through the options.
DB	Parity	Sets the port parity, either none or odd.
DC	Stop Bits	Sets the number of stop bits: 1 or 2.
E1	Terminal Remote	Enter the terminal remote mode.
F1	Computer Remote Control Mode	Enables Computer Remote Control (CRC) mode.
F9	Timeout	Disables/Enables the 25-second timeout, active unless disabled during I/O operations. 25 seconds is the maximum time the Model 60 will wait when receiving or sending.

FA CHARACTER OUTPUT

One way of testing the serial port is to send a single ASCII character through, and then verify that it was transmitted. Use the following procedure to enter the hex code for an ASCII character which will be transmitted to the port each time **START** is pressed (this function is inhibited in system remote control):

Procedure	Keystroke	Model 60 Displays
1. Select the character output command.	**SELECT F A** **START**	OUTPUT CHAR FA OUTPUT CHAR ^00
2. Enter the hex code for the ASCII character to be transmitted.	**H H** **START**	OUTPUT CHAR ^HH OUTPUT CHAR **
3. To re-transmit the same character, press the **START** key again. To transmit a different character, perform step 2 again.		

FC REMOTE ON/OFF

If you want to use ASCII characters to enable or disable the port remotely, use select code FC. Use the following procedure to enter hex codes for ASCII characters that can be used to turn remote control on or off.

Procedure	Keystroke	Model 60 Displays
1. Select the remote on or off command.	**SELECT F C** **START**	REMOTE ON/OFF FC RMT ON/OFF ^ HH HH
2. Select and enter the hex ON code.	**H H** **START**	RMT ON/OFF HH ^ HH RMT ON/OFF HH ^ HH
3. Select the hex OFF code	**H H** **START**	RMT ON/OFF HH ^ HH REMOTE ON/OFF **

Memory

Use the following procedure to set the size record.

D8 SIZE RECORD

	Procedure	Keystroke	Model 60 Displays
1.	Select the size record function.	**SELECT D 8**	SIZE RECORD D8
2.	Set the size record.	**START**	SIZE REC ^ 00 D8
3.	Enter a new size record or select the default	**H H** **START** or **START**	SIZE REC ^ HH D8 SIZE RECORD ** SIZE RECORD **

6. ERROR CODES

NOTE

If you get a recurring error, call your local customer support center listed at the back of this manual.

Code	Name	Description	Corrective Action
16*	FUNCTION ABORT	Command in progress was aborted by operator.	None
17*	COMMAND ERROR	Illegal key sequence while in Computer Remote Control (CRC).	Check key sequence and re-enter.
20	NONBLANK	Device failed the blank test.	Press START to override this error and program the device.
21	ILLEGAL BIT	Not possible to program the device due to already programmed locations of incorrect polarity.	Erase the device if possible or discard it.
22	PROGRAM FAIL	The program electronics were unable to program the device.	Either the device is bad or the programmer is inoperative or out of calibration.
23	VERIFY FAIL 1	The device data was incorrect on the first pass of the automatic verify sequence during device programming.	This error indicates that the device failed the low voltage verify; the data in the part is not the same as the RAM data.
24	VERIFY FAIL 2	The device data was incorrect on the second pass of automatic verify sequence during programming.	This error indicates that the device failed the high voltage verify; data in the part is not the same as the RAM data.
25	NO SOCKET ADP	A device-related operation was attempted without any programming adapter installed.	Install the appropriate adapter.
26	WRONG SKT ADP	Operation was attempted with the wrong adapter installed.	Install the appropriate adapter.

*Remote Control only; will not occur during front panel operation, hence no front panel display.

Code	Name	Description	Corrective Action
27	RAM EXCEEDED	There is insufficient RAM. The total allotment of RAM resident is less than the word limit or block size, or the begin address is set too high.	Program smaller parts or specific lower beginning address. If enough RAM is installed, it may be faulty.
28	PLCC NOT AVL	The device selected is not supported in the PLCC package type.	If device selected is incorrect, re-select the device. If DIP device was intended, change to the appropriate adapter.
30	FAM/PIN ERROR	An incorrect family and pinout code was entered from the front panel control or a valid pinout code was not appropriate for the operation attempted.	Check the User Note for correct family and pinout code.
31	EXCSS CURRENT	In the operation just attempted, the device was drawing more current than the device manufacturer's specification.	If the device is faulty, replace it. If this is not the problem, the fault may be with the programming electronics. Consult the maintenance manual.
32	BACKWARDS DEV	Backward device	The device is in backwards or there is a faulty device.
3B	CONTINUITY ERROR	The pins of the device are not making proper contact with the socket.	Ckeck the socket adapter and reinsert the device into the socket.
3B	MISJUSTIFY ER	Device is not bottom-justified.	Check to be sure that the bottom-most pins of the device are at the bottom of the socket.
3B	I/O LEVEL ERR	Hardware malfunction in EPROM adapter.	Contact your local Data I/O Service Center.
34	FAM/PIN ERROR	An incorrect family and pinout code was entered.	Check the User Note for correct family and pinout code.

Code	Name	Description	Corrective Action
38	BAD CAL STEP	An inappropriate calibration step was entered.	Recheck the calibration chart for the correct calibration step and try again. The calibration chart is in the maintenance manual.
39	SEC FUS BLOWN	An attempt was made to program a device with the security fuse blown.	Device cannot be programmed again if the security fuse is blown.
3A	NO FUNC DATA	A load or a test operation was attempted with test mode selected for structured vector and fingerprint test only, and no vectors are loaded and the number of fingerprint cycles are zero.	Select an alternate test mode or resolve the undefined vectors or cycle count.
3D	LOGIC OPTION	Identifies a function that applies to logic operation. Occurs when a memory adapter is installed.	Choose a different function or change the adapter.
3E	MEMORY OPTION	Identifies a function that applies to memory operation. Occurs when a logic adapter is installed.	Choose a different function or change the adapter.
41	FRAME ERR	The serial interface detected a start bit but the stop bit was incorrectly positioned.	Check the baud rate and stop bit options (selects DA and DC) or use handshake.
42	OVERRUN ERR	The serial interface received characters when the programmer was unable to service them.	Check the baud rate and stop bit options or use hardware handshake. See the remote control section for instructions.

Code	Name	Description	Corrective Action
46	I/O TIMEOUT	No character (or only nulls and rubouts) were received on serial input for 25 seconds after pressing the START key, or no characters could be transmitted for a period of 25 seconds due to the state of the handshake lines.	Check all connections; then restart the operation, I/O timeout can be disabled by select code F9, which will then allow more than 25 seconds for serial port inputs.
48	I/O OVERRUN	The serial port input buffer received too many characters after the handshake line informed the sending device to stop.	Make sure the handshake lines are hooked up and operative.
52	I/O VFY FAIL	The data from the serial port did not match the data in RAM.	
63	RAM WRITE ERR	The programmer is unable to write the intended data in RAM.	Failure of the associated RAM chip; replace the failed chip.
64	RAM DATA ERR	The programmer detected a spurious change in RAM data.	Reload data into RAM. If problem persists, contact your local Data I/O Service Center.
66	IRQ ERR	The IRQ line to the processor was held low for no apparent reason.	Ignore. If the error persists, service the programmer.
67*	ERROR	Programmer received a non-valid command in Computer Remote Control (CRC).	Re-enter the command.
69	RAM BANK ERR	RAM bank error.	The address size is out of range for the programming adapter installed; reduce the block size to 4000.

*Remote Control only; will not occur during front panel operation, hence no front panel display.

Code	Name	Description	Corrective Action
74	FNGRPRNT FAIL	Logic Fingerprint test verify error.	Indicates one of the following Logic Fingerprint errors: 1. Device passed fuse verify but failed Logic Fingerprint defective device 2. Operator has entered wrong Fingerprint vectors 3. Device cannot be tested with Logic Fingerprint (refer to the device-support list in the User Note)
75	VECTOR FAIL	Structured test verify error	The device passed fuse verify but failed structured test-defective device. Check structured test vectors and make sure they are correct. If not, re-enter the correct vectors. The vector could be invalid, or the operator may have mis-keyed a valid vector.
76	SELF TEST ERROR	Hardware failure on one of the device pin drivers.	Repair required, contact your local Data I/O Service Center.
77	SECURITY FAIL	Security fuse programming error.	The security fuse for the given device failed to program.
79	PRELOAD ERR	Preload implementation error.	The preload algorithm is not implemented for this device or it is implemented incorrectly.
81	PARITY ERR	The incoming data has incorrect parity.	Check the parity option (select DB and try again.
82	SUMCHK ERR	The sumcheck field received by the programmer does not agree with its own calculated sumcheck. For ASCII Binary formats, this error message indicates a missing F character.	Check all connections of units in the system, data format, and data source, and then try again.

Code	Name	Description	Corrective Action
83*	OUT OF RANGE	Value out of range for correct operation in CRC.	Enter legal parameters.
84	INVALID DATA	The programmer received invalid or not enough data characters during format reception. JEDEC Field: F - Invalid character in the field. Only "1" and "0" are allowed. L - A space or carriage return did not follow the fuse number. L - An invalid character was in the fuse state field. Only "1" and "0" are allowed. Spaces, line feeds, and carriage returns are ignored. S - Invalid character in the field. Only "1", "0" and "N" are allowed. V - Too few or too many test conditions.	Check the connection of all units in the system, data format and data source, and then try again.
90	INVALID FORM	1) An I/O operation was attempted while in the logic mode with a non-JEDEC I/O translator. 2) An I/O operation was attempted while in the memory mode with the JEDEC translator selected.	Enter a legal format code for the adapter that is installed.

*Remote Control only; will not occur during front panel operation, hence no front panel display.

Code	Name	Description	Corrective Action
91	I/O FORM ERR	The programmer received an invalid character in the address field. JEDEC Field: C - Invalid character in field, must be four digit hexadecimal number. G - Invalid character in field. Only "1" and "0" allowed. L - fuse number exceeds fuse limit for device or invalid fuse number (must be decimal). P - Too few or too many pins or invalid pin number for device. T - Test cycles greater than 99. R - Invalid character in the field; must be eight digit hexadecimal number.	Check the connection of all units in the system, data format, and data source, and then try again.
92	I/O FORM ERR	The address check was in error Tektronix Hexadecimal format only).	Check the connection of units in the system, data format, and data source, and then try again.
93	I/O FORM ERR	The number of input records did not equal the Record Count	Check the connection of all units in the system, data format, and data source, and then try again.
94	BAD REC TYPE	The record type was in error. (Intel-Intellec 8/MDS, Intel MCS-86) formats only.)	Check the connection of all units in the system, data format, and data source, and then try again.
96	MIDPOINT ERR	An invalid midpoint was entered in CRC mode for a split or shuffle RAM.	Enter a valid midpoint.
97	BLOCK MOVE ERR	Block Move was attempted outside RAM boundaries.	Select new RAM boundaries.
98	DEV EXCEEDED	Programming data exceeded the last device address.	Redefine parameters.

Code	Name	Description	Corrective Action
A1	NO ID FOUND	Programmer failed to detect an electronic identifier in the device.	Enter the correct family and pinout code for the device. See the device-support list in the User Note.
A2	INVALID ID	Device cannot be programmed with the current family and pinout codes if in effect.	Consult the device-support list in the User Note for the correct family and pinout code and re-enter the information into the programmer.
—	SYSTEM EPROM ERR	Programmer failed to detect the proper revision level of installed software.	Contact your local Data I/O Service Center.

7. GLOSSARY

Action Symbol — A special character ⊕ used by Data I/O programmers to indicate that the programmer is executing an operation.

Algorithm — Mathematical formula used for problem solving.

Configuration Number — A four-digit signature sumcheck of the data contained in a set of firmware.

CRC — Computer Remote Control.

EPLD — Erasable Programmable Logic Devices; PLDs that can be erased and re- programmed.

EPROM — Erasable Programmable Read Only Memory device.

Error Code — A two-digit hexadecimal code indicating an operational or functional error or incompatibility.

Family/Pinout Code — A two-digit hexadecimal number that designates the programming algorithm (family) followed by a two-digit hexadecimal number used to differentiate device types based on pin assignment and array size (pinout).

FPLA — Field Programmable Logic Array.

FPLS — Field Programmable Logic Sequencer.

Function Abort — Exiting or escaping from an operation.

IFL — Integrated Fuse Logic.

LCA — Logic Cell Array; static RAM based PLD that is programmed in-circuit by the host system or microprocessor.

Master Device — Previously programmed device used as a data source for programming other devices or for loading into RAM.

Offset Address — Used in memory data transfer through a serial port to relocate received data to usable RAM.

PAL — Programmable Array Logic.

PLCC — Plastic Leadless Chip Carrier.

PLD — Programmable Logic Device.

PROM — Programmable Read Only Memory device.

Select Function — Special two-character hexadecimal codes that allow you to select several programmer operating modes.

Self Test — During power-up, a series of functional tests automatically performed by Data I/O programmers.

Serial Port — RS232-C connection to allow programmer operation in remote mode.

Sumcheck — A four-digit (logic) or six-digit (memory) hexadecimal number used to verify the integrity of a data transfer.

Terminal Mode — Allows execution of all the Model 60A commands from a local terminal's keyboard.

Test Vector — A set of inputs together with the expected outputs used to test ICs under actual in-circuit conditions.

UV Lamp — Programmer capability to erase programmed MOS EPROMS and erasable logic devices.

Verify — Checks that the information in two or more locations is the same, thereby verifying the integrity of the data transfer.

8. INDEX

NOTE

Entries are listed by section — each section is individually numbered. Sections are denoted as follows:

No prefix — Introduction
1 — Getting Started
2 — Programming With Logic Adapter
3 — Programming With Memory Adapter
4 — Remote Control
5 — Select Functions
6 — Error Codes