Black Opal HD Model D15-6242 Flat Panel Display System

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1 DESCRIPTION

Black Opal D15-6242 is a 15.6” Full High Definition 1920 x 1080px multi-function display that features low latency full HD video processing, sealed and N_2 purged chassis, as well as enhanced remote control and interoperability with external devices through its communications ports. Black Opal HD displays are engineered for ultra-reliable Military or Civil use in land, sea and airborne applications including Surveillance, Information Display and Equipment Control.

Black Opal D15-6242 display backlight operates in three distinct modes: a sunlight readable high brightness white backlight that can dim to completely black for black-out conditions and has settings suitable for low light viewing; a MIL-STD-3009 compliant backlight for operation with NVIS equipment; and a low level red backlight for unaided covert viewing in extreme dark. Button backlighting can be set red or green.

Black Opal D15-6242 display supports DVI, HDMI and SDI video inputs (up to full HD). It also has a re-clocked SDI output. The input shown on-screen is selected by a dedicated SRC button. Other inputs and outputs may be able to be supported by the internal video processor – so contact the factory if additional capability is required.

The LCD is protected by an AR-coated resistive touchscreen window that contains EMI/EMC shielding layers and an integral heater. The chassis is fully sealed, with environmentally sealed controls and connectors. Each chassis is pressure tested, purged and backfilled with N_2 for component preservation. A pressure safety valve ensures safe operation beyond 15,000ft altitude. This model is button operated, with dedicated controls for backlight dimming/mode, video contrast, input source select. It also has 15 buttons that are soft programmable and able to control external equipment over the RS422 port. All buttons have a dimmable backlight which also provides for status indication. Black Opal Display Systems are designed to comply with MIL-STD-810 for Environmental Survival and MIL-STD-461 for Conducted and Radiated emission compliance.

2 SYSTEM SPECIFICATIONS

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

2.1 System Performance

PARAMETER		SPECIFICATION
Designation		
D15-6242		Display, 15.6”, Full HD Widescreen, Resistive 5-wire touch-screen (over USB)
Control		
Control Functions [factory configurable to customer requirements]		Standby/On/Blackout mode; backlight intensity; video contrast; source toggle; custom comms message on press and release.
Controls		21 tactile LED-backlit buttons
Display		
Type		Amorphous Silicon Active Matrix Colour (24-bit colour) LCD Module
Display Size (″) {cm}	**diagonal**	15.6” {396mm}
	active area	13.5” {344.16mm} x 8” {193.59mm}
Aspect Ratio [width:height]		16:9
Pixel Number [1 pixel is RGB trio]		1920 x 1080
Colour		16.7M (24bit)
Grey Scale		256 (8bit)
Backlight Luminance [LED type;	**minimum**	0.3 minimum on (day mode), plus 0
approx.; adjustable] (cdm^{-2}) [1]	**maximum**	720
Contrast Ratio [limiting; LCD]		400:1 min, 500:1 typ
Response Time [typ.] (ms)		8 [full cycle]
Readability [ambient conditions]		black-out to full direct sunlight [10^5 lux]
Night Vision Device compatible?		yes [low intensity green/red selectable]
System Readiness		<20 seconds (>0degC)

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

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PARAMETER		SPECIFICATION
Viewing Angle (°)	**vertical**	± 60
	horizontal	± 70
Video Inputs		
Inputs		1 x SDI, 1 x DVI, 1 x HDMI
Signal Formats	**DVI**	VESA (1080p60 max)
	HDMI	VESA (1080p60 max)
	SDI	HD-SDI, 3G-SDI (1080p60)
Video Outputs		
Outputs		1 x SDI
Signal Formats	**SDI**	re-clocked copy of SDI input
Safety & Protection		
Cooling		thermal transfer by internal and external convection;
Backfill		purged & backfilled [N_2]
Display Window		Antireflection, hard-coated, sealed, EMI/EMC shielded
Altitude/Decompression		pressure relief valve fitted
Electrical Protection		conforms to MIL-STD-704E, MIL-STD-1275E
Audible Emission [@ ≥ 10m]		nil
Support		
MTBF [@30°C; 50% duty cycle] (hours)	**Airborne Rotary Winged**	13,689
	Ground Mobile	28,213
	Naval Sheltered	44,226
	Naval Unsheltered	18,867
Operational Life (years)		10

2.2 Controls

2.2.1 Local

Control Type	Location		Primary Label	Primary Function
Button	upper front face	left	**PWR**	Switch between STANDBY, ON, BLACKOUT modes. [note]
Button	upper front face	right	**SRC**	cycle through all available video inputs
	left front face	top (L1)	O	soft assignable/programmable buttons
		2nd top (L2)		
		3rd top (L3)		
		middle (L4)		
		3rd bottom (L5)		
		2nd bottom (L6)	Δ	backlight up / DAY mode [note]
		bottom (L7)	∇	backlight down / NIGHT mode [note]
	lower front face	left (B1)	O	soft assignable/programmable buttons
		2nd left (B2)		
		centre (B3)		
		2nd right (B4)		
		right (B5)		
	right front face	top (R1)		
		2nd top (R2)		
		3rd top (R3)		
		middle (R4)		
		3rd bottom (R5)		
		2nd bottom (R6)	Δ	contrast up
		bottom (R7)	∇	contrast down

Note: The display will assume a default (EEPROM set) backlight mode and level when **PWR** is pressed to turn the display on. To force the display to turn on in either DAY or NIGHT modes, hold down buttons **L6** or **L7** respectively while pressing **PWR**. While the display is ON, a momentary press of **PWR** will toggle the display mode between BLACKOUT and ON, whereas a long press of **PWR** will force the display to STANDBY. Refer to the user manual for more details, and how to set the default backlight level.

2.2.1 Remote

Any front bezel button can be pressed, held and released through the RS422 communications port, including hard functions like turn on/off, day/night mode and backlight. Additionally the communication port can output a button code when any of the front face buttons are pressed / released. Refer to the factory for details if these features are required. Additionally, the port can be configured for RS232 – contact the factory if this is required.

2.3 Communications

PARAMETER		SPECIFICATION
Ports		One Serial port and one USB port
Serial	**Format**	RS-422 (RS232 available on request)
	Rate (Baud)	19,200
Touchscreen	**Format**	USB

2.4 Physical Characteristics

PARAMETER		SPECIFICATION
Mass [approx.] (kg)		5.6 kg
Dimensions	**Width**	420
	Height	272.5
	Depth	63.5
Specific Gravity		> 1 [non-floatation]
Mounting	**Panel Mount**	4 x 5.5mm dia. clearance holes, one in each corner
	Side Mount	8 x threaded M6 mounting holes 6mm deep, 2 each on top, bottom, left and right of flange

2.5 Electrical Requirements

PARAMETER		SPECIFICATION
Supply Voltage (Vdc)		18 to 33 [24 nominal]
Current Drain	**heater on**	< 5
[@ 24Vdc; maximum] (A)	**heater off**	< 2

2.6 Environmental

PARAMETER			SPECIFICATION
Temperature (°C) [2]	**Operate**	**min.**	-40 [without wind-chill]
		max.	+55 [without solar radiation]
	Survive	**min.**	-45 [without wind-chill]
		max.	+71 [without solar radiation]
Vibration and Shock [3]			MIL-STD-810G
Sealing [4]	**with pressure relief valve**		IP66
	without pressure relief valve		IP67
EMI/EMC [3,4]			MIL-STD-461E

2.7 Connector/Pin Details

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
J1: "POWER/COM", Power / Comms Connection: Connector, MilSpec, D38999/24WB35PB					
1	**V+**	1	Input power (+24V)	5A dc	+20..+33V input
2	**V-**	2	Input power return (0V) connection	5A dc	internally isolated from comms and video GND.
3	**GND1**	3	RS-422 shield / RS232 COMMON	signal	controls and programming common
4	**TX1/TX1+**	4	RS-422+ transmit / RS232 TX	signal	controls and programming
5	**TX1-**	5	RS-422- transmit	signal	controls and programming
6	**RX1/RX1+**	6	RS-422+ receive / RS232 RX	signal	controls and programming
7	**RX1-**	7	RS-422- receive	signal	controls and programming
8	**D+**	8	USB Data+	signal	touch screen
9	**D-**	9	USB Data-	signal	touch screen
10	**GND2**	10	USB Ground	signal	touch screen
11	**GND3**	11	USB Ground	signal	touch screen
12	**VBUS**	11	USB power (+5V)	signal	touch screen
13	**RSVD_1**	12	Reserved	signal	factory use – N/C

[2] When used in accordance with procedures in User's Manual
[3] Refer to manufacturer for details.
[4] With compliant line connectors attached, including sealing SDI line connections.

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
J2: Earth Point					
J3: "SDI IN", 3G-SDI/HD-SDI Video In Connection: BNC (with sealing collar)					
1	**GND**	Shield	SDI input GND	coax, 75Ω shield	tied to housing
2	**SDI IN**	Centre	SDI in	coax, 75Ω centre	SDI video input, 75Ω
J4: "SDI OUT", 3G-SDI/HD-SDI Video Out Connection: BNC (with sealing collar)					
1	**GND**	Shield	SDI output GND	coax, 75Ω shield	tied to housing
2	**SDI OUT**	Centre	SDI out	coax, 75Ω centre	SDI video output, 75Ω
J5: "DVI IN", DVI Input: Connector, MilSpec, Jam Nut, D38999/24xD19PN					
1	**/RX0**	A	TMDS Data 0-	100ohm pair	Shield tied to P
2	**RX0**	B	TMDS Data 0+	100ohm pair	Shield tied to P
3	**/RX1**	C	TMDS Data 1-	100ohm pair	Shield tied to R
4	**RX1**	D	TMDS Data 1+	100ohm pair	Shield tied to R
5	**/RX2**	E	TMDS Data 2-	100ohm pair	Shield tied to S
6	**RX2**	F	TMDS Data 2+	100ohm pair	Shield tied to S
7	**/RXC**	G	TMDS Data CLK-	100ohm pair	Shield tied to T
8	**RXC**	H	TMDS Data CLK+	100ohm pair	Shield tied to T
9	**DDC_CLK**	J	I^2C CLK (SCL) for DDC		
10	**DDC_DATA**	K	I^2C DATA (SDA) for DDC		
11	**VS_IN**	L	DVI Analog vertical sync		
12	**DDC_+5V**	M	+5V power for DDC		
13	**GND**	N	GND for VS, +5V		
14	**Screen/GND for Data0**	P		Shield for A,B	
15	**Screen/GND for Data1**	R		Shield for C,D	
16	**Screen/GND for Data2**	S		Shield for E,F	
17	**Screen/GND for Data CLK**	T		Shield for G,H	
18	**GND for DDC**	U	GND for I^2C bus		
19	**Hot plug**	V	Hot Plug detect	Signal	

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
J6: "HDMI IN", HDMI Input: Connector, MilSpec, Jam Nut, D38999/24xD19PN					
1	**/RX0**	A	TMDS Data 0-	100ohm pair	Shield tied to P
2	**RX0**	B	TMDS Data 0+	100ohm pair	Shield tied to P
3	**/RX1**	C	TMDS Data 1-	100ohm pair	Shield tied to R
4	**RX1**	D	TMDS Data 1+	100ohm pair	Shield tied to R
5	**/RX2**	E	TMDS Data 2-	100ohm pair	Shield tied to S
6	**RX2**	F	TMDS Data 2+	100ohm pair	Shield tied to S
7	**/RXC**	G	TMDS Data CLK-	100ohm pair	Shield tied to T
8	**RXC**	H	TMDS Data CLK+	100ohm pair	Shield tied to T
9	**DDC_CLK**	J	I^2C CLK (SCL) for DDC		
10	**DDC_DATA**	K	I^2C DATA (SDA) for DDC		
11	**VS_IN**	L	DVI Analog vertical sync		
12	**DDC_+5V**	M	+5V power for DDC		
13	**GND**	N	GND for VS, +5V		
14	**Screen/GND for Data0**	P		Shield for A,B	
15	**Screen/GND for Data1**	R		Shield for C,D	
16	**Screen/GND for Data2**	S		Shield for E,F	
17	**Screen/GND for Data CLK**	T		Shield for G,H	
18	**GND for DDC**	U	GND for I^2C bus		
19	**Hot plug**	V	Hot Plug detect	Signal	

Note: For EMI/EMC compliance, the cables that run to *each D38999 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 D38999 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. Additionally, the earth point (J2) must have a short, low impedance connection to an RF ground for compliance.

Note: The coaxial cable (and connectors) used for the SDI connections must comply with the loss characteristics and impedance requirements of SMPTE292M.

2.8 Touch Screen

The touch screen uses a Microchip AR1100 controller. Drivers and diagnostic tools can be downloaded from http://bit.ly/1XJtIqY or from Microchip web site at http://www.microchip.com/wwwproducts/en/AR1100.

3 SET-UP

3.1 Mounts

The unit has two methods of mounting:

1. by sides or top/bottom or both using 8 x threaded M6 mounting holes 6mm deep, 2 each on top, bottom, left and right of flange; and
2. panel mounting using 4 x 5.5mm dia. clearance holes, one in each corner.

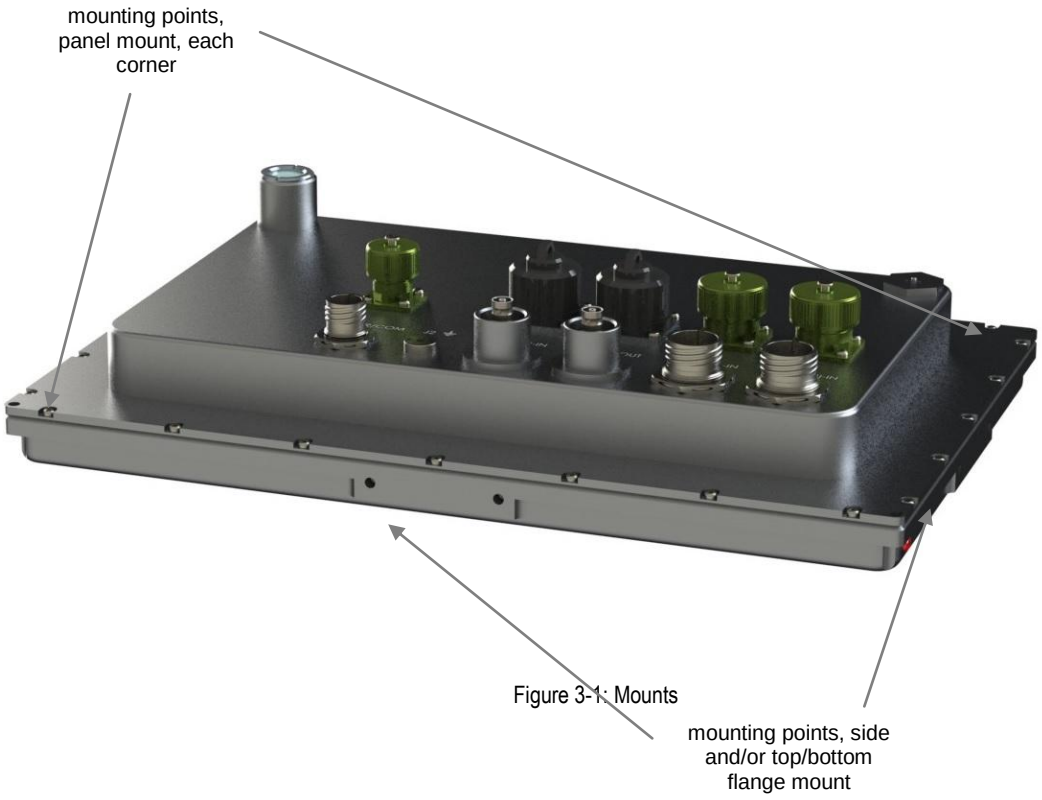

Figure 3-1: Mounts

3.2 Connections

The unit has six connection points located on the rear of the unit:

Connector J1, “PWR/COM”, the power/control connector;
Connector J2, the Earth Point connector;
Connector J3, “SDI IN”, a 3G-SDI/HD-SDI Input connector;
Connector J4, “SDI OUT”, a 3G-SDI/HD-SDI Output connector;
Connector J5, “DVI IN”, a DVI Input connector; and
Connector J6, “HDMI IN”, an HDMI Input connector.

Figure 3-2: Connections

Note: Each of the 2 SDI connections have collars provided to support an external cable-to-display flexible boot to provide an environmental seal for the BNC connections. Sealing boots are required for the display to be IP66 rated. Choose a sealing boot that suits the SDI coaxial cable diameter, and the 25mm collar diameter. Note that the boot may need to be located onto the cable prior to fitting the BNC plug.

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.

- If the display is required to transmit custom codes when the programable buttons are pressed, this should be programmed prior to installation. Refer to the user manual or contact the factory for specific details when this feature is required.
- Mount the unit to the vehicle or platform, using one of the mounting methods provided. Note that as the display will need an annual nitrogen purge (due to the presence of a pressure relief valve), this should be a consideration when mounting the display (i.e. for ease of removal, or access to the purge ports).
- Connect the earth point on the unit to an appropriate point on the vehicle.
- Connect the required video input cables to the display, and to the external imaging system(s) or recorder output.
- If required, connect the required video output cables to the display, and to the external destination.
- If required, connect the required data cable to the display, and to the communication data source (e.g. Memoreyes 3G recorder or PC or other).
- Connect the required power cable to the display, 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. Every heating and cooling setting can be programmed by the user, but we do not recommend deviating from the default settings. If a change is required contact the factory for instructions. The data below represents system default settings.

The approximate warm-up rate is 30s/C° max (e.g. with starting internal temperature of -40°C, unit will operate after 15 minutes; with starting internal temperature of -25°C, unit will power up in approximately 7 minutes). As a safeguard, an internal timer is implemented to guarantee the display will power on and operate after 15 minutes of heater activity regardless of the actual internal temperature.

Once a 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	≤ -10	unit will not power up; heater on
		> -10	unit will power up; heater on
0 to +55	none	≥ 10	heater off
		≥ 55	backlight power may be reduced to manage thermal load and keep unit internal temp in operating range.
+55 to +71	provide forced air cooling		
+71	do not attempt to operate unit	≥ 87	unit will run for >0.5hrs as per MIL-STD-810E
> 71			unit will not power up

4 OUTLINE DRAWING

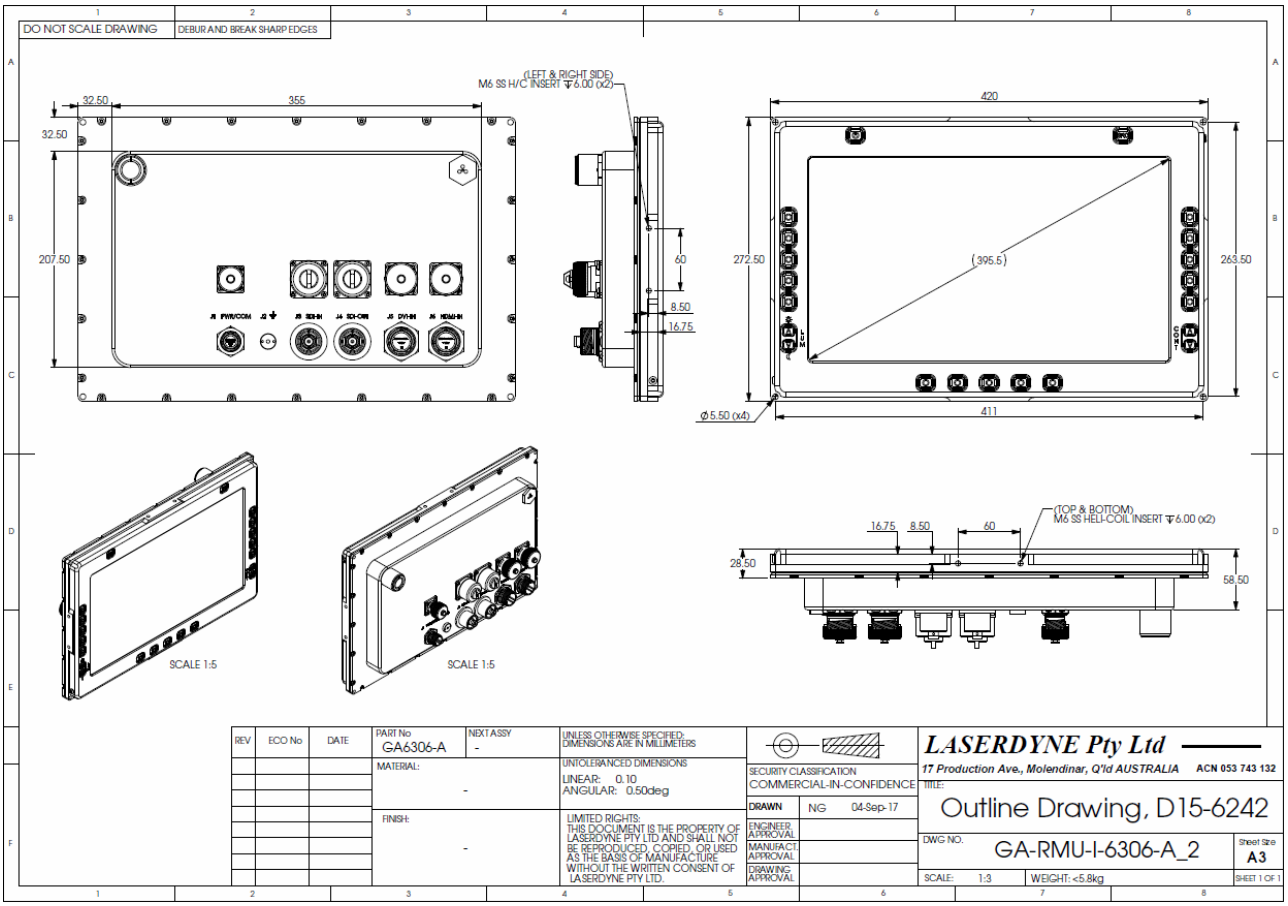

Figure 4-1: Outline Drawing

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