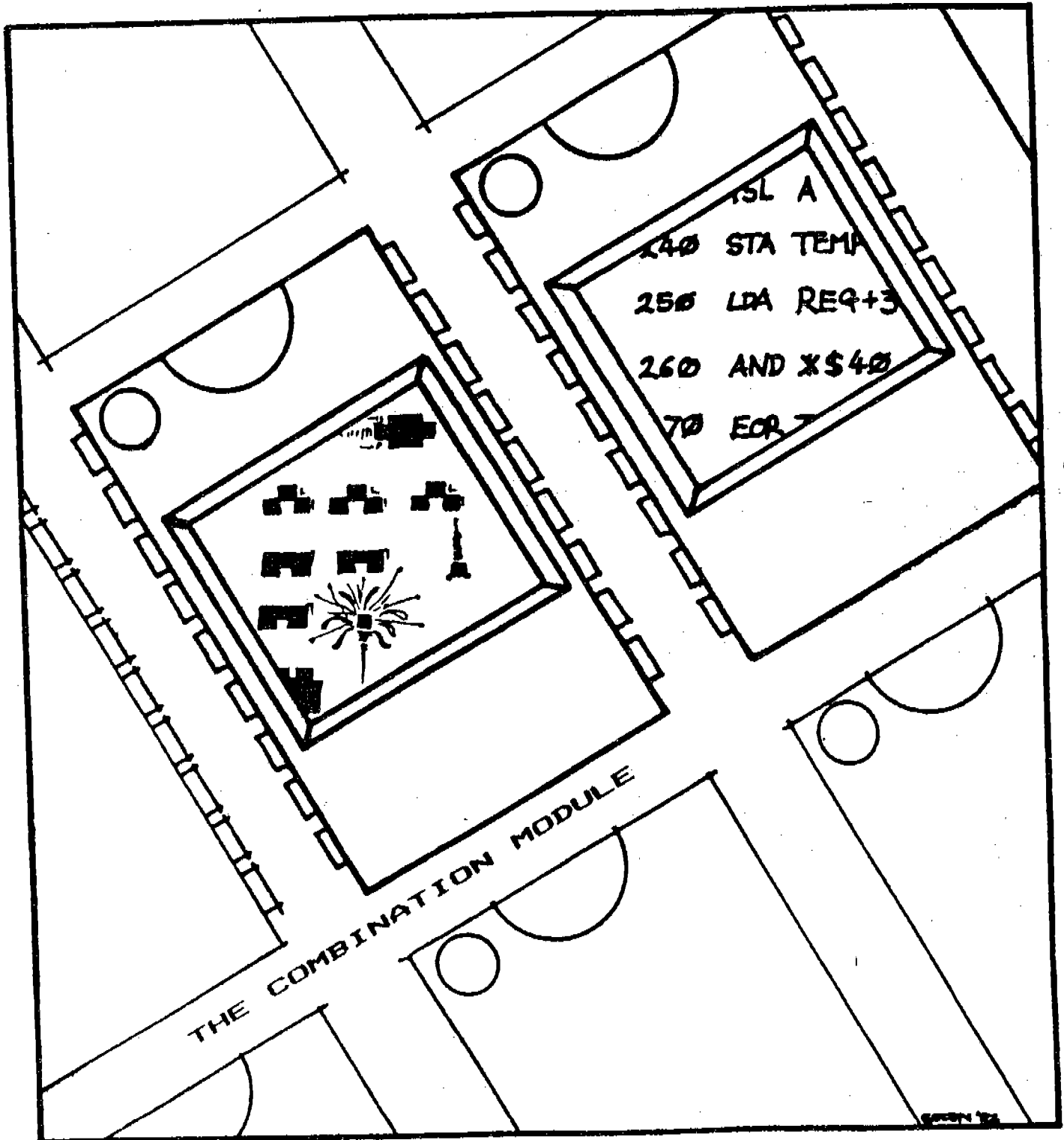


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THE COMBINATION MODULE

An Introduction

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Driver Software

Module Memory Map

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INTRODUCTION

The Combo module has been designed to facilitate the users need to bulk store information or data on a temporary basis. Whether used to store Eproms or Ram, the Combo offers the user the best of choices to achieve maximum flexibility of requirements. The need for more storage space which can be accessed at short notice is of vital importance in some applications.

Very fast data transfer speeds are possible using this concept of data storage facility with typically accurate results every time.

OPERATION

With the appropriate software installed within a 'Toolkit' etc, the Combo module could not be easier to work with. Any portion of any Eprom or Ram can be called into the working ram area at a moments notice whether one byte or many.

The User will determine the location of the operating software and will therefore be aware of its general facilities.

The Combo module does not require any abnormal power requirements and can therefore be installed anywhere within the system rack at any slot on the system mother board.. The module has been designed to allow the user to select between four addresses with the I/O space available on the Microtan 65 system. It should be noted that future expansion plans of the system within this area should be considered thoroughly before commitment by the user.

Detailed study of the Operating Software should be carried out if the User requires any modifications to the Combo module to meet specific requirements.

INSTALLATION

The Combo module uses eight consecutive bytes of the User I/O locations on the Microtan System. The user is able to select these addresses as follows:-

- (1) \$BD00 - \$BD07
Connect a wire link between 'F' to 'H'
 'L' to 'K'
- (2) BD08 - \$BD0F
Connect a wire link between 'F' to 'H'
 'I' to 'K'
- (3) BD80 - BD87
Connect a wire link between 'G' to 'H'
 'L' to 'K'
- (4) BD88 - BD8F
Connect a wire link between 'G' to 'H'
 'I' to 'K'

EPROM OR RAM SELECTION

With the I/O address selection complete, the choice of either 2716 - 2732 Eproms or 6116 Rams variety may now be completed. Depending on the choice, the Combo module memory map will contain board decoded according to the chart.

Notes:- 6116 Ram will decode indentically to that of the 2716 Eprom.

Eprom 2716	Range:-	\$0000 - \$7FFF	32K Bytes
Ram 6116	"	\$0000 - \$7FFF	32K "
Eprom 2732	"	\$0000 - \$FFFF	64K "

This new address bus is invisible to the system memory map and should therefore be treated as an individual by the user.

Type selection as follows:-

2716 Eprom	2732 Eprom	6116 RAM
Link A - 1	Link B - 1	Link A - 1
B - 2	C - 2	B - 2
C - 3	D - 3	C - 3
D - 4	E - 4	D - 4
5 - 5 v	A - 5	

With the board configured to requirements, the module will now accept those chosen at any address within the memory map of the module:-
No's 01 - 16.

The software driving routines are found overleaf. There are two routines to be considered. That for normal eprom configurations, and the extra routine for the handling of the 6116 rams. This routine allows for the 'Writing' of data to the module. The software itself is self explanatory and in general performance the user may wish to modify it to suit their own requirements.

The Ram handling routines require four parameters to be met, these are as follows:-

Ram Start:- Start address of data on Combo Module./System Ram

Ram End:- Equal to the end address of stored data, on Combo Module
System Ram

RAM START:- The address at which the data is to be stored at in
system memory. / Combo Module

'L' = Yes! Load into system memory.

'D' = Dump from system memory to Combo module memory.

GENERAL CONSTRUCTION

A high quality 'Plated Thru' board has been provided for the constructor. The i.c. locations are easily found by the appropriate markings. It is expected that with the small number of components required, the constructor will have no difficulty in assembling this module. All i.c.'s should be socketed for easy removal or repair.

The socket position marked 'Plug' has been included only for the future expansion of the module details of which can be found at the end of this chapter.

Those components required for modules 6116 Ram configuration are marked '*' and need only be installed when this configuration is to be employed. Note: A small D.I.L. switch is needed to 'Write Protect' the stored data. This is not required of course if only Eproms are employed.

COMPONENTS

I.C.1.	6821 (PIA)	40 pin	
I.C.2.	6821 (PIA)	40 pin	
I.C.3.	74154 LS	24 pin	Replaced by 74159 for 6116 config
I.C.4.	74365 LS	16 pin	
I.C.5.	CD4078	14 pin CMOS	
I.C.6.	7400 LS	14 pin	

16 x 24 pin sockets (Eproms/6116)

Resistors:-

R1-3	270 Ohm $\frac{1}{4}$ watt	
R4	2K2 Ohm $\frac{1}{4}$ watt	6116 option
R5	20 100K Ohm $\frac{1}{4}$ watt	6116 option
R21	2K2 Ohm $\frac{1}{4}$ watt	6116 option
R22	1K Ohm $\frac{1}{4}$ watt	6116 option

D1 - D2	Diode 1N914	6116 option; Replace D1 with link
Battery (Nicad)	3.6 volt	for Eprom version
	RS type 591 477	6116 option (Optional)

Capacitors 1 - 14

0.047 uF Disc ceramic low voltage (12v)

1 x 64 way A+B Edge connector

1 x DIL Switch 6116 option

NOTE:- The battery need not be installed if the Combo module is to remain on system supply, however, all data may be lost on power down. It is advisable therefore to install the battery to secure stored data from being lost. Please note also, that these batteries come in an unknown energy state and therefore may require charging before use.

URGENT

EPROMS must be the 5 VOLT SINGLE RAIL TYPE ONLY

either 2716's or 2732's

EPROM DRIVER SOFTWARE

```

1EF00
EF00 2073FE R $1 ; Routine to set up six zero page locations
EF03 A000 LDY #0 ; from screen questions
EF05 B9CBEF LDA $EFCB,Y ; Output questions and display
EF08 C900 CMP #0000
EF0A F007 BEQ $EF13
EF0C 2075FE JSR $FE75
EF0F C8 INY
EF10 4C05EF JMP $EF05
EF13 2073FE JSR $FE73
EF15 20ABEF JSR $EFAB ; Get data from keyboard
EF19 A513 LDA $0013
EF1B B540 STA $0040
EF1D A514 LDA $0014
EF1F B541 STA $0041

EF21 A000 LDY #0000 ; Output 2nd question and display
EF23 B9D7EF LDA $EFD7,Y
EF26 C900 CMP #0000
EF28 F007 BEQ $EF31
EF2A 2075FE JSR $FE75
EF2D C8 INY
EF2E 4C23EF JMP $EF23
EF31 2073FE JSR $FE73
EF34 20ABEF JSR $EFAB ; Get data from keyboard
EF37 A513 LDA $0013
EF39 B542 STA $0042
EF3B A514 LDA $0014
EF3D B543 STA $0043
EF3F A000 LDY #0000
EF41 B9E1EF LDA $EFE1,Y ; Output 3rd question and display
EF44 C900 CMP #0000
EF46 F007 BEQ $EF4F
EF48 2075FE JSR $FE75
EF4B C8 INY
EF4C 4C41EF JMP $EF41
EF4F 2073FE JSR $FE73
EF52 20ABEF JSR $EFAB ; Get data from keyboard
EF55 A513 LDA $0013
EF57 B544 STA $0044
EF59 A514 LDA $0014
EF5B B545 STA $0045
EF5D A900 LDA #0000 ; Initialise I/O devices
EF5F A2FF LDX #00FF
EF61 A004 LDY #0004
EF63 BD01BD STA $BD01
EF65 BD03BD STA $BD03
EF67 BD07BD STA $BD07
EF6C BE00BD STX $BD00
EF6F BE02BD STX $BD02
EF72 BD06BD STA $BD06
EF75 BC01BD STY $BD01
EF78 BC03BD STY $BD03
EF7B BC07BD STY $BD07
EF7E A540 LDA $0040 ; Start of main data transfer routine
EF80 BD00BD STA $BD00
EF83 A541 LDA $0041
EF85 BD02BD STA $BD02
EF88 AD06BD LDA $BD06
EF8B A000 LDY #0000

```

```

EF8D 9144 STA ($0044),Y
EF8F A543 LDA $0043
EF91 C541 CMP $0041
EF93 D006 BNE $EF98
EF95 A542 LDA $0042
EF97 C540 CMP $0040
EF99 F00E BEQ $EFA9
EF9B E640 INC $0040
EF9D D002 BNE $EFA1
EF9F E641 INC $0041
EFA1 E644 INC $0044
EFA3 D0D9 BNE $EF7E
EFA5 E645 INC $0045
EFA7 D0D5 BNE $EF7E
EFA9 60 RTS
EFAA EA NOP
EFAB A924 LDA #$0024
EFAD 2075FE JSR $FE75
EFB0 20FAFD JSR $FDFA
EFB3 A501 LDA $0001
EFB5 C90D CMP #$000D
EFB7 F006 BEQ $EFBF
EFB9 2075FE JSR $FE75
EFBC 4CB0EF JMP $EFB0
EFBF A000 LDY #$0000
EFC1 2028FF JSR $FF28
EFC4 2073FE JSR $FE73
EFC7 2073FE JSR $FE73
EFCA 60 RTS
EFCB 4550 EOR $0050
EFCF 4D2053 EOR $5320
EFD2 54 ?
EFD3 4152 EOR ($0052,X)
EFD5 54 ?
EFD6 00 BRK
EFD7 4550 EOR $0050
EFD9 52 ?
EFDA 4F ?
EFDB 4D2045 EOR $4520
EFDE 4E4400 LSR $0044
EFE1 52 ?
EFE2 4140 EOR ($0040,X)
EFE4 205354 JSR $5453
EFE7 4152 EOR ($0052,X)
EFE9 54 ?
EFEA 00 BRK
EFEB 6F ?
EFEC FF ?
EFED FF ?
EFEE FF ?
EFEF FF ?
EFF0 205DEF JSR $EF5D
EFF3 60 RTS
EFF4 205DEF JSR $EF5D
EFF7 00 BRK
EFF8 2000EF JSR $EF00
EFFB 60 RTS
EFFC 2000EF JSR $EF00
EFFF 00

```

```

; End

```

```

; Keyboard Read routine

```

```

; After ? there is a CR then '$' is output to
; the screen. User enters four digit number
; transfered by JSR FF28 into location
; $13 - $14.

```

```

; Screen data 'Eprom Start'

```

```

; 'Eprom End'

```

```

; 'Ram Start'

```

```

; Start option 'Question on Screen
; with an RTS
; Same
; With BRK
; Routine without questions
; with RTS
; Same
; with BRK

```

```

18400
3400 202384 JSR 18423
3403 A93F LDA #003F
3405 2075FE JSR 18423
3408 20FAFD JSR 18423
340B A501 LDA #0001
340D C744 CMP #0044
340F D002 BNE 18413
3411 F006 BEQ 18419
3413 C74C CMP #004C
3415 D0EC BNE 18403
3417 F06C BEQ 18485
3419 205184 JSR 18451
341C 207E84 JSR 1847E
341F 206384 JSR 18463

3422 00 BRK
3423 A000 LDY #0000
3425 A2FF LDX #00FF
3427 A904 LDA #0004
3429 8C818D STY 18081
342C 8C838D STY 18083
342F 8C858D STY 18085
3432 8C878D STY 18087
3435 8E808D STX 18080
3438 8E828D STX 18082
343B 8E848D STX 18084
343E 8E868D STX 18086
3441 8D818D STA 18081
3444 8D838D STA 18083
3447 8D858D STA 18085
344A 8D878D STA 18087
344D 8E848D STX 18084
3450 60 RTS
3451 A544 LDA #0044
3453 8D808D STA 18080
3456 A545 LDA #0045
3458 8D828D STA 18082
345B B140 LDA (#0040),Y
345D 8D868D STA 18086
3460 207E84 JSR 1847E
3463 A543 LDA #0043
3465 C541 CMP #0041
3467 D006 BNE 1846F
3469 A542 LDA #0042
346B C540 CMP #0040
346D F00E BEQ 1847D
346F E640 INC #0040
3471 D002 BNE 18475
3473 E641 INC #0041
3475 E644 INC #0044
3477 D008 BNE 18451
3479 E645 INC #0045
347B D004 BNE 18451
347D 60 RTS
347E 8C848D STY 18084
3481 8E848D STX 18084
3484 60 RTS
3485 A4FE LDY #00FE
3487 8D848D STA 18084

```

COMBO MODULE 6116 SOFTWARE ROUTINE

Main Routine start at 184E0

Output '?' to screen and
reply with either 'D' = DUMP
or 'L' = LOAD

If 'L' goto 18485
If 'D' goto transfer routine

END
Initialise I/O devices

Start of main dump routine

Start of main load routine

```

848A A900 LDA #$0000
848C A2FF LDX #$00FF
848E A004 LDY #$0004
8490 8D81BD STA $BD81
8493 8D83BD STA $BD83
8496 8D87BD STA $BD87
8499 8E80BD STX $BD80
849C 8E82BD STX $BD82
849F 8D86BD STA $BD86
84A2 8C81BD STY $BD81
84A5 8C83BD STY $BD83
84A8 8C87BD STY $BD87
84AB A540 LDA $0040
84AD 8D80BD STA $BD80
84B0 A541 LDA $0041
84B2 8D82BD STA $BD82
84B5 AD86BD LDA $BD86
84B8 A000 LDY #$0000
84BA 9144 STA ($0044),Y
84BC A543 LDA $0043
84BE C541 CMP $0041
84C0 D006 BNE $B4C8
84C2 A542 LDA $0042
84C4 C540 CMP $0040
84C6 F00E BEQ $B4D6
84C8 E640 INC $0040
84CA D002 BNE $B4CE
84CC E641 INC $0041
84CE E644 INC $0044
84D0 D0D9 BNE $B4AB
84D2 E645 INC $0045
84D4 D0D5 BNE $B4AB
84D6 8E84BD STX $BD84
84D9 00 BRK
84DA 00 BRK
84DB 00 BRK
84DC 00 BRK
84DD 00 BRK
84DE 00 BRK
84DF 00 BRK
84E0 2073FE JSR $FE73
84E3 A000 LDY #$0000
84E5 B944B5 LDA $B544,Y
84E8 C900 CMP #$0000
84EA F007 BEQ $B4F3
84EC 2075FE JSR $FE75
84EF C8 INY
84F0 4CE584 JMP $B4E5
84F3 2073FE JSR $FE73
84F6 2050B5 JSR $B550
84F9 A513 LDA $0013
84FB B540 STA $0040
84FD A514 LDA $0014
84FF B541 STA $0041
8501 A000 LDY #$0000
8503 B94AB5 LDA $B54A,Y
8506 C900 CMP #$0000
8508 F007 BEQ $B511
850A 2075FE JSR $FE75
850D C8 INY

```

MAIN PROGRAM STARTS HERE \$84E0

Get first question and output to screen 'Start'

Output CR to screen
Gosub Answer from keyboard

Get second question 'End'

850E 4C0385 JMP \$8503	
8511 2073FE JSR \$FE73	
8514 205085 JSR \$8550	Gosub Answer
8517 A513 LDA \$0013	
8519 8542 STA \$0042	
851B A514 LDA \$0014	
851D 8543 STA \$0043	
851F A000 LDY #\$0000	
8521 894085 LDA \$8540,Y	Get third question 'Ram Start'
8524 C900 CMP #\$0000	
8526 F007 BEQ \$852F	
8528 2073FE JSR \$FE75	
852B C8 INY	
852C 4C2185 JMP \$8521	
852F 2073FE JSR \$FE73	
8532 205085 JSR \$8550	Gosub Answer
8535 A513 LDA \$0013	
8537 8544 STA \$0044	
8539 A514 LDA \$0014	
853B 8545 STA \$0045	
853D 4C0084 JMP \$8400	Off to main transfer routine
8540 52 ?	'Ram'
8541 616D ADC (\$006D,X)	
8543 205374 JSR \$7453	'Start'
8546 6172 ADC (\$0072,X)	
8548 74 ?	
8549 00 BRK	
854A 456E EOR \$006E	'End'
854C 64 ?	
854D 00 BRK	
854E FF ?	
854F FF ?	
8550 A924 LDA #\$0024	
8552 2073FE JSR \$FE75	Output a '\$' to the screen
8555 20FAFD JSR \$FDFA	Get 4 digit number from user
8558 A501 LDA \$0001	and store \$13 & \$14 by JSR \$FF28
855A C90D CMP #\$000D	
855C F006 BEQ \$8564	
855E 2073FE JSR \$FE75	
8561 4C5585 JMP \$8555	
8564 A000 LDY #\$0000	
8566 2028FF JSR \$FF28	
8569 2073FE JSR \$FE73	CR
856C 2073FE JSR \$FE73	CR
856F 60 RTS	

This program is easily relocatable anywhere in ram perhaps as part of an existing 'lookit'. This is a long hand version however, there is no reason to include the Questions and Answers if they are undesirable, this will shorten the routine considerable.

THE MEMORY MAP



EPROM NUMBER Address range 2716/6116 Address Range 2732

01	\$0000 - \$07FF	\$0000 - \$0FFF
02	\$0800 - \$0FFF	\$1000 - \$1FFF
03	\$1000 - \$17FF	\$2000 - \$2FFF
04	\$1800 - \$1FFF	\$3000 - \$3FFF
05	\$2000 - \$27FF	\$4000 - \$4FFF
06	\$2800 - \$2FFF	\$5000 - \$5FFF
07	\$3000 - \$37FF	\$6000 - \$6FFF
08	\$3800 - \$3FFF	\$7000 - \$7FFF
09	\$4000 - \$47FF	\$8000 - \$8FFF
10	\$4800 - \$4FFF	\$9000 - \$9FFF
11	\$5000 - \$57FF	\$A000 - \$AFFF
12	\$5800 - \$5FFF	\$B000 - \$BFFF
13	\$6000 - \$67FF	\$C000 - \$CFFF
14	\$6800 - \$6FFF	\$D000 - \$DFFF
15	\$7000 - \$77FF	\$E000 - \$EFFF
16	\$7800 - \$7FFF	\$F000 - \$FFFF

BASIC +

PGM

T/HIT

XBUG,
F000

VIDEO T/HIT
BASE 0000

20055 CPN

20055 ASSEM.
C000

APPENDIX

COMBO BOARD

To make the board function as an E.S.C., a link must be added from pin 18 of IC3 to 0V. This will allow the board to function using the standard E.S.C. data transfer software.

ALTERNATIVE

If the DIL switch is added and enabled, then the wire link can be removed and the board will function using the Combo Module software, but NOT the E.S.C. software! The switch is thus acting as a read enable select on the card with Eprom's installed.

If you ever change your board to use the 6116 devices, then no wire link is required and the information in the manual should be followed.

