# XP640 EPROM PROGRAMMER

# USERS MANUAL

# XP640 Manual - Table of Contents

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## Introduction

### XP640 EPROM Programmer

The XP640 is designed to keep you ahead in the fast moving world of programmable device technology. It combines both a reliable EPROM duplicator, RAM editor, video display and comprehensive input/output to make it one of the most sophisticated machines available anywhere.

The RAM editor can be "locked out" at any time to make the XP640 a very easy to use EPROM workstation. This allows the machine to be used by unskilled personnel for low volume production runs.

The XP640 works equally well in either true stand-alone mode or connected to your computer or development system. Once connected, data can be transferred between the two machines and the programmer can be remotely controlled to make it an integral part of your workstation.

### XU620 Universal Programming Module

The XP640 is expandable with the XU620 module to support:

BIPOLAR PROM from all major manufacturers
SINGLE CHIP EPROM MICROCOMPUTERS
PROGRAMMABLE ARRAY LOGIC (PALs)

### XM512 EPROM Emulation Module

The emulation option provides up to 64k x 8 of emulation memory.
Two modules can be connected for 16 bit emulation. Data can be written from the target side to allow its use with microprocessor emulators.

## Section 1: General Operating Instructions

### Supply Voltage

Machines supplied in the UK and Europe are set to operate at 240v, 50Hz supply. A mains cable is supplied with the machine. The cores of the cable are colour coded as follows:

Live: Brown  Neutral: Blue  Earth: Green/Yellow

The mains cable plugs into the XP640 via the fused connector located on the righthand side, rear of the unit. The pins on this connector are:

Earth

Live  Neutral

The unit is protected by a 500mA Antisurge fuse located in the mains connector. Ensure mains voltage is disconnected before attempting to replace the fuse.

### Using the Machine - Points to note

To ensure trouble free operation, please observe the following points:

a/ Operate the machine on a vibration free surface

b/ Do not locate the machine near any source of heat or in direct sunlight

c/ Ensure no metal parts can fall into the machine

d/ Disconnect from the mains supply when not in use

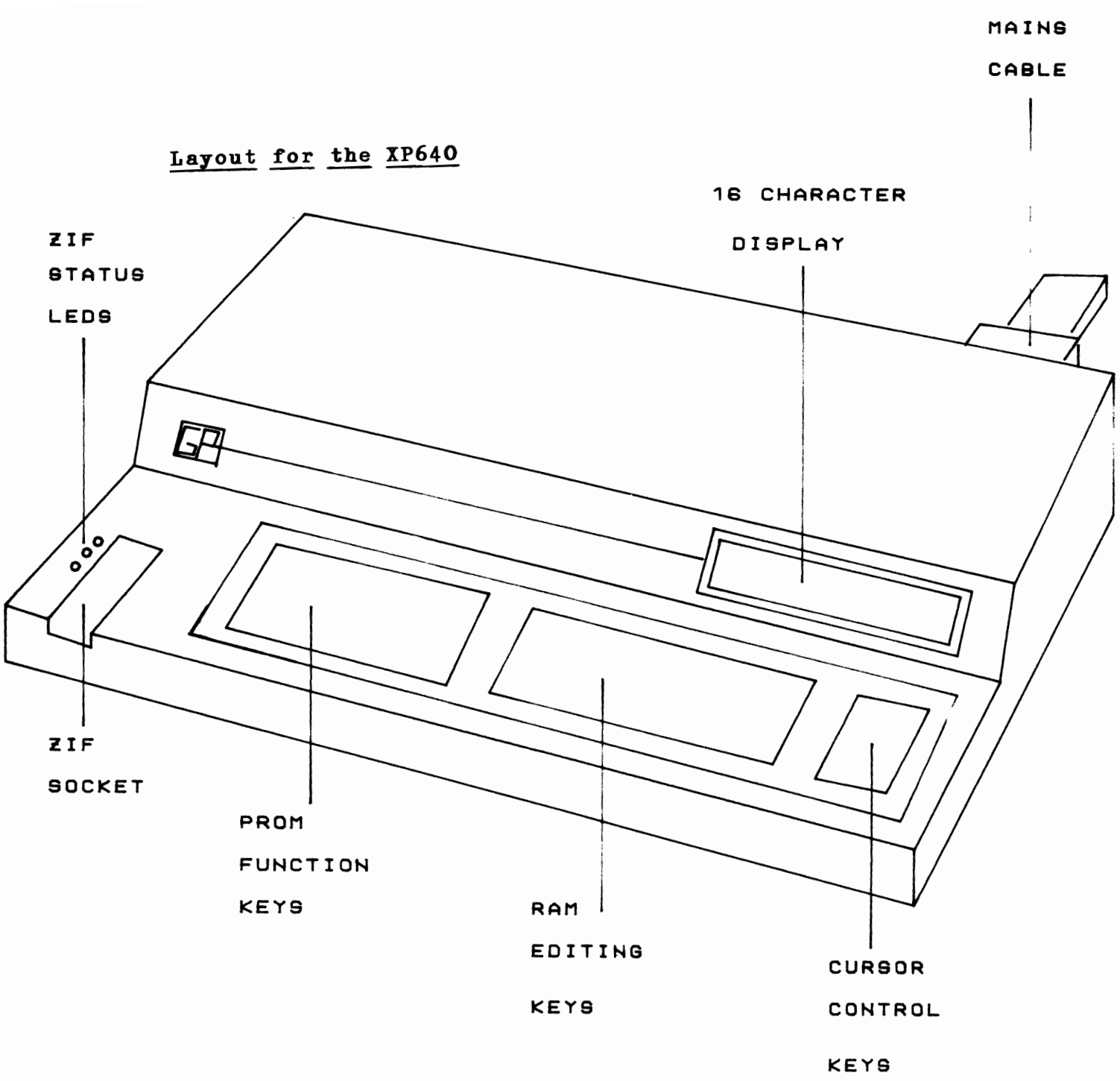
e/ DO NOT switch the machine on or off with EPROM devices in the ZIF socket

f/ Check the device type setting when inserting EPROMs into the ZIF socket

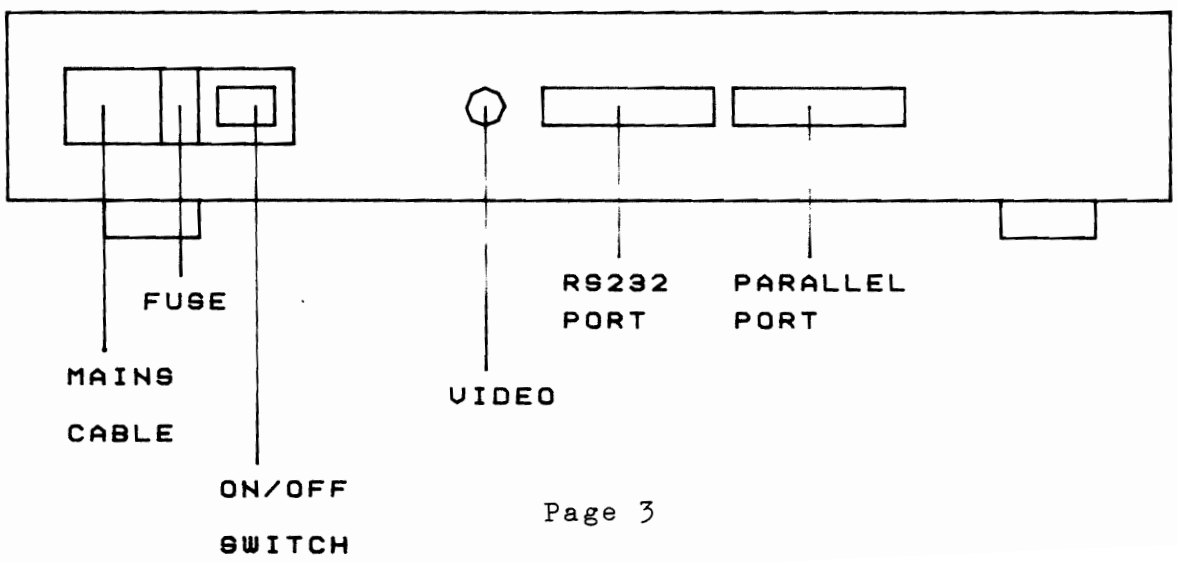
g/ Periodically clean the ZIF socket with a stiff bristle brush to ensure good contact

h/ Never force an EPROM into or out of ZIF socket - it is a zero insertion force socket

## Layout for the XP640




XP640 REAR PANEL



## The Keypad

The keypad is divided into three separate sections.

(a) the right hand section is used for cursor and keyboard control
(b) the centre section for the Hex editor
(c) the left hand section is subdivided into input/output and PROM function keys

The keyfunctions are described in detail in the later sections of the manual.

## 16 Character Alphanumeric Display

This is the on-board display and allows the XP640 to be used without a video monitor. it is used to display keyboard commands, messages, address and data information.
The display usually shows the cursor address (current address of interest) and RAM and PROM data at that address as illustrated below:

```
        0000    FF    32    READY

    cursor    RAM   PROM   message
    address   data  data
```

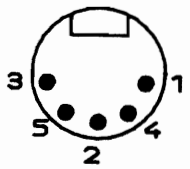
## Video Display

A composite video output is provided at the DIN connector labelled VIDEO at the rear of the XP640.

DIN socket connections (viewed from machine rear)

DIN CONNECTOR

(REAR VIEW)




| | |
|---|---|
| 1 | Video out |
| 2 | Signal ground |
| 3 | Video out |
| 4 | +5v - do not connect |
| 5 | Lightpen - do not connect |

## Video Display Format

The video display is divided into four sections:-

1/ A status section showing selected device type and input/output parameters
2/ Data entry line - similar to the on-board line display
3/ Address and data display showing the cursor address and PROM and RAM data at that address and the ASCII equivalent of the RAM byte.
4/ A hex dump of 256 bytes with on-screen cursor.

## Discrete LED indicators

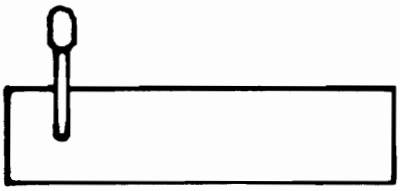
The programming socket has 3 LEDs associated with it.
The active LED indicates when power is applied to the ZIF socket - EPROMs should not be inserted or removed when the LED is on. (the socket can be powered down by pressing the STOP key.)
The other two LEDs indicate the position of pin 1 for the selected device depending on whether it has 28 pins or 24 pins.

## Firmware Version Number

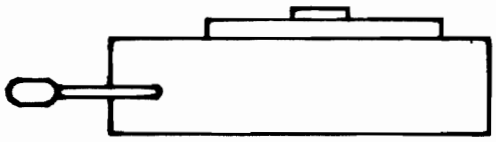
When power is first applied to the XP640 an 'INITIALISE BUSY' message is displayed whilst it performs a system self check.
When complete the Firmware version number is displayed in the message 'XP640 V X.Y READY' where X,Y is the version number.

**Zero Insertion Force Socket**

The socket is a zero insertion force type and will give reliable service provided it is kept clean and used in the proper way. The diagram below shows the correct way to load a PROM into the socket.

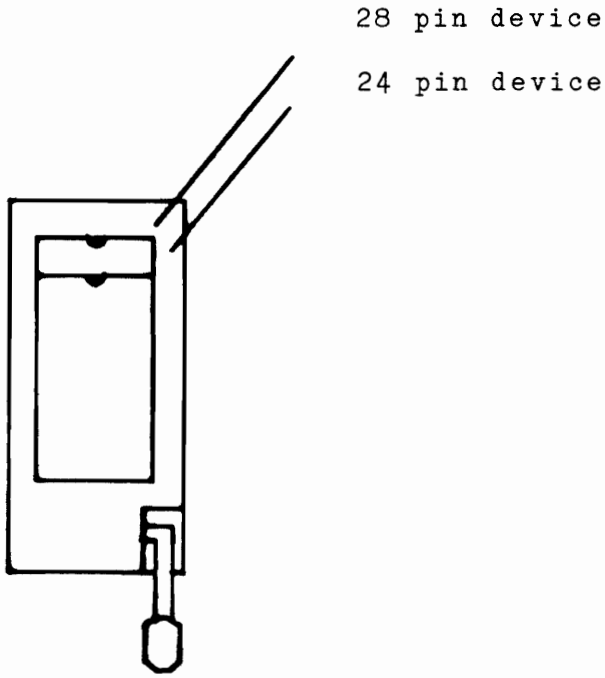


Lever open, insert or remove PROM



Lever closed, PROM is firmly held

The ZIF is designed to accomodate both 24 pin and 28 pin PROMs. The diagram below illustrates correct PROM orientation.



## Section 2: Hex Editor
## XP640 RAM Editing Functions

This section gives a detailed description of the XP640 editing facilities taken one key at a time.
Examples are given on the use of each key by itself, and in conjunction with other keys.
The table below gives a list of the available RAM editing facilities.

| KEY | DECSRIPTION |
|---|---|
| STOP | Power down ZIF socket, return to normal mode |
| HEX | Hexadecimal data keys |
| FN | Function key to activate editing keys |
| CURSOR | move cursor up, down, left & right |
| ENTER | load hex entry from display buffer |
| CLEAR | clear last hex entry |
| MEM | move cursor to memory address |
| DATA | change hex data |
| PAGE | select a 256 byte page |
| ASCII | display ASCII dump on-screen |
| DEFINE | define a RAM block for editing & PROM functions |
| INVERT | invert data in RAM block |
| SHIFT | shift data with cursor keys or to any address |
| COPY | copy source block to destination |
| FILL | fill block with a data value |
| SPLIT | 16 bit to 8 bit split |
| SHUFFLE | 8 bit to 16 bit shuffle |
| INSERT | insert data at address |
| DELETE | delete data at address |
| REPLACE | change data strings to new strings |
| SEARCH | find accurance of data string |
| LOCK | lock or unlock RAM editor |

**Note:** in the examples which follow the 'DISPLAY' section means the on-board fluorescent display. The video display gives similar messages, but in expanded form.

## STOP

This will stop any function and return the machine to normal mode ready to accept new keyboard commands. After STOP the ZIF socket is powered down and any previously defined block is now undefined.

## HEXADECIMAL KEYS (0123456789ABCDEF)

These lower case keys are only enabled when the XP640 requires entry of hexadecimal data, otherwise they are not directly accessible.

## FN (FUNCTION)

This key is used to enable any editing key and must be used prior to any RAM editing function. Its use prevents unintentional or accidental use of the editor.

**Example:** Select page 34 for display

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| FN | FN | RAM editor is enabled |
| PAGE | PAGE_ | prompt for page number |
| 34 | PAGE 34 | enter the page number |
| ENTER | 3400 FF -- | cursor address is 3400, RAM data FF, no PROM data |

## CURSOR

These are the arrow keys and can be used at any time to move the cursor up, down, left or right. Pressing the key once will move the cursor one position. Holding the cursor key down will continuously move the cursor as required.

**Example:** Move cursor right, down, left, up

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| Right arrow | 0001 FF FF | increment cursor address by one |
| Down arrow | 0011 FF FF | increment cursor address by 16 (1 screen line) |
| Left arrow | 0010 FF FF | decrement cursor address by one |
| Up arrow | 0000 FF FF | decrement cursor address by 16 (1 screen line) |

**Note:** 1/ The cursor address is shown followed by RAM data and PROM data - both are hex FF in this example.
2/ The video always shows a dump of RAM data. PROM data at the corresponding RAM cursor address is also shown. If the PROM data is shown as '--' then the cursor is outside the range of the selected EPROM (i.e. no PROM data is available).

**ENTER**

This is used during the course of hexadecimal data entry.
E.g. address and data information, Fill parameter, lock code.
It is also an implied 'YES' key to reply to questions asked by the XP640.
The XP640 will only act on the data entry once the ENTER key has been pressed.

**CLEAR**

This can be used to clear a hex entry - E.g. if a mistake has been made. it is also used as an implied 'NO' key for use in response to questions asked by the XP640.

**Example:** Move the cursor to address 013F and correct mistake

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) MEM | ADDRESS_ | prompt for memory address |
| 013C | ADDRESS 013C | enter address but last digit is wrong |
| CLEAR | ADDRESS 013_ | last entry cleared |
| F | | OK now enter the correct digit |
| ENTER | 013F DE FF | cursor address is 013F, RAM data DE, PROM data FF |

**MEM (Memory address)**

This moves the cursor to any RAM address within the 64k x 8 user RAM. The base address of the RAM is 0000 and corresponds to PROM (ZIF) address 0000. The last address of the RAM is FFFF. The last address of the PROM depends on the size of the device selected.

**Example:** Move cursor to address FFFF.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) MEM | ADDRESS_ | prompt for new cursor address |
| FFFF | ADDRESS FFFF | enter the address |
| ENTER | FFFF FF -- READY | cursor is now at FFFF, RAM data is FF but no PROM data is available because the selected device is smaller than the RAM |

**Note:** 1/ Blanks are shown in the PROM data field if the cursor address is outside the range of the PROM.
2/ The cursor can also be moved with the cursor control keys or the page select key.
3/ If no hex address entry is made and ENTER is pressed the XP640 will substitute 0000 as the required address as shown below.

**Example:** Move cursor to address 0000

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) MEM | ADDRESS_ | prompt for new cursor address |
| ENTER | 0000 FF FF READY | no address entered so XP640 substitutes 0000 at new cursor address. RAM and PROM data is FF. |

**DATA**

This command allows keyboard entry of hex data at the cursor address.

**Example:** Change data at address 8000, 8001, 8002 to 01, 23, 45

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) MEM | ADDRESS_ | prompt for new cursor address |
| 8000 | ADDRESS 8000 | enter address |
| ENTER | 8000 FF __ READY | cursor address is 8000, RAM data is FF |
| (FN) DATA | 8000 FF -- _ | prompt for data entry |
| 01 | 8000 FF -- 01 | enter the data |
| ENTER | 8001 FF -- _ | cursor moved to next address, enter data |
| 23 | 8001 FF -- 23 | keep entering data, cursor will increment after each entry |
| ENTER | 8002 FF -- _ | |
| 45 | 8002 FF -- 45 | |
| ENTER | 8003 FF -- _ | |
| STOP | 8003 FF -- READY | data entry terminated |

**Note:** If no hex entry is made & the ENTER key is pressed, the XP640 will substitute 00 as the data as shown below.

**Example:**

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) DATA | 8003 FF -- _ | prompt for data |
| ENTER | 8004 FF -- _ | no data entry made so XP640 enters 00 and increments cursor |
| LEFT ARROW | 8003 00 -- _ | review data entry - change data entry is required |
| STOP | 8003 00 -- READY | terminate data entry function |

**Note:** 1/ The cursor keys can be used during data entry to move to a new address
2/ Data entry mode is terminated with the STOP key

**PAGE**

This is almost identical to the MEM key but positions the cursor at the start of a 256 byte page. The cursor is placed at the top left of the video.

**Example:** Select page 83 (put cursor at address 8300)

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) PAGE | PAGE_ | prompt for page number |
| 83 | PAGE 83 | enter page |
| ENTER | 8300 49 -- READY | cursor moved to address 8300, RAM data is 49, no PROM data available (blanks in the PROM data field) |

**ASCII**

Provides an ASCII dump of the on-screen hex dump.
The cursor position is shown by a corresponding cursor (inverted video) in the ASCII dump. This function is only usable with a video monitor connected to the XP640.

**DEFINE**

This is the powerful block define function for use with many of the PROM functions and editing keys. It defines the start and end address of a RAM block.
There are two different ways to define a block - using the cursor keys or using the hex keys.

**Example:** Define the block 0000 - 1FFF using the hex keys

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) DEFINE | DEFINE_ | prompt for start address of RAM block |
| 0000 | BLOCK 0000_ | enter the start address |
| ENTER | BLOCK 0000-_ | prompt for end address |
| 1FFF | BLOCK 0000-1FFF_ | enter the end address |
| ENTER | BLOCK 0000-1FFF_ | block is now defined |
| FN | FN 0000-1FFF | press FN prior to an editing command and block limits are shown |
| STOP | 875D 43 -- READY | terminate edit command |

**Note:** 1/ If a block is defined then the function (FN) key will always display the block limits prior to any editing command (this is useful reminder that those editing functions that can act on a block will do so).
2/ The cursor can be moved through a defined block - the READY message being replaced by DEF-D (defined) as a reminder that the block is defined.
3/ If a block has been defined, the PROM function keys will prompt for a ROM start address, and the function will act on the block.
4/ When STOP is pressed, the block is undefined, but the previously entered limits are still available and can be recalled by the key sequence (FN) DEFINE ENTER. (i.e. define a block without manually entering limits will define the block using the last entered limits).
5/ A block need not be defined to use the block editing functions (INVERT, SHIFT, COPY, FILL) as these will prompt for start and end addresses if there is no previously defined block but a PROM function will not prompt for block addresses since their block limits are taken to be the PROM start and end addresses (see PROM function).
6/ A block remains defined until STOP is pressed.
7/ The cursor is not part of the block unless it is used to define the block, as shown in the following example.

The previous example is typical for defining large data blocks for use with the PROM functions - e.g. block program, copy a PROM block to RAM etc.
The following example shows how the cursor can be used to define blocks.

**Example:** Define the block 1FFF - 2000 using the cursor

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) MEM | ADDRESS_ | prompt for new cursor address |
| 1FFF | ADDRESS 1FFF | |
| ENTER | 1FFF FF FF READY | put cursor at 1FFF |
| (FN) DEFINE | DEFINE_ | prompt for block start |
| RIGHT ARROW | 2000 FF FF *1FFF | move cursor, XP640 fixes address 1FFF as start of the block |
| ENTER | BLOCK 1FFF - 2000 | the block has been defined |

**Note:** The cursor can be moved in any direction to define a block

**INVERT**

Inverts data in a RAM block - This is useful for microsystems which have inverting buffers on the data bus.

**Example:** Invert the data in the block 0000 - 0011

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) INVERT | DEFINE_ | prompt for start address of block to be inverted |
| 0000 | BLOCK 0000_ | enter the start address |
| ENTER | BLOCK 0000 -_ | prompt for end address |
| 0011 | BLOCK 0000-0011_ | |
| ENTER | BLOCK 0000-0011 | define the block |
| | INVERTING | busy inverting |
| | DONE | function complete |

**Note:** 1/ In the example, the block was defined as part of the INVERT function, however if the block had previously been defined (using DEFINE), then no prompts would have appeared for the block limits.
2/ The block remains defined until STOP is pressed

**SHIFT**

This function shifts a defined block through memory using the cursor keys or direct to the cursor address. Data is shifted without overwriting or loss of data. Data in front of the block is transferred to the other side as the block moves through the RAM.

**Example:** Shift the block 0000 - 0001 to address F000.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) MEM | ADDRESS_ | prompt for new cursor address |
| F000 | ADDRESS F000 | |
| ENTER | F000 C3 -- READY | put the cursor at F000 |
| (FN) SHIFT | DEFINE_ | prompt for block start |
| 0000 | BLOCK 0000 _ | |
| ENTER | BLOCK 0000- | prompt for block end |
| 0001 | BLOCK 0000-0001_ | |
| ENTER | BLOCK 0000-0001 | define the block |
| | SHIFT TO F000 | data can be shifted to cursor position (see note) |
| ENTER | BUSY | |
| | F000 D9 -- DONE | shift complete |

**Note:** 1/ When the message "SHIFT TO " is displayed a hex entry can be made as the address to where the block is to be shifted. pressing ENTER (as in the example), the cursor is used as the shift address.
2/ For small shift movements the cursor keys can be used to move the block when the "SHIFT TO " message is displayed.
3/ The block could have been defined using the define function
4/ When shift is complete, the block remains defined until the STOP key is depressed

## COPY

This command will copy blocks of data within the RAM. When a copy has been completed, the source data has not been changed, but has been duplicated at the destination address. The copy command is 'intelligent' in that if the destination block overlaps the source block, then a complete copy is made at the destination, the source overlap obviously having been overwritten.
The data block can be defined as part of the COPY command or using the DEFINE function.

**Example:** Copy the block from 0000 - 0800 to the area starting at address 1000.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) COPY | DEFINE | prompt for source block start address |
| 0000 | BLOCK 0000 _ | |
| ENTER | BLOCK 0000 -_ | prompt for block end |
| 0800 | BLOCK 0000-0800_ | |
| ENTER | COPY TO F002 | prompt for destination address or option to use the cursor adddress (F002) |
| 1000 | COPY TO 1000_ | but enter address 1000 as required |
| ENTER | BUSY<br>1000 F4 1A DONE | block has been copied, cursor is at 1000 RAM and PROM data are different |

**Note:** In this example the cursor was at address F002 and would have been used as the destination address if ENTER had been pressed when the 'COPY TO F002' prompt had appeared.

**FILL**

Memory fill is used to fill all or part of the RAM with a specific value.

**Example:** Fill the RAM block 0123 - 0234 with 0A

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) FILL | DEFINE_ | prompt for block start |
| 0123 | BLOCK 0123_ | |
| ENTER | BLOCK 0123-_ | prompt for block end |
| 0234 | BLOCK 0123-0234_ | |
| ENTER | BLOCK 0123-0234 | define the block |
| | FILL WITH - | prompt for fill parameter |
| 0A | FILL WITH 0A | |
| ENTER | BUSY | |
| | 0123 0A -- DONE | block is filled with 0A cursor is at the start of the block |

**Note:** 1/ The block could have been defined using the DEFINE function
2/ The filled block remains defined until the STOP key is pressed

**SPLIT**

This divides the RAM block as specified by the device type selection into two. All data at even addresses is stored in the lower half of the block, and all odd address data is stored in the top half.

The effect is that if 16 bit data had been loaded into the RAM (from the serial port) it can be split so that 2 EPROMs can be programmed : one containing the data at even addresses, the other containing data at odd addresses.

**SHUFFLE**

This is the converse of SPLIT.
The effect of shuffle is to interleave the data in the top half of the block with data in the lower half i.e. a 16 bit to 8 bit shuffle.
The block limits are defined by the device selected from the menu.

## INSERT (also see DELETE)

Inserts a free byte (FF) at any address in the RAM.
The XP640 searches the RAM starting at the current cursor address for the occurance of 5 unused bytes (5 bytes at FF).
If free space is found, the first byte at FF is shifted back through the intervening data to the cursor address. The data at this address can now be modified using the DATA function.
Once the INSERT mode has been entered, pressing ENTER will insert free bytes as often as required. if there are no free bytes or the RAM is completely cleared, a 'NO SPACE' message is displayed. To exit from INSERT mode, press STOP.

**Example:** Insert data at address 0010.
This example assumes the RAM is completely filled with data except for 5 free bytes starting at address 0030.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| | 0010 00 FF READY | position cursor at the insert address |
| (FN) INSERT | BUSY | locating free bytes |
| | 0010 FF FF INS' | insert complete |
| ENTER | 0010 FF FF BUSY | locating free bytes |
| | NO SPACE | no free bytes available |

**Note:** No data has been lost or added. The first FF in the 5 byte block has been shifted through memory to the cursor address, no further insertions were possible because there was no more free space

## DELETE (Also see INSERT)

Deletes any byte in RAM provided there are at least 5 bytes of free space above the delete address. The XP640 will search for free bytes starting at the cursor address and working to the top of the RAM. Once found, the data at the cursor address will be deleted intervening data will be shifted down one address and an FF will be added to the free bytes block.

**Example:** Delete data at 0005. This example assumes the RAM is completely filled with FF except for a data block at 0000 - 0007.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| | 0005 00 FF READY | cursor is at the delete address |
| (FN) DELETE | 0005 00 FF DEL' | delete first byte |
| ENTER | 0005 00 FF DEL' | delete again |
| ENTER | 0005 FF FF DEL' | and again |
| ENTER | 0005 FF FF BUSY | |
| | NO SPACE | no more deletions possible - all data from cursor to top of RAM is at FF |

## REPLACE (also see SEARCH)

Replaces a data string with a new data string. Any number of occurances of a string can be found, (see SEARCH) and changed to the new string. Maximum string length is 10 bytes.
The search for strings begins at the cursor address and works towards the top of the RAM.

**Example:** Replace the data strings at 0010, 0020 to 45, 67. This example assumes that the RAM is filled with FF except for the 2 strings of 01, 23 at addresses 0010, 0020.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| | 0000 FF FF READY | position cursor to start of RAM to start search |
| (FN) REPLACE | FIND_ | prompt for string data to be found |
| 0123 | FIND 01 23 _ | |
| ENTER | REPLACE WITH _ | prompt for new string data |
| 4567 | REPLACE WITH 45 67 | |
| ENTER | HOW MANY SWOPS_ | prompt for the number of string changes |
| 2 | HOW MANY SWOPS 2 | |
| ENTER | BUSY | busy searching |
| | DONE | all required strings have been replaced with the new string |
| STOP | 0020 45 FF READY | cursor is at the start of the last string to be replaced |

**Note:** 1/ The maximum string length that can be changed is 10 bytes
2/ Any number of strings can be replaced

## SEARCH (also see REPLACE)

Searches the RAM for the occurance of a specified data string. The search starts at the current cursor address and proceeds until a match is found with the specified string.
Subsequent or previous string occurances can be found by using the cursor right and cursor left keys.

**Example:** Search the RAM for the data strings 30, 31.
This example assumes that the RAM is filled with FF except for two strings of 30, 31 at addresses 0010, 0020.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| | 0000 FF FF READY | position cursor at RAM start |
| (FN) SEARCH | FIND_ | prompt for string data |
| 30 31 | FIND 30 31 _ | |
| ENTER | BUSY | search for first string |
| | 0010 30 FF NEXT | found it at 0010 |
| RIGHT ARROW | 0020 30 FF NEXT | next string found |
| RIGHT ARROW | 0020 30 FF BUSY | |
| | DATA NOT FOUND | no more strings in RAM |

**Note:** The maximum string length that can be searched for is 10 bytes.

## LOCK

This useful command will lock out the RAM editor to prevent accidental use or use by unauthorised personnel. The PROM functions and cursor keys are not inhibited.
A 4 digit code is required to lock and unlock the editor.

**Example:** Lock and unlock the editor with code 0123

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) LOCK | LOCK_ | prompt for code |
| 0123 | LOCK 0123_ | |
| ENTER | 0020 30 FF READY | editor is locked out |
| FN | UNLOCK_ | pressing FN asks for unlock code |
| 0123 | 0020 30 FF READY | editor unlocked |

## The PRINT Key

This key outputs data in the currently selected format via the parallel port. The key requests start and end addresses, and for records with address fields it also asks for an offset.

Once all parameters have been entered, it will print the data.

## Section 3: PROM Functions

The table below briefly describes the PROM function keys - a detailed explanation is given later in this section.
Each function (except BLANK, ERASE, MENU, EMU) operates on a user defined block of data in the RAM and device socket.
If no block has been defined, then the function operates on the whole device and its corresponding RAM area.

| KEY | DESCRIPTION |
|---|---|
| IBC | Perform an illegal bit check on the PROM using RAM block data |
| CRC | Calculate the cyclic redundancy check value for the complete PROM or a specified RAM block |
| SUM | Calculate the checksum of the complete PROM or a specified RAM block |
| STORE | Copy PROM data starting at the specified address to the RAM block |
| VERIFY | Verify PROM against RAM and show error data |
| PROGRAM | Program the PROM at any specified address with the RAM block |
| BLANK | Performs a blank check on the entire device |
| ERASE | Electrically erase EEPROMs |
| MENU | Device table |
| EMU | Emulation function |

Note: 1/ The block is defined using the DEFINE key and defines a RAM block
2/ If no block is defined, the function will operate on the whole PROM and the corresponding RAM area
3/ If the PROM start address is outside the range of the selected device it will be rejected and requested again

**Menu (device selection, Electronic Identifier)**

The XP640 must be set up to correspond to the particular type of EPROM to be read or programmed. The device type is selected using the MENU key and the cursor up, down keys or hex keys.

By depressing the MENU key the machine will display the current EPROM selected. The XP640 when supplied as new will default to 2764 at power on - however this default value can be changed at any time (see SET PARAMETERS).
Depressing either the cursor up or cursor down keys will step the display through the EPROM list.
Once the required device appears in the display, press ENTER to select it.

A Device selection can also be made using the hex keys followed by ENTER.

The currently selected device number always appears in the status section of the video display.

To select the correct device from the device menu, refer to the two tables listed overleaf.

PROM manufacturers are listed on the left hand side of the page, and their respective devices are listed to the right.
The correct selection for the XP640 is listed at the top of the page in the line labelled DEVICE MENU.

Some devices are apparantly duplicated in the device menu.
E.g. 2764N, 2764I, 2764A & 2764Q.
The suffixes (N, I, A or Q) refers to the programming method required by those devices as stipulated by the EPROM manufacturers -

N = Normal program (50ms pulse)
I = Intelligent programming
A = INTEL 'A' version of standard part
Q = Fujitsu Quick Pro programming method

It is important to match the XP640 with the devices you are programming - E.g. a 2764A does **NOT** program in the same way as a 2764.
Damage to the devices or inadequate programming may result if the incorrect setting is used.

**Electronic Identifier**
Many manufacturers of EPROMs now provide high speed programming algorithms along with electronic identifiers (e.g. INTEL's intelligent identifier, SEEQ's silicon signature).
These identifiers are provided to match the selected device to the correct high speed algorithm. Its main use is to prevent the use of a high speed programming algorithm on non-intelligent devices (and thereby possibly under-program the device).
If an intelligent device is selected from the menu, the user is given the option to use the electronic algorithm identifier.
In response to the prompt "AUTO SELECT ?" key CLEAR for NO (don't use the identifier) or ENTER for yes (use identifier).

## DEVICE TABLE 1

| Device Menu | 2508 | 2758A | 2758B | 2716 | 2815 | 2816 | 48016 | 9716 | 2532 | 2732 | 2732A | 2564 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Manufacturer** | | | | | | | | | | | | |
| **AMD** | | | | 2716DC | | | | | | 2732DC | 2732ADC | |
| **EUROTECHNIQUE** | | | | ET2716 | | | | | | ET2732 | | |
| **FUJITSU** | | | | 8516 | | | | | | MBM2732 | MBM2732A | |
| **HITACHI** | | | | HN462716 | | | HN48016 | | HN482532 | HN482732 | | |
| **INTEL** | | 2758A | 2758B | 2716 | 2815 | 2816 | | | | | | |
| **MITSUBISHI** | | | | M5L2716K | | | | | | M5L2732K | | |
| **MOTOROLA** | | | | MCM2716<br>MCM27A16 | | | | | MCM2532 | | | |
| **NATIONAL** | | | | MM2716<br>NMC27C16 | | NMC2816 | | NMC9716 | NMC2532 | NMC2732<br>NMC27C32 | | |
| **NEC** | | | | UPD2716D | | | | | | UPD2732D | UPD2732AD | |
| **OKI** | | | | 2716 | | | | | | | 2732A | |
| **ROCKWELL** | | | | | | R5213 | | | | R87C32 | | |
| **SEEQ** | | | | | | | | | | | | |
| **SGS** | | | | | | 2816A<br>5516A | | | | | | |
| **TEXAS INST** | TMS2508 | | | | | | | | | TMS2532 | TMS2732 | TMS2564 |
| **TOSHIBA** | | | | | | | | | | | TMM2732D | |

This table has been compiler from manufacturers data and is correct to the best of our knowledge

## DEVICE TABLE 2

| Device Menu | 2764E | 2764I | 2764A | 2764Q | 27128E | 27128I | 27128A | 27128Q | 27256I | 27256Q | 27512I |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Manufacturer** | | | | | | | | | | | |
| **AMD** | 2764DC | | | | | 27128DC | | | 27256DC | | 27512DC |
| **EUROTECHNIQUE** | ET2764 | | | | | | | | | | |
| **FUJITSU** | | | | MBM2764<br>MBM27C64 | | | | MBM27128 | | MBM27C256 | |
| **HITACHI** | HN27C64<br>HN482764 | | | | HN4827128 | | | | | | |
| **INTEL** | 2764 | | 2764A | | | 27128 | | | 27256 | | |
| **MITSUBISHI** | | M5L2764K | | | | | | | | | |
| **MOTOROLA** | | | | | | | | | | | |
| **NATIONAL** | | | | | | | | | | | |
| **NEC** | UPD2764D<br>UPD27C64 | | | | | UPD27128D | | | | | |
| **OKI** | MSM2764RS | | | | | | | | | | |
| **ROCKWELL** | R2764<br>R87C64 | | | | | | | | | | |
| **SEEQ** | | 2764 | | | | 27128 | | | | | |
| **SGS** | M2764 | | | | | | | | | | |
| **TEXAS INST** | TMS2764 | | | | | | | | | | |
| **TOSHIBA** | TMM2764D | | | | TMM27128D | | | | | | |

This table has been compiled from manufacturers data and is correct to the best of our knowledge

## PROG (PROGRAM)

Programs the PROM with RAM block data after performing an illegal bit check to test for programmability. Once programming is complete, the PROM is verified and a checksum displayed.

**Example:** Program a complete PROM. Data is programmed into the device with RAM data starting at PROM and RAM address 0000.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| STOP | READY | Remove any block definition & power down the ZIF socket |
| PROG | BIT CHECK FAIL | Fail bit check, ZIF is powered down |
| | PROGRAM BUSY | Bit check pass, program cycle in progress |
| | PROGRAM = F01E | Programming complete, verify pass, checksum displayed |
| | PROGRAM FAIL | Fail to program, enter verify mode |
| | 0024 00 FF VMODE | First error is at RAM & PROM address 0024, RAM data is 00, PROM data is FF. (Error data is available because RAM & ROM start addresses are the same). |

Note: See VERIFY function for a description of VMODE.

**Example** Program the RAM block 8000 - 8010 into the PROM starting at PROM address 0000.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| (FN) DEFINE | DEFINE _ | prompt for start address of block |
| 8000 | BLOCK 8000_ | |
| ENTER | BLOCK 8000-_ | prompt for end address |
| 8010 | BLOCK 8000-8010_ | |
| ENTER | BLOCK 8000-8010_ | RAM block defined |
| PROG | ROM START_ | prompt for ROM address |
| 0000 | ROM START 0000 | |
| ENTER | PROGRAM BUSY | block program in progress |
| | PROGRAM = CD0F | program PASS & block checksum displayed |

## VERIFY

Compares a user-defined RAM block with the PROM. If no block is defined, then the entire PROM is verified against RAM data starting at address 0000.
If the RAM and PROM contain identical data then a PASS message is displayed. If the PROM fails to verify then verify mode is entered to display error data.
Once in verify mode the following points apply:-

1/ If the cursor lies outside the RAM area corresponding to the PROM it is automatically moved to address 0000.
2/ The search for errors always starts from the current cursor position proceeding to the top of RAM.
3/ The display shows the first error encountered and this is the new cursor position.
4/ All errors on a video page are shown, and these are shown as highlighted bytes, the cursor being shown as a highlighted nibble.
5/ The cursor left and cursor right keys can be used to move to the previous or next error occurance - if no more errors are present the display will show an 'OUT OF RAM' message.
6/ If a block has been defined and verify errors are present, the search for the first error always starts from the start address of the block. Only block data is shown - other bytes not in the block are shown as blanks on-screen.
7/ Provided that the RAM block start address is the same as the ROM start address, then actual error data is shown.
If the blocks are at different addresses, the RAM error address is always shown along with RAM and PROM data at that same address.

**Example:** Verify a complete PROM against ROM data.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| STOP | READY | Remove any unwanted block definition |
| VERIFY | VERIFY PASS | RAM and PROM contain identical data |
| | VERIFY FAIL | Errors are present |
| | 3024 00 FF VMODE | The search started from the current cursor position First error is at the new cursor address at 3024, RAM data is 00, PROM data is FF. |

Note: use the cursor left key to view previous errors and the cursor right keyto view next errors.

Part of a PROM can be verified with any user specified RAM block - illustrated in the following example.

**Example:** Verify the RAM block 8000 - 8010 with a 2716 EPROM starting at PROM address 0000.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| FN DEFINE | DEFINE_ | prompt for RAM block start address |
| 8000 | BLOCK 8000_ | enter start address |
| ENTER | BLOCK 8000-_ | prompt for end address |
| 8010 | BLOCK 8000-8010_ | enter end address |
| ENTER | BLOCK 8000-8010 | block is now defined |
| VERIFY | ROM START_ | prompt for ROM start address |
| 0000 | ROM START 0000_ | enter ROM start |
| ENTER | VERIFY BUSY | comparing PROM and RAM data |
| | VERIFY PASS | verify complete |
| | VERIFY FAIL | verify mode entered, first error is at RAM address 8001 (PROM address 0001). This is the first error address to be found, but no error data is available because the RAM block start and ROM start addresses are different. |
| | 8001 00 00 VMODE | |

**STORE**

Copies data from the PROM to the RAM, verifies PROM against RAM data then calculates and displays a checksum. A complete device can be stored, or part of a device may be stored using the DEFINE function.

**Example:** STORE a 2764 into the RAM.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| STOP | READY | Un-define any RAM block |
| STORE | STORE BUSY | Copy the PROM to the RAM starting at RAM address 0000, then verify and checksum the PROM |
| | STORE = 2D9A | Store successful & checksum displayed |
| | STORE FAIL | Store unsuccessful (fail verify) |
| | 0044 00 FF VMODE | Verify mode now entered - use the cursor left or cursor right keys to view error data. (First error is at 0044, RAM data is 00, PROM data is FF). |

Note: 1/ For a description of the verify mode and how error data is displayed, see VERIFY function.

Part of a PROM can be stored to any RAM start address as shown below:

**Example:** STORE a PROM block 0010 - 001F to the RAM block 2030 - 203F.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| FN DEFINE | DEFINE_ | Prompt for RAM block start address |
| 2030 | BLOCK 2030 | Enter block start |
| ENTER | BLOCK 2030-_ | Prompt for RAM block end address |
| 203F | BLOCK 2030-203F | Enter the block end |
| ENTER | BLOCK 2030-203F | Block defined |
| STORE | ROM START_ | Prompt for ROM start of block |
| 0010 | ROM START 0010_ | Enter ROMstart |
| ENTER | STORE BUSY | Stores the data block & verifies |
| | RAM C'SUM = 0769 | Store successful, display RAM block checksum |
| | STORE FAIL | Store unsuccessful |
| | 2034 AA AA VMODE | First error is at RAM address 2034, but both PROM and RAM data are AA at this address (actual error data cannot be shown because the RAM & PROM blocks do not start at the same address). |

Note: 1/ See DEFINE function for more details on block defining
2/ See VERIFY function for details of VMODE (verify mode)

**SUM (Checksum)**

Calculates the 2 byte checksum of any length RAM block or of the entire PROM.
the checksum is the 16 bit addition of all the bytes in the block. The carry from the 16th bit is discarded to give a 2 byte value.

**Example:** Calculate the checksum for the RAM block 0000-1FFF.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| FN DEFINE | DEFINE_ | Prompt for start address of block |
| 0000 | BLOCK 0000_ | Enter the start address |
| ENTER | BLOCK 0000-_ | Prompt for end address of block |
| 1FFF | BLOCK 0000-1FFF_ | Enter end address |
| ENTER | BLOCK 0000-1FFF | Block now defined and highlighted on-screen |
| SUM | RAM C'SUM BUSY | Calculate checksum |
| | RAM C'SUM = F01E | Display checksum (F01E in this case) |

Note: 1/ Once a block has been defined it is highlighted on-screen and shown by DEF-D (defined) on the fluorescent display. To clear the block definition, press STOP.
2/ The block could have been defined using the cursor keys. (See DEFINE function).

A complete device can be quickly checksummed as shown in the following example.

**Example:** Calculate the checksum of a 2716 EPROM (select 2716 from the device menu).

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| STOP | READY | 'Un-define' any unwanted block |
| SUM | CHECKSUM BUSY | Calculating the checksum |
| | CHECKSUM = 26AD | Display checksum (26AD in this case) |

Note: 1/ To calculate the PROM checksum no block must be defined - a defined block operates on the RAM, not the PROM.
2/ See DEFINE function for further details of block defining.

## CRC (Cyclic Redundancy Check)

The cyclic redundancy check is a complex algorithm which produces a unique number to 'describe' a block of data. it is similar in many respects to a checksum, but is more reliable as a check value since any changes in the data will always produce a new CRC value. (This is not always the case with checksum).

The CRC function will calculate a value for any length RAM block or produce a value for the entire PROM.

**Example:** Calculate the CRC for the RAM block 0100-01FF.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| FN DEFINE | DEFINE_ | Prompt for start address of block |
| 0100 | BLOCK 0100_ | Enter block start |
| ENTER | BLOCK 0100-_ | Prompt for end address of block |
| 01FF | BLOCK 0100-01FF_ | Enter block end address |
| ENTER | BLOCK 0100-01FF | Block now defined & highlighted on screen |
| CRC | RAM CRC BUSY | Calculating CRC of block |
| | RAM CRC = EF67 | CRC for the RAM block is displayed (EF67 in this case) |

Note: 1/ The block remains defined unless the STOP key is pressed.
2/ The block could have been defined using the cursor keys (See DEFINE section).

**Example:** Calculate the CRC of a 27128 EPROM (select 27128 from the device menu).

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| STOP | READY | Clear any defined block |
| CRC | CRC BUSY | Calculating PROM CRC |
| | CRC = E5CF | CRC for the PROM is displayed (E5CF in this case) |

Note: 1/ To calculate the PROM CRC, no block must be previously defined - a defined block operates on the RAM, not the PROM.

## IBC (Illegal Bit Check)

Performs an illegal bit check on the PROM using RAM block data starting at a specified PROM start address.
The IBC is a check for programmability - it checks that all bits in the device can be set to the required pattern in the RAM.
A programmed '0' cannot be set to a '1' without exposure to Uv light (EPROMs), or electrical erasure (EEPROMs).

**Example:** Illegal bit check an entire device with RAM data starting at address 0000. (Select the required device from the menu).

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| STOP | READY | ZIF powered down - insert device, un-define any RAM block |
| IBC | BIT CHECK BUSY | Perform IBC on PROM using RAM data starting at 0000 |
| | BIT CHECK PASS | Device can be programmed with RAM data |
| | BIT CHECK FAIL | Fail IBC |

An illegal bit check can also be performed using the block DEFINE function:

**Example:** Illegal bit check a PROM block starting at PROM address 0200 using a pre-defined RAM block at 0400-0500.

| KEYPRESS | DISPLAY | MEANING |
|---|---|---|
| FN DEFINE | DEFINE_ | Prompt for RAM block start address |
| 0400 | BLOCK 0400_ | Enter start address |
| ENTER | BLOCL 0400-_ | prompt for RAM block end address |
| 0500 | BLOCK 0400-0500_ | Enter end address |
| ENTER | BLOCK 0400-0500 | Block defined |
| IBC | ROM START_ | Prompt for ROM start address |
| 0200 | ROM START 0200_ | Enter PROM start |
| ENTER | BIT CHECK BUSY | Performing bit check |
| | BIT CHECK PASS | PROM can be programmed successfully |
| | BIT CHECK FAIL | Fail illegal bit check |

Note: 1/ See DEFINE function for details of block defining.

**BLANK**

Performs a blank check on the selected device. If all bytes in the selected device are Hex FF, a PASS message is displayed.

**ERASE**

Electrically erases the selected EEPROM then performs a blank check to give a PASS or FAIL message.
The device type selected must be an EEPROM - any other selection will give an error message.

**EMU (Emulate)**

Sends RAM data to the optional XM512 Emulator Module via the parallel port. The data sent is the same length as the currently slected device and starts at address 0000.
Typical time to transfer the entire RAM (64k x 8) is 6 seconds.

## SECTION 4 XP640 Interfaces

## XP640 Serial Data Transfers

### Introduction

The XP640 has a bidirectional RS232C port as standard. This port may be used to receive data for device programming from a host computer, transmit data to a host computer or printer, or used as a communications link to an RS232C terminal for remote operation.

The RS232C port will support transmission/reception baud rates between 110 and 19K2 baud. The data may be received in any one of 15 formats, and transmitted in 16.

These formats are:

| | |
|---|---|
| 1 | MOS TECHNOLOGY |
| 2 | SIGNETICS ABSOLUTE |
| 3 | TEKTRONIX HEXADECIMAL |
| 4 | BINARY |
| 5 | DEC BINARY |
| 6 | ASCII HEX COMMA |
| 7 | ASCII HEX APOSTROPHE |
| 8 | ASCII HEX PERCENT |
| 9 | ASCII HEX SPACE |
| 10 | BIOF |
| 11 | BHLF |
| 12 | BPNF |
| 13 | LIST (Output only) |
| 14 | MOTOROLA EXORCISER |
| 15 | INTEL HEX |
| 16 | GP BINARY |

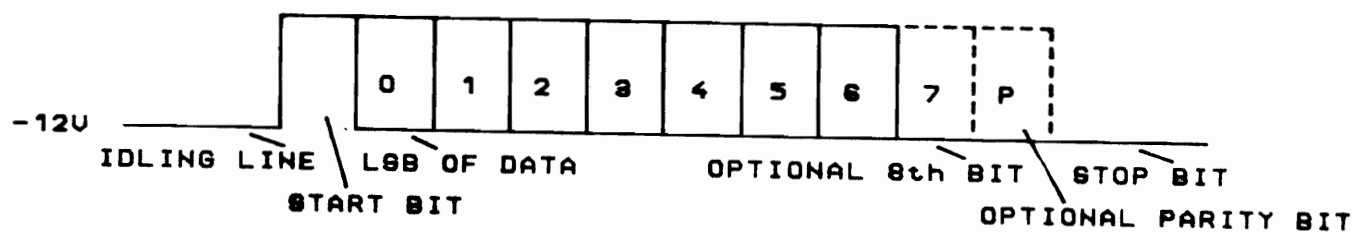
These formats are all described in detail in Appendix A.
A full specification of the serial will be found in the appendix.

The speed, format, word format and handshaking selections are made using the XP640 menu selection.

**Word Format** The XP640 word format is:

START BITS : 1
STOP BITS : 1 OR 2
DATA BITS : 7/8
PARITY : ON/OFF/ODD/EVEN

**The Serial Word:**



**Handshaking:** The XP640 uses hardware handshaking via CTS/DTR and DSR/RTS. When the XP640 is receiving, the DTR and RTS line (pin 20 and pin 4) must be used to control the data flow into the programmer.
A high level (+12v) on the RTS & DTR line indicates ready to receive. A low level (-12v) indicates not ready.
Before the XP640 will output data, the input handshake lines CTS and DSR, (pins 5 and 6) must taken to a high level (> 3v).
If a handshake line changes state during a byte, the XP640 expects the transfer to continue until the end of the next stop bit.

## Serial Output

The XP640 serial output key instructs the programmer to output data. The programmer will prompt for start and end addresses for the data to be transmitted.
Once the limits have been entered, the XP640 will prompt for an offset address. This address is added to the actual address of the data and transmitted in the address field of those formats that have address information.
Once this has been entered the XP640 will either transmit the data and display the message "DONE SOUT" or, it will show "TIMEOUT ERROR" if the handshake lines are preventing serial output.

## Serial Input

The serial input key instructs the XP640 to load data from the RS232 port into the RAM in the currently selected data format.
Once the key has been pressed the XP640 will prompt for an "OFFSET ADDRESS". This is either taken as the start address of data for formats with no address information, or it is added to the address of those formats which include address information.
If the currently selected format does not have a byte count facility, the XP640 will prompt for a "length" of the data being input.
Once these parameters have been entered the XP640 will load in the data and display "DONE".
If for any reason, no data is transmitted to the XP640, it will display "TIMEOUT ERROR".

## Remote Operation of the XP640

Pressing the Remote Key on the XP640 causes the XP640 to transfer control to the RS232 port. The first operation of the remote mode for the XP640 to send out a menu of possible commands.
All communication is at the settings previously defined from the port menu. Once the Command Menu has been sent, the XP640 outputs the prompt ">" indicating that it is ready to receive a command.

Commands are entered by typing all or part of the menu commands, following by a carriage return. If you enter an ambiguous command the XP640 will interpret it as being the first matching command in the Menu. The Command Menu is listed below:

| **COMMAND** | **OPERATION** |
|---|---|
| MENU; | Define a block |
| SHIFT; | Shift a block |
| FILL; | Fill a block |
| MERGE; | Combine 16 bit data |
| DELETE; | Delete byte at cursor |
| FIND; | Find string |
| DATA; | Data entry |
| DUMP; | Hex dump of memory |
| INVERT; | Complement memory |
| COPY; | Copy a block |
| SPLIT; | Split 16 bit data |
| INSERT; | Insert FF at current cursor |
| REPLACE; | Replace string |
| MEM; | Define cursor address |
| PAGE; | Define current page |
| PRINT; | Parallel print |
| SOUT; | Serial output |
| VERIFY; | Verify device against RAM |
| CHECKSUM; | Checksum |
| BITCHECK; | Illegal Bit Check |
| ERASE; | Erase EEPROMs devices |
| PARALLEL SELECT; | Select list format |
| STATUS; | List XP640 status |
| SIN; | Serial input |
| PROGRAM; | Program device |
| STORE; | Copy device data into RAM |
| CRC; | Cyclic redundancy check |
| BLANKCHECK; | Blank check |
| DEVICE SELECT; | Device selection |
| EMULATE; | Emulation function |
| LOCAL; | Return command to XP640 |

All functions work in the same way as in the local mode, with the following addition: The cursor keys are implemented as:

"H" = cursor right
"G" = cursor left
"T" = cursor up
"Y" = cursor down

A function may be terminated by keying "Q", to which the XP640 will reply "ABORTED" and then it will redisplay the prompt.

Selection of device and parallel formats is made by typing in the name of the device format after selecting the selection mode. The XP640 confirms this selection by displaying your choice.

The ready prompt is displayed together with cursor and block information.

```
          AAAA     DD     PP     XYZ&B

        Cursor   RAM    PROM   Machine
        address  data   data   status

BLOCK WXYZ - ABCD   -----  Block limits
```

**DUMP** is used to display hexadecimal data.
It prompts for start and end addresses, once given it will print Hex data on the screen. Dump may be interupted by keying CTRL-S which will cause the display to stop at the end of the current line.
The dump may then be resumed with a carriage return or ended with "Q".

## Internal Parameter Set-Up

All parameters of the XP640 operating system (other than the device type) are set up using the port key. The parameter selection is menu driven with the menus being visible on both the video display and the vacuum fluorescent display.

On the video display a complete menu is displayed, with the current selection indicated by a cursor on the active line of the menu. The vacuum fluorescent display shows only the current line. On the left hand side of each menu line is a 2 digit number, this gives the line number of the menu entry (in HEXADECIMAL).

Selection from the menu may be made in one two ways:

**Method 1:** Use the Up and Down cursor keys to select the required line of the menu and press ENTER to select it.

**Method 2:** Press the HEX keys to select the desired line number. As soon as the first hex key is pressed the display show "SELECT _ ". The CLEAR and ENTER keys are used as for all other hex entry. If an invalid selection is made, the XP640 will beep and reprompt with "SELECT _ ".

All of the sub menus return control to the main menu.
To return to the XP640 ready mode options 7 or 8 should be selected.

## Main Port Menu

| | | | |
|---|---|---|---|
| 00 | BAUD RATE | ; | set up serial speed |
| 01 | SERIAL FORMAT | ; | select serial data transfer format |
| 02 | PARALLEL FORMAT | ; | select print data format |
| 03 | WORD FORMAT | ; | set up serial word format |
| 04 | EMULATION | ; | select 8 or 16 bit emulation |
| 05 | KEYBEEP | ; | switch keybeep on/off |
| 06 | STATUS | ; | menu display of current status (nothing may be changed) |
| 07 | CALIBRATE | ; | calibrate procedure |
| 08 | SET PARAMETERS | ; | save paramters in internal EEPROM and return to command |
| 09 | END | ; | return to command level |

The **baud rate, serial format** & **parallel format** options present lists of speeds/ formats which may be selected.

The **word format** option goes through a series of questions. These are:

```
DATA BITS -          (answer 7 or 8)
STOP BITS -          (answer 1 or 2)
TEST PARITY ? -      (ENTER = YES, CLEAR = NO)
ODD PARITY ? -       (only if YES to above, then
                      ENTER = YES, CLEAR = NO)
HANDSHAKE ? -        (ENTER = YES, CLEAR = NO)
```

Returns to main menu

The **emulation option** asks whether the emulation is 8 or 16 bits - the appropriate value should be entered.

The **keybeep option** asks:

```
KEYBEEP ON ? -       (ENTER = YES, CLEAR = NO)
```

The **status option** gives the following display:

| | |
|---|---|
| 00 | Device type |
| 01 | Baud rate |
| 02 | Message saying "SERIAL" (aids use with fluorescent display) |
| 03 | Serial format |
| 04 | Message saying "PARALLEL" (aids use with fluorescent display) |
| 05 | Parallel format |
| 06 | Stop bits |
| 07 | Data bits |
| 08 | Parity |
| 09 | Handshake |
| 0A | Emulation |

The cursor keys may be scrolled through the display to show the current parameters. Selecting any option causes a return to the main menu.

The **calibrate option** allows the user to check the internal voltages of the XP640. See the section on calibration.

**Set parameters** saves the selection made in the internal EEPROM so that they will always be recalled on power up.

The **end option** configures the machine with the new parameters but does not save them in the EEPROM.

## Calibration Procedure

The XP640 is a precision made machine.

All timing for program pulses, set up times etc. are software controlled by a Z80 Microprocessor and are therefore crystal controlled and fixed.

The power supply voltages are preset and computer tested before they leave the factory.

These voltages may need adjustment from time to time.
Before attempting to calibrate the XP640, first check that it is required:-
Select CALIBRATE from the port menu.

Follow the sequence of steps listed below and measure the voltage as specified.
Move to the next step by pressing the UP ARROW key.
To exit from calibrate mode, press 'STOP'.

If one or more of the measured voltages are outside those specified in the table then repeat the procedure and adjust the preset potentiometers numbered below.

To gain access to the potentiometers, remove the XP640 top cover - Please follow the instructions on its removal as given in the XP640 Users Manual.

NOTE
1/ There are dangerous voltages inside the XP640 and calibration should only be carried out by a competent electronics engineer or technician.

2/ When reassembling the XP640 please follow the procedure given in the users guide.

3/ Damage caused by incorrect calibration or inexpert dismantling of the XP640 will void the warranty.

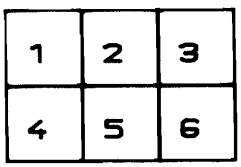
Calibration table:

| Step Number | Pin Number | Lo Volt Limit | Hi Volt Limit | Adjust |
|---|---|---|---|---|
| One | 28 | 5.80 | 6.20 | 1 |
| Two | 28 | 4.80 | 5.20 | 4 |
| Three | 1 | 24.70 | 25.50 | 6 |
| Four | 1 | 20.70 | 21.50 | 3 |
| Five | 1 | 11.70 | 12.40 | 2 |
| Six | 1 | 4.80 | 5.20 | 5 |
| Seven | Measure the pulses on pin 27 of the copy socket to be mark space TTL pulses of 1ms (approx). This checks that the system clock (crystal controlled) is OK to guarantee software timing. No adjustment is possible or should ever be necessary. | | | |

To exit from CALIBRATE mode, press 'STOP'.

**Potentiometer Identification**

POTENTIOMETER IDENTIFICATION



## The Printer Interface

### General

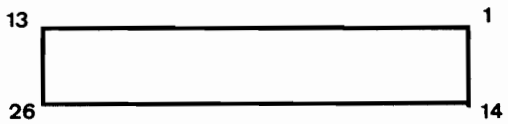
The XP640 printer interface is a parallel interface.It is compatible with the Centronics type port which the majority of printers are equipped with. The data is transmitted in standard ASCII code with the 8th bit set to a zero. Carriage Returns and Line Feeds are sent at the end of each line.

### Connection

The printer port is the 26 pin IDC connector on the rear of the XP640. It may be connected to any **CENTRONICS** type printer via an **IDC/CENTRONICS** cable. The pinout of the connector is shown in the table below:

| PIN | SIGNAL | PIN | SIGNAL |
|---|---|---|---|
| 1 | STROBE | 14 | TWISTED PAIR GROUND (PIN 1) |
| 2 | DATA 1 | 15 | TWISTED PAIR GROUND (PIN 2) |
| 3 | DATA 2 | 16 | TWISTED PAIR GROUND (PIN 3) |
| 4 | DATA 3 | 17 | TWISTED PAIR GROUND (PIN 4) |
| 5 | DATA 4 | 18 | TWISTED PAIR GROUND (PIN 5) |
| 6 | DATA 5 | 19 | TWISTED PAIR GROUND (PIN 6) |
| 7 | DATA 6 | 20 | TWISTED PAIR GROUND (PIN 7) |
| 8 | DATA 7 | 21 | TWISTED PAIR GROUND (PIN 8) |
| 9 | DATA 8 | 22 | TWISTED PAIR GROUND (PIN 9) |
| 10 | NC | 23 | TWISTED PAIR GROUND (PIN 10) |
| 11 | BUSY | 24 | TWISTED PAIR GROUND (PIN 11) |
| 12 | NC | 25 | GND |
| 13 | NC | 26 | NC |

### The Centronics Type Printer Port

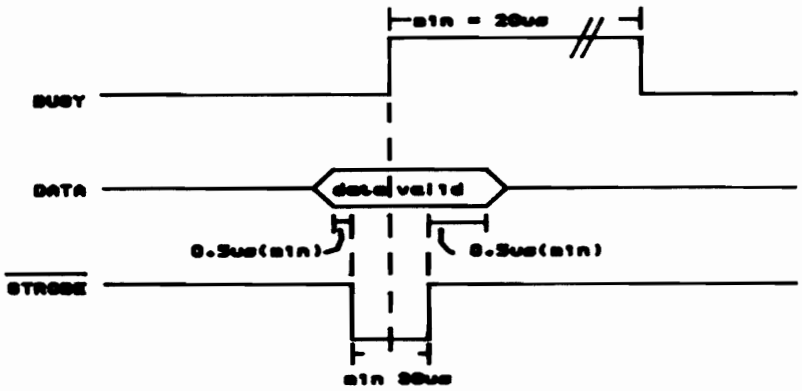



### Pin Out of The Centronics Connector

### Description of Signals on the Centronics Interface

**STROBE** an active low output signal which is output to indicate that there is valid data on the port.
**BUSY** when this input is high the XP640 will not output data. It is used to indicate that the printer is not ready to receive data.
**DATA 1-8** these lines carry the output data.
**GND** all of the ground lines are linked to the XP640 system ground. Problems with parallel interfaces often stem from bad grounds, hence ensure that all grounds are connected.

## Timing Diagram for the Centronics Port




## RS232C Connector Pinout

| Pin | Name | Direction | Description |
|---|---|---|---|
| 1 | Protective ground | | |
| 2 | TXD | OUT | Output data from P9000 |
| 3 | RXD | IN | Input data from P9000 |
| 4 | RTS | OUT | Paired with DTR |
| 5 | CTS | IN | Handshaking input (controls data output) |
| 7 | Signal ground | | |
| 20 | DTR | OUT | Handshaking output (controls data input) |

## Intel Hex Data Format

### General

The Intel Hex format is a widely used format for the transfer of binary data. It transmits the data as short data records in ascii code each, record having a checksum in order to ensure integrity of the data.

There are several record types within the definition of Intel Hex, but the XP640 only uses three of them. These are: type 00 -data record, type 01 the end of file record and type 02 the extended address record. If the XP640 receives any other records it just discards them.

### Intel Data Record Format (type 00)

| | |
|---|---|
| Byte 1 | Colon (:) delimiter |
| 2 - 3 | Number of binary bytes of data in this record. The maximum is 32 binary bytes (64 ASCII bytes). |
| 4 - 5 | Most significant byte of the start address of the data. |
| 6 - 7 | Least significant byte of the start address of the data. |
| 8 - 9 | ASCII zeroes. The "record type" for a data record. |
| 10 - | Data bytes. Each binary byte is sent as two ASCII characters each one representing one nibble of the Hex representation of the byte. |
| Last two bytes | Checksum of all bytes in the record, excluding the delimiter, carriage return and line feed.The checksum is the negative of the modulo 256 binary sum of all of the bytes in the record. |
| CR,LF | Carriage return, line feed. |

**Intel Extended address record (Type 02)**

| | |
|---|---|
| Byte 1 | Colon (:) delimiter |
| 2 - 3 | "02" The record length |
| 4 - 5 | ASCII zeroes |
| 6 - 7 | Record type "02" |
| 8 - 9 | USBA Upper segment base address (The top 16 bits of a 24 bit address) It is used in Intel's 16 bit data records. If no 02 records are sent the USBA is set to zero. If a USBA is specified then the bottom 12 bits are added to the offset address of the data records. |
| 10 - 11 | Checksum of all bytes in the record, excluding the delimiter, carriage return and line feed.The checksum is the negative of the modulo 256 binary sum of all of the bytes in the record. |
| CR,LF | Carriage return,line feed. |

**Intel End of File Record (Type 01)**

| | |
|---|---|
| Byte 1 | Colon (:) delimiter. |
| 2 - 3 | ASCII zeroes. |
| 4 - 5 | Most significant byte of transfer address (not used by XP640 ; set to zeroes). |
| 6 - 7 | Least significant byte of transfer address (not used by XP640 ; set to zeroes). |
| 8 - 9 | Record type 01. Indicates end of record |
| 10 - 11 | Checksum. |
| CRLF | Carriage return, line feed. |

**Note: all ASCII code is sent as seven bits**

**An Example of Intel Hex.**
Given the data stream 23 45 AF B1 D0 77 to be sent as an Intel Hex Record to start at address 0000. The Record would be:
:060000002345AFB1D077EB<CR><LF>

Which may be broken down as:

| | |
|---|---|
| Delimiter | : |
| Number of Bytes in the Record | 06 |
| Start Address High | 00 |
| Start Address Low | 00 |
| Record Type | 00 |
| Data | 23 |
| | 45 |
| | AF |
| | B1 |
| | D0 |
| | 77 |
| Checksum | EB |
| CR,LF | 0D |
| | 0A |

Where the Checksum is calculated as follows:

| | |
|---|---|
| CS= 06+00+00+00+23+45+AF+B1+D0+77+ | =315 |
| Modulo 256 | =15 |
| Negative | =EB |

N.B.: The above checksum calculation was performed in Hexadecimal.

## Upper Segment Base Addresses (USBA)

The Intel Hex records which may be received by the XP640 may be either the standard 8 bit format (record types 0 & 1) or the extended 16 bit format (additional record type 2).

The USBA is a 16 bit number which is used to set the current segment base. (This terminology is derived from the Intel 8086). In effect this means that the 16 bit number is shifted right four times and added to the 16 bit address of the type 0 data records. This results in a 24 bit address. The XP640 only actually uses the 16 least significant bits.

E.g.:

| | |
|---|---|
| USBA = | 1263H |
| ADDRESS IN DATA RECORD= | 3334H |
| ACTUAL ADDRESS OF DATA= | 12340H |
| | + 3334H |
| | ------- |
| | 15674H |

IN THE XP640 THIS WOULD BE 5674H

## Motorola Exorciser or "S" Format

### General

The Motorola "S" format provides for the transmission of data in printable ASCII format. The data is divided into records. The XP640 recognises and uses three types of record, these are: "S1" and "S2" the data records, and "S9" the end of file record.

### Exorciser Data Record Format (type S1)

Byte 1 "S" character delimiter

2 ASCII 1. The record type for data.

3 - 4 Byte count. The number of binary data bytes in the record plus three (1 for checksum and 2 for address).

5 - 6 Most significant byte of the start address of the data record.

7 - 8 Least significant byte of the start address of the data record.

9 - Data bytes. Each byte is sent as two ASCII characters, each representing one nibble of the Hex representation of the byte.

Last two bytes
Checksum of all bytes in the record excluding the delimiter and record type. The checksum is the 2's complement (NOT) of the modulo 256 binary sum of the bytes in the record.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

### Exorciser Data Record Format (type S2)

Byte 1 "S" character delimiter

2 ASCII 2. The record type for data.

3 - 4 Most significant byte of start address of the data record

5 - 6 Next most significant byte of start address of the data record

7 - 8 Least significant byte of start address of the data record

9 - Data bytes. Each byte is set as two ASCII characters, each representing one nibble of the hex representation of the byte.

Last two bytes
Checksum of all bytes in the record excluding the delimiter and record type. The checksum is the 2's complement (NOT) of the modulo 256 binary sum of the bytes in the record.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

**Exorciser End of File Record**

Byte 1 "S" delimiter

2 ASCII 9 Indicates end of file record

3 - 4 Byte count = 03 in end of file record

5 - 6 Most significant byte of start address (not used in the XP640 ; set to zero)

7 - 8 Least significant byte of start address (not used by the XP640 ; set to zero).

9 - 10 Checksum

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

**An Example of Motorola Format.**
A Motorola record consisting of the data 67 A0 4A 2B to start at 213F would be:

S107213F67A04A2B1C<CR><LF>

Which consists of:

| | |
|---|---|
| Delimiter | S |
| Record Type | 1 |
| Byte Count (Data + 3) | 07 |
| Start Address High | 21 |
| Start Address Low | 3F |
| Data | 67 |
| | A0 |
| | 4A |
| | 2B |
| Checksum | 1C |
| CR | 0D |
| LF | 0A |

Where the Checksum is calculated as follows:
CS = 07+21+3F+67+A0+4A+2B = 1E3
Modulo 256 E3
1's Complement 1C

N.B.: The above calculations were performed in Hexadecimal

## GP Binary Format

### General

This is a simple format devised by GP specifically for users writing there own formats. It is designed to be as simple as reasonably possible to write drivers/ receivers for. All data is sent in 8 bit binary, LSB first.

### Format of GP binary

Then data is preceded by a 4 byte block consisting of a block-length and a checksum:

Byte 1 Least significant byte of the block length.

2 Most significant byte of block length.

3 Least significant byte of the checksum.

4 Most significant byte of the checksum.

5 - Data bytes.

The block length is the number of bytes in the data record.

The checksum is the modulo 65536 binary sum of the data being transferred.

### An Example of GP Binary .

A GP Binary record to send the following data 23 67 8F 2A would be:

| | |
|---|---|
| Low Block Length | 04 |
| High Block Length | 00 |
| Low part of Checksum | 43 |
| High part of Checksum | 01 |
| Data | 23 |
| | 67 |
| | 8F |
| | 2A |

Where the Checksum was calculated as follows:
CS= 23+67+8F+2A =143

N.B.: The above calculation was performed in Hexadecimal

## Format of Serial List

This format is an output only format designed primarily to drive a serial printer. Data is output as ASCII characters in rows of 16 characters, each row being preceeded by the address of the first character in the row. Each row is terminated by carriage return and line feed. The data is sent in blocks of 256 bytes. After every third block a form feed is sent to prevent data being printed on the perforations of the paper.

**Example of serial list output**

```
0000 E4 AA CD 00 99 C9 E5 F5 E1 F1 4F 7D ED CF 21 01
0010 21 FF FF 0A E4 C4 01 C9 22 FD 22 E4 14 C3 FF FF
```

## The Tektronix Hexadecimal format (TEKHEX)

This format provides for the transfer of data blocked into records of printable ASCII characters. There are 2 types of records used and recognised by the XP640. These are the data record and the end of file record.

### Tekhex Data Record.

Byte 1 "/" character; delimiter

2 - 3 Most significant byte of the start address of the data record.

4 - 5 Least significant byte of the start address of the data record.

6 - 7 Byte count. The number of binary data bytes in the record .

8 - 9 First checksum, sum of all bytes, modulo 256 of the six hex digits of the load address and byte count.

10 - Data bytes. Each byte is sent as two ASCII characters, each representing one nibble of the Hex representation of the byte.

Last two bytes
Checksum of all of the data bytes in the record, calculated as the modulo 256 sum of all the nibbles making up the data bytes.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

### Tekhex End of File Record

Byte 1 "/" delimiter

2 - 3 Most significant byte of start address (not used in the XP640 ; set to zero)

4 - 5 Least significant byte of start address (not used by the XP640 ; set to zero).

6 - 7 Byte count = 00 in end of file record

9 - 10 Checksum of all bytes in the record excluding the delimiter and record type. The checksum is the modulo 256 binary sum of the NIBBLES making up the bytes in the record.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

### An example of TEKHEX data format

To send the data 23,00,A8,A9,17,04 the data format would look like:

/000006062300A8A9170436<CR><LF>

Which consists of:

| | |
|---|---|
| Delimiter | / |
| Start Address | 0000 |
| Byte Count | 06 |
| Checksum of Address field | 06 |
| Data | 23,00,A8,A9,17,04 |
| Checksum | 36 |

Where the checksums were calculate as:

Checksum of Address = 0+0+0+0+6= 6
Checksum of data = 2+3+0+0+A+9+1+7+0+4=36H

## MOS Technology data format

In this format the data is divided into records and sent as printable ASCII characters. There are two types of record used and recognised by the XP640. These are the data record and the end of file record.

## MOS Data Record

Byte 1 ";" character; delimiter

2 - 3 Byte count. The number of binary data bytes in the record .

4 - 5 Most significant byte of the start address of the data record.

6 - 7 Least significant byte of the start address of the data record.

8 - Data bytes. Each byte is sent as two ASCII characters, each representing one nibble of the Hex representation of the byte.

Last four bytes
Checksum ,sum of all data bytes in the record. The checksum is the modulo 65536 binary sum of all the bytes in the record including the block length and address, but excluding the delimiter and the checksum itself. It is transmitted high byte then low byte.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

**MOS End of File Record**

Byte 1 ";" delimiter

2 - 3 Byte count = 00 in end of file record

4 - 5 Most significant byte of sum of total bytes sent in all records

6 - 7 Least significant byte of sum of total bytes sent in all records

8 - 9 Most significant byte of checksum

10 - 11 Least significant byte of the checksum of all bytes in the record excluding the delimiter and record type. The checksum is the modulo 65536 binary sum of the bytes in the record.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

**Example of MOS TECHNOLOGY data records.**

To send the data record 86 AF E5 64 98 99 99 00 the MOS record would be:

;08000086AFE564989999000448<CR><LF>

Which consists of:

| | |
|---|---|
| Delimiter | ; |
| Byte Count | 08 |
| Start Address | 0000 |
| Data | 86AFE56498999900 |
| Checksum | 0448 |

Where the checksum is calculate as:

Checksum = 86+AF+E5+64+98+99+99+00=0448

## Signetics Absolute Data Transmission Format

In this format data is divided into records of printable ASCII characters. The XP640 uses and recognises two types of data record. The data record and the end of file record.

## Signetics Absolute Data Record

Byte 1 ":" character; delimiter

2 - 3 Most significant byte of the start address of the data record.

4 - 5 Least significant byte of the start address of the data record.

6 - 7 Byte count. The number of binary data bytes in the record .

8 - 9 Checksum of all the bytes in the address and data fields, calculated by EXORing each byte with the previous byte, then rotating the resultant byte left one bit.

10 - Data bytes. Each byte is sent as two ASCII characters, each representing one nibble of the Hex representation of the byte.

Last two bytes
Checksum ,sum of all data bytes in the record the checksum is calculated in the same way as the first checksum.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

## Signetics Absolute End of File Record

Byte 1 ":" delimiter

2 - 3 Most significant byte of start address (not used in the XP640 ; set to zero)

4 - 5 Least significant byte of start address (not used by the XP640 ; set to zero).

6 - 7 Byte count = 00 in end of file record

8 - 9 Checksum of all the bytes in the address and data fields, calculated by EXORing each byte with the previous byte, then rotating the resultant byte left one bit.

CR,LF Carriage return and line feed are output from the XP640, but are not checked when input.

**Example of SIGNETICS ABSOLUTE data format**

To send the data 23 EE F1 2A D4 55 99 the data record would be as follows:

:0000070E23EEF12AD4559946<CR><LF>

Which consists of:

| | |
|---|---|
| Delimiter | : |
| Start Address | 0000 |
| Byte Count | 07 |
| First Checksum | 0E |
| Data | 23EEF12AD45599 |
| Second Checksum | 46 |

Where the checksums are calculated as follows:

First Checksum (((00 EXOR 00)*2 EXOR 00)*2 EXOR 07)*2=0E

Second Checksum ((((((23 EXOR EE)*2 EXOR F1)*2 EXOR 2A)*2 EXOR D4)*2 EXOR 55)*2 EXOR 99)*2=46

## The ASCII Space, Comma, Apostrophe and Percent

Data in these formats is transmitted in sequential, two character groups representing hex bytes followed by the execute code space, percent, apostrophe or co a. Data may be transmitted as either 4 or 8 bits. The XP640 assumes that the two characters prior to the execute code were a valid character. If only one character was received prior to the execute code then a leading zero is assumed.

When the XP640 is receiving in these formats it recognises 3 types of information; these are Address information, Data and Checksum.

**General**
The data transmission must be preceeded with an <STX> character (02H) which may then be followed immediately with data or by an address field. The transmission must be terminated with an <ETX> (03H) followed by either a checksum field or at least 16 nulls.

**Data field**

Each time an execute code is received the two previous bytes are assumed to be valid data. If there have not been two valid ASCII Hex bytes prior to the execute code then the programmer assumes leading zeroes.

**Address field**

When the XP640 receives a "$" followed by an "A" it then expects 4 ASCII Hex digits giving the address of the first data field. This address must be terminated by a comma (except in the "Comma" format where it is terminated by a full stop).The input data will then be loaded, starting at this address.

**Checksum field**

The data field must be terminated with an <ETX> this may optionally be followed with a checksum. The checksum is expected as "$" followed by "S" followed by the four bytes of the checksum. The checksum must be terminated with a comma (or for the comma format a full stop). The checksum is calculated as the modulo 65536 sum of all of the data sent since the previous <STX>. If the checksum is not sent then at least 16 characters must follow the <STX> to prevent a time-out error.

**An example of an ASCII SPACE data transmission**

<STX>$A0000,<CR><LF>
31 FF 77 C3 FF FE 76.....<ETX><CR><LF>
$S1234,<CR><LF>

**An example of an ASCII COMMA data transmission**

<STX>$A0000.<CR><LF>
31,FF,77,C3,FF,FE,76.....<ETX><CR><LF>
$S1234.<CR><LF>

**An example of an ASCII PERCENT data transmission**

<STX>$A0000,<CR><LF>
31%FF%77%C3%FF%FE%76.....<ETX><CR><LF>
$S1234,<CR><LF>

**An example of an ASCII APOSTOPHE data transmission**

<STX>$A0000,<CR><LF>
31'FF'77'C3'FF'FE'76.....<ETX><CR><LF>
$S1234,<CR><LF>

**ASCII BPNF,BHLF,B1OF Formats**

In these formats each byte of data is transmitted as an ASCII "B" followed by eight ASCII bytes representing the bits of the data byte. Zeroes and ones are represented respectively in the two formats by: "N", "P" or "L", "H", or "O", "1". Each byte is terminated with the ASCII character "F". The data is transmitted least significant bit first. The entire data stream must be started with a non-printable <STX> and ended with a non-printable <ETX>. The data output from the XP640 is formatted to suit a list device by outputting a space between each byte, and a <CR><LF> at the end of each line of six bytes.

**An example of BPNF format.**

The data stream 0F,84,73,21 would be sent as:

<STX>BPPPPNNNNF BNNPNNNNPF BPPNNPPPNF BPNNNNPNNF<ETX>

**An example of BHLF format.**

The data stream 0F,84,73,21 would be sent as:

<STX>BHHHHLLLLF BLLHLLLLHF BHHLLHHHLF BHLLLLHLLF<ETX>

**An example of B1OF format.**

The data stream 0F,84,73,21 would be sent as:

<STX>B11110000F B00100001F B11001110F B10000100F<ETX>

## DEC Binary and Binary formats

In both of these formats data is transmitted as a string of binary information. The only difference in the two formats is the start of record. For Binary the record starts with any number of nulls followed by a rubout (FFH). In DEC binary the format starts with any number of rubouts followed by a null. The data after the record start is a string of binary data with no checksums, no byte counts and no print formatting. As there is no end of file delimiter the receiving machine must have been told how many bytes to expect. In the XP640 this is entered from the keyboard.

**XP640 INDEX**

**XP640 INDEX**