Pluto 5 & Pluto 5 Casino EPROM Configurations and Autoselect Feature Manual

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1 POSSIBLE EPROM CONFIGURATIONS

1.1 Diagram Descriptions

Each diagram shows comprehensive details of the following: -

1 EPROM Type

The type of EPROM that can be used. Where we quote the EPROM type as a 27C040, you can also use 27C4001's but the ***scramble*** command line remains unchanged.

2 EPROM Size

The total amount of EPROM space that will be required in Megabytes.

3 EPROM Location

Where each EPROM will be located.

4 Address Range

The address ranges of each memory block.

5 Configuration Byte

The configuration byte of the top EPROM.

6 Command Line

The command line that is required to convert the Motorola S Record file into an EPROM binary file. This is shown in the bold box.

(NOTE: - Command lines are Case Sensitive)

1.2 EPROM locations

These diagrams show the EPROM locations for all the possible PCB configurations.

Pluto 5 or Pluto 5 Casino

Diagrams 2.1.1 to 2.1.4 show the EPROM locations and parameters for the Pluto 5 or the Pluto 5 Casino Board only.

With Expansion Card

Diagrams 2.2.1 to 2.2.8 show the EPROM locations and parameters for the Pluto 5 or the Pluto 5 Casino Board fitted with either the 2 EPROM/RAM, the 2 EPROM or the 4 EPROM Expansion cards.

With Calypso 16

Diagrams 2.3.1 to 2.3.10 show the EPROM locations and parameters for the Pluto 5 or the Pluto 5 Casino Board fitted with the Calypso 16 Video Graphics Card.

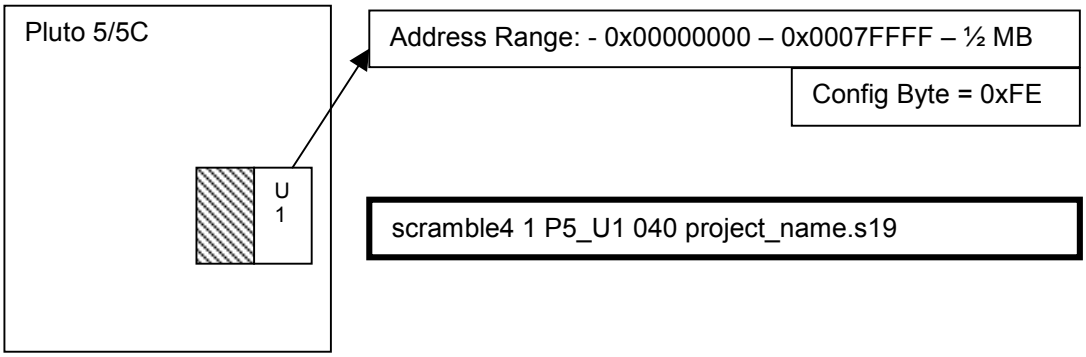
With Calypso 16 and Expansion Card

Diagrams 2.4.1 to 2.4.4 show the EPROM locations and parameters for the Pluto 5 or the Pluto 5 Casino Board fitted with the Calypso 16 Video Graphics Card and fitted with either the 2 EPROM/RAM, the 2 EPROM or the 4 EPROM Expansion cards.

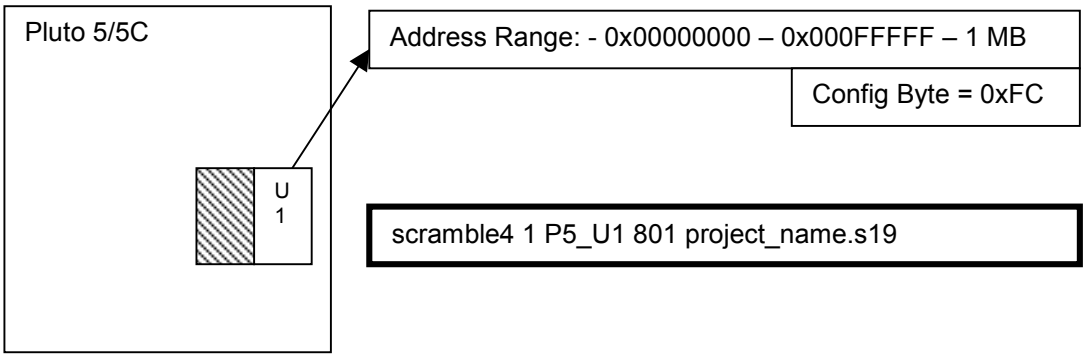
2 DIAGRAMS OF POSSIBLE EPROM CONFIGURATIONS

2.1 Pluto 5 or Pluto 5 Casino only.

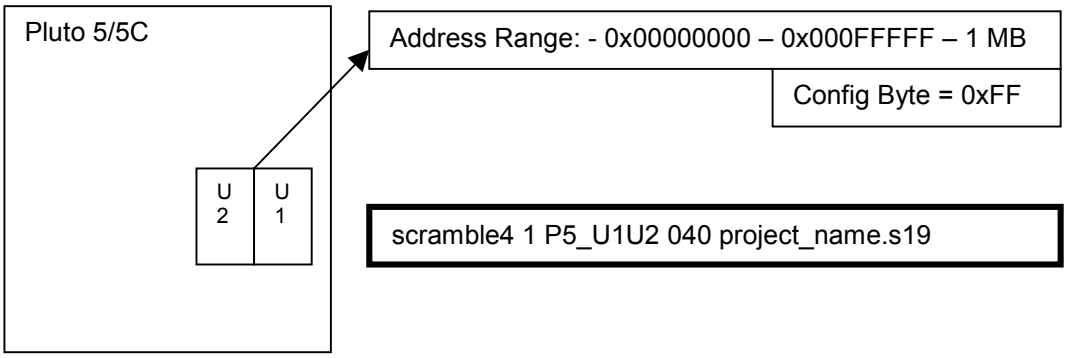
2.1.1 1 x 27C040 Total = ½ MB



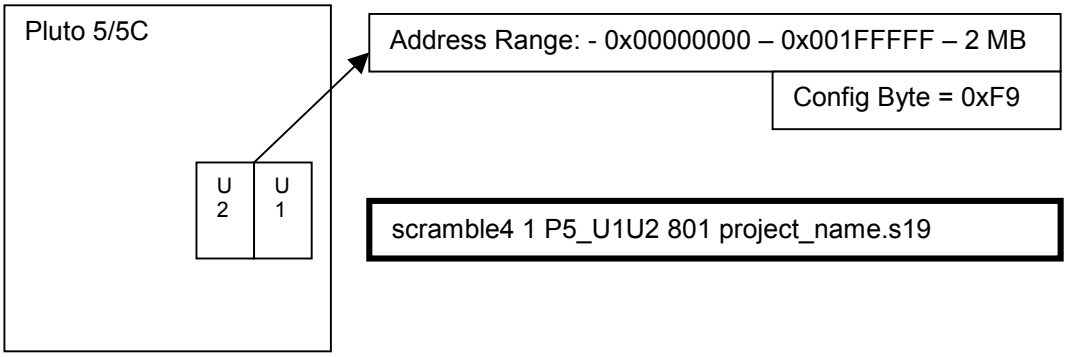
2.1.2 1 x 27C801 Total = 1 MB



2.1.3 2 x 27C040 Total = 1 MB

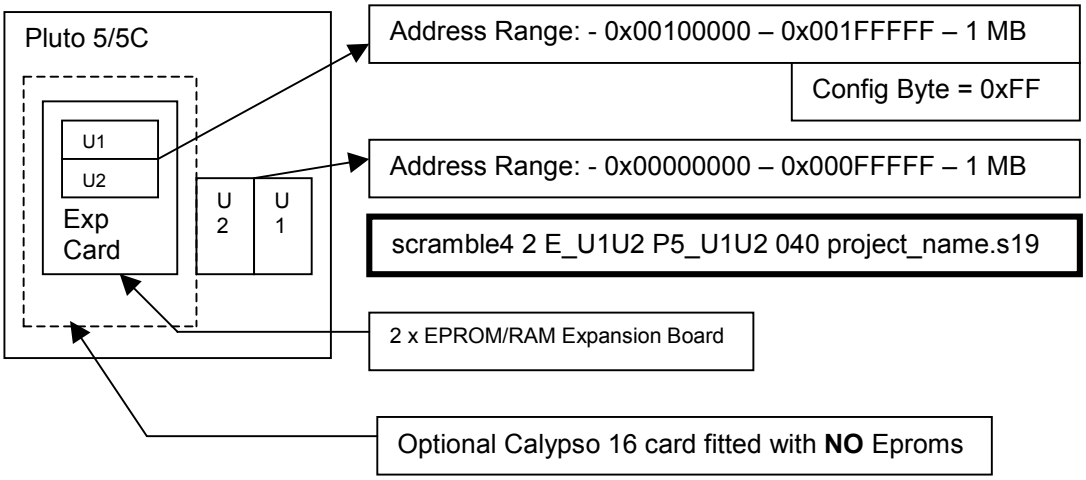


2.1.4 2 x 27C801 Total = 2 MB

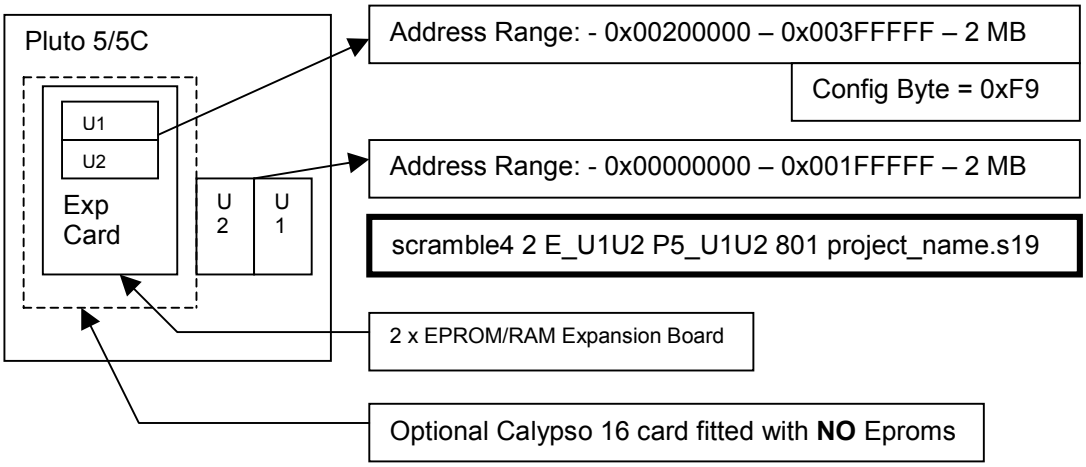


2.2 Pluto 5 or Pluto 5 Casino with Expansion card.

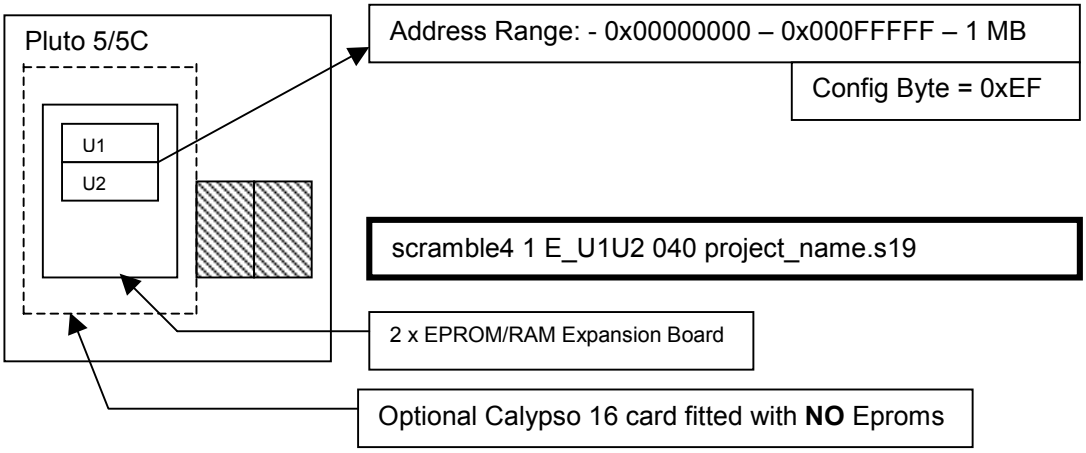
2.2.1 4 x 27C040 Total = 2 MB



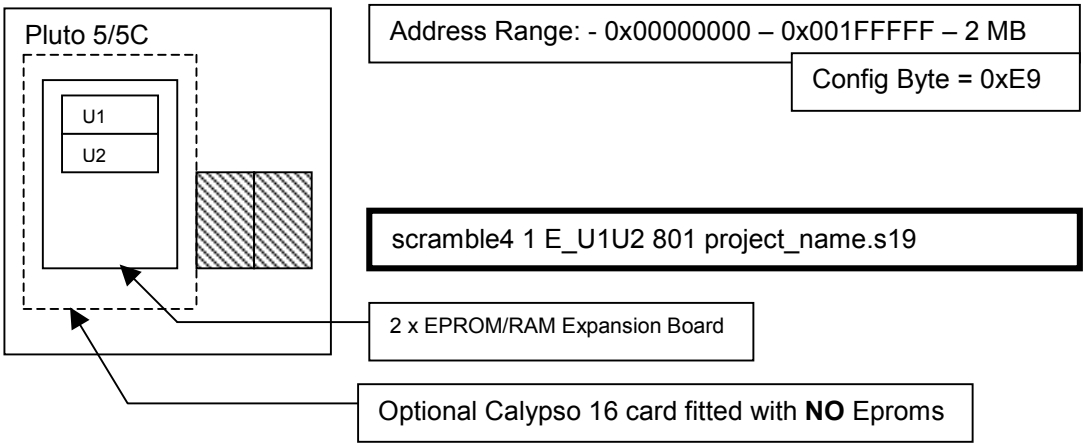
2.2.2 4 x 27C801 Total = 4 MB



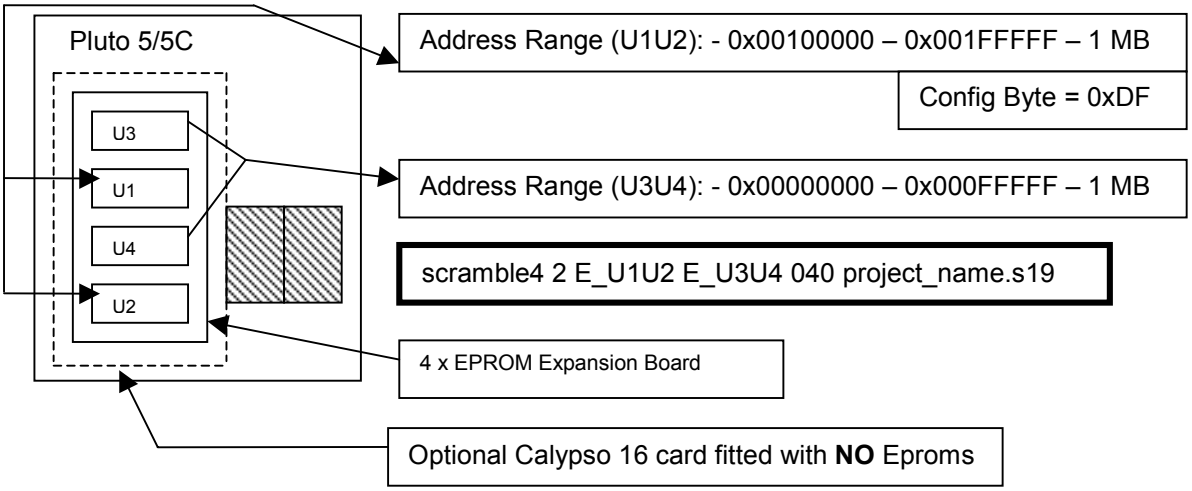
2.2.3 2 x 27C040 Total = 1 MB



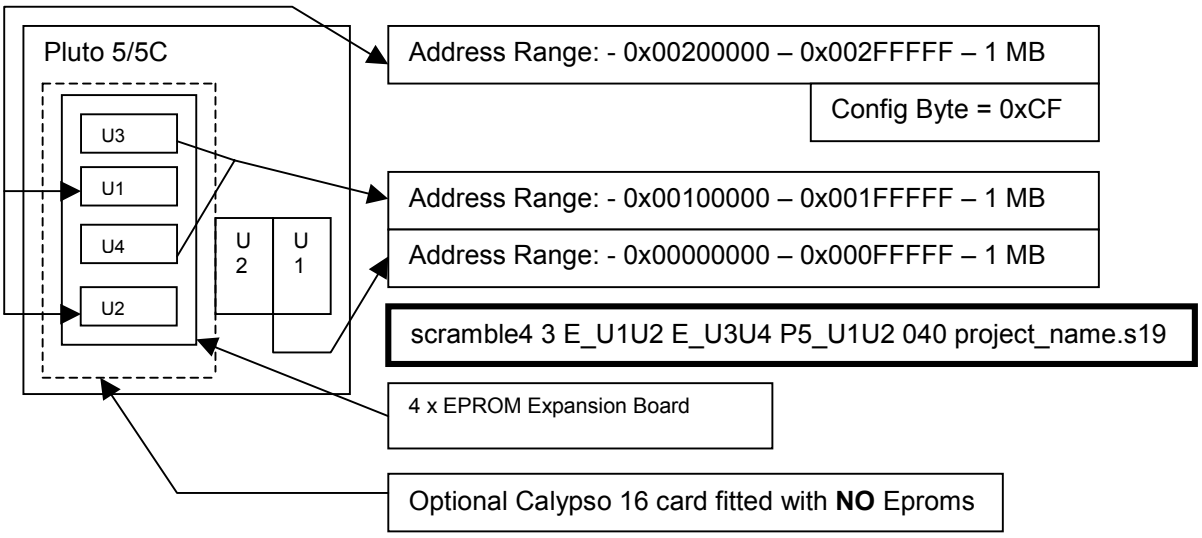
2.2.4 2 x 27C801 Total = 2 MB



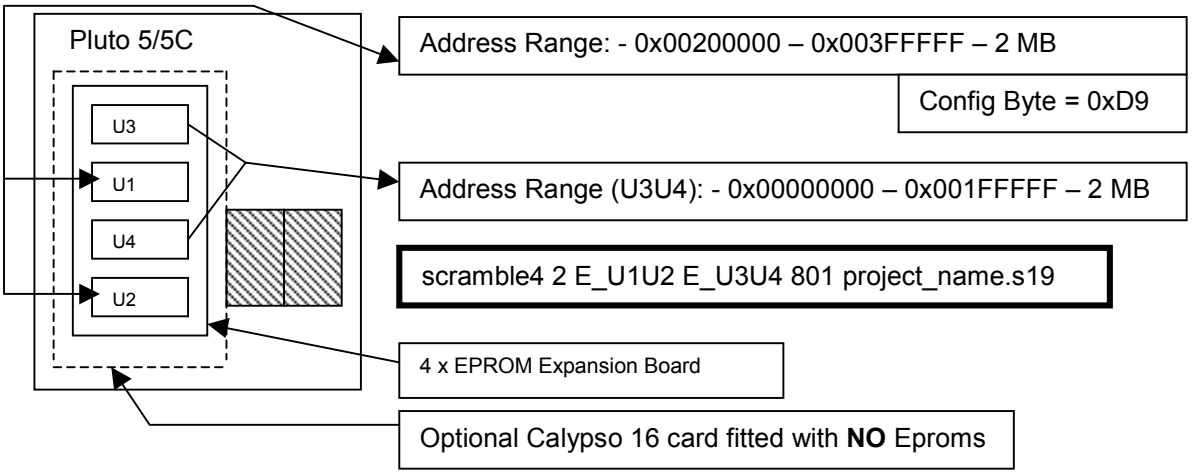
2.2.5 4 x 27C040 Total = 2 MB



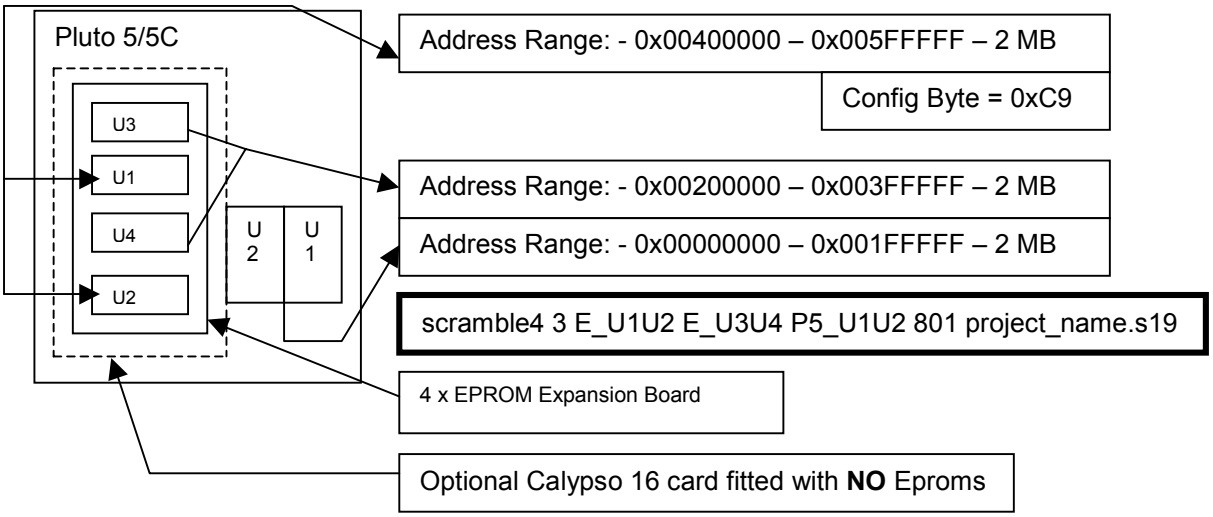
2.2.6 6 x 27C040 Total = 3 MB



2.2.7 4 x 27C801 Total = 4 MB

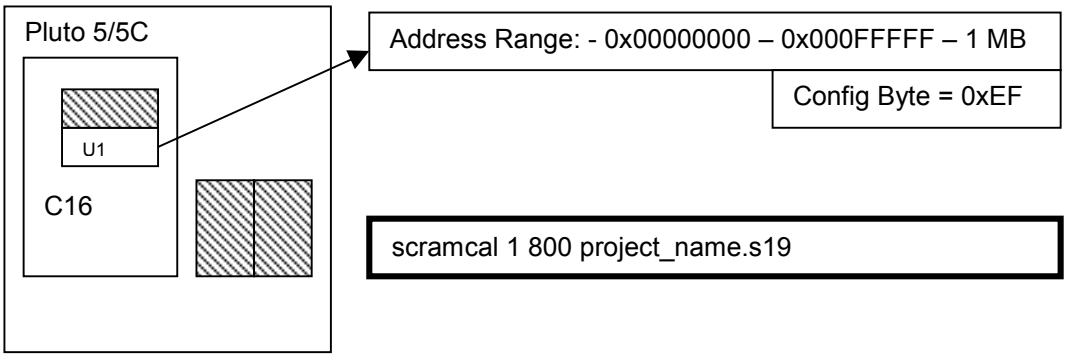


2.2.8 6 x 27C801 Total = 6 MB

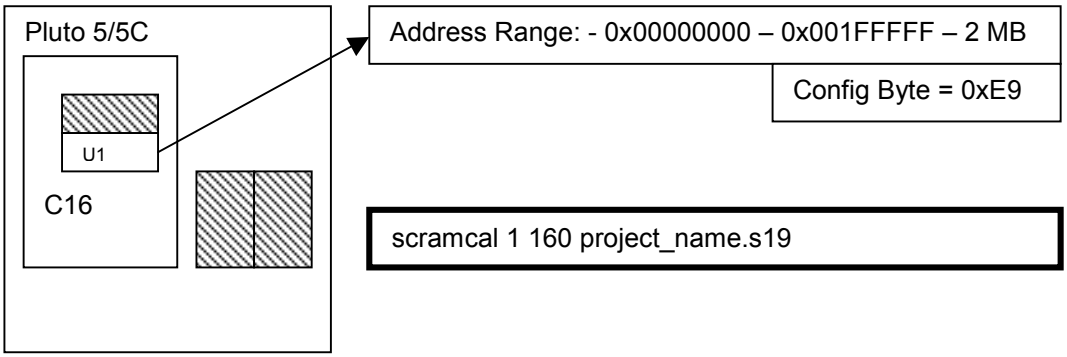


2.3 Pluto 5 or Pluto 5 Casino with Calypso 16

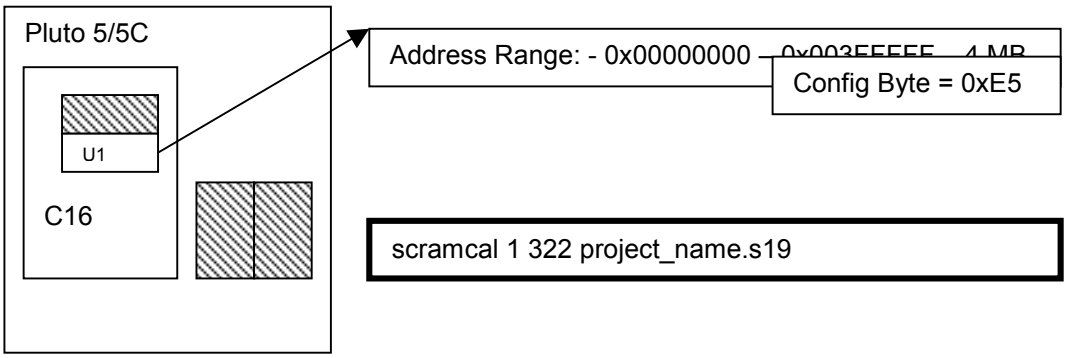
2.3.1 1 x 27C800 Total = 1 MB



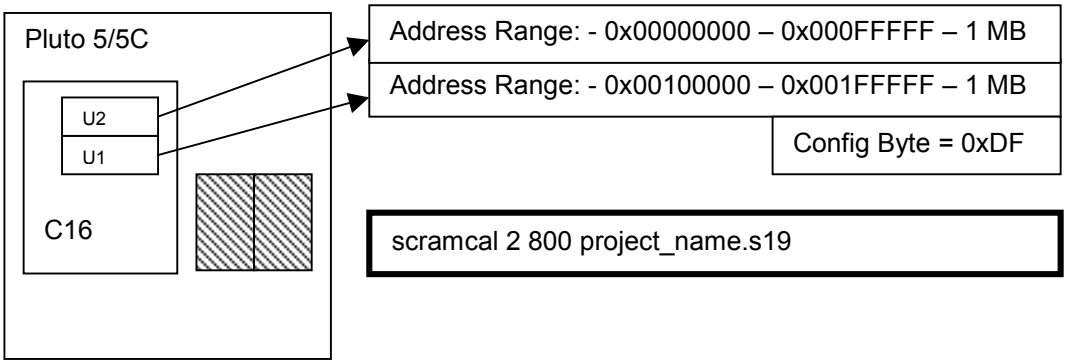
2.3.2 1 x 27C160 Total = 2 MB



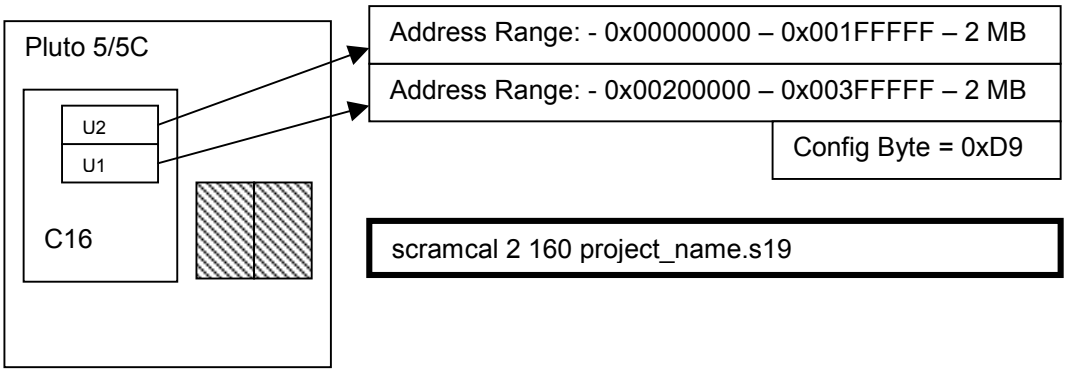
2.3.3 1 x 27C322 Total = 4 MB



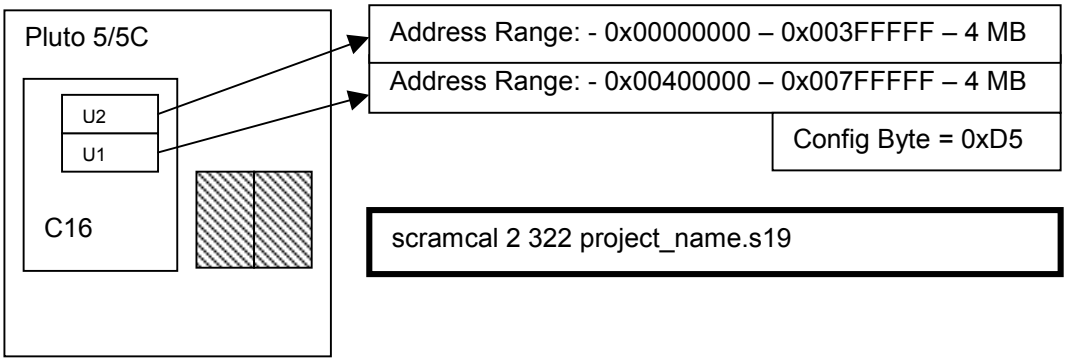
2.3.4 2 x 27C800 Total = 2 MB



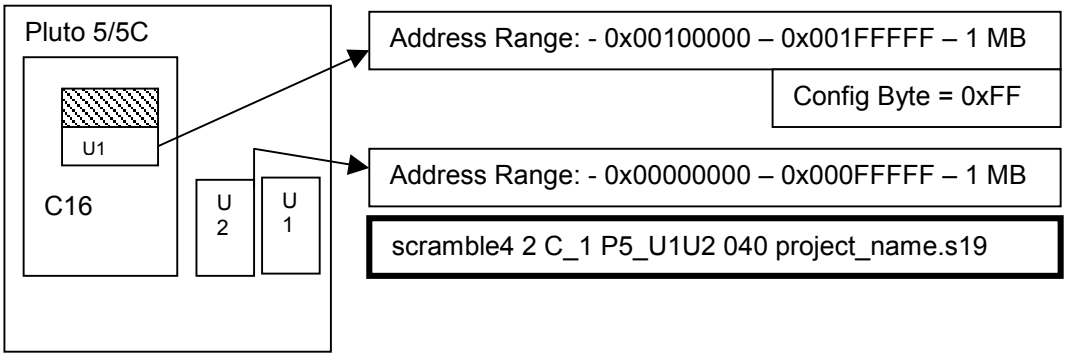
2.3.5 2 x 27C160 Total = 4 MB



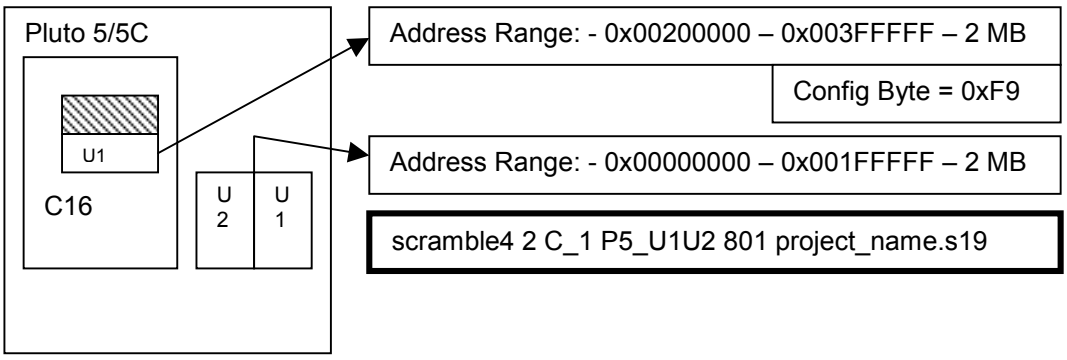
2.3.6 2 x 27C322 Total = 8 MB



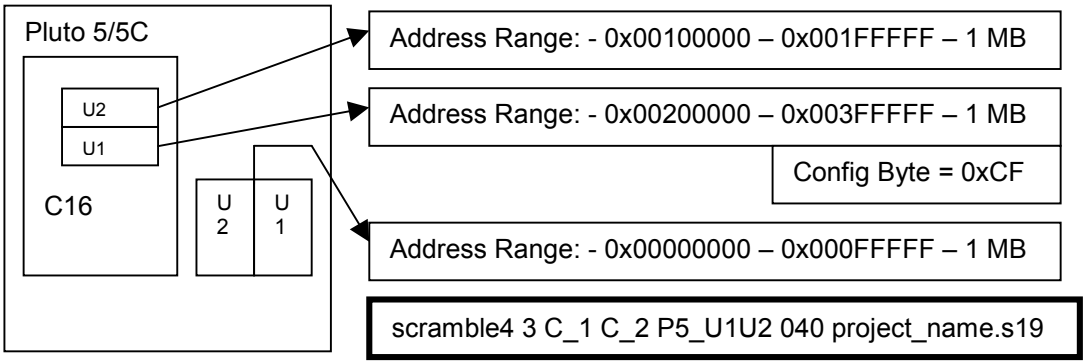
2.3.7 1 x 27C800 & 2 x 27C040 Total = 2 MB



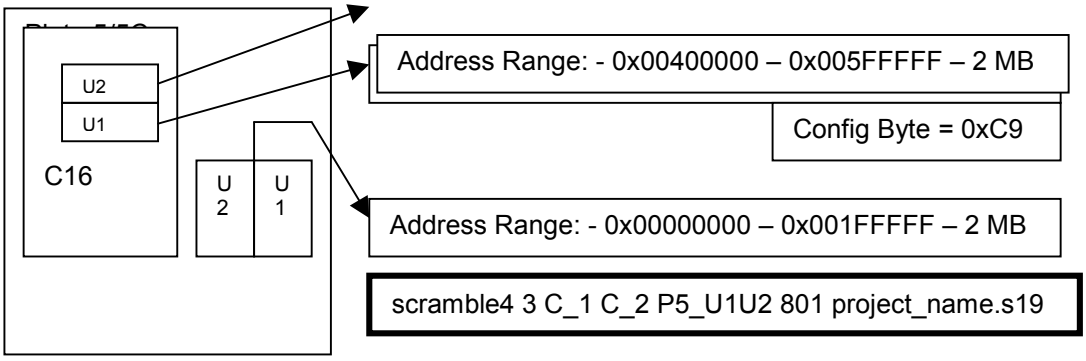
2.3.8 1 x 27C160 & 2 x 27C801 Total = 4 MB



2.3.9 2 x 27C800 & 2 x 27C040 Total = 3 MB

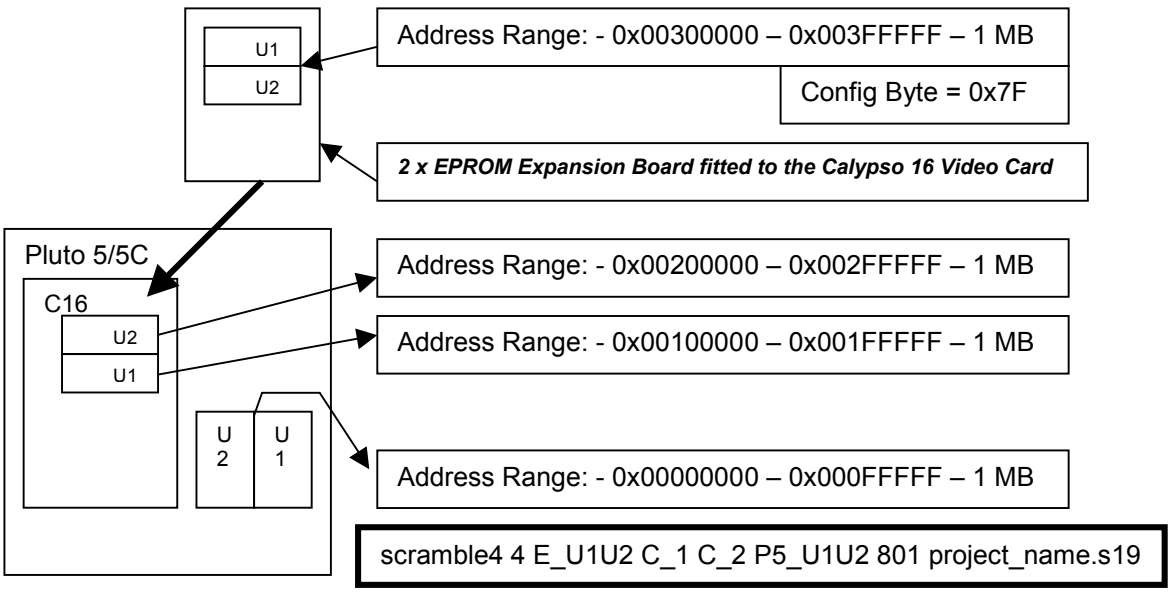


2.3.10 2 x 27C160 & 2 x 27C801 Total = 6 MB

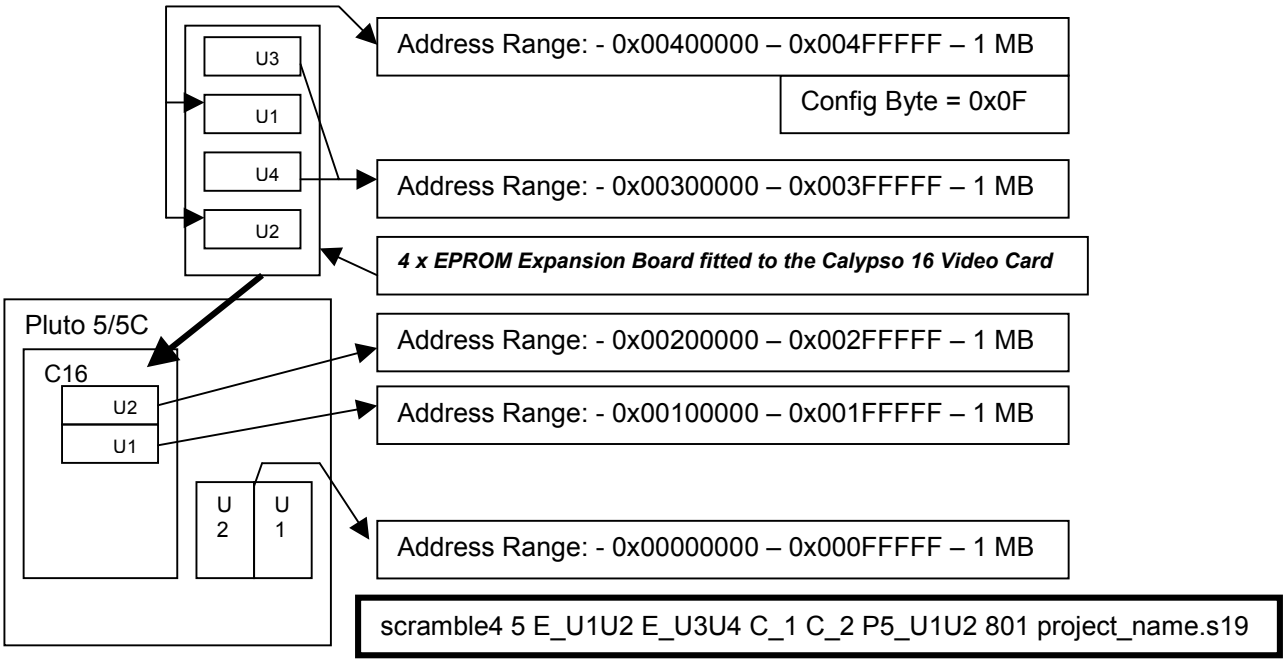


2.4 Pluto 5 or Pluto 5 Casino with Calypso 16 and Expansion card.

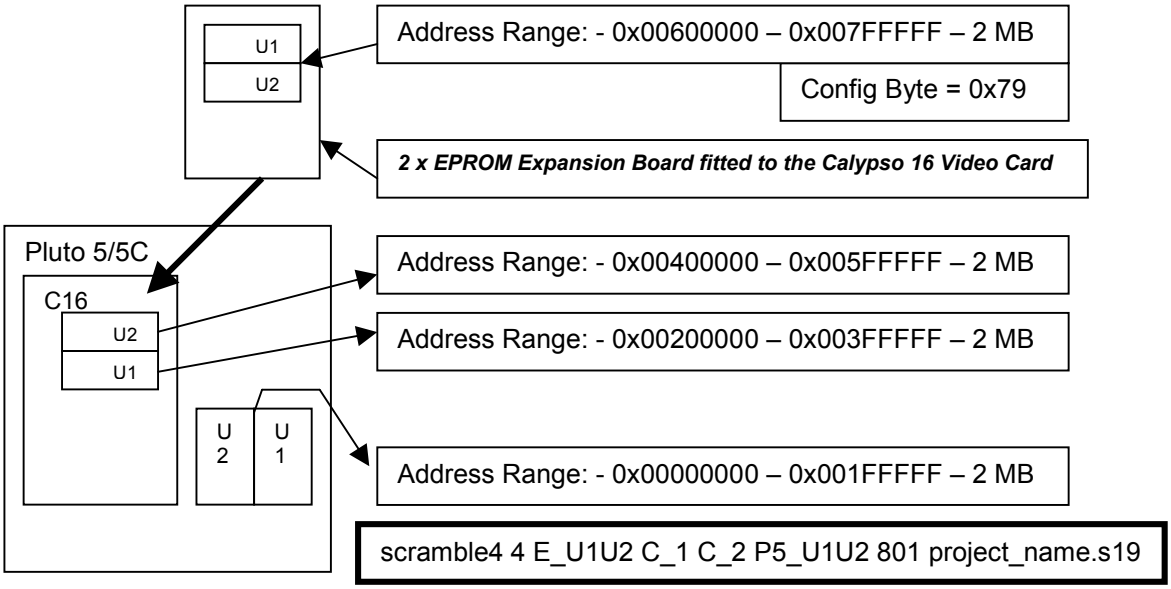
2.4.1 2 x 27C800 & 4 x 27C040 Total = 4 MB



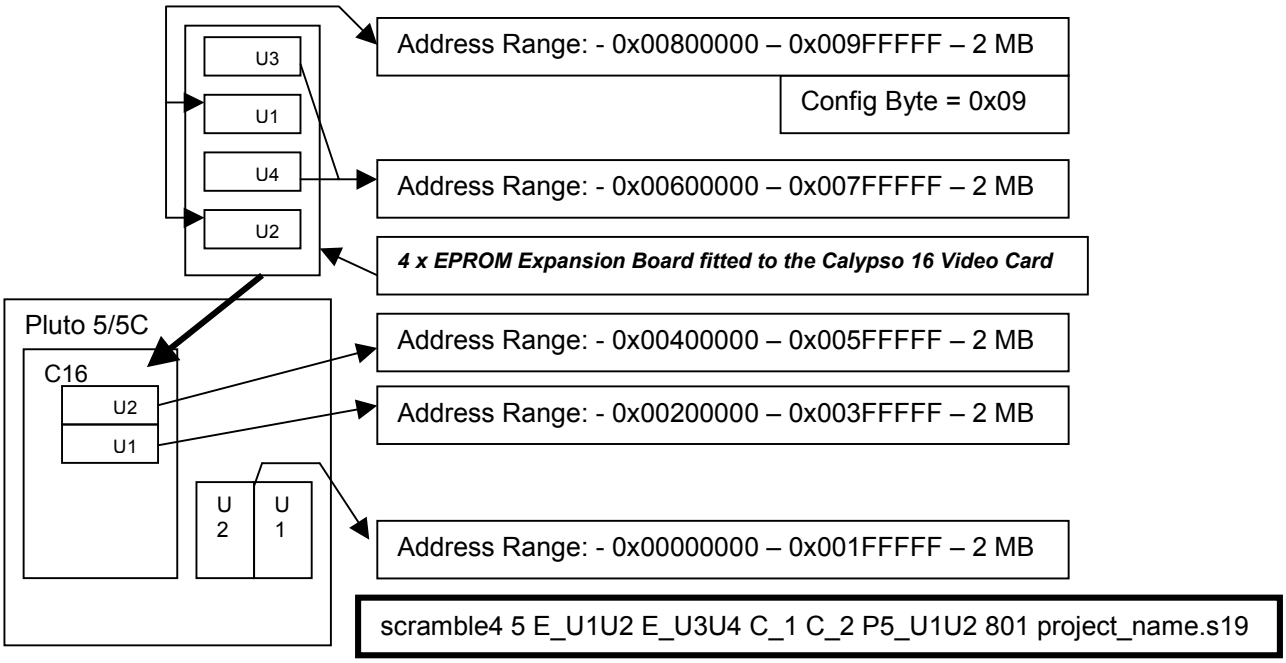
2.4.2 2 x 27C800 & 6 x 27C040 Total = 5 MB



2.4.3 2 x 27C160 & 4 x 27C801 Total = 8 MB



2.4.4 2 x 27C160 & 6 x 27C801 Total = 10 MB



3 ROM AUTOSELECT FEATURE INTRODUCTION

As standard, the **Pluto 5 Controller** incorporates a feature known as “ROM AUTOSELECT”.

This feature allows different combinations of programme memory devices, either on-board or on a Memory Expansion Card, to be used on the system while eliminating the need for any link selection.

The **Pluto 5 Controller** has a pair of sockets that will accept one or two 27C040/27C801 EPROM devices.

The **Pluto 5 Controller** has a Memory Expansion Connector, P15 to which may be added additional boards allowing either an increase to the total size of programme memory, or allowing the programme memory to be in the form of a removable module.

4 OVERVIEW

Most aspects of the mapping of the Programme Memory for the Pluto 5 Controller, using both the On-Board EPROM Sockets and, optionally, an expansion board fitted to P15, are controlled by the FPGA.

The basis of the system is that the FPGA on the Pluto 5 Controller will read the top byte of an EPROM/ROM during the power-up reset period and use the data contained in this byte to configure the EPROM/ROM Memory Map correctly. Thus, the executable module for any game must contain, in it’s top address, the appropriate configuration byte compatible with the configuration of memory that is to be used. This byte may be included either placing the appropriate directives in the Source Code, or by post-processing the final object module to add the appropriate byte.

Two basic configurations satisfy most operational needs:

- Pluto 5 Controller with no memory expansion
- Pluto 5 Controller + Memory Expansion Card

5 START-UP OPERATION

Immediately after Power-Up, during the period that the RESET line from the TL7705 Reset IC (U17) is being asserted HIGH, the FPGA sets the various lines that control the mapping of the EPROM/ROM devices to default states and latches the data that is presented on Data Bus Lines D8-D15.

The behaviour of the FPGA during the Reset state depends upon whether any Expansion Memory Card is fitted. The presence of an Expansion memory Card is signalled to the FPGA by a link on the Card pulling the line FPGA0 to GND.

This allows the ROM Autoselect Control Byte to be read from the EPROMs present in the board(s).

The actual EPROM from which the Control Byte is read depends upon the configuration of boards fitted and is as follows:

Table 1 - Location of Autoselect Control Byte in EPROM

BOARD CONFIGURATION	READ CONTROL BYTE FROM TOP LOCATION IN:
Pluto 5 Controller only	Pluto 5 U1
Pluto 5 Controller + EPROM Card	EPROM Card U1
Pluto 5 Controller + Video Card	Video Card U1
Pluto 5 Controller + Video Card + EPROM Card	EPROM Card U1

6 CONTROL BYTE FUNCTIONS

Table 2 - Autoselect Control Byte

Autoselect Control Byte

7	6	5	4	3	2	1	0
EXTERNAL MAPPER	MAP_SEL2	MAP_SEL1	MAP_SEL0	BLK_SIZ1	BLK_SIZ0	EPROM_ TYPE	8/16 BIT

BIT 0, 8/16 BIT – Select 8 bit or 16 bit wide EPROM.

When set to 0, 8 bit operation mode is selected and the Pluto 5 Controller may be run with a single 27C040 or 27C801 device fitted in position U1.

When set to 1, 16 bit operation mode is selected. In this case the Pluto 5 Controller requires the programme memory area to be 16 bits wide and therefore requires both U1 and U 2 to be fitted to the board, or an external 16 bit memory card must be fitted.

BIT 1, EPROM_TYPE – Select 27C040 or 27C801 EPROM type.

This bit controls the setup of line ROM_P1 which feeds Pin 1 of on-board 27C040/801 sockets and any corresponding devices on an expansion memory card.

If the programme is in 27C040 devices, set this bit to 1. When using 27C801 EPROMs in the on-board sockets, or if an Expansion Memory Card is used containing devices other than 27C040s, set this bit to 0.

***Note*:** The line ROM_P1 is set to be Address A20 at all times EXCEPT when a EPROM/ROM read operation, mapped by CS0- is occurring. If 27C040 mode is set, then during EPROM/ROM reads, the ROM_P1 line is set high. If 27C040 mode is not set, then during EPROM/ROM reads, the ROM_P1 line is set to A20.

BIT 3 / BIT 2, BLK_SIZ1/0 – Set size of EPROM/ROM blocks.

Table 3 - BLK_SIZ0/1 EPROM Block Size Selection

BLK_SIZ1	BLK_SIZ0	Block Size
1	1	1Mbyte
1	0	2Mbyte
0	1	4Mbyte
0	0	8Mbyte

The function of these bits is overridden if BIT 7, “External Mapper” is set to 0. In this case, they may serve an alternate function.

***Note*:** Obviously, the software must programme the SIM40 Module of the MC68340 processor such that the address range mapped by CS0- is adequate for the total number and size of EPROM/ROMs being fitted.

BITS 4-6, MAP_SEL2/1/0 – Select order of EPROM/ROM selects.

The EPROM/ROM map, selected by CS0-, is broken up into 5 contiguous blocks (BLK0-4) of size determined by the setting of the SIZ1 & SIZ0 bits. The MAP_SEL bits allocate how these 5 block addresses are mapped to the available EPROM sockets in the system.

If the system contains only 2 boards, the EXTERNAL_MAPPER bit should be set to 1, and the MAP_SEL bits will set up the mapping as shown below in Table 4 below.

Table 4 - MAP_SEL bits operation with EXTERNAL_MAPPER Bit == 1

MAP_SEL bits		Pluto 5		Expansion Card (Memory or Video)	
MAP_SEL2	MAP_SEL1	MAP_SEL0	U1/U2	U1/U2	U3/U4
X	1	1	Blk 0	Blk1	Blk2
X	1	0	Blk 2	Blk0	Blk1
X	0	1	Blk 2	Blk1	Blk0
X	0	0	Blk 0	Blk2	Blk1

If the system contains 3 boards (Pluto 5, Video and EPROM Expansion), the EXTERNAL_MAPPER bit should be set to 0, and the MAP_SEL bits will set up the mapping as shown below in Table 5 below.

Table 5 - MAP_SEL bits operation with EXTERNAL_MAPPER Bit == 0

MAP_SEL bits			Pluto 5	C16 Video Card		EPROM Expansion Card	
MAP_SEL 2	MAP_SEL 1	MAP_SEL0	U1/U2	U1/U2	U3/U4	U1/U2	U3/U4
1	1	1	Blk 0	Blk 1	Blk 2	Blk 3	Blk 4
1	1	0	Blk 3	Blk 1	Blk 0	Blk 2	Blk 4
1	0	1	Blk 2	Blk 0	Blk 3	Blk 1	Blk 4
1	0	0	Blk 4	Blk 2	Blk 3	Blk 0	Blk 1
0	1	1	Blk 4	Blk 3	Blk 2	Blk 1	Blk 0
0	1	0	Blk 4	Blk 0	Blk 3	Blk 2	Blk 1
0	0	1	Blk 4	Blk 1	Blk 0	Blk 3	Blk 2
0	0	0	Blk 0	Blk 2	Blk 1	Blk 4	Blk 3

BIT 7, EXTERNAL MAPPER – External mapping logic present.

When this bit is set to 1, the mapping is controlled by the FPGA on the Pluto 5 Controller. This mode is selected when only 1 Expansion Card is fitted to the Pluto 5 Controller, i.e. in the following configurations:

a) Pluto 5 Controller with no memory expansion
b) Pluto 5 Controller + Memory Expansion Card

7 SETTINGS FOR PINS ROM_P1 AND ROM_P12

The FPGA pins ROM_P1 and ROM_P12 are outputs from the FPGA which are configured by the ROM Autoselect Feature to provide different signals depending on the EPROM Type and Mode selected.

Pin ROM_P1 connects to Pin 1 of the two On-Board EPROM sockets U1/2 and is also connected to the Memory Expansion Connector P15.

Pin ROM_P12 connects to Pin 12 of the two On-Board EPROM sockets U1/2 only.

The functions of these two pins is set in accordance with the following table:

Table 6 - ROM_P1 and ROM_P12 Pin Functions

MODE	XAUTO BITS		Pin ROM_P1	Pin ROM_P12
	27C040	8/16 BIT		
1*27C040	1	0	Vcc (*Vpp*)	A0 (a0)
Pairs of 27C040	1	1	Vcc (*Vpp*)	A19 (a0)
1*27C801	0	0	A19 (*A19*)	A0 (a0)
Pairs of 27C801	0	1	A20 (*A19*)	A19 (a0)
RESET	x	x	Vcc	Vcc
Non-CS0 Cycle	x	x	A20	A0 or A19

8 PRODUCTION EPROM CONFIGURATIONS

The following sections describe the most common production programme (ROM) memory configurations. Other configurations are possible which may be used during software development.

8.3 Pluto 5 Controller, No Memory Expansion

Table 7 - Production EPROM Configurations – Pluto 5 Only

Size	Device(s)	Pluto 5 U1/(U2)	Mode	Block Size	Config. Byte
0.5Mbyte	1*27C040 (U1 only)	Blk 0 (0000 0000 – 0007 FFFF)	8 bit	1Mbyte	0xFE
1Mybte	1*27C801 (U1 only)	Blk 0 (0000 0000 – 000F FFFF)	8 bit	1Mbyte	0xFC
1Mybte	2*27C040	Blk 0 (0000 0000 – 000F FFFF)	16 bit	1Mbyte	0xFF
2Mybte	2*27C801	Blk 0 (0000 0000 – 001F FFFF)	16 bit	2Mbyte	0xF9
		Autoselect Control byte Read from Here			

8.4 Pluto 5 Controller + EPROM/RAM Card 01-15301

This configuration consists of a Pluto 5 Controller fitted with an EPROM/RAM Expansion Card
The EPROM/RAM Expansion Card contains 2 EPROM sockets capable of accepting either 27C040 or 27C801 devices.

This allow a maximum total (including U1/U2 on the Pluto 5 Controller) EPROM area of 4Mbytes when using 27C801 devices or 2Mbytes when using 27C040 devices.

Table 8 - Production EPROM Configurations – Pluto 5 + EPROM/RAM Card

Total Size	Devices	EPROM/RAM U1/U2	Pluto 5 U1/U2	Config. Byte
1Mbyte	2*27C040	0000 0000 – 000F FFFF	-	-0xEF
2Mbyte	4*27C040	0010 0000 – 001F FFFF	0000 0000 – 000F FFFF	0xFF
2Mbyte	2*27C801	0000 0000 – 001F FFFF	-	-0xE9
4Mbyte	4*27C801	0020 0000 – 003F FFFF	0000 0000 – 001F FFFF	0xF9
		Autoselect Control byte Read from Here		

***Note*:** In the above table, the EPROMs occupying the highest address are always in the U1/U2 position on the Expansion Card which are also where the Configuration Byte is read from. Thus, the Configuration Byte may always be inserted to the top address of the code space.

8.5 Pluto 5 Controller + 4 EPROM Card 01-15160

This configuration consists of a Pluto 5 Controller fitted with a 4 EPROM Expansion Card.

The 4 EPROM Expansion Card contains 4 EPROM sockets capable of accepting either 27C040 or 27C801 devices.

This allow a maximum total (including U1/U2 on the Pluto 5 Controller) EPROM area of 6Mbytes when using 27C801 devices or 3Mbytes when using 27C040 devices.

Table 9 - Production EPROM Configurations – Pluto 5 + 4 EPROM Card

Total Size	Devices	EPROM U1/U2	EPROM U3/U4	Pluto 5 U1/U2	Block Size	Config. Byte
1Mbyte	2*27C040	0000 0000 – 000F FFFF	-	-	1Mbyte	0xEF
2Mbyte	4*27C040	0010 0000 – 001F FFFF	0000 0000 – 000F FFFF	-	1Mbyte	0xDF
3Mbyte	6*27C040	0020 0000 – 002F FFFF	0010 0000 – 001F FFFF	0000 0000 – 000F FFFF	1Mbyte	0xCF
2Mbyte	2*27C801	0000 0000 – 001F FFFF	-	-	2Mbyte	0xE9
4Mbyte	4*27C801	0020 0000 – 003F FFFF	0000 0000 – 001F FFFF	-	2Mbyte	0xD9
6Mbyte	6*27C801	0040 0000 – 005F FFFF	0020 0000 – 003F FFFF	0000 0000 – 001F FFFF	2Mbyte	0xC9
		Autoselect Control byte Read from Here				

***Note*:** In the above table, the EPROMs occupying the highest address are always in the U1/U2 position on the Expansion Card which are also where the Configuration Byte is read from. Thus, the Configuration Byte may always be inserted to the top address of the code space.