

# COMBAT DISPLAY KIT™

Military-Grade, Sunlight Readable, LED Backlit, NVIS Compliant, 15.4" LCD Display Kit

General Digital is pleased to introduce the 15.4" Combat Display Kit. Designed to meet the stringent requirements of the Joint Light Tactical Vehicle (JLTV) program for military ground vehicles, its modular design is ideal for other demanding military, industrial or maritime applications. The default configuration for 15.4" Combat Display Kit consists of the following:

- Optically enhanced 15.4" LCD display
- Unique and revolutionary, field replaceable, sunlight readable / NVIS compliant LED backlight (Patent Pending)
- Integrated optical heater
- Thermal and optical sensors
- Machined LCD replacement bezel and protective rear enclosure

General Digital has selected a high resolution (1680 x 1050 pixels), 15.4" display as the foundation of our design. The commercial-grade, OEM LCD frame has been replaced with a custom, machined (MIC6 cast aluminum) frame/bezel for increased support and durability. A milled out compartment beneath the bezel houses both the LCD and an optical heater. Eight (M3) mounting holes with helicoil inserts (located on left and right sides) provide integrators with twice as many mounting points as the OEM LCD which presents a myriad of mounting options. The additional mounting holes facilitate the integration of the Combat Display Kit into fully sealed enclosures. To ensure that the bonded display does not develop compression birefringence or delaminate, uniform and evenly distributed pressure is applied to all four edges of the display against a gasket or O-ring.

General Digital has redesigned the LCD to accommodate an LED backlight that is capable of producing up to 2,400 nits of luminance at the viewing surface of the LCD (excluding heater, touchscreen or other overlays), but can be operated at lower brightness to conserve on power and reduce heat emissions. Most commercial LED backlights drive their LED rails in a serial manner. While this approach is the least expensive to implement, a single LED failure will render an entire rail inoperable, a catastrophe to a mission critical application. Our LED rails use a serial-parallel design, whereby the LEDs are driven in groupings of four. A single LED failure will affect only its immediate grouping (Figure 1), leaving the remaining groups fully operational. In addition to the backlight adhering NVIS guidelines (per MIL-L-3009), General Digital has carefully selected its NVIS LEDs and filters to also allow "White Test" requirement compliance. Our unique backlight design has been skillfully engineered to simplify the process of replacing the internal LED rails in the field. The highly efficient LED backlight cleverly addresses thermal management to ensure that the LCD does not overheat, which allows the LEDs to operate at their greatest efficiency. An integrated optical sensor reports the brightness of the backlight while an integrated thermal sensor reports the temperature of the LED rails.

A 90% transmissive ITO (10 ohm/sq) heater is optically bonded to the LCD to achieve the greatest thermal efficiency and to create a highly shock and vibration resistant assembly.

An optional 5-wire resistive, sunlight readable, antireflective coated touchscreen (with and without copper wire ITO mesh) is available to be mechanically mounted on top of the machined frame. Although the 15.4" Combat Display Kit is offered as a kit, it can also be purchased as a turnkey monitor, complete with integrated controllers for video, backlight control, heater management, touch and calibration/control. Consult with an Application Engineer to discuss these and other options.



QUICK LOOK

## MECHANICAL

- » Machined Front Bezel
- » Rugged, All-Metal Construction
- » Field-Removable Bracket for LED Rails
- » Rear Cover Protects LCD Electronics

## DISPLAY

- » 15.4" Diagonal Active Matrix TFT LCD
- » WSXGA+ (1680 x 1050 pixels) Resolution
- » Wide Viewing Angles (Horizontal & Vertical)
- » Fast Response Times
- » Extended Operating Temperatures

## SUNLIGHT READABLE BACKLIGHTS

- » LED Backlight Produces LCD Surface Brightness (Excluding Overlays) of:
  - 2,400 Nits @ 34 Watts
  - 1,500 Nits @ 23 Watts
  - 1,000 Nits @ 14 Watts
  - 550 Nits @ 5.5 Watts

## LED BACKLIGHT (Patent Pending)

- » Innovative, Low Power, High Performance Design
- » Sunlight Readable Luminance per MIL-L-85752-A
- » NVIS Compliant per MIL-L-3009
- » Field-Replaceable Sunlight Readable and NVIS LED Rails
- » Optical Sensor Provides Luminance Feedback
- » Temperature Sensor Indicates Display is Beyond Operation Limits

## NVIS

- » Programmable Brightness Range (with Optional LED Controller)
- » Meets the MIL-L-3009 White Test

## LCD HEATER

- » Fully Integrated
- » Optically Bonded to Improve Thermal Efficiency and Resistance to Shock and Vibration

## OPTIONS

- » Integrated Control Electronics
  - Video Controllers; LED Controllers; Heater Controllers; Touchscreen Controllers; Calibration and OSD Controllers
- » Touch Screens (with and without ITO Shielding)
- » EMI / RFI Filters
- » Vandal Shields
- » Power Supplies
- » Custom Enclosures
- » Optical Bonding and Film Lamination Services

**Designed and Manufactured in the U.S.A.**

**GD GENERAL DIGITAL**  
The Innovators of Flat Panel Technology

**DISPLAY/BACKLIGHT**

	Size (Diagonal)	Backlight Type	Viewing Area (W x H)	Resolution (Pixels)	Number of Colors	Luminance (0° Max.) <sup>1</sup>	Contrast (Max.) <sup>1</sup>	Power (Watts)	Response Time (Rise/Decay)	Horizontal Viewing Angle	Vertical Viewing Angle	Shock <sup>2</sup>	Vibration <sup>2</sup>
CDK-15A-949	15.4"	LED	13.04" x 8.15"	1680 x 1050	262,000	1,000 Nits	TBD	14	16 ms	± 65°	± 55°	180 G, 2 ms, ½ Sine Wave	1.5 G (10–500 Hz)
CDK-15A-949 w/Heater	15.4"	LED	13.04" x 8.15"	1680 x 1050	262,000	900 Nits	TBD	14	16 ms	± 65°	± 55°	180 G, 2 ms, ½ Sine Wave	1.5 G (10–500 Hz)
CDK-15A-949 w/Heater & Touch	15.4"	LED	13.04" x 8.15"	1680 x 1050	262,000	700 Nits	TBD	14	16 ms	± 65°	± 55°	180 G, 2 ms, ½ Sine Wave	1.5 G (10–500 Hz)

**1** Brightness and Contrast values reflect measurements obtained with a Minolta® CS100 photometer; these values are nominal and may vary.

**2** Shock and Vibration data reflect parameters for baseline industrial monitors. Military-grade monitors could sustain even greater shock and vibration levels. Please inquire with a Sales Engineer for more information.

**HEATER** All Equipped Models

Surface Treatment	Resistivity	Transmission	Substrate
Antireflective	10 Ohm, ± 15%, U-Shaped Busbar	90%	Corning Glass 1737F (1.1 mm)

**MTBF** All Models

Display	Backlight <sup>3</sup>
> 50,000 Hours (Minimum)	> 50,000 Hours (Typical)

**3** The hours for MTBF refer to the half-life of the bulbs; that is, the point at which the bulbs reach half of their original brightness. *It does not indicate the life expectancy of the bulbs.*

**ENVIRONMENTAL**

	Temperature, Operating	Temperature, Storage	Humidity, Operating	Humidity, Storage	Altitude, Operating	Altitude, Storage
Display Only	0° C to 50° C <sup>4</sup>	-20° C to 60° C	10% to 90% RH Non-condensing	10% to 90% RH Non-condensing	10,000 Feet	40,000 Feet
Display w/Heater	-46° C to 50° C <sup>5</sup>	-20° C to 60° C	10% to 90% RH Non-condensing	10% to 90% RH Non-condensing	10,000 Feet	40,000 Feet

**4** Clearing Point >= 70° C

**5** Survives 240 hour soak at -46° C

**MECHANICAL** All Models

Dimensions (H x W x D)	Construction	Finish	Mounting Holes	Weight, Operating	Weight, Shipping
14.125" x 9.25" x 0.750"	5052-H32 Aluminum / MIC6 Cast Aluminum / Copper Alloy 110	Irridite (Aluminum Only)	Side Mounting, 4 Places Each Side, M3	7 Pounds (Base Model)	13 Pounds (Base Model)

**I/O CONNECTIONS** All Models

Display Data	Heater	Optical Sensor	Touch Sensor	High Bright LCD	NVIS LED
JAE FI-XB30SR-HF11	Leads	Leads	Leads	Leads	Leads

**CALIBRATION & USER CONTROLS** All Models

dd <sup>6</sup>	Interface	Functions	Advanced
35, 52	On-screen Displays Navigated by 10-button Membrane Pad	Brightness, Contrast, Phase, Clock, Saturation, Hue, Sharpness, Scaling (Fill Screen, Fill to Aspect Ratio), Image Position (Horizontal & Vertical)	Auto Source Seek, Auto Picture Setup, Auto Color Gain, Auto Power Off, Picture-In-Picture (Variable Position, Any Input Combination, 3 Sizes), Color Temperature, Programmable Hot Keys, OSD (Position, Timeout, Language, Transparency), Video Standard, Image Orientation (Horizontal & Vertical Image Inversion, Rotate), Gamma, Serial Port Protocol, Day Mode, Night (NVIS) Mode

**6** See Video Controller chart below

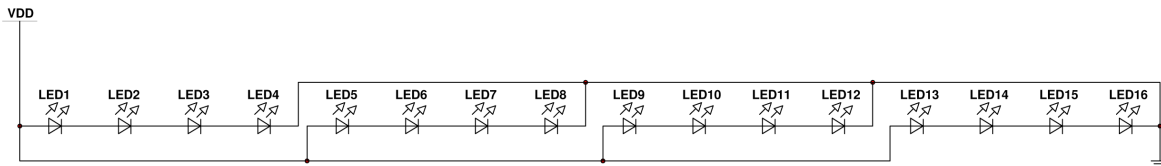


Figure 1: Serial-Parallel LED Layout

## OPTIONS

All Models (Ordered Separately – Please Inquire with a Sales Engineer for Additional Options and Accessories)

### VIDEO CONTROLLER

dd	Analog RGB & DVI-D	Video	Resolution/Frequency <sup>7</sup>								Scaling
			640 x 480 VGA	800 x 600 SVGA	1024 x 768 XGA	1280 x 1024 SXGA	1366 x 768 WXGA	1440 x 900 WSXGA	1600 x 1200 UXGA	1680 x 1050 WSXGA+	
35	Digital, Separate, Composite, Sync-on-Green, DVI-D	NTSC / PAL / SECAM (Interlaced), Composite, S-Video, RGB, SD Component	60, 72, 75 Hz	56, 60, 72, 75 Hz	60, 70, 75 Hz	60 Hz	60, 75 Hz	60 Hz	60 Hz	60 Hz	On / Off
52	Digital, Separate, Composite, Sync-on-Green, DVI-D	NTSC / PAL / SECAM (Interlaced), Composite, S-Video, RGB, SD Component, HD-SDI	60, 72, 75 Hz	56, 60, 72, 75 Hz	60, 70, 75 Hz	60 Hz	60, 75 Hz	60 Hz	60 Hz	60 Hz	On / Off

<sup>7</sup> Most common video modes listed. Other video modes supported. Speak with a Sales Engineer for more information.

### DISPLAY OVERLAY (Other Overlays Available – Please Inquire with a Sales Engineer)

gg	Description	Surface Hardness	Linearity	Linearity Force	Surface Treatment
54	Resistive Touch Screen, 5-Wire, Sunlight Readable, Glass/Film/Glass	7H	< = 1.5%	250 g	Antireflective
55	Resistive Touch Screen, 5-Wire, Sunlight Readable, Glass/Film/Glass with EMI Copper Wire Mesh	7H	< = 1.5%	250 g	Antireflective

### POWER SUPPLY<sup>8</sup>

hij	Input Voltage Range	Output	Frequency Range	Line Entry Module/Filter	Power Factor
EPO2 (Rear Mount)	85–264 VAC	75 W / +12 VDC	47–63 Hz	Yes	0.95
EPO3 (Rear Mount)	85–264 VAC	100 W / +12 VDC	47–63 Hz	Yes	0.99

<sup>8</sup> Most popular power supply options listed. For a complete list, please contact an Applications Engineer.

### OTHER

Optical Enhancements	Bonding of Overlay and Display Using Indice-Matched Optical Materials; Brightness and Contrast Enhancing Films and Laminations
Power Supplies	AC and DC Supplies; Various Input Ranges, Input Frequencies; Separate or Attached; Power Factor Correction; AC and DC Power Cables
Video Accessories	Video Cables; Signal Extenders; Cable Adaptors (HD 15-pin, 13W3 [SUN], BNC); NTSC/PAL Support
Remote Control	IR or Serial Calibration/Control Interface
Customization	Custom Mechanical and Electrical Modifications; Custom Finishing; Custom Software and Performance Modifications; Private Labeling

### MODEL NUMBER CONFIGURATOR<sup>9</sup>

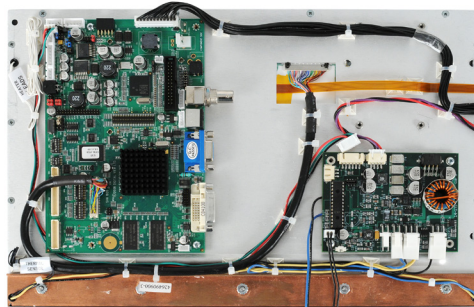
Model Style	Size & Resolution (aab)	Display (ccc)	Video Controller (dd)	Keyboard/Pointer (ee)	Industrial Enclosure (ff)	Display Overlay (gg)	Power Supply (hij)	Special
CDK-	15A-	949-	##-	00-	17-	##-	####	–
CDK-	15A-	949-	##-	00-	17-	##-	####	H
CDK-	15A-	949-	##-	00-	17-	##-	####	HT

<sup>9</sup> The pound symbol (#) indicates customer-defined values.

### ORDERING

Model Number <sup>10</sup>	Description
CDK-15A-949- <b>dd</b> -00-17- <b>gg-hij</b>	Open Frame Display Kit, 15.4" Diagonal, WSXGA+, Widescreen, Sunlight Readable, NVIS Compliant, Ruggedized LCD Monitor
CDK-15A-949- <b>dd</b> -00-17- <b>gg-hij</b> -H	Open Frame Display Kit, 15.4" Diagonal, WSXGA+, Widescreen, Sunlight Readable, NVIS Compliant, LCD Heater, Ruggedized LCD Monitor
CDK-15A-949- <b>dd</b> -00-17- <b>gg-hij</b> -HT	Open Frame Display Kit, 15.4" Diagonal, WSXGA+, Widescreen, Sunlight Readable, NVIS Compliant, LCD Heater, Touch Sensitive, Ruggedized LCD Monitor

<sup>10</sup> **Bold Italicized letters** refer to standard customer-defined configurations (see Model Number Configurator above).



Rear view of Combat Display Kit



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