Black Opal R15-5799 R15 with 4 SD Inputs Flat Panel Display System

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1 DESCRIPTION

The R15 with 4 SD inputs (**R15-5799**) model is an XGA resolution, 15" member of the Black Opal display family. It is suitable for use in fixed or vehicle mounted surveillance systems. All Laserdyne 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.

A standard feature of all R15 models is the ruggedization and advanced video processing features for which Black Opal displays are renowned. The R15-5799 also features 4 standard-definition inputs (SD1..SD4), and supports simultaneous viewing of any of the 4 channels using a variety of screen layouts.

To provide Outdoor Readability the R15 is fitted with a full sunlight readable high brightness LCD (with LED backlight). The R15 screen may be viewed in full direct sunlight to full darkness. While the LCD backlight does have a wide dimming range, night vision modes (as per MIL-STD-3009) are not provided on this variant.

The LCD is optically bonded to a tough, laminated, EMI shielded, antireflection treated window. LCD Heater technology ensures operation of the LCD screen at low temperatures with no degradation of image quality, and no fogging. The two-part chassis is manufactured from solid aluminium billets and finished to be tough and scratch resistant, as well as being a heat sink to aid high temperature operation, and for EMC compliance. The R15 has low mass to support airborne as well as land-based applications.

State of the art real time video processing in an FPGA processor provides video display with ultra-low video latency for operator comfort under all operational scenarios. Black Opal displays also 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) or low contrast using a proprietary low-latency maximum-entropy image enhancer, operational within an adjustable central window where contrast and colour are enhanced.

Digital Zoom: a fully X & Y interpolated zoom;

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 from interlaced sources.

Multiple Video Window 'layouts' supported, including splits and quad.

2 SYSTEM SPECIFICATIONS

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

2.1 System Performance

PARAMETER		SPECIFICATION
Designation		
R15-5799		Black Opal 15", high brightness, XGA resolution.
Control		
Control Functions		On/Off; NVIS mode; backlight intensity; image controls. Screen layout controls.
Controls		21 tactile LED-backlit (green or red selectable) buttons.
Display		
Type		Active Matrix Colour (24-bit colour) LED backlit LCD Module
Display Size (″ {cm})	**diagonal**	15 {38.1}
	active area	11.97 {30.4} x 8.98 {22.8}
Aspect Ratio [width:height]		4:3
Pixel Number [1 pixel is RGB trio]		XGA: 1,024 x 768px
Colour		16.7M colours [24-bit RGB]
Grey Scale		256 [8-bit Greyscale]
Backlight Luminance [LED type;	**minimum**	< 0.2
approx.; adjustable] (cdm^{-2}) [1]	**maximum**	900 (typ)
Contrast Ratio [limiting; LCD]		approx 800:1
Response Time [typical] (ms)		8 [T_r =5.7 T_f = 2.3] @ 25'C
Readability [ambient conditions]		black-out to full direct sunlight [10^5 lux]
Night Vision Device compatible?		no
Viewing Angle	**vertical**	+70/-80
[full angle] (°)	**horizontal**	±80

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

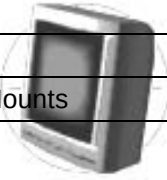
PARAMETER		SPECIFICATION
Video IO		
Physical Connections		4 channels of CVBS input, 1 channel of CVBS output.
Signal Formats supported		Standard definition (SD) only: (PAL/NTSC/SECAM/CCIR-601/RS170
Connection Formats		CVBS, 75ohm terminated
Safety		
Cooling		thermal transfer by internal and external convection
Display Window		Antireflection, hard-coated, sealed, EMI/EMC shielded; index-matched to LCD glass.
Electrical Protection		conforms to: MIL-STD-704F; MIL-STD-1275D; STANAG 3350 (all analogue video inputs)
Audible Emission [@ ≥ 10m]		nil
Support		
MTBF [100% duty cycle] (hours)	**Ground Mobile [wheeled]**	> 14,343 hrs @ 40'C
	Airborne Rotary Wing	> TBD
Operational Life (years)		10

2.2 Communications

PARAMETER		SPECIFICATION
Ports		2 Serial ports
Data	**Format**	1 x RS-422 and 1 x RS-232
	Rate (Baud)	57600,n,8,1 standard

2.3 Physical Characteristics

PARAMETER		SPECIFICATION
Mass [approx.] (kg)		5.4
Dimensions	**Width**	364
	Height	332
	Depth (body)	62
Mounting		Rear, Side, and Top Mounts



2.4 Electrical Characteristics

PARAMETER		SPECIFICATION
Supply Voltage (Vdc) [MIL-STD-1275D]		18 to 32V DC
Current Drain, Basic Unit,	**heater on**	4A (112W) typ
100% Backlight [@ 28Vdc] (A)	**heater off**	< 1.5A (~42W)

2.5 Environmental

PARAMETER				SPECIFICATION
Temperature (°C)	**Operate** [2]	**min.** [3]		-40
[MIL-STD-810F,		**max.** [4]	**long term**	+55
Method 501.4;			**short term**	+71
Method 502.4,	**Survive**		**min.** [3]	-40
Procedures I, II]			**max.** [4]	+71
Thermal Shock [MIL-STD-810F, Method 503.4, Procedure II] (°C transfer 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; 5Hz to 1kHz; 4 hours per axis
Shock [MIL-STD-810F, Method 516.5, Procedure I]				40g, 11ms each direction each axis, sawtooth
Sealing [MIL-STD-810F, Method 512.4, Procedure I] [5]				complete immersion
Altitude/Low Pressure [transport; MIL-STD-810F, Method 500.4, Procedure I]				15,000 feet
EMI/EMC [5, 6]				MIL-STD-461D

2.6 Connector/Pin Details

Connectors are organised in two groups

1. Standard connectors that include Video, Communications and Power
2. Processor/expansion connectors that host x86 Computer IO as well as any custom IO specified by the customer.

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

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
VIDEO: SD Video: Connector, MilSpec, Jam Nut, D38999/24WC35PB					
1	**CH1_OUT**	1	CVBS video out	Coax, 75Ω centre	video output, 75Ω
2	**GND**	2	Video output GND	Coax, 75Ω shield	
3	**CH3_IN**	3	CVBS Channel 3 video in	Coax, 75Ω centre	video input, 75Ω
4	**GND**	4	Channel 3 input GND	Coax, 75Ω shield	
5	**CH2_IN**	5	CVBS Channel 2 video in	Coax, 75Ω centre	video input, 75Ω
6	**GND**	6	Channel 2 input GND	Coax, 75Ω shield	
7	**CH1_IN**	7	CVBS Channel 1 video in	Coax, 75Ω centre	video input, 75Ω
8	**GND**	8	Channel 1 input GND	Coax, 75Ω shield	
9	**CH4_IN**	7	CVBS Channel 4 video in	Coax, 75Ω centre	video input, 75Ω
10	**GND**	8	Channel 4 input GND	Coax, 75Ω shield	
11	**N/C**	11			
12	**N/C**	12			
13	**N/C**	13			
14	**N/C**	14			
15	**N/C**	15			
16	**N/C**	16			
17	**N/C**	17			
18	**N/C**	18			
19	**N/C**	19			
20	**N/C**	20			
21	**N/C**	21			
22	**N/C**	22			
COMMS: Comms Connection: Connector, MilSpec, D38999/24WB35PB					
1	**RS-232 TX**	1	RS-232 transmit	signal	output
2	**RS-232 RX**	2	RS-232 receive	signal	input
3	**RS-232 GND**	3	Comms GND	signal	
4	**RS-422 TX+**	4	RS-422 transmit	signal	output
5	**RS-422 TX-**	5	RS-422 transmit	signal	output
6	**RS-422 RX+**	6	RS-422 receive	signal	input
7	**RS-422 RX-**	7	RS-422 receive	signal	input
8	**RS-422 GND**	8	RS-422 shield	signal	
9	**(factory use only)**	9	Ethernet transmit	signal	Upgrade port
10	**(factory use only)**	10	Ethernet transmit	signal	Upgrade port

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
11	**(factory use only)**	11	Ethernet receive	signal	Upgrade port
12	**(factory use only)**	12	Ethernet receive	signal	Upgrade port
13	**GND**	13		signal	
POWER: Power Input: Connector, MilSpec, D38999/24WB98PN					
1	**V+**	A	Input power (+28V) for display	6A dc (peak)	18..36V input
2	**V-**	B	dc- (GND) connection	6A dc (peak)	Isolated from chassis
3	**V+**	C	Input power (+28V) for display	Redundant	18..36V input
4	**V-**	D	dc- (GND) connection	Redundant	Isolated from chassis

Note: For EMI/EMC compliance, the cables that run to *each connector* MUST have a high quality RF shield over all conductors, and this shield **must** be RF bonded to the connector shell. *This includes the power cable*. Additionally, a small ferrite ring clamped over the outside of each cable near the connector can reduce emissions, and may be required for compliance. The need for these will be installation dependent – and will only improve the EMI profile of the system, so are strongly recommended.

2.7 Embedded Customer Specified Circuits

Not applicable for this system.

3 SET-UP

3.1 Mounts

Multiple fastening points allow use of shock absorbers or mounting hardware per the customer's preference. Please note that all environmental and performance specifications (to MIL-STD-810F) are quoted, tested and qualified without shock absorbers fitted. Shock absorbers may be necessary where operation beyond parameters outlined in this document is required.

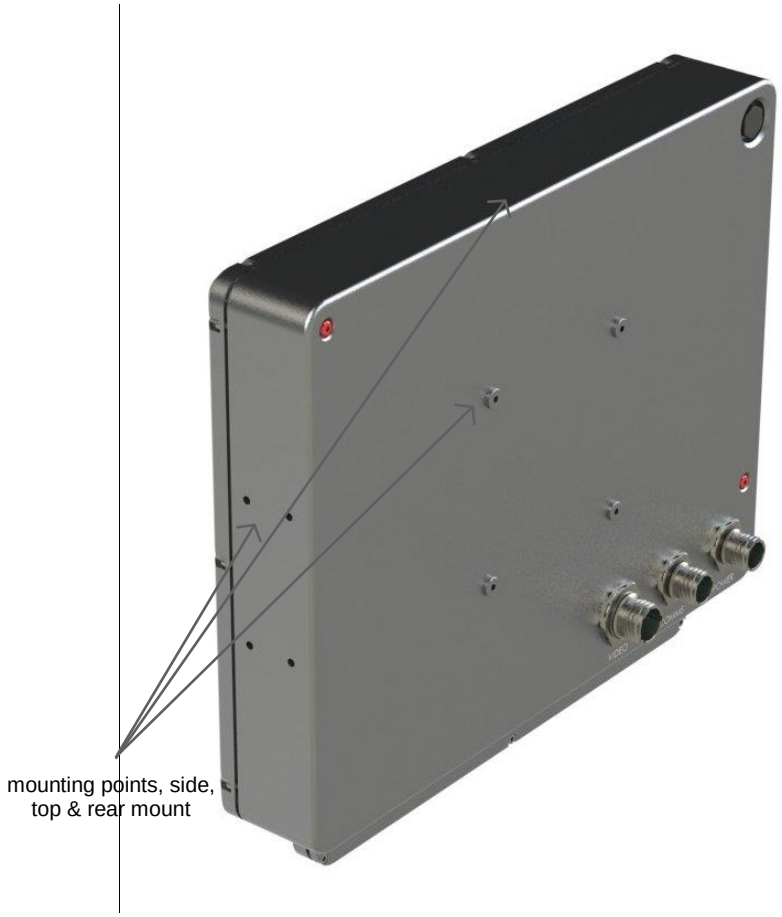


Figure 3-1: Mounts

The unit has three mounting methods:

Rear mount;

- VESA 100mm
- Four M4 with stainless steel heli-coil inserts
- 8mm deep

Side mounts and Top mount;

- Four M5 per side with stainless steel heli-coil inserts
- 8mm deep
- 25mm and 75mm separation.

3.2 Connections

The unit has three connection points located on the rear:

Power connection;

Comms connection; and

Video 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 one of the mounting methods provided.
- Connect the required power cable to the unit and to the external power source.
- Connect the required data cable to the unit and to the communication data source.
- Connect the required video cable to the unit and to the external imaging system(s).

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 conservatively 20s/°C. Testing has shown that when starting at -40'C with no wind chill, this equates to a usable display in 5 minutes, subjectively good optical performance by 10 minutes and a display free from any degradation in approx. 20 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	Shield from wind chill Remove any attached ice Cover display until usable	≤ 0	Heater on @ full power; performance not specified, operation not recommended.
-40 to 0	Shield from wind chill Remove any attached ice Cover the display until usable	≤ 0	Heater on @ full power; usable in 5 to 10 minutes
		> 0	Heater on @ low power; usable in < 5 minutes
0 to +55	none	≥ 10	Normal operation, heater off
		≥ 55	Reducing the backlight is recommended
+55 to +70	Keep display in shade provide forced air cooling (e.g. fan)		Reducing the backlight is recommended
> +70	Keep display in shade Provide forced air cooling	≥ 75	Performance not specified, operation not recommended.

4 OUTLINE DRAWING

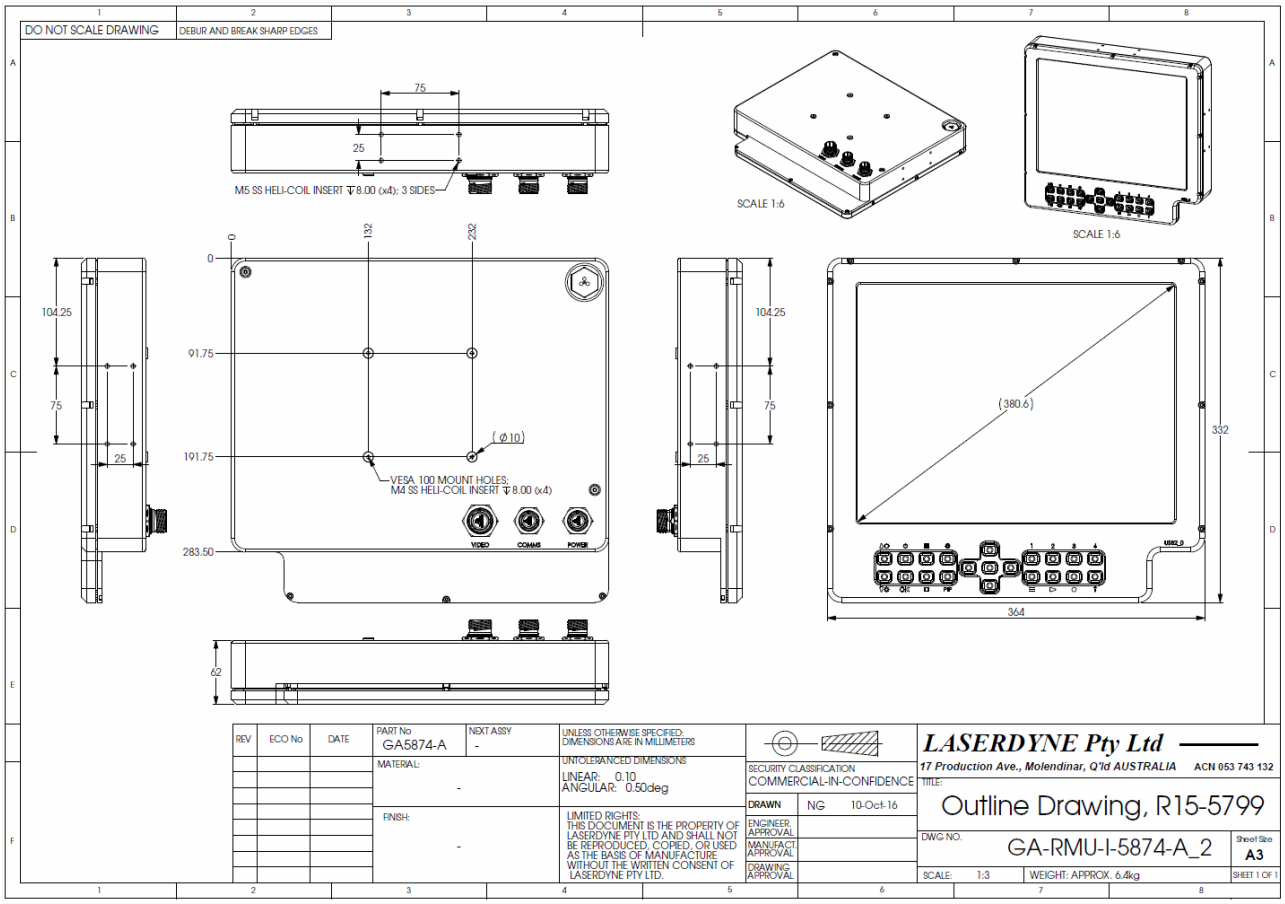


Figure 4-1: Outline Drawing

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