



# DATA SHEET

- Auto Display Recognition**
- Up To 256 Stored Messages**
- Low Power**
- Serial Interface**
- Parallel Interface**
- Single +5V Supply**

## DMX C3

This data sheet is to be used in conjunction with module data sheet. The DMX C3 completes the interface between a character or graphic display and the user's system. It operates in two basic modes. In the first, the DMX C3 acts as a simple ASCII display terminal (Character display) or displays the transmitted data as a bit-pattern (DMX 973). The DMX C3 automatically distinguishes between a character or graphic display. In the second mode, messages stored in a second (optional) ROM are displayed according to either the serial number transmitted or the binary number applied to the C3's parallel port. It is therefore possible to have up to 256 stored character displays or 29 complete graphic pictures (DMX 973). Fitting the ROM automatically selects MODE 2.

Power connection to the C3 is by screw-terminals and connection between the C3 and the module is via a 16 way ribbon cable link. The serial interface is by a 9 way "null modem" AT type serial link. A viewing angle control is fitted to the board which can be disconnected for external operation.

The controller can be mounted on a panel using M3 pillars. The standard version can also be fitted directly into a Bopla 800 series hand held case. The OKW type G case can accommodate the DMX C3-OKW version. Mounting holes on the P.C.B. enable accurate positioning of the display module in the cases' aperture.

SPECIFICATIONS		MIN.	TYP.	MAX.	UNIT
Supply Voltage (V+)		4	5	5.5	Vd.c
Supply Current*			20		mA
Supply Voltage (wide range option)		7		27	V
Vee Adjustment Range (R11)		0		0.8	V
Port 1	Input Low	-0.5		0.2(V+) -0.1	V
	Input High	0.7 (V+)		0.5 + V+	
Input Low Current**				-50	µA
Serial	Input Voltage Range	-30		+30	V
	Input Threshold Low	0.8	1.2		V
	Input Threshold High		1.7	2.4	V
	Input Hysteresis	0.2	0.5	1.0	V
	Input Resistance	3	5	7	kilohms
Output Voltage (5k load)			+9		V
Optional ROM Type		27C16		27C64	
Operating Temperature Range		0		50	°C

\* Includes module supply but not backlight supply.

\*\* Port 1 pins have an internal pull-up .



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## GETTING STARTED

**Setup** - If you are using a character display, you first need to set SW2 to the correct display type:-

SW2*	0	DMX 908 (Default)
	1	DMX 916
	2	DMX 161 (C, B)
	3	DMX 162 (B)
	4	DMX 202
	5	DMX 204
	6	DMX 402
	7 - F	Reserved

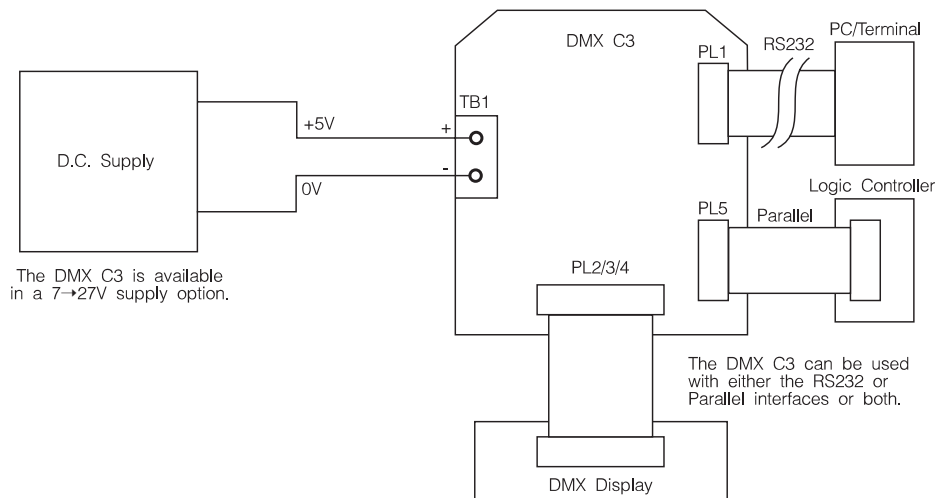
\*If a DMX 973 is fitted, SW2 will be ignored.

Then set SW3 to the correct BAUD rate:-

SW3	0	9600 (Default)
	1	150
	2	300
	3	600
	4	1200
	5	2400
	6	4800
	7	9600
	8	19200
	9 - E	Reserved
	F	Serial link not used

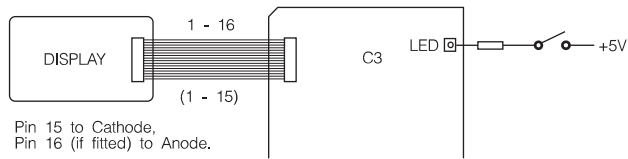
**Basic Connections** - Refer below for full connector details.

**Fig. 1**

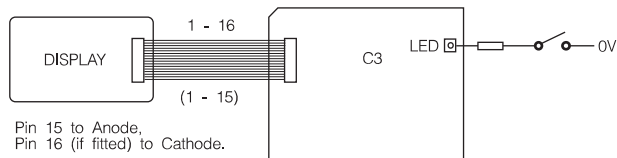


## Displays with integral backlight pins

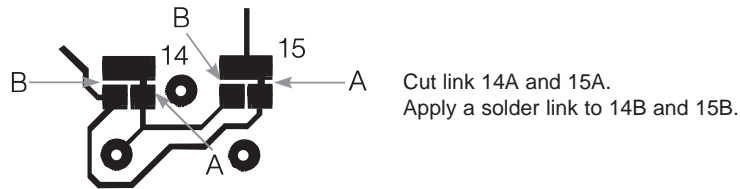
**Fig. 10** Normal polarity



**Fig. 11** Reversed polarity - use links 14 & 15 to reverse the lamp connections.



**Fig. 12** Reversing the lamp connections

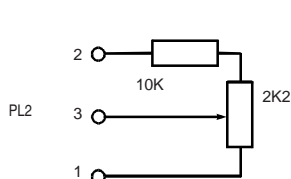


If you have any doubt about how to connect the backlighting - contact the Lascar Technical Helpline.

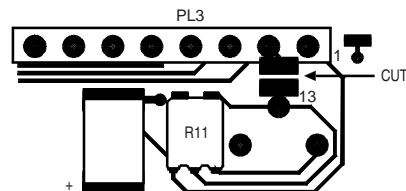
## EXTERNAL CONTRAST CONTROL

To control the contrast externally cut Link 13, taking care not to damage adjacent track, and arrange components as shown in Fig.A.6a.

**Fig. 13**



**Fig. 14**



## MODE

Decide in which mode you will be operating the DMX C3.

**Romless Mode - (Mode 1).** You create a message or display by entering character or pixel data via the serial or parallel interfaces. This is the default mode.

**ROM Mode - (Mode 2).** In this mode a single byte of serial or parallel data will recall a complete message from the EPROM fitted into the IC11 socket. ROM Mode is automatically selected by fitting an EPROM with messages.

If you intend to operate the DMX C3 in ROM Mode, check that the PCB links under IC11 have been set correctly and fit the message ROM in the IC11 socket.

**Auto ROM Mode - (Mode 3).** This is a variation of ROM Mode where the parallel port is continuously polled for data without the need to strobe it in with INT0. It is selected by connecting INT1 to 0V.

## APPLYING POWER

Refer to Fig 1 and connect the display to the DMX C3. If you are using the Backlighting, see below. If you are using the serial link, connect the RS232 lead and switch on the computer/terminal. If you are not using the serial link, set SW3 to "F". Apply a stable 5V D.C. to TB1 and switch on. Adjust R11 for optimum display contrast. At power-on the C3 checks that a display module is connected and whether it is a character or graphic type.

**Serial Link** - The DMX C3 works best with an ASCII terminal or a computer running terminal emulation software. Check that the Protocol is 8 bit, no parity, one stop bit and the BAUD rate matches that set by SW3.

At power-on and following a valid CTS input, the C3 transmits the following status message:-

```
DMX C3 VER *.*
MODE:- ***
DMX_ *** FITTED
*** BAUD SET
```

The message starts with an STX character (code 02) and ends with an ETX character (code 03). Some terminal programs may display these characters.

If no display is fitted the following is sent:-

```
DMX C3 VER *.*
MODE:- ***
!!NO DISPLAY!!
```

and the bell is sounded.

**Parallel Input** - Parallel input data is applied to PL5 and entered by pulsing INT0 or INT1 low as appropriate. In ROM Mode PL5 will be continuously monitored for data if INT1 is connected to 0V (AUTO ROM Mode). In AUTO ROM Mode the character DC2 (code 18 decimal) is transmitted to warn the terminal that the C3 is in this mode.

## ROMLESS OPERATION OF CHARACTER DISPLAYS

At power-on the module is cleared and the cursor is located at the beginning of line 1. When data is entered (either by serial or parallel input) it is checked to see if it is a control code and if not passed straight to the display. (See the module data sheet for character codes). Pressing RES after power-on will not clear the display but will return the cursor to the beginning of line 1 and transmit the status message.

### Control Codes (a)

DEC.	HEX.	BINARY	KEY(S) PRESSED (a)	ACTION
8	08	00001000	Backspace	Cursor moves 1 space to left & changes line if applicable.
10	0A	00001010	Line Feed	Cursor moves to beginning of next/previous line.
13	0D	00001101	Carriage Return	Cursor moves to beginning of next/previous line.
17	11	00010001	ALT + 17 or ^Q	Toggles cursor ON/OFF.
32	20	00100000	Space	Makes a space at the cursor position.
(b) 46	2E	00101110	ALT + C	Clears display.
(b) 72	48	01001000	Up Arrow	Moves cursor up one line.
(b) 75	4B	01001011	Left Arrow	Cursor moves 1 space to left & changes line if applicable.
(b) 77	4D	01001101	Right Arrow	Cursor moves 1 space to right & changes line if applicable.
(b) 80	50	01010000	Down Arrow	Moves cursor down one line.
255	FF	11111111	ALT + 255	Cursor moves 1 space to right & changes line if applicable.

Notes: (a). Non control codes lower than 32 (Dec) are ignored.  
 (b). These are IBM™ Extended Character codes and are preceded by a byte of 00H.

## ROMLESS OPERATION DMX 973

At power-on the module is cleared and the data entry point set to page 0, seg 0, line 0. Pressing RES will not clear the display but will set the data entry point to page 0, seg 0, line 0.

Data entered, either serially or from the parallel input, will be reproduced bit by bit on the screen. At the end of each page (70 bytes) the beginning of the next page is automatically selected. Thus a complete screen can be written to by entering a stream of 280\* bytes at the end of which the data entry point will return to 0,0,0.

### \*DMX 973 Serial Mode

It is anticipated that binary files will be used to transfer serial data to the 973. However, the end of each file may contain a Carriage Return (0DH), a Line Feed (0AH) or other characters. They will be counted by the C3 but not passed to the display. The following should be noted:-

1. A Serial Display consists of 282 bytes, after which the data entry point is reset.
2. The Data entry point will be reset if CTS is interrupted so when transmitting, turn CTS on (TRUE) transmit the data and then turn CTS off (FALSE). If CTS cannot be controlled connect it to DTR (Pin 4,PL1).

## BACKLIGHTING

While a standard exists for the main data interface to the DMX modules, there is none for the backlighting connections. Pins 15 and 16 (if they exist) are used but their polarity may change. When the DMX C3 has been configured correctly for the relevant display, the LED pin (next to Pin 16 of PL2) is used to switch the backlighting. Lascar 900 series DMX displays interface directly and the LED pin only needs to be connected to V+ to turn on the light.

If you are fitting another display with LED backlighting to the DMX C3, study the data sheet of the display to establish the following.

- Do Pins 15 and 16 exist and form part of the main plug? If not, power the light separately using "flying" leads.
- Does a series current limiting resistor need to be fitted?
- What is the polarity of Pins 15 and 16?
- Is either Pin 15 or 16 connected to the power supply pin and if so which?
- If only Pin 15 exists, is it connected to the anode (A) or cathode (K) of the backlight?

### Display with separate backlight pins

Fig. 8

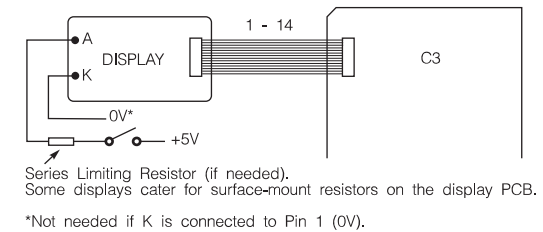
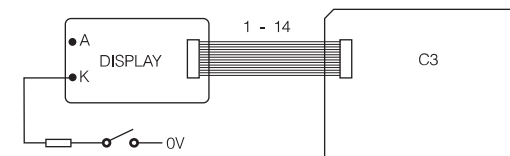


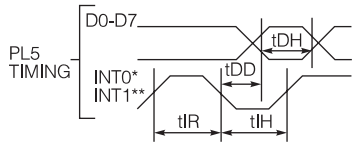
Fig. 9 If A is connected to +5V (Pin 2) on the display:



## Parallel Input

With PL5 configured as a parallel port for data input, data is applied to PL5 and entered by pulsing INT0 or INT1 low as appropriate.

**Fig. 5**



\*INT0 timings apply to strobe input mode only.  
\*\*INT1 timings apply to DMX 973 mode only.

PARAMETER	SIGNAL	SYMBOL	MIN.	MAX.	UNIT
Interrupt Reset Time	INT0, 1	tIR	2	-	µs
Data Delay Time	D0-D7	tDD	-	3	µs
Data Hold Time	D0-D7	tDH	15	-	µs
Interrupt Hold Time	INT0, 1	tIH	3	-	µs

## PL6

### System Expansion

- A1 Address bus signal.
- A2
- A3
- A4
- A5
- A6
- A7
- LE Signal decoded by addresses 8000 - 9FFF and a dummy read, to set up external address latches. Active high.
- MAX RD Read signal for addresses C000 - DFFF. Active low.
- MAX WR Write signal for addresses C000 - DFFF. Active low.
- Y3 Chip enable signal for addresses 6000 - 7FFF. Active low - connected to output control of IC1.
- Y2 Chip enable signal for addresses 4000 - 5FFF. Active low.
- Y1 Chip enable signal for addresses 2000 - 3FFF. Active low.
- Y0 Chip enable signal for addresses 0000 - 1FFF. Active low.

## PL7

### Parallel Interface 2

- Parallel data bit 7
- Parallel data bit 6
- Parallel data bit 5
- Parallel data bit 4
- Parallel data bit 3
- Parallel data bit 2
- Parallel data bit 1
- Parallel data bit 0
- LATCH Connected via Link 17 to +5V. To latch Port 2 input, cut Link 17 and connect to 0V.
- RES Connect to +5V to reset the C3.

## TB1

### Power supply connection.

- +. Positive (V+) power input.
- . Negative (0V) power input.

**LED+** LED back-light supply. Connect to V+ to turn on display module backlight.

Note: PL5 and PL7 can be run together on a 20-way connector.  
PL4 and PL5 can be run together on a 30-way connector.  
PL4, PL5 and PL7 can be run together on a 40-way connector.

## ROM LOCATIONS DMX 202

MESSAGE NUMBER	INPUT BYTE (HEX.)	ROM LOCATIONS (HEX.)		2716	2732	2764
		LINE 1	LINE 2	2k	4k	8k
0	00	00 - 13	14 - 27	●	●	●
14	0E	230 - 243	244 - 257	●	●	●
64	40	A00 - A13	A14 - A27		●	●
127	7F	1360 -1373	1374 - 1387			●

General Formula:-  
(Decimal)  
Line 1 Starting Address = Message N<sup>o</sup> x 28<sub>H</sub>.  
Line 2 Starting Address = (Message N<sup>o</sup> x 28<sub>H</sub>) + 14<sub>H</sub>.

## ROM LOCATIONS DMX 204

MESSAGE NUMBER	INPUT BYTE (HEX.)	ROM LOCATIONS (HEX.)				2716	2732	2764
		LINE 1	LINE 2	LINE 3	LINE 4	2k	4k	8k
0	00	00 - 13	14 - 27	28 - 3B	3C - 4F	●	●	●
14	0E	460 - 473	474 - 487	488 - 49B	49C - 4AF	●	●	●
64	40	1400 - 1413	1414 - 1427	1428 - 143B	143C - 144F			●

General Formula:- (Decimal)

Line 1 Starting Address = Message N<sup>o</sup> x 50<sub>H</sub>.  
Line 2 Starting Address = (Message N<sup>o</sup> x 50<sub>H</sub>) + 14<sub>H</sub>.  
Line 3 Starting Address = (Message N<sup>o</sup> x 50<sub>H</sub>) + 28<sub>H</sub>.  
Line 4 Starting Address = (Message N<sup>o</sup> x 50<sub>H</sub>) + 3C<sub>H</sub>.

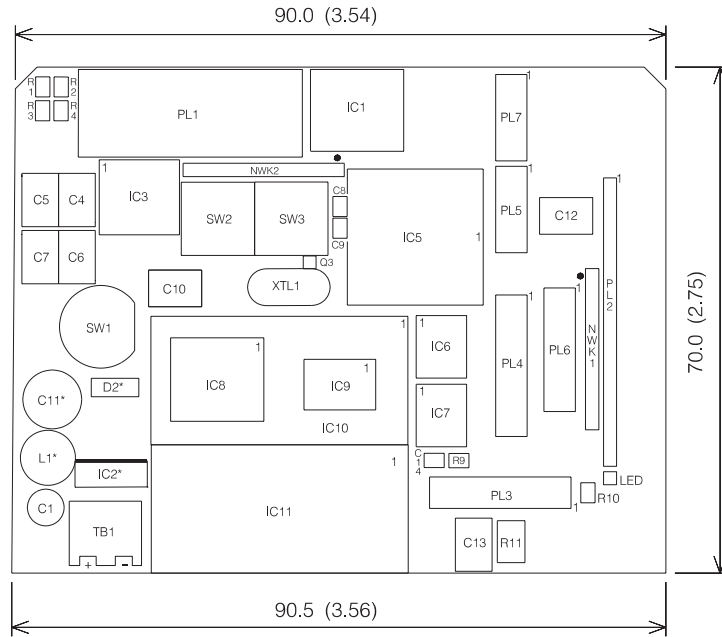
## ROM LOCATIONS DMX 402

MESSAGE NUMBER	INPUT BYTE (HEX.)	ROM LOCATIONS (HEX.)		2716	2732	2764
		LINE 1	LINE 2	2k	4k	8k
0	00	00 - 27	28 - 4F	●	●	●
14	0E	460 - 487	488 - 49B	●	●	●
64	40	1400 - 1427	1428 - 144F			●

General Formula:-  
(Decimal)  
Line 1 Starting Address = Message N<sup>o</sup> x 50<sub>H</sub>.  
Line 2 Starting Address = (Message N<sup>o</sup> x 50<sub>H</sub>) + 28<sub>H</sub>.

The DMX C3 can be factory configured for larger memories - call Lascar for details.

## PHYSICAL DIMENSIONS



## C3 - MODULE PINNING

The original dot-matrix character displays have a 14 pin interface in either a 14 x 1 or 7 x 2 format. PL2 caters for the former and PL3 and PL4 cater for the latter. All Lascar 900 series dot-matrix displays follow the original 7 x 2 format for compatibility and ease of replacement. However the "de facto" standard 7 x 2 pinning on the character displays is the mirror image of the popular standard M50 IDC connection system, so to make it possible to use M50 connectors, PL3 and PL4 are similarly "mirrored". The diagram below shows how to interface using M50 cable. For consistency PL's 5, 6 and 7 are also mirrored, thus genuine M50 orientation is available for all connectors from the underside of the P.C.B. For special connector requirements please call the sales office.

## CONNECTORS

### MODULE - C3

Max. cable length 50cm.

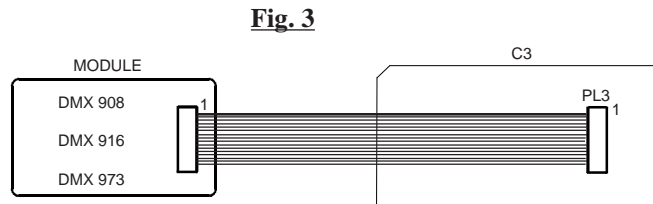
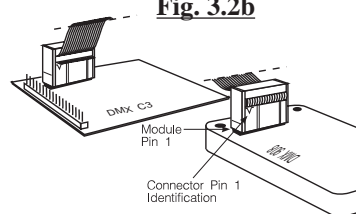


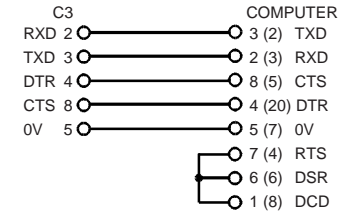
Fig. 3.2b



## C3-PC/XT/AT

Max. cable length 15m.

Figures in brackets refer to 25 way PC/XT connector



## PIN FUNCTION

### PL1

- 1,6,7 & 9. No connection.
2. RXD. Serial data input.
3. TXD. Serial data output.
4. DTR. Data Terminal Ready output.
5. 0V. Ground connection.
8. CTS. Clear To Send input.

### RS232 Interface.

### PL2, 3, 4\*

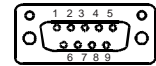
1. 0V. Ground power supply to DMX.
2. V+. Positive power supply to DMX.
3. Vee. LCD contrast supply.
4. A0. Register select input to DMX.
5. R/W. Read/Write signal for DMX.
6. E. DMX Enable signal.
7. D0.
8. D1.
9. D2.
10. D3.
11. D4.
12. D5.
13. D6.
14. D7.
15. LED-. Ground supply for backlight LED's.
16. LED+. Positive supply for backlight LED's.

### Interface from controller to DMX display.

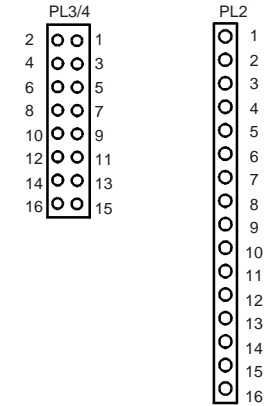
Data Bus

Fig. 4

### PIN VIEW PL1



### TOP VIEW



\*Note: PL4 is not fitted with pins to enable direct mounting of the display to the P.C.B.

### PL5

### Parallel Interface. C3 Standard Function

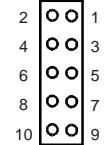
1. INT1. ROMless Mode:  
DMX 973 instruction input strobe.  
ROM Mode:  
o/c or V+ - INT0 is message input strobe  
0V - INT0 is ignored and message input is continuous on PL5 (AUTO ROM mode).
2. INT0. Data input strobe unless deselected by INT1 (see above).
3. Parallel Data.Bit 7.
4. Parallel Data.Bit 6.
5. Parallel Data.Bit 5.
6. Parallel Data.Bit 4.
7. Parallel Data.Bit 3.
8. Parallel Data.Bit 2.
9. Parallel Data.Bit 1.
10. Parallel Data.Bit 0.

µC PINS  
(See Manufacturer's Data Sheet)  
INT 1

INT 0

P1.7  
P1.6  
P1.5  
P1.4  
P1.3  
P1.2  
P1.1/T2EX  
P1.0/T2

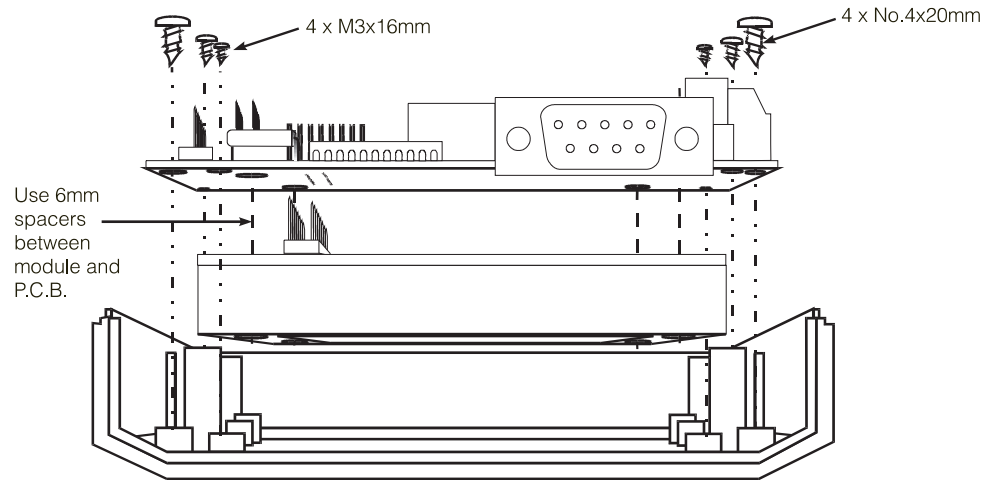
### TOP VIEW PL5



## FITTING TO BOPLA SERIES 800 HANDHELD CASE

The following diagram gives an installation guide. You are strongly advised to check operation with the display module on a separate link before soldering the module to the board.

**Fig. 7**



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## DMX 973 Parallel Mode

INT0 Strobe: Data applied to PL5 D0-D7 and strobed in by INT0 will be displayed.

INT1 Strobe: Data strobed in by INT1 will have the following effect:- (See section 4).

	COMMAND	CODE								FUNCTION
		D7	D6	D5	D4	D3	D2	D1	D0	
1	Display ON/OFF	1	0	1	0	1	1	1	0/1	Turns all display on or off, independently of display RAM data or internal status. 1: ON 0: OFF (Power-saving mode with static drive on)
2	Display start line	1	1	0	Display Start Address (0-31)					Specifies RAM line corresponding to the upper most line (COM0) of display.
3	Set Page Address	1	0	1	1	1	0	Page (0-3)		Sets display RAM page in page address register.
4	Set Column (Segment) Address	0	Column Address (0-79)							Sets display RAM column address in column address register.
8	Select ADC	1	0	1	0	0	0	0	0/1	Used to invert relationship of assignment between display RAM column addresses and segment driver outputs. 0: CW output (forward) 1: CCW output (reverse)
9	Static Drive ON/OFF	1	0	1	0	0	1	0	0/1	Selects normal display or static driving operation. 1: Static drive (Power-saving mode) 0: Normal driving
11	END	1	1	1	0	1	1	1	0	Clears read modify write mode.
12	Reset	1	1	1	0	0	0	1	0	Sets display start line register on the first line. Also sets column, page and data entry point to 0.
13	Restore	1	1	1	1	1	1	1	1	As Reset but data entry point is returned to original position.

Note :- Using commands 3,4 and 8 will disable the data entry point monitor and the user must check for correct display alignment. RESTORE will restore the monitor.

## ROM MODE (ALL DISPLAYS)

At power-on the C3 will scan all the locations in the area of IC11 and if any data other than 00H (no ROM fitted) and FFH (blank ROM) is found, the C3 will assume ROM MODE. In this mode an entire page of data is recalled by a single byte of either serial or parallel data.

The data in the ROM will be either text (character display) or a bit-pattern (DMX 973). Consult the relevant module data sheet for further information and the code table.

## ROM LOCATIONS DMX 908

MESSAGE NUMBER	INPUT BYTE (HEX.)	ROM LOCATIONS (HEX.)		2716	2732	2764
		LINE 1	LINE 2	2k	4k	8k
0	00	00 - 07	08 - 0F	●	●	●
14	0E	E0 - E7	E8 - EF	●	●	●
64	40	400 - 407	408 - 40F	●	●	●
127	7F	7F0 - 7F7	7F8 - 7FF	●	●	●
211	D3	D30 - D37	D38 - D3F		●	●
255	FF	FF0 - FF7	FF8 - FFF		●	●

General Formula:-  
Line 1 Starting Address  
= Message N° x 10<sub>H</sub>.

Line 2 Starting Address  
= Message N° x 10<sub>H</sub> + 8.

