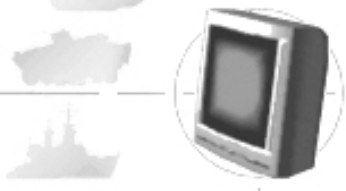
Black Opal Model RMU8HX-P Flat Panel Display System

TABLE OF CONTENTS



1 DESCRIPTION

The Model RMU8HX-P is an 8.4" [with XGA (1,024 x 768) resolution] multi-function version of the Laserdyne Black Opal display, customised for use with observation/surveillance systems on armoured vehicles arising from specific European programmes. This model is a multi-function display, in that it features remote controls which the integrator may use for control of external devices via the comms port. Button markings may be customised during manufacture to suit specific programmes.

Black Opal displays have been engineered for a wide range of land-, sea- or air-borne display applications including remote/indirect viewing of video images generated by day, night or thermal cameras.

This model is fitted with a high brightness LED backlight module. LED backlighting improves reliability when compared with standard CCFL (lamp) backlights – not only by substituting solid-state components for fragile lamps, but also by the graceful nature of LED backlight degradation as the unit ages – a missing lamp may make an LCD unreadable, but a few fading LEDs make little difference.

Each Black Opal model consists of an LCD, a low reflection high clarity window, a microprocessor unit, and power & control electronics. All items are housed within a rugged enclosure containing heating and cooling mechanisms. The LCD is protected by a tough, antireflection-coated window which also provides EMI/EMC shielding. All models are button operated.

This model features *MultiVision* which allows for 2 video inputs, and provides simultaneous display.

Images are displayed on a LED backlit LCD that may be viewed in full direct sunlight down to full darkness and feature backlight settings suitable for low light viewing, for viewing with Night Vision Devices and completely off for black-out conditions.

Black Opal displays have several features designed to increase the effectiveness of surveillance, sighting and security systems, including:

Image Enhancement: video inputs are compensated for obscuration (e.g. rain, fog, snow, mist or smoke) within an adjustable central window where contrast and colour are enhanced. For a chosen window size, the enhancement is applied to that portion of the displayed image;

Digital Zoom: a fully X & Y interpolated "smart" zoom, not merely pixel multiplying, yields a clear zoomed image without the blocky "pixelated" appearance often seen with digital zooming; and

Freeze Frame: freezes the current prime video channel while leaving live any video inset.

Colourisation: applies preloaded colour palettes to monochrome imagery.

Motion ("edge tearing") compensation: minimises the jagged edges that can occur with motion in video on LCDs.

These displays also provide overlay (chroma keying) capability.

Black Opal display software is easily upgradeable, upgrades can be downloaded in the field via a PC.

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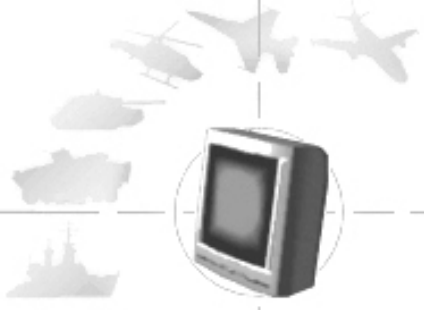
This model incorporates a single board computer (SBC) using a 'Gumstix Overo COM' (**C**omputer-**O**n-**M**odule). The range of processors available in this family is based on TI DSP, and support a wide range of peripherals and options.

The standard features of the COM are:

- **Processor:** AM3703, DM3730, OMAP3503 or OMAP3530 Applications Processor with ARM® Cortex™-A8 Core
- **Speed:** up to 1GHz
- **Memory:** 512MB or 256MB low-power DDR RAM, 512MB NAND Flash, (Overo® Tide COM and Overo SAND COM have no NAND Flash)
- **On-board:** microSD slot
- **PreFlashed:** Linux 2.6.34 (Overo®) and 2.6.31 or higher (verdex pro™)
- **Environment:** OpenEmbedded (**Developer website:** www.gumstix.net)

The specific features of the IronSTORM COM are as follows:

- **Architecture**: ARM Cortex-A8 Temperature Built with components rated -40C < T < 85C except:
  - microSD card slot: -25C < T < 85C
- **Processor**: Texas Instruments DM3730 Digital Video Processor (Processor Speed Built to operate at 1 GHz - Gumstix currently recommends 800MHz for reliable performance)
- **Digital signal processor (DSP)** High Performance Image, Video, Audio (IVA2.2™) Accelerator Subsystem OpenGL POWER SGX™ Graphics Accelerator
- **RAM** 512 MB
- **NAND** 512 MB
- Performance Up to 2,000 Dhrystone MIPS.



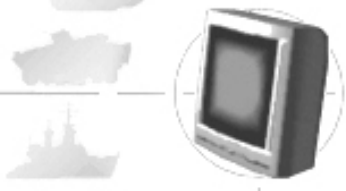
2 SYSTEM SPECIFICATIONS

Notation - use of brackets in tables: [*notes & qualifications*] (*units*) {*alternate units*}.

2.1 System Performance

PARAMETER		SPECIFICATION
Designation		
RMU8HX-P		Remote Monitor Unit, 8", High brightness, XGA resolution – Programme specific
Control		
Control Functions [factory configurable to customer requirements]		on/off; day/night select; backlight intensity; menu select; select screen lay-out; select image enhancement feature; digital zoom; freeze frame
Controls		21 tactile LED-backlit (green or red selectable) buttons
Display		
Type		Amorphous Silicon Active Matrix Colour (24-bit colour) LCD Module
Display Size (″ {cm})	**diagonal**	8.4 {21.34}
	active area	6.71 {17.05} x 5.04 {12.79}
Aspect Ratio [width:height]		4:3
Pixel Number [1 pixel is RGB trio]		1,024 x 768
Colour		16 Million [8-bit each colour]
Grey Scale		256 [8-bit]
Backlight Luminance [CCFT type;	**minimum**	0
approx.; adjustable] (cdm^{-2}) [1]	**maximum**	1,100
Contrast Ratio [limiting; LCD]		400:1
Response Time [max.] (ms)		25
Readability [ambient conditions]		black-out to full direct sunlight [10^5 lux]
Night Vision Device compatible?		yes [low intensity green; red selectable]

[1] 1 cdm^{-2} = 1 nit.



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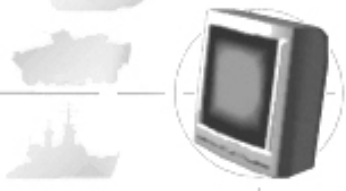
PARAMETER		SPECIFICATION
Viewing Angle	**vertical**	170
[full angle] (°)	**horizontal**	170
Inputs		
Inputs		2 analogue video
Signal Formats		PAL [all forms], NTSC [all forms], SECAM [all forms]
Connection Formats		Composite (CVBS)
Outputs		
Video		Composite
Safety & Protection		
Cooling		thermal transfer by internal and external convection
Display Window		Antireflection, hard-coated, sealed, EMI/EMC shielded; index-matched to LCD glass
Electrical Protection		conforms to: QSTAG 307; MIL-STD-704E; MIL-STD-1275D; STANAG 3350 (all analogue video inputs) RTCA/DO-160D, Category Z, power input 18 to 30.3Vdc [min. max. & emergency operation, interrupts, abnormal surge (48Vdc for 1s), engine starting undervoltage]; RTCA/DO-160D, Category A, voltage spike [600Vdc for 10μs]
Cooling		thermal transfer by internal and external convection; cooling fin fitted to rear
Audible Emission [@ ≥ 10m]		nil
Backfill		purged & backfilled [N_2]
Support		
MTBF (hours)		> 8,000
Operational Life (years)		10



2.2 Controls

2.2.1 Local

Control Type	Location		Primary Label	Primary Function
Button	upper front face	left	⏻	toggle between active and standby
Button		right	☼|☾	toggle between Day and Night backlight modes
Button	left front face	top (L1)		menu
Button		2nd top (L2)		show assigned screen lay-outs for selection
Button		3rd top (L3)	O	enhance
Button		middle (L4)		zoom
Button		3rd bottom (L5)		freeze
Button		2nd bottom (S1)	∆	backlight up; scroll/adjust up
Button		bottom (S2)	∇	backlight down; scroll/adjust down

2.2.1 Remote

Control Type	Location		Primary Label	Primary Function
Button	right front face	top (R1)	O	assignable/ programmable buttons
Button		2nd top (R2)		
Button		3rd top (R3)		
Button		middle (R4)		
Button		3rd bottom (R5)		
Button		2nd bottom (S4)	∆	scroll/adjust up
Button		bottom (S3)	∇	scroll/adjust down
Button	lower front face	left (B1)	O	assignable/ programmable buttons
Button		2nd left (B2)		
Button		middle (B3)		
Button		2nd right (B4)		
Button		right (B5)		

2.3 Communications

PARAMETER	SPECIFICATION
Ports	three Serial ports (maximum)
Data Format	2 x RS-232, 1 x RS-422

2.4 Physical Characteristics

PARAMETER		SPECIFICATION
Mass [approx.] (kg)		< 2.6
Dimensions	**Width**	237
(mm)	**Height**	203.2
	Depth [2]	83
Specific Gravity		> 1 [non-floatation]
Mounting		8 x M4 tapped holes, 8mm deep, 4 each top and bottom

2.5 Electrical Requirements

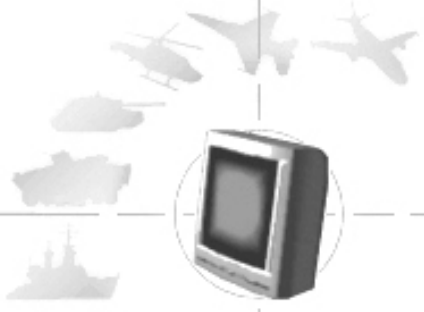
PARAMETER		SPECIFICATION
Supply Voltage (Vdc)		18 to 33 [28 nominal]
Current Drain	**heater on**	< 6
[@ 28Vdc; typical] (A)	**heater off**	< 2

[2] Excluding control knobs

2.6 Environmental

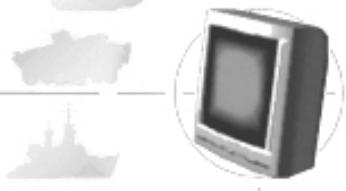
PARAMETER				SPECIFICATION
Temperature (°C)	**Operate** [3]	**min.** [4]		-40
[MIL-STD-810F,		**max.** [5]	**long term**	+55
Method 501.4;			**short term**	+71
Method 502.4,	**Survive**		**min.** [4]	-40
Procedures I, II]			**max.** [5]	+71
Thermal Shock [MIL-STD-810F, Method 503.4, Procedure II] (°C in ≤ 1 minute)				-30 to +50
Vibration [MIL-STD-810F, Method 514.5, Procedure I, Category 20 ground vehicle wheeled and tracked]				spectra as per figure 514.5C-4; 10Hz to 2kHz; 4 hours per axis
Shock [MIL-STD-810F, Method 516.5, Procedure I]				40g, 11ms each direction for each axis, half-sine
Sealing [MIL-STD-810F, Method 512.4, Procedure I] [6]				full immersion
Altitude/Low Pressure [transport; MIL-STD-810F, Method 500.4, Procedure I]				15,000 feet
EMI/EMC [6, 7]				MIL-STD-461D

[3] When used in accordance with procedures in User's Manual.
[4] Without wind-chill.
[5] Without solar radiation.
[6] With compliant line connectors attached.
[7] Refer to manufacturer for details.

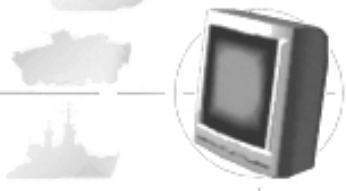


2.7 Connector/Pin Details

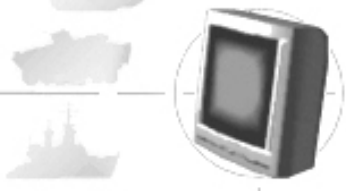
No.	Name	Pin Marking	Purpose	Notes for Harness
J1: Video In/Out & Comms Connection: Connector, MilSpec, 38999/24FE99PN, Panel, Plug, 'click' screw-on, 23 Way [mating line connector: 38999/26FE99SN]				
J1-A	TX+	A	RS422 TX+	comm. channel TX+
J1-B	RX+	B	RS422 RX+	comm. channel RX+
J1-C	TX-	C	RS422 TX-	comm. channel TX-
J1-D	RX-	D	RS422 RX-	comm. channel RX-
J1-E	GND RS422	E	RS422 common	comm. channel COMMON (tied to GND)
J1-F	unused	F		
J1-G	unused	G		
J1-H	unused	H		
J1-J	unused	J		
J1-K	CVBS OUT	K	Video output (to recorder)	75 ohm terminated
J1-L	CVBS OUT GND	L	Video output GND	shield for CVBS OUT signal
J1-M	CH2 IN	M	Video Input #2	75 ohm terminated
J1-N	CH2 IN GND	N	Video input #2 GND	shield for CH2 IN
J1-P	CH1 IN	P	Video Input #1	75 ohm terminated
J1-R	CH1 IN GND	R	Video input #1 GND	shield for CH1 IN
J1-S	unused	S		
J1-T	unused	T		
J1-U	unused	U		
J1-V	unused	V		
J1-W	unused	W		
J1-X	unused	X		
J1-Y	unused	Y		
J1-Z	unused	Z		



No.	Name	Pin Marking	Purpose	Notes for Harness
J2: Maintenance Connection: Connector, MilSpec, 38999/24FE99PA, Panel, Plug, 'click' screw-on, 23 Way [mating line connector: 38999/26FE99SA]				
J2-A	Ethernet RX+	A	Ethernet Receive+	Ethernet compatible cabling
J2-B	Ethernet RX-	B	Ethernet Receive-	Ethernet compatible cabling
J2-C	Ethernet TX+	C	Ethernet Transmit+	Ethernet compatible cabling
J2-D	Ethernet TX-	D	Ethernet Transmit-	Ethernet compatible cabling
J2-E	GND	E	Ethernet protective GND	Tied to protective shield (if used)
J2-F	USBH_VCC	F	USB HOST +5V	USB Host – pin 1
J2-G	USBH_N	G	USB HOST D-	USB Host – pin 2
J2-H	USBH_P	H	USB HOST D+	USB Host – pin 3
J2-J	USBH_GND	J	USB HOST GND	USB Host – pin 4
J2-K	USBOTG_VCC	K	USB On-the-go +5V	USB On-the-go – pin 1
J2-L	USBOTG_N	L	USB On-the-go D-	USB On-the-go – pin 2
J2-M	USBOTG_P	M	USB On-the-go D+	USB On-the-go – pin 3
J2-N	USBOTG_GND	N	USB On-the-go GND	USB On-the-go – pin 4 / 5 (connector dependent)
J2-P	RS232_TX1	P	spare RS232 TX	future expansion
J2-R	RS232_RX1	R	spare RS232 RX	future expansion
J2-S	RS232_GND1	S	spare RS232 GND	future expansion
J2-T	RS232_TX2	T	SBC Debug RS232 TX	debug connection for SBC
J2-U	RS232_RX2	U	SBC Debug RS232 RX	debug connection for SBC
J2-V	RS232_GND2	V	SBC Debug RS232 GND	debug connection for SBC
J2-W	unused	W		
J2-X	USBOTG_ID	X	USB On-the-go ID	Control pin for 'On-the-go' port – n/c or pin 4
J2-Y	unused	Y		
J2-Z	unused	Z		



No.	Name	Pin Marking	Purpose	Notes for Harness
J3: Power Connection: Connector, MilSpec, 38999/24FD05PN, Panel, Plug, 'click' screw-on, 5 Way [mating line connector: 38999/26FD05SN]				
J3-A	+28V	A	Power input, 28V	Connect to 5A capable +28V
J3-B	0V	B	Power input, return	Connect to 5A capable 0V
J3-C	Earth	C	Chassis	Frame connection – also connected internally to Video GND.
J3-D	unused	D		
J3-E	unused	E		
J4: Earth Point Connection: M5 threaded stud				



3 SET-UP

3.1 Mounts

The unit has one mounting method, being:

8 x M4 tapped holes, 8mm deep, 4 each top and bottom.

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Figure 3-1: Mounts

3.2 Connections

The unit has four connection points located on the rear underside:

Connector J1, the Video In/Out & Comms connection;

Connector J2, the Ethernet/USB connection;

Connector J3, the Power connection; and

Connector J4, the Earth Point connection.

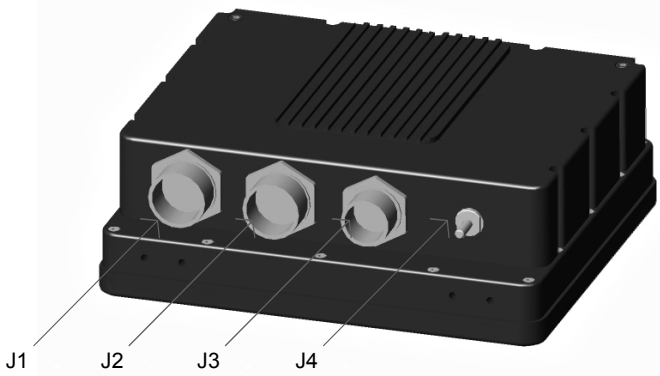


Figure 3-2: Connections

3.3 Set-up Procedure

CAUTION: **User-supplied cables must be correctly wired (see list of Connector/Pin Details).**

Ensure that external power is within the range specified herein.

Ensure that external power is OFF before proceeding with set-up.

- Mount the unit to the vehicle or platform, using the mounting method provided.
- Connect the earth point on the unit to an appropriate point on the vehicle.
- Connect the required cables for video in/out and communications to the unit, and to the external imaging system(s) and communication data source.
- Connect the required Ethernet/USB cable to the unit and to the external system (when required for maintenance).
- Connect the required power cable to the unit and to the external power source.

3.4 Heating and Cooling

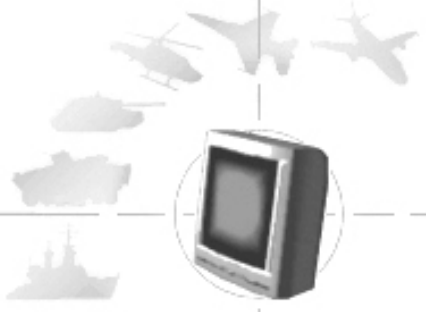
The unit contains internal heating and cooling mechanisms that are triggered at certain internal temperatures.

The approximate warm-up rate is 17s/°C (e.g. with starting internal temperature of -40°C, unit will power up in about 11 minutes; with starting internal temperature of -25°C, unit will power up in about 7 minutes).

Once the unit has warmed it will operate normally provided that the ambient temperature stays within the specified operating temperature range.

The operating procedures, internal temperatures and resulting operating conditions are shown in the following table.

Ambient Temp. (°C)	Procedure	Internal Temp. (°C)	Operating Condition
< -40	do not attempt to operate unit		
-40 to 0	de-ice unit prior to start-up	≤ 0	unit will not power up; heater on
		> 0	unit will power up; internal convection on
0 to +55	none	≥ 10	heater off
		≥ 55	backlight reduces
+55 to +70	provide forced air cooling (e.g. fan)		
> +70	do not attempt to operate unit	≥ 75	unit will not power up



3 OUTLINE DRAWINGS

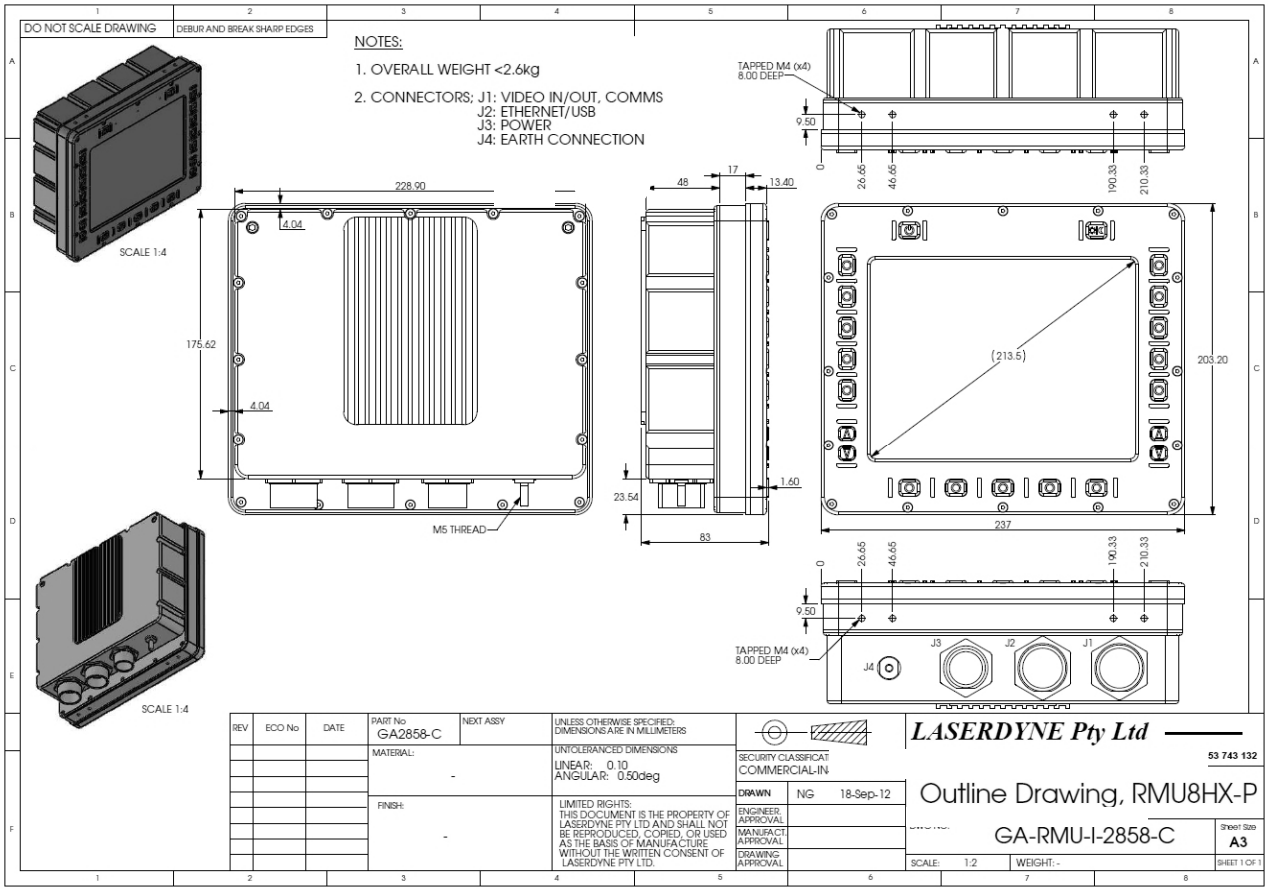


Figure 4-1: Outline Drawing

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