SHOOTER
EPROM PROGRAMMER

USER MANUAL

LOGICAL DEVICES
PO BOX 8400
DENVER, CO 80201
TEL:303-813-9000
FAX:303-813-9019
WWW.LOGICALDEVICES.COM

Release Information

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1.0 UNPACKING

1. Carefully unpack unit from the shipping container and inspect for possible shipping damage.

2. Check for the following items:

   a) SHOOTER EPROM programmer
   b) Set of 10 configurators (for 2716, 2732, 2732A, 2532, 2764, 2764A, 27128, 27128A, 27256, 27256 [21 volt])
   c) Warranty registration
   d) Serial communication cable (without RS-232 connector)

2.0 OPERATION

The SHOOTER programmer is a complete stand-alone unit with an RS232 interface capability. All operating controls and indicators are contained on the front panel and at the back of the unit as shown in Figure 2-1. There are three basic modes of operation: stand-alone, terminal controlled, and computer controlled.

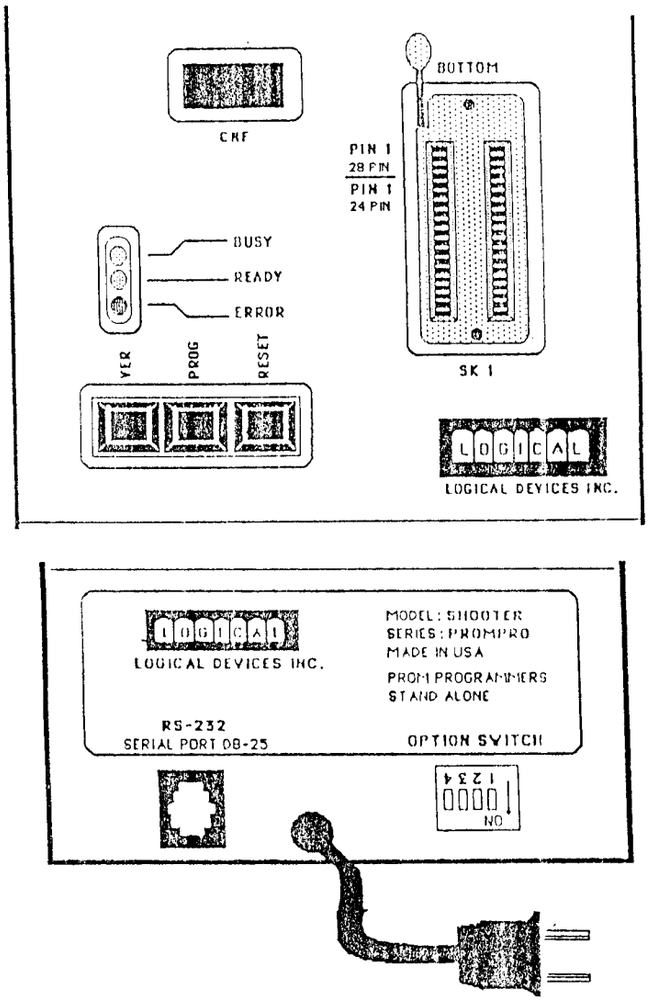


Figure 2-1. SHOOTER Front Panel and Rear Panel Controls and Indicators.

2.1 STAND ALONE MODE

In the stand-alone mode of operation, you copy and verify EPROMs using the front panel function switches. There is no need for a computer or terminal interface in this mode of operation.

NOTE

220 volt operation requires a 220 volt modification option.

1. Plug the unit into the appropriate AC outlet. The front panel status LEDs will light in sequence (red - ERROR, yellow - BUSY, green - READY). The red will flash briefly, the yellow will flash for a short while, and then the green LED will stay on to indicate that the unit is ready to accept a command.

2. Refer to Section 5.0 to choose the proper configurator plug. With the white dot to the left, insert the proper Configurator plug in the CNF socket.

3. Insert the master EPROM (the one you wish to copy) into the ZIF socket. Align the EPROM so that pin 1 is in the upper left corner of the ZIF socket (the same side as the ZIF handle) and the ground pin (pin 12 of 24-pin EPROMS, pin 14 of 28-pin EPROMS) is in pin 14 of the ZIF socket. Refer to Appendix E for additional EPROM insertion instructions.

4. Press the front panel RESET switch to reset the system and automatically read the entire contents of the master EPROM into the programmer RAM buffer.

NOTE

The front panel LED status indicators will light in sequence as in the power-up procedure.

5. Remove the master EPROM and replace it with an erased EPROM of the same type.

NOTE

To verify that an EPROM is properly erased in the stand-alone mode:

a. Insert a known blank EPROM in the unit and press the RESET switch.
b. Insert the EPROM in question into the unit.
c. Press the VERIFY switch. If the red LED status indicator lights, the EPROM is not completely erased.

6. Be sure both the EPROM and the configurator plug are inserted correctly in their respective sockets. This is a very important step to prevent damage to the device.

----- CAUTION -----

Before continuing, be sure all previous steps have been performed correctly or you may damage the device.

7. Depress the PROG switch on the front panel (the yellow BUSY indicator will remain on during programming). When the program cycle is complete, the green READY indicator will light. If the EPROM does not program properly, the red ERROR indicator will light.

8. To insure that every location has been programmed properly, initiate the Verify feature by pressing the VERIFY switch on the front panel. This will initiate a comparison of every data byte in the EPROM against the programmer RAM. If there is any discrepancy, the red ERROR indicator will light.

2.2 TERMINAL MODE/COMPUTER MODE

NOTE

Generally, the serial cabling to a computer is different from the serial cabling to a CRT terminal. Refer to Section 6.0 for wiring details.

2.2.1 Terminal

SHOOTER has the ability to operate directly with a terminal. An internal communications program allows you to use the terminal to control SHOOTER operation. Refer to Section 6.0 for interface connection and baud rate setting information.

1. Connect the unit to a serial terminal or a computer through the serial communication connector located on the back of the unit. Set the dip switches on the rear panel for the the desired baud rate.

2. Upon power up, SHOOTER sends a command menu to the terminal followed by a * prompt. A command may be entered after the prompt appears. Refer to Section 3.0 for detailed descriptions of the following commands:

C = CHECKSUM	H = HEX LOAD
F = FILL RAM	G = HEX DUMP
N = BLANK CHECK	L = BINARY LOAD
P = PROGRAM	K = BINARY DUMP
R = READ EPROM	T = DOWNLOAD
V = VERIFY	U = UPLOAD
X = EXAMINE	W = UPLOAD WITH WAIT
? = MENU	O = OFFSET xx
I = INTEL	
M = MOTOROLA	

NOTE

An * appears beside either Intel Hex or Motorola Hex to indicate in which mode SHOOTER is currently.

NOTE

You may display the menu at any time by typing a question mark.

4. After completing any command, SHOOTER transmits either the character sequence ^F*EOJ* or ^U*EOJ*. The character ^ preceding any character indicates the control code for that character. A ^F (HEX 06) indicates an ACK (Acknowledge) meaning that all went well in the previous instruction. A ^U (HEX 15) transmitted indicates a NAK (Negative Acknowledge) meaning that an error was encountered on the previous instruction. The codes $06 or $15 are typically non-displaying characters that would only be used when connected to a host computer.

NOTE

^U*EOJ* transmission sequence means a control U, followed by ASCII characters *EOJ* is sent.

5. Files may be uploaded to the terminal screen from the SHOOTER for viewing. Files may also be sent directly to the SHOOTER RAM by manually keying in the data from the terminal keyboard.

2.2.2 Computer

The SHOOTER also has the ability to communicate with a computer, in one of two ways, if the computer is executing the appropriate software.

1. COMPUTER EMULATING A TERMINAL (Host terminal) - To make your computer function as a terminal, you must instruct your computer via a software program. This type of software program is generally referred to as a Terminal or Modem program. Generally these are available commercially under various names; e.g. CROSS-TALK, MODEM-7, ASCII EXPRESS. Many such commercial programs have a capture function that allows uploaded files to be saved to a disk file. Frequently, a send file function, which allows a disk file to be downloaded to the SHOOTER, is also available.

2. COMPUTER OPERATING THE SHOOTER (File transfer) - A custom program may be written in either Basic or any other language that utilizes any or all of the commands supported by the SHOOTER. This allows the transfer of a HEX file to the SHOOTER or the reading of a HEX file from the SHOOTER (refer to Appendix A for details on hex formats). In this way, a turnkey operation may be created.

NOTE

The RAM buffer size on the SHOOTER is 128 Kbits, or 16 Kbytes.

3.Ø SHOOTER COMMAND DICTIONARY

C	CHECKSUM	:	H	HEX LOAD
F	FILL RAM	:	G	HEX DUMP
N	BLANK CHECK	:	L	BINARY LOAD
P	PROGRAM	:	K	BINARY DUMP
R	READ EPROM	:	T	DOWNLOAD
V	VERIFY	:	U	UPLOAD
X	EXAMINE MEMORY	:	W	UPLOAD WITH WAIT
?	MEMU	:	O	OFFSET ØØ
I	INTEL HEX *			
M	MOTOROLA HEX			

Following are descriptions of the command character sequences sent via RS232 serial interface port.

NOTE

The identifier should not be sent. No carriage return should be sent after the command character(s). Lower case xx indicates a two digit hexadecimal number. All characters sent must be uppercase.

3.1 C = CHECKSUM

Directs the SHOOTER to calculate a checksum of the RAM data specified by the CNF plug. The resulting 16-bit sum is sent to the terminal or computer. The checksum is calculated by adding memory contents byte by byte and truncating the result to two bytes.

3.2 FXX = FILL RAM

Directs the SHOOTER to fill the entire RAM (as specified by the configurator plug) with any desired pattern. The function is followed by two hex digits representing the desired pattern.

3.3 G = HEXADECIMAL UP-LOAD

Directs the SHOOTER to transmit the contents of it's internal RAM to the terminal or computer. The amount that will be transmitted will be automatically determined by the configurator plug in the CNF socket.

For example:
2716 = 2K byte file
Data A2 (Hex) = 1Ø1ØØØ1Ø (binary)
2 Characters sent: A1(Hex) and 32(Hex)

3.4 H = HEXADECIMAL DOWN-LOAD

1. Directs the SHOOTER to enter the Hex DOWN-LOAD mode. All succeeding character values are stored beginning at location 0000.

2. If no character is received within approximately seven seconds, the unit will exit the DOWN-LOAD mode and return to the READY state. This is the normal way to exit this command.

For example: 2 Characters sent: A and 2
Data stored A2 (hex) = 10100010 (binary).

3.5 K = BINARY UP-LOAD

Directs the SHOOTER to transmit the contents of it's internal RAM to the terminal or computer. The data is sent as a character, byte by byte. The amount to be be transmitted will be determined automatically by the configurator plug in the CNF socket.

For example: 2716 = 2K
Data sent A2 (hex) = " (ASCII)
(Double quotes, MSB set)

3.6 L = BINARY DOWN-LOAD

1. Directs the SHOOTER to enter the DOWN-LOAD mode. The character's ASCII value is stored as data beginning at location 0000.

2. If no character is received within approximately seven seconds, the unit will exit the DOWN-LOAD mode and return to the READY state. This is the normal exit of this command.

For example: Data sent A and Z (ASCII)
Data stored location 0000 = 41,
Data stored location 0001 = 32.

3.7 N = BLANK CHECK

The BLANK CHECK command directs the SHOOTER to check an unknown EPROM for the blank data pattern. If the EPROM is not erased the SHOOTER will respond with the character sequence NB ERROR and light the ERROR indicator. If the target EPROM contains all FF's, the characters *EOJ* will be sent.

3.8 P = PROGRAM

Directs the SHOOTER to program the EPROM. A simple transfer takes place when the contents of the RAM are programmed into the coinciding locations of the EPROM.

NOTE

The EPROM being programmed must be blank or previously erased using a QUV-T8 EPROM eraser or equivalent.

1. Type a P on the terminal. The BUSY indicator will light.

2. After the EPROM has been completely programmed, all locations are then compared to the RAM. If any errors are found, (see VERIFY) the ERROR indicator will light. If you are using the Intellegent Programming Algorithm, the program cycle will stop at the first unprogrammable location.

3. If an error occurs, check the configurator plug for proper type and proper insertion in the CNF socket.

3.9 R = READ EPROM

The READ command directs the SHOOTER to read the EPROM into the SHOOTER internal RAM. Make sure that the EPROM is inserted correctly and the proper configurator plug is inserted in the CNF socket before issuing the READ command.

3.10 T = FORMATTED HEXADECIMAL DOWN-LOAD

1. Directs the SHOOTER to enter the DOWN-LOAD mode. The unit is now expecting the header character of the specified format, either an S for MOTOROLA or an : for INTEL. At this point all other characters will be ignored until the header is received. The most significant bit of an address will be ignored and any references to address space from 4000H to 7FFFH will not write to RAM. When the address is received, the contents of the offset register (see OFFSET command) will be subtracted from it and the result will be the actual RAM address where the data will be stored.

2. If no header character is received within approximately seven seconds, the unit will exit the DOWNLOAD mode and return to the READY state.

3. The checksum is compared at the end of each data record. If an error is detected, the ERROR indicator will light but the data will still be stored in RAM and the unit will still remain in this mode either until the end of the record is found or until transmission stops.

3.11 Uxx = FORMATTED HEXADECIMAL UP-LOAD

1. Directs the SHOOTER to transmit the contents of it's internal RAM to the terminal or computer. The amount that will be transmitted will be automatically determined by the configurator plug in the CNF socket.

For example: 2716 = 2 Kbytes

2. The SHOOTER is now expecting two more characters. These characters will be two hexadecimal digits which are added to the SHOOTER addresses to form the address field in each record. Later, when the uploaded hex file is used on the host computer, it will be located at a valid memory location and not '0', which on many host computers is not usable as a data area.

For example: A 4 Kbyte Up-Load from a 2732

	Range of addresses in file	
UPLOAD WITH OFFSET COMMAND	STARTING ADDRESS	FINAL ADDRESS
U00	0000	0FFF
U30	3000	3FFF
U96	9600	A5FF
UCF	CF00	DEFF

3. The SHOOTER will transmit the contents of it's internal RAM buffer beginning at location 0000 in the hexidecimal record format previously specified. If you do not change the format after power up, INTEL format will be used. A seven second delay before transmission is incorporated in order to allow setup time for the host computer.

3.12 V = VERIFY

This feature, whether directed from the terminal or the front panel switch, initiates a location-by-location comparison of the RAM buffer against the EPROM. If a discrepancy occurs, the red LED indicator will light. If all data compares, the green LED indicator lights. This is a very useful feature for comparing a large number of EPROMs against a known master.

3.13 W = UPLOAD WITH WAIT

This function is useful mainly when using the CPM PIP command or custom programs to UPLOAD to a host computer. The WAIT option causes a 25-second delay before transmission to allow the PIP command (or equivalent). In addition to a delay, the transfer is terminated with a control Z (1A hex), which is necessary to correctly close the file.

3.14 X = EXAMINE

The EXAM command allows you to gain direct access to a specific memory location in the SHOOTER internal RAM and, if desired, change the contents of that location.

1. To use this command type X.

2. A space will then be displayed.

3. The SHOOTER is now waiting for a 4-digit hex address. The specified address must be within the range of the EPROM being programmed.

4. After the address has been entered, the SHOOTER will display the address, an = sign, and the contents of this location.

5. If no change is to be made to this location enter a space (space bar) to increment the address and display the contents of the next location. To change the data, simply enter new data (two Hex digits).

6) To terminate the EXAM command, type a CR.

For example: Examine location 0200 and change location 0201 from 67 to 55 verify that location 201 contains 55.

User entry is in bold type.

```
* X 0200
0200=45 <SPACEBAR>
0201=67 55
0202=7A <CR>
*
* X 0201
0201=55 <CR>
*
```

3.15 ? = MENU

You may recall the SHOOTER command menu at any time by entering a question mark from the terminal.

3.16 I = INTEL HEXADECIMAL FORMAT

An I entered via the RS-232C port will direct all file transfer communications to be carried out in the INTEL hexadecimal format. See Appendix A for details and examples.

NOTE

The SHOOTER will default to INTEL upon power up.

3.17 M = MOTOROLA HEXADECIMAL FORMAT

An M entered via the RS-232C port will direct all communications to be carried out in the MOTOROLA hexadecimal format. See Appendix A for details and examples.

3.18 O = OFFSET

The OFFSET function is used in conjunction with the DOWNLOAD command and, once set, will retain its value until another OFFSET command is issued. When downloading formatted hex records the OFFSET value is subtracted from the most significant byte of each record.

For example:
```
Record start address.....0500
OFFSET value.............05
RAM address..............0000
```

NOTE

The OFFSET value defaults to 00 on power up.

4.0 INDICATORS AND ERROR CODES

4.1 Status Indicators

There are three LED Status Indicators on the SHOOTER front panel. These Status Indicators are used in both stand-alone mode and RS-232 mode.

ERROR (Red LED Status Indicator)

Lights when the following faults occur:

A. An EPROM did not program correctly. Try erasing the EPROM again for a longer period of time. Also, check the configurator plug.

B. An error was found when performing a DOWNLOAD. Check baud-rate selection. Check for non-valid data in the host computer's hex file.

BUSY (Yellow LED Status Indicator)

Lights whenever the SHOOTER CPU is engaged in a command.

***** CAUTION *****

DO NOT remove or install an EPROM at any time when the BUSY (yellow status indicator) is lit or the device may be destroyed.

READY (Green LED Status Indicator)

Lights when the unit is in idle state. All power, address, and data lines have been taken low (i.e. less than 1 volt) making it safe to remove or install the EPROMs at this time.

4.1 ERROR CODES

Some commands will send an error message, indicating a failed condition, to the terminal. Following is a list of these errors and the coresponding error message.

```
BLANK CHECK.....................NB ERROR
PROGRAM (INTELIGENT ONLY).......PF ERROR
VERIFY..........................NV ERROR
```

After each command is completed, the SHOOTER will send the character sequence *EOJ* preceded by either a hex 06 (the code for ACK) if the function passed or a hex 15 (code for NAK) if it failed.

5.0 DEVICE CONFIGURATION

In order to configure SHOOTER for a particular device type, you must plug one of the small DIP configurator plugs supplied with SHOOTER into the front panel CNF socket. These plugs are coded with a generic number representing the device type.

The configurator plug can be changed while power is on without damage to the unit but not while the BUSY (yellow status indicator) is lit. It is possible to edit the RAM buffer without the configurator plug inserted.

Data can be transferred from one EPROM device type to another by changing configurator plugs after the READ operation is complete. To avoid damage, do not insert any other type of hardware into the CNF socket. If additional or replacement Configurators are required, they can be obtained from LOGICAL DEVICES, INC.

NOTE

For some EPROMs the DIP switch located on the back of the unit (SWITCH #3) must also be set in addition to using the proper configurator. This switch controls the VCC voltage (5V or 6V) and the type of programming algorithm (standard or intelligent) used. For these devices, the DIP switch setting is indicated in the Device Dictionary under the column marked DIP SWITCH 3. ON (Down) is for intelligent programming and OFF (Up) is for standard programming. If you are using the 27256 EPROM, switch #4 will be used as the upper address bit (A14). The reason for this is that the 27256 EPROM is a 256 K-bit device and SHOOTER has only 128 K-bits of RAM buffer; therefore, programming must be done in two passes. The position of switch 4 is OFF (Up) for the lower half (low bytes) of the 27256 and ON (down) for the upper half (high bytes) of the 27256.

To use the Device Dictionary simply locate the manufacturer in the left column. Locate the device in the second column. Determine the number for the configurator plug you must insert in the CNF socket under the CNF column. Insert the EPROM in the ZIF socket.

6.0 DEVICE DICTIONARY

NOTE

SHOOTER supports all of the devices listed in this Device Dictionary. Due to continual upgrading though, all supported devices may not be listed. For specific device requirements not listed, please call Logical Devices, Inc.

MANUFACTURER	DEVICE	ARRAY SIZE	CNF
EXEL	2816	2K X 8	2816
EXEL	2816A	2K X 8	2816
INTEL	2816-x	2K X 8	2816
MOTOROLA	MCM2816	2K X 8	2816
NS	NMC2816-x	2K X 8	2816
ROCKWELL	2816	2K X 8	2816
XICOR	X2816	2K X 8	2816
AMD	AM2532	4K X 8	2532
AMD	AM27128	16K X 8	27128
AMD	AM27128A	16K X 8	27128A
AMD	AM2716	2K X 8	2716
AMD	AM2716B	2K X 8	2716B
AMD	AM27256	32K X 8	27256
AMD	AM2732	4K X 8	2732
AMD	AM2732A	4K X 8	2732A
AMD	AM2732B	4K X 8	2732B
AMD	AM27512	64K X 8	27512
AMD	AM2764	8K X 8	2764
AMD	AM2764A	8K X 8	2764A
AMD	AM27C256	32K X 8	27256
AMD	AM27C512	64K X 8	27512
AMD	AM9716	2K X 8	2716
AMD	AM9732	4K X 8	2732
AMD	AM9732A	4K X 8	2732A
AMD	AM9764	8K X 8	2764
ATMEL	AT27256	32K X 8	27256
ATMEL	AT27C256	32K X 8	27256
ATMEL	AT27C512	64K X 8	27512
ELEC ARRAY	2716	2K X 8	2716
EUROTECH.	ET2716	2K X 8	2716
EUROTECH.	ET2732	4K X 8	2732
EUROTECH.	ET2764	8K X 8	2764
EUROTECH.	ETC2716X8	2K X 8	2716
FAIRCHILD	2764	8K X 8	2764
FAIRCHILD	F2716	2K X 8	2716
FAIRCHILD	F2732	4K X 8	2732
FUJITSU	MBM27128Q	16K X 8	27128
FUJITSU	MBM27128S	16K X 8	27128
FUJITSU	MBM2716	2K X 8	2716
FUJITSU	MBM27256Q	32K X 8	27256
FUJITSU	MBM2732	4K X 8	2732
FUJITSU	MBM2732A	4K X 8	2732A
FUJITSU	MBM2764Q	8K X 8	2764
FUJITSU	MBM2764S	8K X 8	2764
FUJITSU	MBM27C128Q	16K X 8	27128
FUJITSU	MBM27C128S	16K X 8	27128
FUJITSU	MBM27C256	32K X 8	256-21
FUJITSU	MBM27C256AQ	32K X 8	27256
FUJITSU	MBM27C32	4K X 8	2732
FUJITSU	MBM27C32A	4K X 8	2732A
FUJITSU	MBM27C512	64K X 8	27512
FUJITSU	MBM27C64Q	8K X 8	2764
FUJITSU	MBM27C64S	8K X 8	2764
GI	27256	32K X 8	27256
GI	27512	64K X 8	27512

MANUFACTURER	DEVICE	ARRAY SIZE	CNF
GI	27C128	16K X 8	27128A
GI	27C256	32K X 8	27256
GI	27C512	64K X 8	27512
GI	27C64	8K X 8	2764A
GI	27HC64	8K X 8	2764A
HITACHI	2732A	4K X 8	2732A
HITACHI	HN27256G	32K X 8	27256
HITACHI	HN27512G	64K X 8	27512
HITACHI	HN27C256G	32K X 8	27256
HITACHI	HN27C32	4K X 8	2732
HITACHI	HN27C64G	8K X 8	2764
HITACHI	HN27C64GQ	8K X8	2764
HITACHI	HN462532G	4K X 8	2532
HITACHI	HN462716G	2K X 8	2716
HITACHI	HN462732G	4K X 8	2732
HITACHI	HN462732P	4K X 8	2732
HITACHI	HN472532	4K X 8	2532
HITACHI	HN4827128G	16K X 8	27128
HITACHI	HN4827128GQ	16K X 8	27128
HITACHI	HN4827128P	16K X 8	27128
HITACHI	HN4827128PQ	16K X 8	27128
HITACHI	HN482716	2K X 8	2716
HITACHI	HN4827256	32K X 8	27256
HITACHI	HN482732AG	4K X 8	2732A
HITACHI	HN482764G	8K X 8	2764
HITACHI	HN482764GQ	8K X 8	2764
HITACHI	HN482764P	8K X 8	2764
HITACHI	HN482764PQ	8K X 8	2764
INTEL	27128(I)	16K X 8	27128
INTEL	27128(S)	16K X 8	27128
INTEL	27128A(I)	16K X 8	27128A
INTEL	27128A(Q)	16K X 8	27128A
INTEL	27128B	16K X 8	27128A
INTEL	2716	2K X 8	2716
INTEL	27256(I)	32K X 8	27256
INTEL	27256(Q)	32K X 8	27256
INTEL	2732	4K X 8	2732
INTEL	2732A	4K X 8	2732A
INTEL	2732B	4K X 8	2732B
INTEL	27512(I)	64K X 8	27512
INTEL	27512(Q)	64K X 8	27512
INTEL	2758	1K X 8	2716
INTEL	2764	8K X 8	2764
INTEL	2764A(I)	8K X 8	2764A
INTEL	2764A(Q)	8K X 8	2764A
INTEL	27C256(I)	32K X 8	27256
INTEL	27C256(Q)	32K X 8	27256
INTEL	27C64(I)	8K X 8	2764A
INTEL	27C64(Q)	8K X 8	2764A
INTEL	P27128A	16K X 8	27128A
INTEL	P2732A	4K X 8	2732A
INTEL	P2764	8K X 8	2764
INTEL	P2764A	8K X 8	2764A
INTERSIL	6716	2K X 8	2764A
MATSUSHITA	27128	16K X 8	27128

MANUFACTURER	DEVICE	ARRAY SIZE	CNF
MATSUSHITA	2764	8K X 8	2764
MITSUBISHI	M5L27128K	16K X 8	27128
MITSUBISHI	M5L2716K	2K X 8	2716
MITSUBISHI	M5L27256K	32K X 8	27256
MITSUBISHI	M5L2732AK	4K X 8	2732A
MITSUBISHI	M5L2732K	4K X 8	2732
MITSUBISHI	M5L27512K	64K X 8	27512
MITSUBISHI	M5L2764K	8K X 8	2764
MITSUBISHI	M5M27C128K	16K X 8	27128
MITSUBISHI	M5M27C256K	32K X 8	27256
MOSTEK	2764	8K X 8	2764
MOSTEK	MK2716-n (all)	2K X 8	2716
MOTOROLA	MCM2532	4K X 8	2532
MOTOROLA	MCM2716	2K X 8	2716
MOTOROLA	MCM2732	4K X 8	2732
MOTOROLA	MCM27A16	2K X 8	2716
MOTOROLA	MCM27L16	2K X 8	2716
NEC	uPD27128	16K X 8	27128
NEC	uPD2716	2K X 8	2716
NEC	uPD27256	32K X 8	256-21
NEC	uPD2732	4K X 8	2732
NEC	uPD2732A	4K X 8	2732A
NEC	uPD2764	8K X 8	2764
NEC	uPD2764A	8K X 8	2764A
NEC	uPD27C256	32K X 8	256-21
NEC	uPD27C256A	32K X 8	27256
NEC	uPD27C512	64K X 8	27512
NEC	uPD27C64	8K X 8	2764
NEC	uPD27C64A	8K X 8	2764A
NEC	uPD8716	2K X 8	2716
NS	2532	4K X 8	2532
NS	25C32	4K X 8	2532
NS	27C128	16K X 8	27128
NS	MM2716E	2K X 8	2716
NS	MM2716M	2K X 8	2716
NS	MM2732	4K X 8	2732
NS	MM2758A	2K X 8	2716
NS	MM2758B	2K X 8	2716
NS	NMC2732	4K X 8	2732
NS	NMC2732A	4K X 8	2732A
NS	NMC2764	8K X 8	2764
NS	NMC2764Q	8K X 8	2764
NS	NMC27C128	16K X 8	27128
NS	NMC27C16	2K X 8	2716
NS	NMC27C16H	2K X 8	2716
NS	NMC27C256	32K X 8	256-21
NS	NMC27C256A	32K X 8	27256
NS	NMC27C32	4K X 8	2732
NS	NMC27C32A	4K X 8	2732A
NS	NMC27C32H	4K X 8	2732
NS	NMC27C512	64K X 8	27512
NS	NMC27C58A	1K X 8	2716
NS	NMC27C58B	1K X 8	2716
NS	NMC27C64	8K X 8	2764
NS	NMC27CP128B	16K X 8	27256

MANUFACTURER	DEVICE	ARRAY SIZE	CNF
OKI	2532	4K X 8	2532
OKI	27128	16K X 8	27128
OKI	2716	2K X 8	2716
OKI	27256	32K X 8	27256
OKI	27256A	32K X 8	27256
OKI	2732	4K X 8	2732
OKI	2732A	4K X 8	2732A
OKI	2758	1K X 8	2716
OKI	2764	8K X 8	2764
OKI	27C256	32K X 8	27256
SCS	M2732A	4K X 8	2732A
SEEQ	27128	16K X 8	27128
SEEQ	27128A	16K X 8	27128A
SEEQ	27256	32K X 8	27256
SEEQ	2764	8K X 8	2764
SEEQ	27C128	16K X 8	27128
SEEQ	27C256	32K X 8	27256
SEEQ	27C64	8K X 8	2764
SEEQ	27C64A	8K X 8	2764A
SEEQ	DQ5133	8K X 8	2764
SEEQ	DQ5143	16K X 8	27128
SGS-ATES	2532	4K X 8	2532
SGS-ATES	27128A	16K X 8	27128A
SGS-ATES	2716	2K X 8	2716
SGS-ATES	27256	32K X 8	27256
SGS-ATES	2732A	4K X 8	2732A
SGS-ATES	27512	64K X 8	27512
SGS-ATES	2764	8K X 8	2764
SGS-ATES	2764A	8K X 8	2764A
SIGNETICS	27C64	8K X 8	2764
SYNERTEK	2716	2K X 8	2716
TI	SMJ2516	2K X 8	2716
TI	SMJ2532	4K X 8	2532
TI	TMS2516	2K X 8	2716
TI	TMS2532	4K X 8	2532
TI	TMS27128	16K X 8	27128
TI	TMS27128A	16K X 8	27128A
TI	TMS2732	4K X 8	2732
TI	TMS2732A	4K X 8	2732A
TI	TMS27512	64K X 8	27512
TI	TMS2764	8K X 8	2764
TI	TMS27C128	16K X 8	27128A
TI	TMS27C256	32K X 8	27256
TI	TMS27C64	8K X 8	2764A
TI	TMX27C512	64K X 8	27512
TOSHIBA	TC57256	32K X 8	256-21
TOSHIBA	TC57256D	32K X 8	256-21
TOSHIBA	TC57512	64K X 8	27512
TOSHIBA	TMM27128	16K X 8	27128
TOSHIBA	TMM27128AD	16K X 8	27128A
TOSHIBA	TMM27128D/DI	16K X 8	27128
TOSHIBA	TMM27256AD	32K X 8	27256
TOSHIBA	TMM27256D/DI	32K X 8	256@21
TOSHIBA	TMM2732	4K X 8	2732
TOSHIBA	TMM2732A	4K X 8	2732A

MANUFACTURER	DEVICE	ARRAY SIZE	CNF
TOSHIBA	TMM27512D	64K X 8	27512
TOSHIBA	TMM2764	8K X 8	2764
TOSHIBA	TMM2764AD	8K X 8	2764A
TOSHIBA	TMM2764D/DI	8K X 8	2764
VTI	27C128	16K X 8	27128
VTI	27C256	32K X 8	27256
VTI	27C512	64K X 8	27512
VTI	27C64	8K X 8	2764A
WAFERSCALE	WS27C128F	16K X 8	27128
WAFERSCALE	WS27C64F	8K X 8	2764A

SUPPORT NOTES:

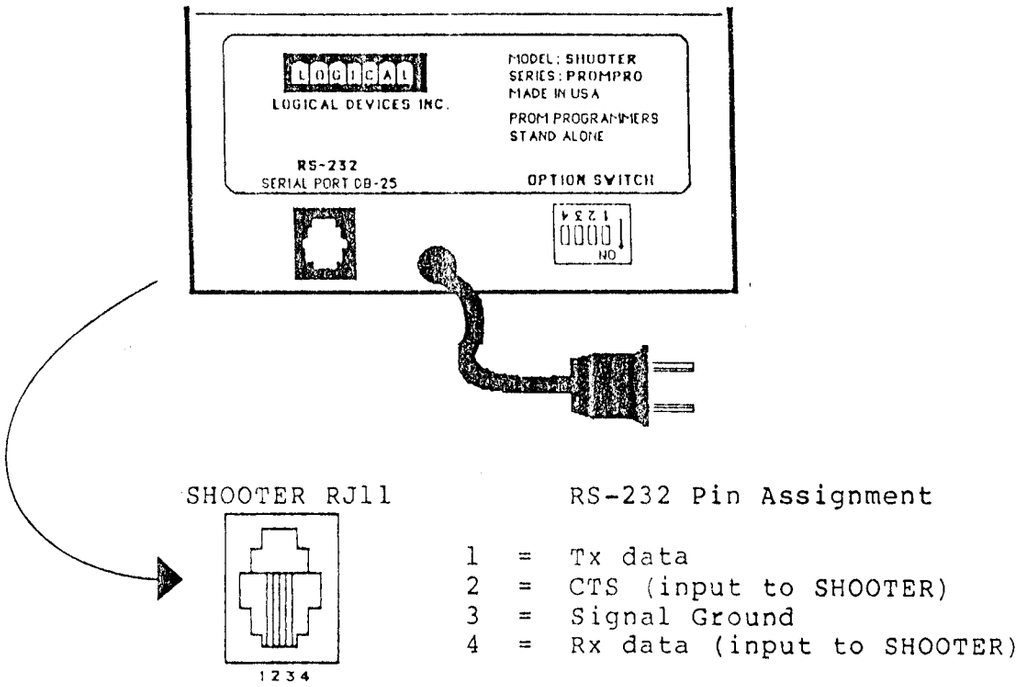
CNF 2816 REQUIRES THE AR6 MODULE OPTION.
CNF 2716B AND 2732B ARE EXTRA. THEY ARE NOT INCLUDED IN THE STANDARD SET OF CONFIGURATORS.
CNF 27512 IS INCLUDED WITH THE 512K UPGRADE.

7.0 COMMUNICATIONS

7.1 SERIAL INTERFACE

SHOOTER has a built-in serial I/O. The serial communication connector is located on the rear of the SHOOTER. See Appendix C for more information about the connector wiring.

The serial I/O can be directly connected to a CRT terminal (with pin 5 left disconnected). For most computer interfaces RS232 pins 2 and 3 must be reversed. It is always a good idea to refer to the pin-out of the serial interface for each terminal or computer to make sure that the wiring is correct.



SHOOTER RJ11

RS-232 Pin Assignment

1 = Tx data
2 = CTS (input to SHOOTER)
3 = Signal Ground
4 = Rx data (input to SHOOTER)

(View of RJ 11 socket from the back of SHOOTER)

Figure 7-1. SHOOTER RS-232C Pin Assignment.

NOTE

SHOOTER provides an, internal pull-up resistor for the CTS line providing a user option to exercise this handshake line. Certain development systems may require long delays in responding to the serial port, in which case the CTS line to SHOOTER must be used. If CTS line is not activated by the computer or terminal, disconnect pin 5 from the RS232 connector cable to avoid accidently exercising this hand-shake line.

7.2 BAUD RATE SETTING

Prior to establishing communications between a terminal or computer and the SHOOTER, the baud rate switches on the SHOOTER rear panel must be set for the same baud rate as the terminal or computer. The baud rate switches are switches 1 and 2 of the four position DIP switch on the rear of the unit.

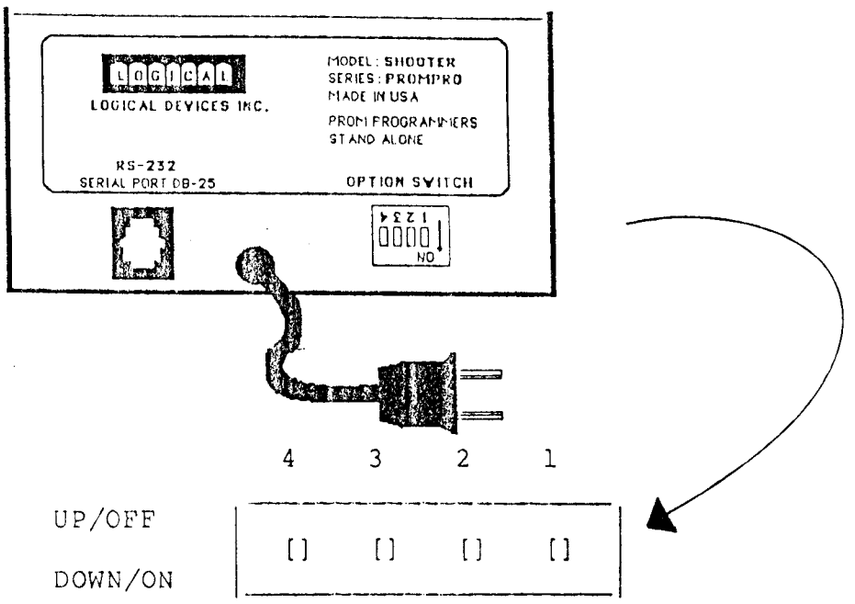


Figure 7-2. Baud Rate Setting Switches

BAUD RATE	SW 1	SW 2
110	DN/ON	DN/ON
300	UP/OFF	DN/ON
1200	DN/ON	UP/OFF
2400	UP/OFF	UP/OFF

SERIAL DATA FORMAT:

Half-Duplex
One start bit
8 data bits
Two stop bits
No parity

SERIAL SIGNAL LEVELS; +12V,-12V (CTS ENABLED = + 12V, NOT CTS = ON -12V)

8.0 SOFTWARE INTERFACE

In order to establish communication between SHOOTER and a computer, a computer RS-232C serial port at either 110, 300, 1200, or 2400 baud must be provided. In a typical development cycle the user assembles the program into an object file and then transfers that object file from either memory or disk to SHOOTER via the RS-232 interconnect. Some software development tools, such as assemblers and compilers, generate the assembled program output file in the form of INTEL or MOTOROLA hex formats. In such a case the job of sending the program information to the SHOOTER is only a matter of instructing the computer to transfer that output file to SHOOTER via the RS-232 interface.

Most operating systems provide a utility command to facilitate file transfer operations. For example, under the CPM operating system the PIP command is used to do such a task. Under PC DOS the COPY command is used. If your development system does not generate the standard formats, then a program to convert a binary or straight ASCII file into the standard HEX formats must be provided. The following software drivers are available, on floppy disk, from Logical Devices, Inc.:

IBM PC software driver	(Part No. SD-PC)
APPLE -II software driver	(Part No. SD-APPLE)
CPM 2.2 8" SS SD	(Part No. SD-CPM)
Commodore 64	(Part No. SD-C64)

It is very important to insure that the serial interface is working properly. If using the computer serial interface for the first time, there is always a possibility that it is not functioning properly. Read the instruction manual for your serial port very carefully. Monitor both the transmit and the receive line with an osciloscope to insure that data is being sent and received. In debugging any system always islolate each unknown and deal with one unknown at a time.

It is also necessary to understand how the serial communication for a particular computer is accomplished. Each system uses a slightly different hardware for the Serial/Modem port. For many systems a simple Terminal/Modem program is all that is required to operate the SHOOTER in the conversational mode. These programs are readily available for most systems.

A terminal program is basically a program that makes the computer look like a CRT terminal. All console entries are directed to the serial port and all data received from your serial port is

displayed on the screen. Prior to sending and receiving data to and from the serial port you must set the following parameters:

Start Bits	1
Stop Bits	2
No. Data Bits	8
Parity	Ignored
Baud	110, 300, 1200, 2400
Mode	Half Duplex

This format is software selectable in certain systems. For example, in a Radio Shack TRS-80 Model II with CPM 2.2 DOS, the SETUP command can be used to set parameters. If you do not have a terminal program and wish to write your own, there are three basic ways to write such programs.

1. Terminal program written in BASIC language.
2. Terminal program using the callable routines in Bios or System Monitor.
3. Assembly language program with your own Serial Port Drivers.

NOTE

All communication is done in ASCII Format. That is, when directing the programmer to program an EPROM, the ASCII equivalent of P (50H) is stored in the data register of the serial controller.

The I/O addresses in many systems are memory mapped. In other words, transferring a byte to and from the I/O port is similar to transferring a byte to and from a memory location. If your system is not I/O memory mapped, you must use the Input/Output instructions of your microprocessor with the corresponding I/O number assignment. Most serial controller chips have two internal registers, one Data and one Control/Status register. If you are writing directly to the serial controller you must always test the condition of the ready status bit to insure that you do not overrun previous data.

8.1 CREATING CUSTOM SOFTWARE INTERFACES

Software drivers consist of two distinct parts: a simple communications (terminal) mode and a Hex converter mode. The software drivers listed in Section 8.0 include either one or both parts. into them. If your system has either a terminal mode or a terminal program, a software driver may not be required. For example, the APPLE II software drivers do not have terminal mode because the APPLE II computer can function as a terminal by using a few simple control characters.

Appendix A lists several programs used to generate the Intel or Motorola Hex formats. In some instances the listing (6809 routines) is only part of a larger program. This partial listing is provided only as an illustration of how it is accomplished. An example of a TRS-80 color computer software driver is also provided. These routines can be used as a guide to develop your own program for any other computer system (refer to Appendix B).

NOTE

A file formatted as Intel or Motorola Hex is not required, but using formatted files allows error checking of records to be done.

Before attempting to analyze the program code it is a good idea to know what the general structure of the software program should look like. The following list defines the driver software structure (a slightly modified version of a standard TERMINAL program).

1. Initialize Serial port.
2. Scan Serial port for input.
3. If input, display on terminal.
4. Scan terminal for user entry.
5. If no entry, go to step 2.
6. Output user entry to serial port.
7. If user entry is T go to download routine.
8. If user entry is U go to upload routine, or go to step 2.

8.1.1 Download Routine

1. Prompt the user with the file name or memory addresses where the data is located.

2. Send either an I or an M command to set the programmer in the proper hex mode.

3. Send an ASCII T (54H) to the serial port to signal the programmer that the next entry is going to be a valid hex file.

4. Send Hex file to the serial port.

8.1.2 Upload Routine

1. Prompt the user for a disk file name or a memory address where the uploaded data is to be stored.

2. Send to the serial port an ASCII U followed by two hex digits indicating the page offset for the load address in system RAM.

3. Go to the Hex load routine.

4. Return.

NOTE

The driver routine address space must not coincide with the same address space as the upload file.

8.2 USING CP/M

Since CP/M is the most common operating system for microcomputers, the following are a few examples of its use with SHOOTER. For the sake of explanation it is assumed that a terminal program for your CP/M system has either been written or purchased for use. The name of this ficticious program will be MODEM.COM. Once power is applied to SHOOTER, the CP/M prompt A> should appear on the screen.

Next type MODEM and enter a carriage return <cr>. The screen will show:

```
A>MODEM
```

Once the program is activated it will provide prompts for several options. Select the Terminal option. If your SHOOTER is properly connected to the serial port and the serial port is operational, the menu should appear either when a power up procedure is performed or when a question mark is sent via the computer/terminal.

To set the programmer in the Intel hexadecimal mode, type I.

SHOOTER will respond with:

```
*EOJ*
*_
```

To examine and change a location in the SHOOTER RAM buffer, type an X, after the * prompt, followed by a four digit hex address of the location to be examined and/or changed. For this example use:

```
*X 0001
```

SHOOTER will respond with:

```
0001=hh
```

NOTE

The hh is a two digit hex value representing the contents of location 0001).

Either type new data or a space to skip:

```
0001=hh [SPACEBAR]
0002=hh [55] (as an example)
0003=hh [RETURN]  Return to prompt *
```

Now go back and examine location 0002. It should contain the data value 55.

Once the edit of the RAM buffer is complete, you can exit the terminal mode program and return to the CP/M operating system.

8.2.1 Using CP/M Submit To Download

Use the editor to create two permanent files. Each file should contain only one character - one file the I and the other file the T. Then using the SUBMIT facility of CP/M, send the files containing the I, the T, and your Hex file with only one command.

If you want to modify the format mode in the SHOOTER, create another permanent file containing either an I or an M. Then, using the SUBMIT facility, send this file as shown in the example below.

Example Submit File for downloading:

```
PIP PUN: = I.DWN
PIP PUN: = T.DWN
PIP PUN: = DATA.HEX
```

The file I.DWN contains only an I.
The file T.DWN contains only a T.
The file DATA.HEX contains data in Intel format to be transferred to the shooter RAM.

Many software development tools, such as assemblers or cross assemblers, have an option that allows the Hex address specification to be different than the actual assembly (ORIGIN) address. SHOOTER loads the Intel Hex file in its RAM buffer at the specified address of the Hex format. Since the programmer always programs the EPROM from location 0000, you must make sure that

the starting address of your file is directed to location 0000 of the SHOOTER RAM buffer. This is accomplished by creating another file that contains the character O (OFFSET COMMAND) followed by two hex digits equal to the PAGE number where your hex file will start. Next, simply send this file to the programmer before the hex file transfer.

Some 8080 Assemblers do no generate the proper Intel Hex Format End of File character. Instead, ten 00 characters are generated. If this last line of zeros is encountered, SHOOTER will generate an error. The easiest way to eliminate this condition is to delete the last line of the Hex File (ten 00's) using the Editor. SHOOTER will then simply time out 7 seconds after the file transfer is completed. Another method is to use the I parameter of the PIP command to ignore the ":00" records of Hex Format. The correct end of file record for Intel format is (:00000001FF). The correct end of file record for Motorola format is (S9030000FC).

8.2.2 Using CP/M PIP Command To Upload

The CP/M PIP command can also be used to UPLOAD a file to a host computer. However, instead of using the character U to initiate the UPLOAD function, the character W should be used (see UPLOAD with WAIT command). This causes a 25 second delay before transmission to allow time for the CP/M PIP command to execute. It will also terminate the transmission with a control Z, which is necessary for CP/M to close the file correctly.

Create a permanent file as described earlier containing only a U and name the file U.UPL. Create another submit file similar to the file described for downloading.

Example Submit File for uploading:

```
PIP PUN: = .DWN
PIP PUN: = .UPL
PIP PUN: = ATA.HEX
```

9.0 OPERATING TROUBLE GUIDE

If you have a problem when using SHOOTER, refer to the following Trouble Guide to determine whether the problem is either in operating the unit or a functional failure of the unit. The Trouble Guide is catagorized by general problem types. Each type is then listed by basic problem, the problem condition, and the possible remedy.

OPERATING TROUBLE GUIDE

General Problem Conditions:

UPON POWER-UP THERE IS NO LED INDICATION.

Assure that the line cord is inserted properly.

EPROM DOES NOT VERIFY AFTER READ.

If, after you have read the EPROM into the SHOOTER internal RAM buffer and depressed the VER switch, the red LED goes on, the following problems may exist:

Configurator plug inserted improperly or incorrect type. Remove the configurator plug and check for bent pins and proper internal connections (refer to CNF diagrams).

EPROM inserted improperly. Make sure that the EPROM pin 1 is in the proper position.

Defective EPROM, replace.

EPROM DOES NOT VERIFY AFTER PROGRAMMING

If, after the program cycle, the red LED goes on, it is an indication that the EPROM did not program properly. The following reasons could account for this program failure:

Check the configurator plug for proper type, bent pins, and proper insertion.

EPROM was not completely erased.

Defective EPROM, replace.

EPROM type is incorrect.

EPROM inserted backward.

Communications Problems:

MENU DOES NOT APPEAR ON THE SCREEN AFTER POWER UP

Chances are your cabling is incorrect. Refer to the cabling information in the serial interface section.

NOTE

In order to force the handshake lines to the proper levels, your terminal/computer may require that the following jumpers be installed on the terminal/computer side of the cable.

Jumper pin 4 to pin 5.
Jumper pins 6, 8, and 20.

MENU APPEARS ON SCREEN BUT UNIT HANGS-UP.

This is an indication that the SHOOTER serial handshake line CTS (pin 5) is at low signal level. This line is internally pulled up to +5V.

LED FLICKER ON DOWNLOAD

If you are downloading a file and you see the green and yellow LED flicker, the SHOOTER has not accepted the transfer (download) command. During a successful download operation the yellow (busy) LED is on continuously. This problem usually occurs because the user sends the T command immediately after the I or M. Since the SHOOTER responds with *EOJ* <cr> lf after it receives the I (INTEL Format) or M (Motorola format) command, it will miss any characters sent to it while it is busy responding. Attempt sending the I seperately in the terminal mode. After the T is received the programmer will ignore any character that is not a header character (S or :).

If no character is received within 7 seconds, the programmer will time-out. If you do not wish to send the I command manually in terminal mode, you may send it automatically:

Create a file with only the character I in the file and create another file with only the character T. Now use the command chain capability of your operating system to send the above files and the Hex file to the programmer with one simple command.

NOTE

This procedure applies to most systems with the exception that certain command names and system parameters may vary. In all cases, the important fact to remember is, if the computer sends any character other than the

SHOOTER commands (with the exception of nulls), the SHOOTER will respond in half duplex with an *. Suppose, when sending the character I, that the computer actually precedes it with a control character. Then SHOOTER is going to miss the I because it is busy sending the *. To avoid this, allow several character times for response. If you encounter error problems during transmission, check the ground connection in your cable. Also, make sure your system is configured for:

ONE START BIT
8 DATA BITS
2 STOP BITS
NO PARITY

10.2 21 VOLT PROGRAM VOLTAGE CHECK

The following procedure verifies the calibration voltage for all EPROM's requiring a 21 volt programming voltage (VPP) such as the 2732A EPROM.

1. Insert configurator plug #2732A in CNF socket.

2. Insert test pins in ZIF socket pins 14 and 22.

3. Connect the DVM ground lead to pin 14 of the ZIF socket. Connect the positive lead to pin 22 of the ZIF socket.

4. Depress the RESET button to reset SHOOTER. When the BUSY (yellow LED) indicator goes out, the DVM should read less than +2 VDC.

5. Depress the PROG button. The BUSY indicator should light and the DVM should read between +20.5 and +21.5 VDC.