Black Opal Model RMU12HX Flat Panel Display System

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1 DESCRIPTION

The Model RMU12HX is the 12.1" [with XGA (1,024 x 768) resolution] version of the Laserdyne Black Opal display, 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.

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.

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.

Each model features *MultiVision*, allowing for 4 video and 1 PC inputs, and providing simultaneous display of two video inputs and one PC input at full frame rates.

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.

2 SYSTEM SPECIFICATIONS

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

2.1 System Performance

PARAMETER		SPECIFICATION
Designation		
RMU12HX		Remote Monitor Unit, 12", High brightness, XGA
Control		
Control Functions [factory configurable to customer requirements]		power On/Off; backlight intensity; menu select; select screen lay-out; select image enhancement feature; digital zoom; freeze frame
Controls		tactile 8-button membrane
Display		
Type		Active Matrix Colour (18-bit colour) LED backlit LCD Module
Display Size (" {cm})	**diagonal**	12.1 {30.73}
	active area	9.68 {24.58} x 7.26 {18.43}
Aspect Ratio [width:height]		4:3
Pixel Number [1 pixel is RGB trio]		1,024 x 768
Colour		262k [6-bit each colour]
Grey Scale		256 [8-bit]
Backlight Luminance [CCFT type;	**minimum**	0
approx.; adjustable] (cdm^{-2}) [1]	**maximum**	1,000 min.; 1,500 typical
Contrast Ratio [limiting; LCD]		500:1 min.; 700:1 typical
Response Time [maximum] (ms)		T_r =15; T_f = 25
Readability [ambient conditions]		black-out to full direct sunlight [10^5 lux]
Night Vision Device compatible?		yes [low intensity green; red selectable]
Viewing Angle	**vertical**	±80
[full angle] (°)	**horizontal**	±80
Inputs		
Inputs		4 video and 1 PC
Signal Formats	**video**	PAL [all forms], NTSC [all forms], SECAM [all forms], CCIR-601, RS170; interlaced and non-interlaced

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

PARAMETER		SPECIFICATION
Inputs (cont'd)		
Signal Formats (cont'd)	**PC**	non-interlaced, 60Hz, RGB, separate Hsync. & Vsync., up to 1,024 x 768 [standard PC XGA]
Connection Formats	**video**	Composite, S-Video [Y-C]
	PC	RGB + Hsync. + Vsync.
Outputs		
Video		prime video input is output [what comes in goes out]
Safety & Protection		
Cooling		thermal transfer by internal and external convection; cooling fin fitted to rear
Backfill		purged & backfilled [N_2]
Display Window		Antireflection, hard-coated, sealed, EMI/EMC shielded
Altitude/Decompression		pressure relief valve, 2-way
Electrical Protection		conforms to QSTAG 307 & MIL-STD-704A
Audible Emission [@ ≥ 10m]		nil
Support		
MTBF [@30°C; 100%	**Ground Mobile [wheeled]**	> 14,700
duty cycle] (hours)	**Airborne Rotary Wing**	> 6,500
Operational Life (years)		10

2.2 Controls

Control Type	Location		Primary Label	Primary Function
Button	membrane on left of	top	⏻	toggle between active and standby
Button	front face	2nd top	**1**	menu
Button		3rd top	**2**	show assigned screen lay-outs for selection
Button		middle	**3**	enhance
Button		3rd bottom	**4**	zoom
Button		2nd bottom	**5**	freeze
Button		bottom left	**-**	backlight down; scroll/adjust down
Button		bottom right	**+**	backlight up; scroll/adjust up

2.3 Communications

PARAMETER		SPECIFICATION
Ports		one Serial port [2]
Data	**Format**	RS-232 [RS-422 optional]
	Rate (Baud)	9,600 [1,200 to 230.6k optional; or to 10 Mbaud for RS-422]

2.4 Physical Characteristics

PARAMETER			SPECIFICATION
Mass [approx.] (kg)			7.2
Dimensions (mm)	**Width**	**body**	324
		overall [3]	350
	Height	**body**	243
		overall [3]	261
	Depth [4]		114
Specific Gravity			> 1 [non-floatation]
Mounting [5]			Dzus fasteners x 8 [type PFSC35] or 2-way adjustable mounting bracket optional

2.5 Electrical Requirements

PARAMETER		SPECIFICATION
Supply Voltage (Vdc)		20 to 33 [28 nominal]
Current Drain	**heater on**	< 4.5
[@ 28Vdc; typical] (A)	**heater off**	< 1.5

[2] Shared with power input.
[3] Including mounting flange.
[4] Excluding connectors.
[5] Optional 2-way adjustable mounting bracket has four ¼" clearance holes for mounting.

2.6 Environmental

PARAMETER			SPECIFICATION
Temperature (°C)	**Operate** [6]	**min.**	-25 [without wind-chill]
		max.	+55 [without solar radiation]
	Survive	**min.**	-46 [without wind-chill]
		max.	+71 [without solar radiation]
Vibration and Shock [7]			MIL-STD-810F, aircraft
Sealing [8]			water resistant [drip & spray]
EMI/EMC [7, 8]			MIL-STD-461E

2.7 Connector/Pin Details

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
A: VGA Input: Connector, MilSpec, Mil-C26482, Panel, Plug, Bayonet, 19 Way, 14 Shell, Pattern 105, square flange, AB05 2100 14-19P N00					
A1	**RED OUT**	A	VGA RED OUTPUT	coax (A,P), 75Ω	only for video out
A2	**RED IN**	B	RED INPUT	coax (B,P), 75Ω	DB15 pin 1. Also Pr input for component video
A3	**GREEN OUT**	C	VGA GREEN OUTPUT	coax (C,R), 75Ω	only for video out
A4	**GREEN IN**	D	GREEN INPUT	coax (D,R), 75Ω	DB15 pin 2. Also Y (and SOG) input for component video
A5	**BLUE OUT**	E	VGA BLUE OUTPUT	coax (E,S), 75Ω	only for video out
A6	**BLUE IN**	F	BLUE INPUT	coax (F,S), 75Ω	DB15 pin 3. Also Pb input for component video
A7	**HS OUT**	G	VGA HSYNC OUTPUT	signal wire	only for video out
A8	**HS IN**	H	HSYNC INPUT	signal wire	DB15 pin 13
A9	**VS OUT**	J	VGA VSYNC OUTPUT	signal wire	only for video out
A10	**VS IN**	K	VSYNC INPUT	signal wire	DB15 pin 14
A11	**DDC_5V**	L	DDC CHANNEL +5V	unused	DB15 pin 9

[6] When used in accordance with procedures in User's Manual.
[7] Refer to manufacturer for details.
[8] With compliant line connectors attached.

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
A: VGA Input (cont'd)					
A12	**DDC_SDA**	M	DDC CHANNEL DATA	unused	DB15 pin 12
A13	**DDC_SCL**	N	DDC CHANNEL CLOCK	unused	DB15 pin 15
A14	**RED GND**	P	RED coax GND	coax braid	DB15 pin 6
A15	**GREEN GND**	R	GREEN coax GND	coax braid	DB15 pin 7
A16	**BLUE GND**	S	BLUE coax GND	coax braid	DB15 pin 8
A17	**DIGITAL GND**	T	HSYNC GND	signal wire	DB15 pin 5
A18	**DIGITAL GND**	U	VSYNC GND	signal wire	DB15 pin 10
A19	**N/C**	V	UNUSED	unused	DB15 pin 4,11
B: Video Input: Connector, MilSpec, Mil-C26482, Panel, Socket, Bayonet, 19 Way, 14 Shell, Pattern 105, square flange, AB05 2100 14-19S N00					
B1	**Y1_GND**	A	Primary video (composite or luma) GND	coax, 75Ω shield	
B2	**Y1_SIGNAL**	B	Primary video (composite or luma) input	coax, 75Ω center	75Ω terminated in display
B3	**Y2_GND**	C	Secondary video (composite or Y) GND	coax, 75Ω shield	
B4	**Y2_SIGNAL**	D	Secondary video (composite or Y) input	coax, 75Ω center	75Ω terminated in display
B5	**RS485+**	E	RS485+ connection	signal	
B6	**RS485-**	F	RS485- connection	signal	
B7	**V-**	G	dc- (GND) connection	5A dc	internally isolated from comms and video GND.
B8	**V+**	H	Output power (+28V)	5A dc	Same as input dc
B9	**V+**	J	Output power (+28V)	5A dc	Same as input dc
B10	**VIDEO_OUT**	K	Switched video output	coax, 75Ω center	either Y1 or Y2 output, 75Ω double terminated
B11	**GND_OUT**	L	Video output GND	coax, 75Ω shield	
B12	**SPARE1**	M	Analogue input	signal	SPARE1
B13	**SPARE2**	N	Analogue input	signal	SPARE2
B14	**C1_SIGNAL**	P	Primary chroma input [or VCR composite input]	coax, 75Ω center	75Ω terminated in display

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
B: Video Input (cont'd)					
B15	**C2_SIGNAL**	R	Secondary chroma input	coax, 75Ω center	75Ω terminated in display
B16	**C_GND**	S	Chroma common [or VCR composite input]	coax, 75Ω shield	
B17	**V-**	T	dc- (GND) connection	5A dc	internally isolated from comms and video GND.
B18	**RS-232_TX**	U	RS-232 transmit (output from display)	signal	
B19	**RS-232_RX**	V	RS-232 receive (input to display)	signal	
C: dc Power Input & Comms Port Connection: Connector, MilSpec, Mil-C26482, Panel, Plug, Bayonet, 12 Way, 14 Shell, Pattern 105, square flange, AB05 2100 14-12P N00					
C1	**COMMS_GND**	A	common for comms	signal	
C2	**N/C**	B	unused		
C3	**RS-232_RX**	C	RS-232 receive (input to display)	signal	
C4	**RS-232_TX**	D	RS-232 transmit (output from display)	signal	
C5	**nRESET**	E	active low display reset control	reserved	
C6	**MODAB**	F	active low display bootload control	reserved	
C7	**RS485-**	G	RS485- connection	reserved	
C8	**RS485+**	H	RS485+ connection	reserved	
C9	**V-**	J	dc- (GND) connection	5A dc	internally isolated from comms and video GND.
C10	**V-**	K	dc- (GND) connection	5A dc	internally isolated from comms and video GND.
C11	**V+**	L	Input power (+28V) for display	5A dc	+20..+33V input
C12	**V+**	M	Input power (+28V) for display	5A dc	+20..+33V input

3 SET-UP

3.1 Mounts

The RMU has two optional mounting methods:

eight type PFSC35 Dzus fasteners, located on the left and right (four per side) of the mounting flange; or

a 2-way adjustable mounting bracket fitted to the RMU.

In the case of the 2-way adjustable mounting bracket, four mounting points are provided, being ¼" diameter clearance holes located in the top section of the bracket.

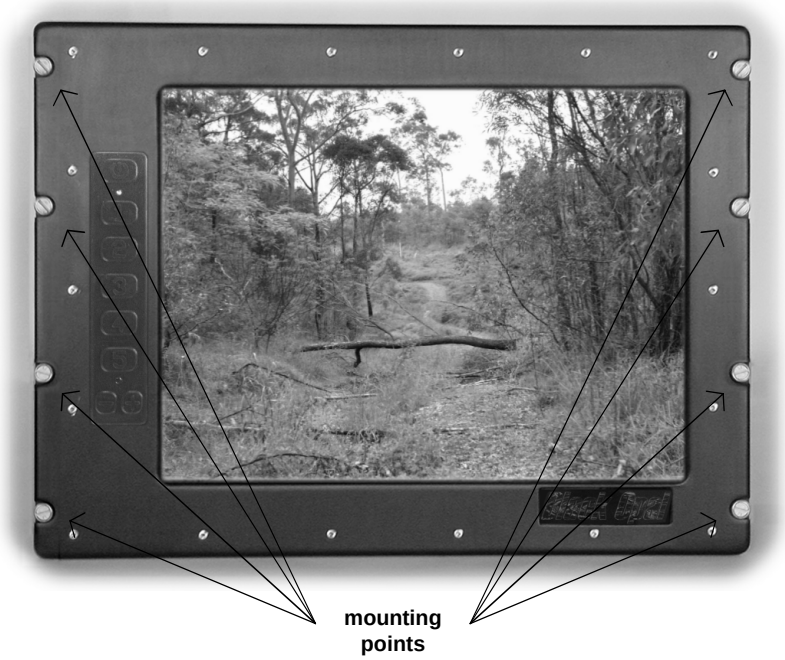

Figure 3-1: Mounts

3.2 Connections

The RMU has three connection points located on the rear of the unit:

Connector A, the VGA Input connector;

Connector B, the Video Input connector; and

Connector C, the dc Power Input & Comms Port connector.

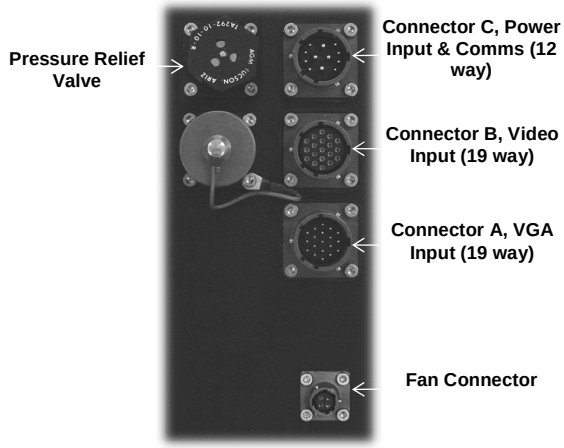

Figure 3-2: Connections

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 eight Dzus fasteners provided.
- Connect the required video cable to Connector B and to the external imaging system(s).
- Connect the required VGA cable to Connector A and to the external VGA source.
- Connect the required power/data cable to Connector C and to the external power source, and to the communication data source (RS-232).
- Connect the fan cable connector to the mating panel connector.

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. Otherwise the heater will remain on.

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
		≥ 30	in-built ducted fan on
		≥ 55	backlight reduces
+55 to +60	provide forced air cooling (e.g. fan)		
> +60	do not attempt to operate unit	≥ 75	unit will not power up

4 OUTLINE DRAWINGS

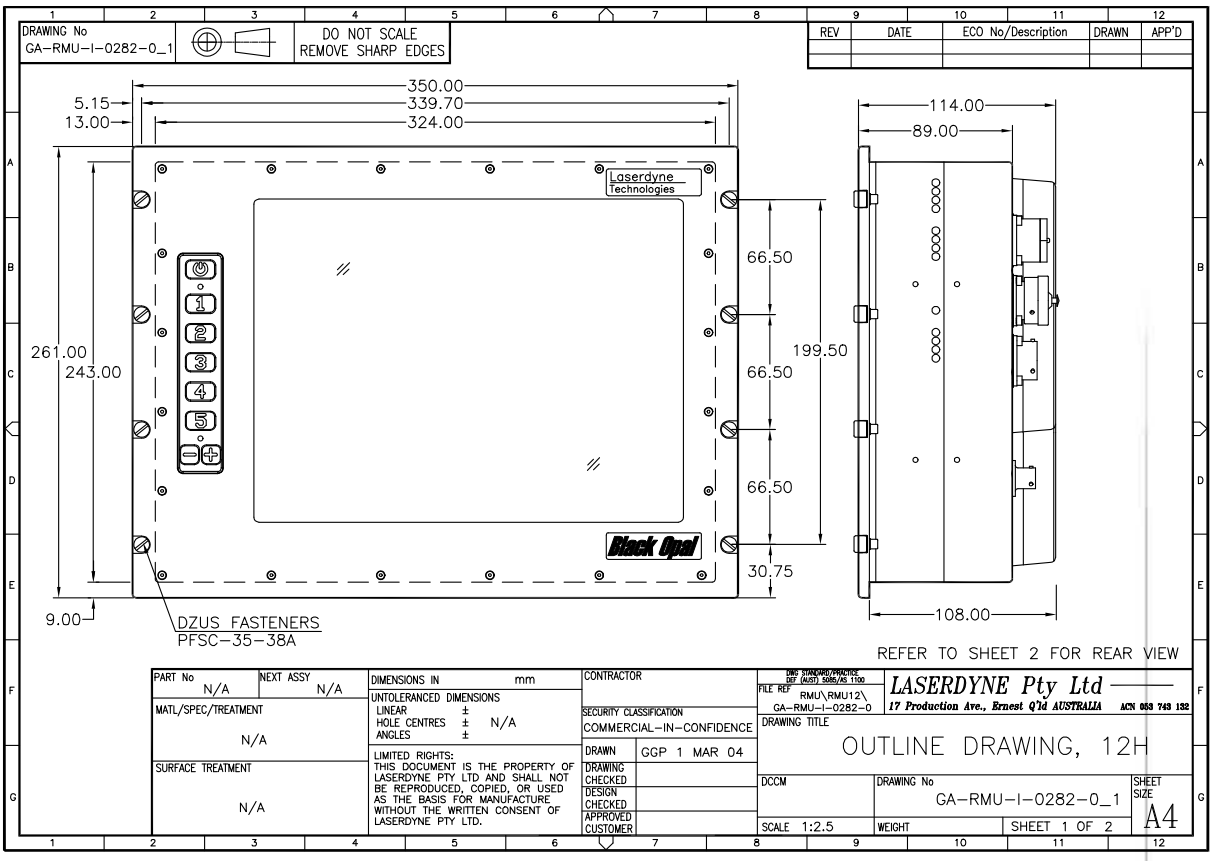

Figure 4-1: Outline Drawing Front View

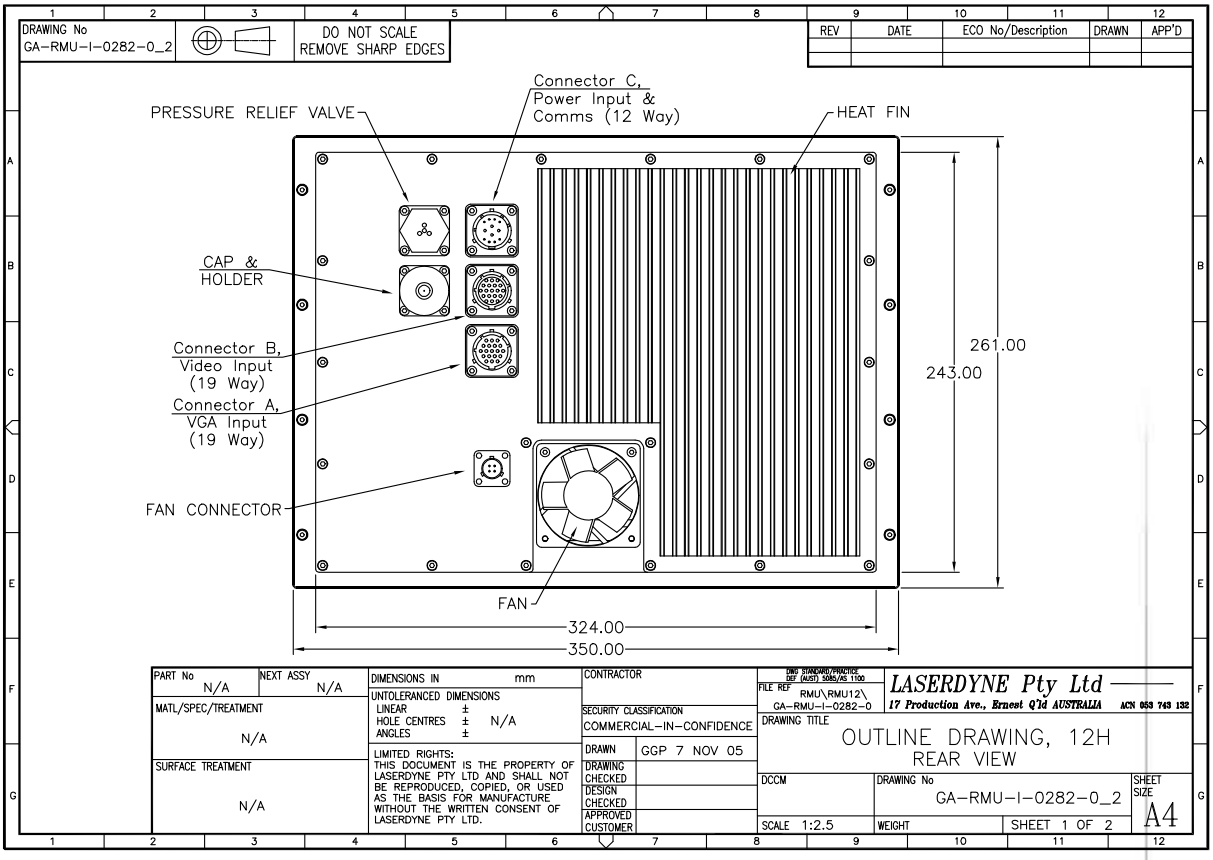

Figure 4-2: Outline Drawing Rear View

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