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## DECLARATION OF DESIGN AND PERFORMANCE

# AVDU-2100-xx-DDP

## 8.4" XGA Multi-function LCD Display



Name and Address of Manufacturer:	Real-Time Vision Ltd. 21 Hornsby Square Laindon Essex. SS15 6SD United Kingdom <a href="http://www.Real-Time-Vision.com">www.Real-Time-Vision.com</a>
Description:	Monitor - LCD 8.4" XGA Designed for rugged, high quality airborne video display applications. High brightness, sunlight viewable video and graphic display system.
Identification (Drawing/Part Number):	AVDU-2100-01 – Polarised – contrast enhancing AVDU-2100-02 - NVG filtered screen – etched surface AVDU-2100-03 – Clear screen - etched surface
Modification Standard (Issue)	Mod Strike 0
GA, Drawing or MRI Reference:	AVDU-2100-01-GA AVDU-2100-02-GA AVDU-2100-03-GA
Other Relevant Drawings:	See Table below
Weight and Overall	Mass: 2.8kg
Dimensions:	Height: 180mm Width: 210mm Depth: 77mm (not including connectors +24mm with)
Electrical Power Requirements:	Aircraft 28V DC supply Typical 1.8A Dissipation typically 45W
Details of Associated Approvals:	As listed herein



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Applicable Manuals (Service, Overhaul, Wiring etc.):	See table below	
Qualification Test Reports:	D0160D Test Report No. N/A See table below	
Stress Report	SR No. N/A (Enclosed box, non hazard)	
Environmental Conditions	Altitude	To 25,000ft
	Temperature	Stand-by -20°C to +70°C Operating -20°C to +55°C Storage -25°C to +80°C
	Humidity	@ +20°C to 80% Non Condensing
	Waterproofed	No - To be cabin mounted.
Other Relevant Reports	N/A	
Limitations:.	As listed herein	

I hereby certify that the above information is accurate. Real-Time Vision cannot accept responsibility for the satisfactory operation of equipment used outside the conditions given above.

Signed:..... *AJMSuggan*.....

Whilst care has been taken to provide as much detail as possible for use of this product it cannot be relied upon as an exhaustive source of information. This product is for use by suitably qualified persons who understand the nature of the work they are doing and are able to take suitable precautions and design and produce a system integration that is safe and meets regulatory requirements.

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### APPLICABLE DOCUMENTS

REFERENCE	TITLE	REV	DATE
AVDU-2100-01-ICD AVDU-2100-02-ICD AVDU-2100-03-ICD	Interface control Drawing	C	28 April 2004
AVDU-2100-01-GA AVDU-2100-02-GA AVDU-2100-03-GA	GA, Drawing or MRI Reference:	B	28 April 2004
AVDU-2100-01-ATP AVDU-2100-02-ATP AVDU-2100-03-ATP	Acceptance Test Procedure for LCD Monitor	B	28 April 2004
AVDU-2100-01-OPS AVDU-2100-02-OPS AVDU-2100-03-OPS	Operator Manual	B	28 April 2004
AVDU-2100-01-DDP AVDU-2100-02-DDP AVDU-2100-03-DDP	Declaration of design and performance	-	- see cover
RTCA DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment	D + Ch 1 Ch 2 Ch 3	Jul 1997 Dec 2000 Jun 2001 Dec 2002
MIL-C-14806	Anti Reflective coating	TBD	
MIL-STD-704E	Transients	E	
MIL-STD-461E	EMI: conducted emission/ conducted susceptibility	E	
MIL-STD-3009	NVG interface and performance requirements (derived from MIL-L-85762A)		February 2001
STANAG 3350 AVS	NATO Military Agency for Standardisation (MAS)  Standardisation Agreement– Analogue Video Standard for Aircraft System Applications	Edition 4	30 <sup>th</sup> October 1995



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### EUROCAE/ED-14D /RTCA DO-160D compliance statement

DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment Issued July-29-1997 Superseded DO-160C, Changes 1, 2 & 3 Prepared by SC-135 Standard procedures and environmental test criteria for testing airborne equipment for the entire spectrum of aircraft from light general aviation aircraft and helicopters through the “Jumbo Jets” and SST categories of aircraft. The document includes 25 Sections and three Appendices. Examples of tests covered include vibration, power input, radio frequency susceptibility, lightning, and electrostatic discharge. Coordinated with EUROCAE, RTCA/DO-160D and EUROCAE/ED-14D are identically worded.

DO-160D is recognized by the International Organization for Standardization (ISO) as de facto international standard ISO-7137.

This unit has been designed to meet the environmental conditions specified in RTCA/DO-160D, dated as indicated below.

Section	Compliance
4 - Temperature & Altitude	Category A1 This unit is considered satisfactory for operation up to an altitude of 25,000 feet un-pressurised.
5 - Temperature Variation	Category C
6 - Humidity	Category A
7 - Operational Shocks & Crash Safety	Category B Operation 6g 11/ms Non operation 15g/11ms
8 - Vibration	Category R+U (equiv: DO-160C Helicopter -Test curve 'N', 1.5g p-p)
9 - Explosion Proofing	N/A Category A Equipment located within the passenger cabin.
10 - Waterproofing	Category W
11 - Fluid susceptibility	Category X
12 - Sand & Dust	Category D
13 - Fungus Resistance	N/A Category F
14 - Salt Spray	N/A Category X
Sections described below, which address the EMC requirements for aircraft, are called up in the Advisory Circular Joint (AC)/ Advisory Material Joint (AMJ) 20.1317 and the User Guide. They describe detailed test EMC requirements and test methods for each of the phenomena listed:	
15 - Magnetic Effect	Category A The unit has no perceivable effect when mounted within 460mm (18”) of an aircraft magnetic compass
16 - Power Input	Category B
17 - Voltage Spike	Category A
18 - Audio Frequency	Categories A + Z
19 - Induced Susceptibility	Category Z
20 - RF Susceptibility (Radiated & Conducted)	Category U
21 - RF Emission	Category B
22 - Lightning Induced Transients	Not considered
23 - Lightning Direct Effects	Not considered
25 – Electrostatic discharge	
24 - Icing	Category X



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### DESIGN STATEMENT

The LCD Monitor, Flat Screen, 8.4 inch diagonal described herein has been designed using techniques, common parts and practices gained from the design and testing to RTCA DO-160 of other monitors in the AVDU series. The principle areas of similarity are:

#### Housing Construction

The housing is constructed from machined aluminium. The front case has a groove around the perimeter that matches the tongue around the perimeter of the rear case. This construction improves EMC and the resistance to the ingress of moisture.

#### Optical Window

The Display is available with three front window options each with its own identifying part number (see below).

AVDU-2100-01 – Polarised – contrast enhancing, anti reflective surface  
AVDU-2100-02 – NVG filtered screen – Etched front surface  
AVDU-2100-03 – Clear screen –Etched front surface

The construction of the Front window comprises sheets of optical material bonded to a layer of clear or filtered polycarbonate.

The front window assembly is constructed using the same materials and techniques as the tested monitors.

The assembly of the window in the front of the housing is achieved with High-grade fungal and insect resistant silicone sealant is identical to the methods used elsewhere.

#### LCD Display panel and Backlight Construction

The internal LCD and backlight assembly is constructed from machined aluminium. The Cold cathode fluorescent tubes are mounted and supported at either end in heat resistant blocks and along the length by reflective silicone. A diffusing panel to give an even light output is fitted to the front of the backlight.

#### Component retention

All major components and assemblies are secured to the chassis using a combination of metal and insulating nylon screws.

Components that may become loosened by vibration, such as plug in components and links, are secured using non-conductive silicon sealant or epoxy.

Screws secure the two halves of the case.

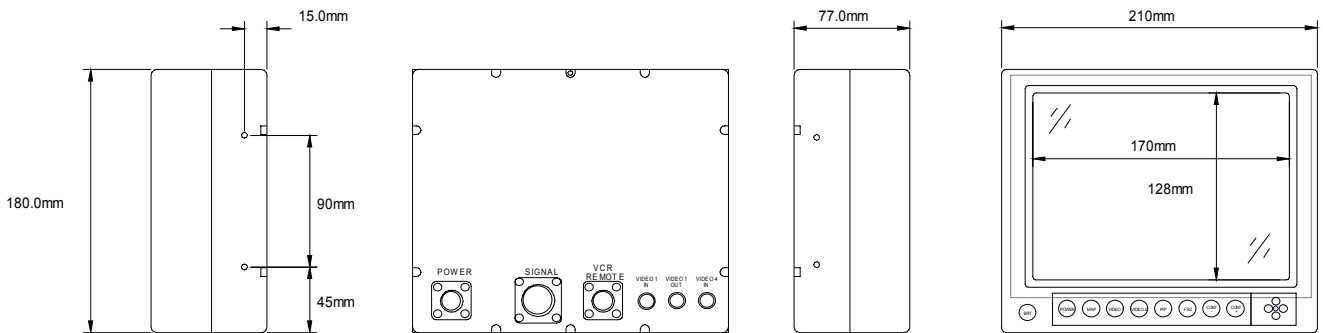
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### General Description

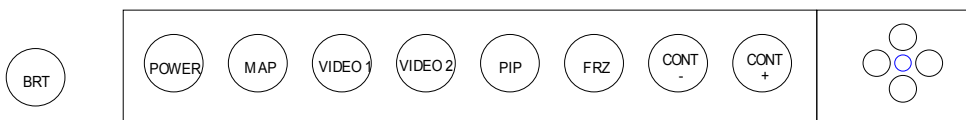
This specification applies to the 210mm (8.4") Colour TFT-LCD Display AVDU-2100-01 and its variants. The display supports the XGA (1027(H) x 768(V)) screen format and 16.7M colours (RGB 8/6-bits data) at high response speeds optimised for high-speed motion video typical in airborne surveillance applications.

This Display contains:

- Power input filter and Power supply module
- Video display driver Panel Electronic Circuit (PEC )
- Inverter PEC for the backlight
- Backlight light box assembly



Standard control panel key designation.





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### Physical

	Specification	Remark
Display resolution (Pixels) (1 pixel = RGB dot triplet)	1024 x 768 XGA	
Active Area	170.9 (H) x 127.9 (V) mm	
Screen size	8.4" (213.4mm) diagonal	
Pixel Pitch	0.1665(W) x 0.1665(H) mm	
Colour configuration	R, G, B, vertical stripe	

Miscellaneous	
Safety	The design of the monitor is such that any failure will not result in a hazardous condition and provides fail-safe features for safety of personnel during the installation, operation, maintenance and repair
Input protection	Short circuit to Chassis of any input will not damage the equipment nor cause an unsafe condition.
Output protection	Short circuit to earth of any output will not damage the equipment nor cause an unsafe condition.
Bonding	All metallic parts are bonded with a max resistance between any two parts of 0.5Ω.
Earthing	The equipment is earthed internally to a chassis bonding tag connected to Pin C of the power connector. All D.C. neutral or negative connections as well as signal returns are brought-out via the external connectors and separated from each other. (exception made for R.F. circuitry)
Insulation Resistance	Insulation between any two points of this equipment not electrically connected to each other is at least 20M ohms. This measurement is made on a complete item of equipment.
Cooling	Cooling of the equipment is by natural convection. The installer must ensure that the case temperatures are not exceeded. (See explanation in Backlight section)



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DESIGN AND PRODUCTION	
Components, materials and processes	Standard parts are used wherever possible. As a general rule, the use of non-approved components is avoided. Where this is not possible, components are selected to meet the conditions of the particular specification of the equipment.
Metallic materials	Metallic materials used for manufacturing the equipment are consistent with the grades selected by the national and international aviation standards. The materials used are adequately protected against corrosion of any origin by using only qualified methods that are sufficiently efficient considering the environmental conditions to be found on the aircraft.
Flammable materials	Materials employed in the equipment design and manufacturing do not promote combustion. In event of fire the metallic and glass construction of the case does not sustain nor support combustion and no hazardous quantities of toxic or noxious (e.g. smoke) products will be distributed in the crew / cargo compartments.
Finishing	Equipment external surfaces are finished Matt Black
Interchangeability	All parts built with the same part number (P/N) or drawing number are functionally and dimensionally interchangeable with each other.
Identification and marking	Information on the equipment identification label is as follows: <ul style="list-style-type: none"> <li>• Manufacturer's name</li> <li>• Item description</li> <li>• Part Number</li> <li>• Serial Number</li> <li>• Date of Manufacture</li> <li>• Identification Firmware revisions (where applicable)</li> </ul>



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### Functions

<b>Display panel</b>	
Vertical refresh rate	60Hz at XGA (1024x768) and up to 85Hz at other lower resolution
Dot clock (pixel clock)	maximum 280MHz
<b>Graphics Input (1 off)</b>	
Graphics formats	Standard VESA VGA, SVGA, XGA, SXGA & UXGA (scaled);
Graphics Connectivity	VGA / SVGA / XGA / SXGA / UXGA analogue
Graphics input (auto mode detect )	VGA, SVGA, XGA, SXGA & UXGA interlaced and non-interlaced standard with automatic detection of: Digital Separate Sync; Composite Sync, Sync On Green.
<b>Video Inputs (6 off)</b>	
Video formats	PAL, NTSC & SECAM,
Video inputs	x2 Composite video - With Loop through outputs x2 S-Video x2 Component video (YCbCr) or RGB Video or STANAG 3350/B/C
<b>Control Functions</b>	
OSD menu functions	On screen display (OSD) of functions Image controls: Panel brightness/contrast, Colour Temperature, Video Adjustment, Video System, Position, PIP, Rotation, Gamma, Video Scaling, Language, Video source, Utilities,
Display controls	Power On/Off Backlight brightness Video Source select OSD Menu OSD Select up OSD Select down Setting + Setting -
Settings memory	Settings are stored in non volatile memory



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### Optical Specifications

	Condition	Min	Typ	Max	Notes (see over)
Display response					
Rise time	$\theta=0^\circ T_r$		10mS	25mS	Note 4
Fall time	$\theta=0^\circ T_f$		10mS	25mS	
Contrast Ratio	$\theta=0^\circ$	TBD	500		Note 3 and 5
Viewing angle	$CR \geq 5$	Right=85° Left=85° Down=85° Up =85°			
Brightness (*Centre)	$\theta=0^\circ$	TBD	300 Cd/m <sup>2</sup>	350 Cd/m <sup>2</sup>	
Colour chromaticity (CIE)	$\theta=0 W_x$ $\theta=0 W_y$				Note 3
White Uniformity	$\delta_w$		0.8	0.71	Note 3,8

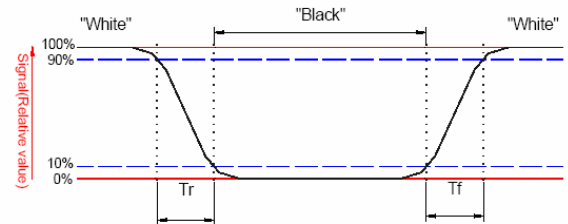
Notes (see next page)

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### Notes:

1. Ambient temperature 25°C
2. Measured in a dark room with the backlight warmed up for 30 min
3. Measured with a viewing cone of 1 (e.g. Topcon luminance meter BM-5A)
4. Definition of response time:

The output signals are measured when the input signal changes from "Black" to "White" (falling time) and "White" to "Black" (Rise time). The time interval is measured between 10% and 90% of the signal amplitude (see diagram)

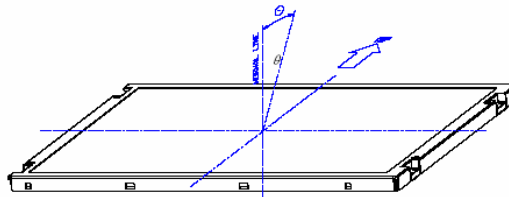


5. Definition of Contrast Ratio

Contrast ratio is calculated with the following formula:

Contrast Ratio(CR)=Brightness in the "ON" state"/Brightness in the OFF" state.

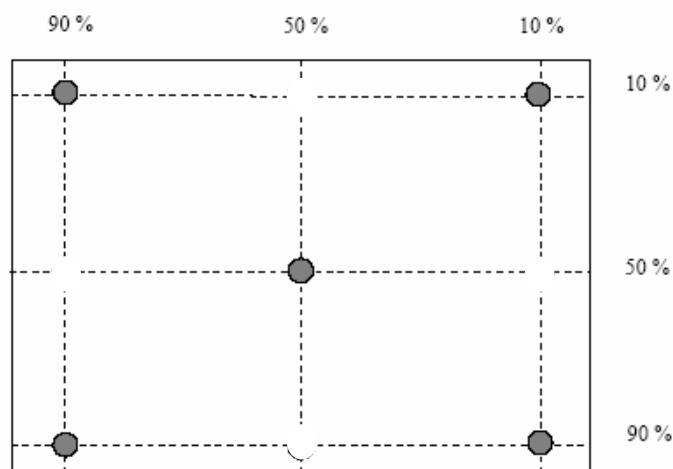
6. Definition of Viewing angle:



7. Definition of White uniformity

White uniformity is measured with the following formula based on five point readings:

$\delta_w = \text{minimum brightness of five points} / \text{maximum brightness of five points}$



### Infra-red transmission

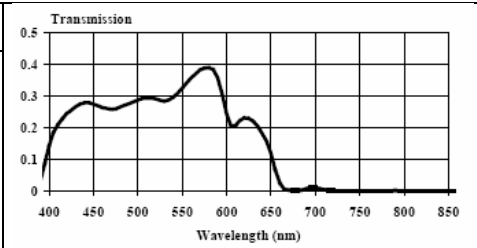
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The AVDU-2100-xx is available with three front window options

- AVDU2100-01 – Polarised
- AVDU-2100-02 – NVG filtered (Etched Surface)
- AVDU-2100-03 – Clear glass (Etched surface)

a. AVDU2100-01 – Anti reflective, Polarised, contrast enhancing (Etched front surface)

b. AVDU-2100-02 – NVG filter performance to full colour NVIS class B

Source	Transmission	Colour (x, y)	Colour (u', v')	(NR) <sub>b</sub>	Transmission
CCFL	29%	0.31, 0.387	0.181, 0.497	$<2.2e^{-9}$	

c. AVDU-2100-03 – Clear glass – Anti reflective – Etched front surface

### Maintenance

There are no user serviceable parts inside the unit.  
1st Line maintenance - Cleaning of Front Window

### Display Quality

The display quality of the Colour TFT should be in compliance with the Real-Time-Vision Quality Inspection standard.

### Handling Precautions

Handling of the Display should be in compliance with Real-Time Vision's handling principles.

- 1) Since front window is an optical assembly and is easily damaged, observe precautions in order not to scratch it.
- 2) Be sure to turn off power supply when inserting or disconnecting the input connectors.
- 3) Wipe off water or fluid droplets immediately. Long contact with water or other fluids may cause discoloration or spots.
- 4) When the front window surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take adequate static electricity precautions and ensure correct human earth bonding when handling.
- 7) Do not open nor modify the Assembly.
- 8) Do not press the front window sheet in any direction.
- 9) At the insertion or removal of the Power and Signal Interface Connector, ensure that the sockets are free from debris and be sure not to damage the Interface pins
- 10) After installation of the Display into a mounted position, do not twist nor bend the Display even momentary. When designing a suitable mounting, it should be taken into consideration that no bending/twisting forces are applied to the Display from outside. Otherwise the TFT -LCD module or backlight may be damaged.



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### Safety

#### Sharp Edge Requirements

There are no sharp edges or comers on the display assembly that could cause injury.

#### Materials

##### Toxicity

There are no carcinogenic materials used anywhere in the display module. Where toxic materials are used, they will be reviewed and approved by the responsible ADT Toxicologist.

##### Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process. The PECs (Panel Electronic Circuit) boards will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board where appropriate.

##### Capacitors

Where polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

##### Hazardous Voltages

Any point exceeding 42.4 volts meets the requirement of the limited current circuit. The current through a 2K $\Omega$  resistance is less than 0.7 x f (kHz) mA.

#### LIMITATION OF LIABILITY

The manufacturer's liability for damages to customer or others resulting from the use of any product supplied hereunder shall in no event exceed the purchase price of said product.

#### IMPORTANT USAGE NOTE

This equipment is for use by developers and integrators, the manufacturer accepts no liability for damage or injury caused by the use of this product. It is the responsibility of the developer, integrators or other user of this product to:

- Ensure that all necessary and appropriate safety measures are taken.
- Obtain suitable regulatory approvals as may be required.
- Check power settings to all component parts before connection.

#### Disclaimer

Real-Time Vision reserves the right to make changes to this document and the product which it describes without notice. In addition, Real-Time vision. shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance, and use of this product.

This product shall not be used for or in connection with equipment that requires an extremely high level of reliability, such as life critical systems, nuclear power control equipment and medical or other life support equipment. Real-Time Vision. takes no responsibility for damage caused by improper use of this product which does not meet the conditions for use specified in this specification sheet.