

## *Black Opal HD Model D15-5982* Flat Panel Display System



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## ***Black Opal HD Model D15-5982*** Flat Panel Display System

### **1 DESCRIPTION**

Black Opal D15-5982 is a 15.6" Full High Definition 1920 x 1080px multi-function display that features full HD video processing, sealed and N<sub>2</sub> 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 displays contain highly developed features that increase the effectiveness of surveillance, sighting and security systems, including: Digital Zoom, Freeze, Motion Compensation of interlaced signals, Picture in Picture viewing, Channel Mixing, Frame Rate conversion, and Video Switching.

Black Opal D15-5982 display backlight operates in three distinct modes: a sunlight readable 1200 cd/m<sup>2</sup> high bright 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.

The LCD is protected by a tough AR coated window, that contains EMI/EMC shielding layers. The chassis is CNC-milled Aluminium with sealed sections, with environmentally sealed controls and connectors. Each chassis is pressure tested, purged and backfilled with N<sub>2</sub> for component preservation. For Airborne applications a pressure safety valve ensures safe operation beyond 15,000ft altitude. All models are button operated, and have 17 buttons that are completely soft programmable and able to master external equipment over communications ports, such as the Memoreyes 3G Video Recorder. 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.

The D15-5982 supports an optional internal SD video recorder feature which can be used to record standard-definition video. Full recorder and playback controls are provided (including event marking and snapshots), and external USB media is used for easily removable content (ready to play in mp4 format). Optional support for input and output streaming video-over-IP is also available, allowing the D15 to display video from a network video source, and also to stream recorded SD video during playback. For HD recording/playback, an external Memoreyes 3G can be used, and controlled directly using the controls on the D15.

## *Black Opal HD Model D15-5982* Flat Panel Display System

### 2 SYSTEM SPECIFICATIONS

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

#### 2.1 System Performance

PARAMETER		SPECIFICATION
<b>Designation</b>		
<b>D15-5982</b>		Display, 15.6", Full HD Widescreen
<b>Control</b>		
<b>Control Functions [factory configurable to customer requirements]</b>		On/Standby/Blackout; Day/Night select; backlight intensity; menu select; select screen lay-out; zoom, etc.
<b>Controls</b>		21 tactile LED-backlit buttons
<b>Display</b>		
<b>Type</b>		Amorphous Silicon Active Matrix Colour (24-bit colour) LCD Module
<b>Display Size (") {cm}</b>	<b>diagonal</b>	15.6" {396mm}
	<b>active area</b>	13.5" {344.16mm} x 8" {193.59mm}
<b>Aspect Ratio [width:height]</b>		16:9
<b>Pixel Number [1 pixel is RGB trio]</b>		1920 x 1080
<b>Colour</b>		24bit
<b>Grey Scale</b>		8bit
<b>Backlight Luminance [LED type; approx.; adjustable] (cdm<sup>-2</sup>) <sup>1</sup></b>	<b>minimum</b>	1% Backlight < 17, Off/Standby = 0
	<b>maximum</b>	> 1200
<b>Contrast Ratio [limiting; LCD]</b>		400:1 min, 500:1 typ
<b>Response Time [typ.] (ms)</b>		8 [full cycle]
<b>Readability [ambient conditions]</b>		black-out to full direct sunlight [10 <sup>5</sup> lux]
<b>Night Vision Device compatible?</b>		yes [low intensity green/red selectable]
<b>System Readiness</b>		< 20 seconds

<sup>1</sup> 1 cdm<sup>-2</sup> = 1 nit.










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PARAMETER		SPECIFICATION
Viewing Angle (°)	vertical	± 60
	horizontal	± 70
<b>Inputs</b>		
Inputs		1 x 3G-SDI, 1 x DVI, 4 x CVBS
Signal Formats	DVI	VESA (1080p60 max)
	SDI	HD-SDI, 3G-SDI (1080p60)
	SD Video	PAL, NTSC (Composite CVBS).
<b>Outputs</b>		
Video	DVI	WYSIWYG [what you see is what you get] output – same as what is shown on the LCD
<b>Optional Integral SD Recorder I/O</b>		
Physical Connections	External Media	1x USB Type A Host (for Media) Mounted in a sealed D38999 Receptacle
	Configuration	1x Gigabit Ethernet RJ-45 Mounted in a sealed D38999 Receptacle.
<b>Safety &amp; Protection</b>		
Cooling		thermal transfer by internal and external convection;
Backfill		purged & backfilled [N <sub>2</sub> ]
Display Window		Antireflection, hard-coated, sealed, EMI/EMC shielded
Altitude/Decompression		pressure relief vent
Electrical Protection		conforms to MIL-STD-704
Audible Emission [ @ ≥ 10m]		nil
<b>Support</b>		
MTBF [Airborne Rotary Winged; @30°C; 100% duty cycle] (hours)		6,800
Operational Life (years)		10

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### 2.2 Controls

#### 2.2.1 Local

Control Type	Location		Primary Label	Primary Function		
<b>Button</b>	upper front face	left		toggle between On and Blackout, hold for 3 seconds to enter Standby		
		right		toggle between Day and Night backlight modes		
	left front face	top (L1)		soft assignable/programmable buttons		
		2 <sup>nd</sup> top (L2)				
		3 <sup>rd</sup> top (L3)				
		middle (L4)				
		3 <sup>rd</sup> bottom (L5)				
		2 <sup>nd</sup> bottom (L6)				backlight up
		bottom (L7)				backlight down
	lower front face	left (B1)		soft assignable/programmable buttons		
		2 <sup>nd</sup> left (B2)				
		centre (B3)				
		2 <sup>nd</sup> right (B4)				
		right (B5)				
	right front face	top (R1)		soft assignable/programmable buttons		
		2 <sup>nd</sup> top (R2)				
		3 <sup>rd</sup> top (R3)				
middle (R4)						
3 <sup>rd</sup> bottom (R5)						
2 <sup>nd</sup> bottom (R6)					backlight up	
bottom (R7)					backlight down	

#### 2.2.1 Remote

Any front bezel button can be pressed, held and released through the RS232 or RS422 communications port, including hard functions like turn on/off, day/night mode and backlight. Additionally the RS232 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.

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### 2.3 Communications

PARAMETER		SPECIFICATION
Ports		Two Serial ports
Data	Format	RS-232 and RS-422
	Rate (Baud)	selectable 9,600 to 115,200 (19,200 default) for RS232 port

### 2.4 Physical Characteristics

PARAMETER		SPECIFICATION
Mass [approx.] (kg)		< 4.5 kg
Dimensions	Width	420
	Height	272.5
	Depth	56
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 [28 nominal]
Current Drain [@ 28Vdc; typical] (A)	heater on	< 8
	heater off	< 2

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### 2.6 Environmental

PARAMETER			SPECIFICATION
Temperature (°C) <sup>2</sup>	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 <sup>3</sup>			MIL-STD-810E, aircraft
Sealing <sup>4</sup>			IP65
EMI/EMC <sup>3,4</sup>			MIL-STD-461E

### 2.7 Connector/Pin Details

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
<b>J1: "VID", SD Video Input: Connector, MilSpec, Jam Nut, D38999/24WC35PB</b>					
1	CH1_IN	1	Channel 1 video (CVBS) in	coax, 75Ω centre	video input, 75Ω
2	GND	2	Channel 1 input GND	Coax, 75Ω shield	
3	CH2_IN	3	Channel 2 video (CVBS) in	coax, 75Ω centre	video input, 75Ω
4	GND	4	Channel 2 input GND	Coax, 75Ω shield	
5	CH3_IN	5	Channel 3 video (CVBS) in	coax, 75Ω centre	video input, 75Ω
6	GND	6	Channel 3 input GND	Coax, 75Ω shield	
7	CH4_IN	7	Channel 4 video (CVBS) in	coax, 75Ω centre	video input, 75Ω
8	GND	8	Channel 4 input GND	Coax, 75Ω shield	
9	RS-232_TX	9	RS-232 Transmit	signal	factory use
10	RS-232_RX	10	RS-232 Receive	signal	factory use
11	RS-232_GND	11	RS-232 GND	signal	
12	RSVD_1	12	Reserved	signal	factory use – N/C
13	RSVD_2	13	Reserved	signal	factory use – N/C
14	RSVD_3	14	Reserved	signal	factory use – N/C
15	RSVD_4	15	Reserved	signal	factory use – N/C
16	RSVD_5	16	Reserved	signal	factory use – N/C

<sup>2</sup> When used in accordance with procedures in User's Manual

<sup>3</sup> Refer to manufacturer for details.

<sup>4</sup> With compliant line connectors attached (not applicable if consumer DVI connectors are fitted).

## *Black Opal HD Model D15-5982* Flat Panel Display System

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
<b>J1: "VID", SD Video Input (cont'd)</b>					
17	N/C	17			
18	N/C	18			
19	N/C	19			
20	N/C	20			
21	N/C	21			
22	N/C	22			
<b>J2: "COM", Comms Connection: Connector, MilSpec, D38999/24WB35PB</b>					
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	RSVD_6	9	Reserved	signal	factory use – N/C
10	RSVD_7	10	Reserved	signal	factory use – N/C
11	RSVD_8	11	Reserved	signal	factory use – N/C
12	RSVD_9	12	Reserved	signal	factory use – N/C
13	GND	13		signal	
<b>J3: "PWR", Power Input: Connector, MilSpec, D38999/24WB98PN</b>					
1	V+	A	Input power (+28V) for display	5A dc	+20..+33V input
2	V-	B	dc- (GND) connection	5A dc	internally isolated from comms and video GND.
3	V+	C	Input power (+28V) for display	5A dc	+20..+33V input
4	V-	D	dc- (GND) connection	5A dc	internally isolated from comms and video GND.



## *Black Opal HD Model D15-5982* Flat Panel Display System

No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
<b>J3: "PWR", Power Input (cont'd)</b>					
5	V+	E	Input power (+28V) for display	5A dc	+20..+33V input
6	V-	F	dc- (GND) connection	5A dc	internally isolated from comms and video GND.
<b>J4: Earth Point</b>					
<b>J5: "SDI", 3G-SDI/HD-SDI Video In Connection: BNC</b>					
1	GND	Shield	3G-SDI input GND	coax, 75Ω shield	tied to housing
2	3G-SDI_IN	Centre	3G-SDI in	coax, 75Ω centre	3G-SDI video input, 75Ω
<b>J6: "DVI IN", DVI Input: Connector, MilSpec, Jam Nut, D38999/24xD19PN</b>					
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 <sup>2</sup> C CLK (SCL) for DDC		
10	DDC_DATA	K	I <sup>2</sup> C 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 <sup>2</sup> C bus		
19	Hot plug	V	Hot Plug detect	Signal	

# Product Specification



No.	Name	Pin Marking	Purpose	Notes for Harness	Comment
<b>J7: "DVI OUT", DVI Output: Connector, MilSpec, Jam Nut, D38999/24xD19SN</b>					
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 <sup>2</sup> C CLK (SCL) for DDC		
10	DDC_DATA	K	I <sup>2</sup> C 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 <sup>2</sup> C bus		
19	Hot plug	V	Hot Plug detect	Signal	
<b>J8: Ethernet RJ45 Connection (rear panel): Connector, Panel, Amphenol RJF6B, IP67, ESD protection only. Typical line connector shell matching part is Amphenol RJFTV6MG.</b>					
<b>J9: USB Host Connection (front panel): Connector, USB, waterproof, ESD protection only</b>					

## *Black Opal HD Model D15-5982* Flat Panel Display System

### 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.

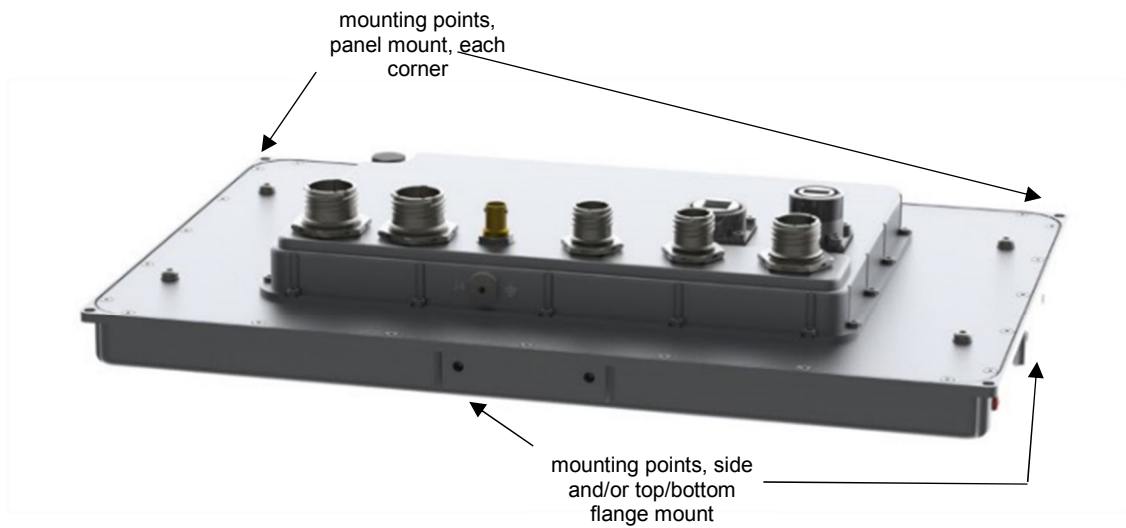


Figure 3-1: Mounts

## ***Black Opal HD Model D15-5982*** Flat Panel Display System

### 3.2 Connections

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

- Connector J1, "VID", the SD Video connector;
- Connector J2, "COM", the Comms connector;
- Connector J3, "PWR", the Power Input connector;
- Connector J4, the Earth Point connector;
- Connector J5, "SDI", a 3G-SDI/HD-SDI Input connector;
- Connector J6, "DVI/IN", a DVI Input connector;
- Connector J7, "DVI/OUT", a DVI WYSIWYG Output connector;
- Connector J8, "ETH", a network connector; and
- Connector J9, "USB", a USB connector.

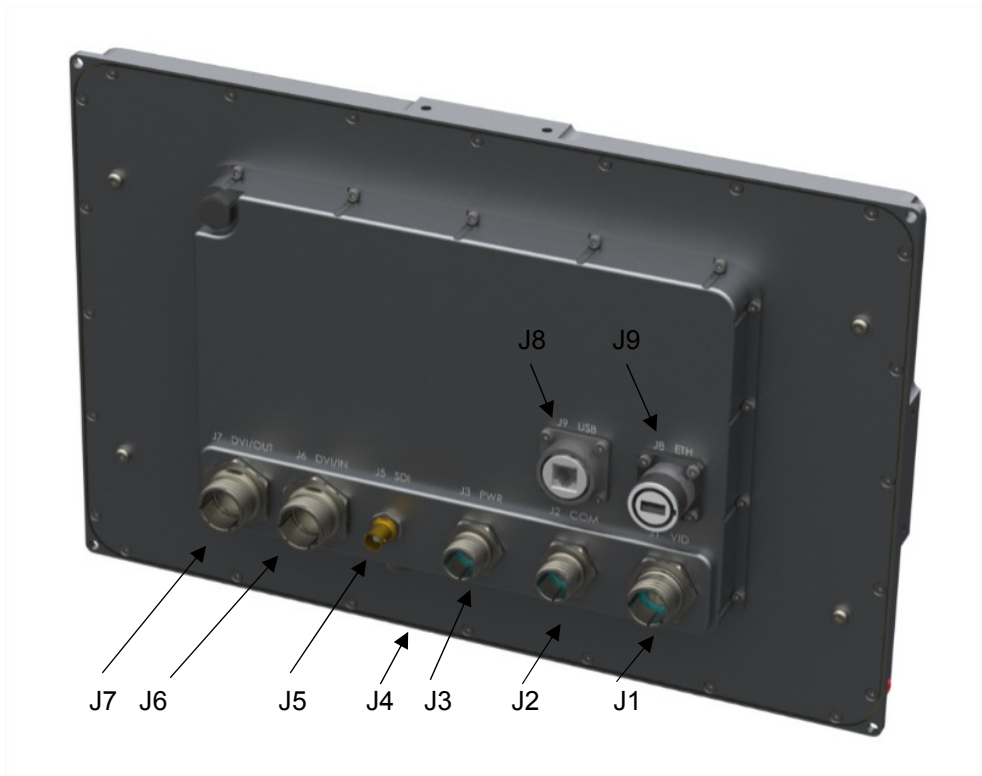


Figure 3-2: Connections

Note: The DVI connectors shown above are fully sealed D38999 connectors. Consumer DVI connectors for DVI (J6 and J7) are available as options – please contact the factory if this option is required.

## ***Black Opal HD Model D15-5982*** Flat Panel Display System

### 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 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.
- If the optional SD video recorder is used, then connect a Memoreyes-to-go USB drive to the USB port (use a short USB2 extension cable if access is an issue). If streaming video is being used, connect an Ethernet cable to the Ethernet port. [The Ethernet port is also used for field upgrades].

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### 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° (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 around unit chassis (e.g. fan)		
+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

## Black Opal HD Model D15-5982 Flat Panel Display System

### 4 OUTLINE DRAWING

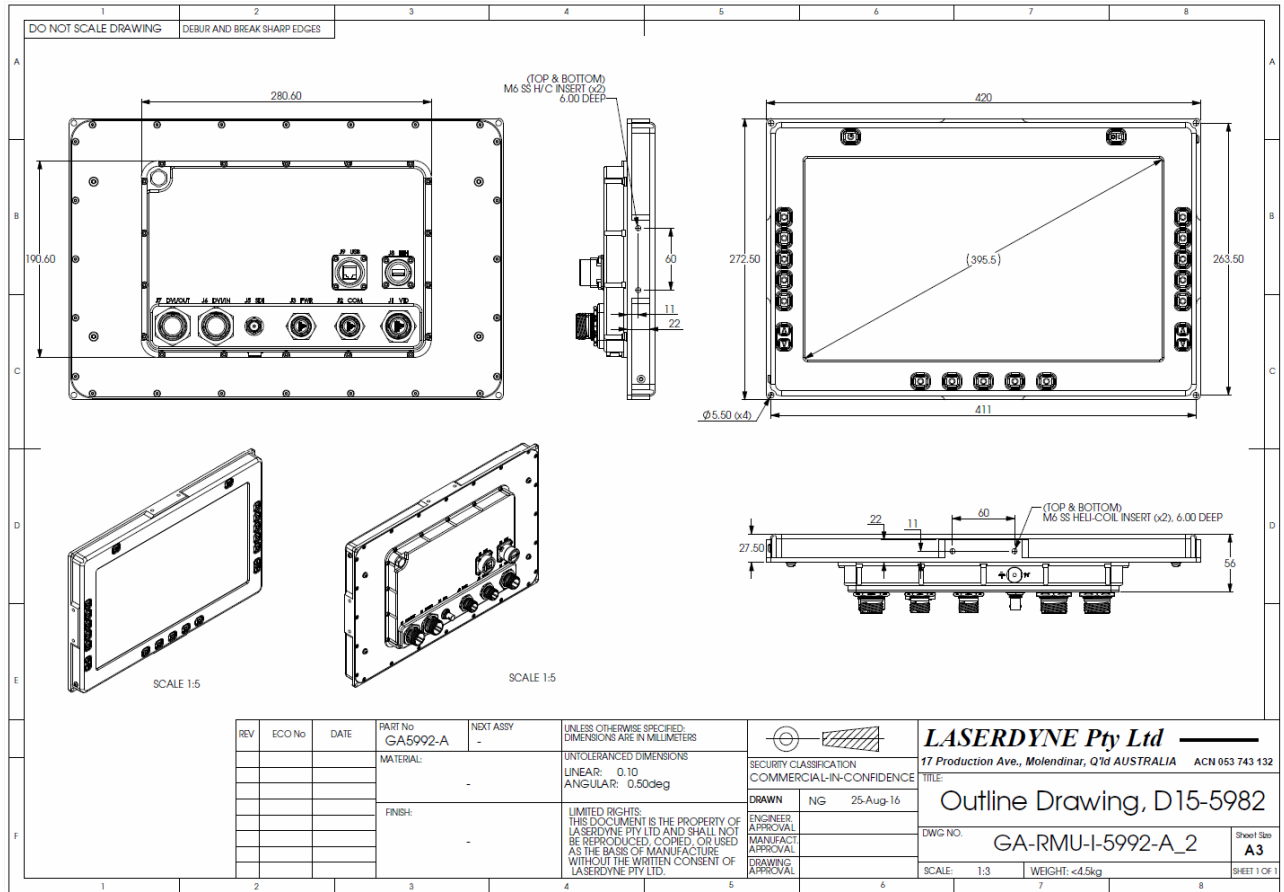


Figure 4-1: Outline Drawing



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