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Type No. **T-51750-SERIES**

LCD MODULE APPLICATION NOTE

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References:

(a) T-51750GD065J-FW-AA LCD Module Technical Specification First Edition 4 December 2003.

(b) T-51750GD065J-FW-AB LCD Module Technical Specification First Edition 24 October 2003.

(c) T-51750AA Series Drawing UE-311848A dated 31 October 2003

1. PURPOSE

1.1. This application note provides information for transitioning from the T-51382-series 6.4-inch thin film transistor (TFT) display to the T-51750-series 6.5-inch display. This document identifies performance and specification differences as well as instructions for direct replacement.

2. T-51750 ERRATA SPECIFICATIONS

2.1. Section 1 of reference (a) identifies the LCD type as normally-white mode / transflective which is not correct. The display is normally-white mode / transmissive.

3. T-51750-SERIES & T-51382-SERIES GENERAL DIFFERENCES

3.1. Table 1 identifies major characteristics of the T-51750 and T-51382 display families. The T-51750-series are smaller, more power efficient, and higher performing display over the series it replaces.

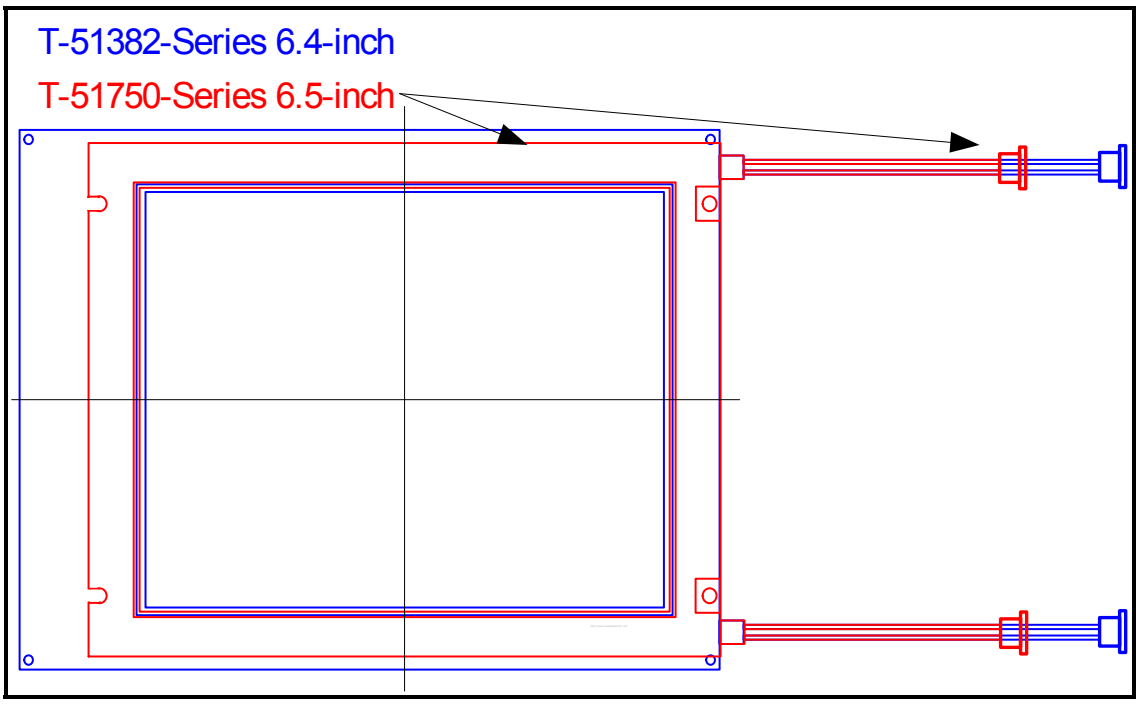
Table 1 -- T-51750-Series & T-51382-Series Characteristics

	T-51750	T-51832			
	-AA & -AB	-AA	-AC	-AD	Notes
Operating Temperature	0° - 60° C	0° - 55° C	-20° - 70° C		
Storage Temperature	-25° - 70° C	-25° - 70° C	-30° - 70° C		
Dot Pitch	0.69 x 3[RGB] x 0.207 mm	0.675 x 3[RGB] x 0.203 mm			T-51750 larger pixel increases aperture ratio which improves color and contrast.
Active Area	132.5 x 99.4 mm	129.6 x 97.4 mm			T-51750 has 4% larger area.
Dimensions	158.0 x 120.36 x 11.55 mm	175.0 x 126.5 x 12.0 mm			15% length reduction 4.5% width reduction 4% height reduction
Weight	190 g	335 g			43% reduction in weight.
Surface treatment	AG on -AA AR on -AB	None			AG – anti-glare coating for reduced reflections (matte surface) AR – anti-reflective coating to reduce glare (caused by index of refraction differences) and improve sunlight readability (AR coating is a specular surface)
CCFL cable length	70 mm	95.25 mm			
Display symmetric about vertical axis	Yes	No			Symmetric display and reverse scan capability allow selection of best viewing direction (6:00 or 12:00) by rotating display and reversing the image.
Display symmetric about horizontal axis	Yes	No			

4. T-51750-SERIES & T-51382-SERIES MECHANICAL DIFFERENCES

4.1. The T-51750-series display outer dimensions are smaller than its predecessors, but has a larger active area. The display is also symmetric about its horizontal and vertical centerlines. Symmetry allows display rotation to alter the viewing angle without requiring housing re-design. Customers do not need to stock different part numbers to have 6:00 and 12:00 viewing displays. See reference (c), Table 1, Figure 1 and Figure 3.

Figure 1 -- T-51382 to T-51750 Size Comparison at Active Area Center



5. T-51750-SERIES & T-51382-SERIES ELECTRICAL DIFFERENCES

5.1. The T-51750 can accept 3.3 V or 5 V logic and power. The T-51382-series are 5 V devices. This power supply change alters the absolute maximum ratings and electrical characteristics.

Table 2 -- T-51750 & T-51382 Electrical Differences

	T-51750	T-51832			
	-AA & -AB	-AA	-AC	-AD	Notes
Vcc Maximum Input Voltage	5.5 V	6.0 V			
Minimum Logic Input Voltage	0 V	-0.3 V			
Maximum Logic Input Voltage	7.0 V	Vcc+0.3 V			
TFT Array & Logic Power Consumption	0.792 W @ 3.3 V & 0.9 W @ 5 V	1.3 W			
Max CCFL Voltage	1500 VAC	Not Rated			
CCFL Starting Voltage	520 Vrms	Not Rated			
CCFL Running Voltage	320 Vrms	380 Vrms			
CCFL Max Current	7.0 mA	Not Rated			

	T-51750	T-51832			
	-AA & -AB	-AA	-AC	-AD	Notes
CCFLTypical Power Consumption	3.84 W	4.56 W			IL = 6.0 mA T-51750 Efficiency is 104 Cd/M^2/W T-51382 –AA & AC is 65 Cd/M^2/W T-51382 –AD is 88 Cd/M^2/W
CCFL Lifetime	30,000 Hours (min)	20,000 Hours (typical)			IL = 6.0 mA
CCFL Frequency	40 to 80 KHz	35 KHz			
Total Display Power Consumption	4.632 W @ 3.3 V & 4.74 W @ 5 V	5.86 W			At maximum luminance. 21% reduction in power consumption.
Logic Voltage High	2.4 to 5.5 V	2.6 to 5.5 V			T-51750 definitions are for 3.3 V or 5 V logic. T-51382 values are for 5 V logic.
Logic Voltage Low	0 to 0.8 V	0 to 0.5 V			T-51750 definitions are for 3.3 V or 5 V logic. T-51382 values are for 5 V logic.

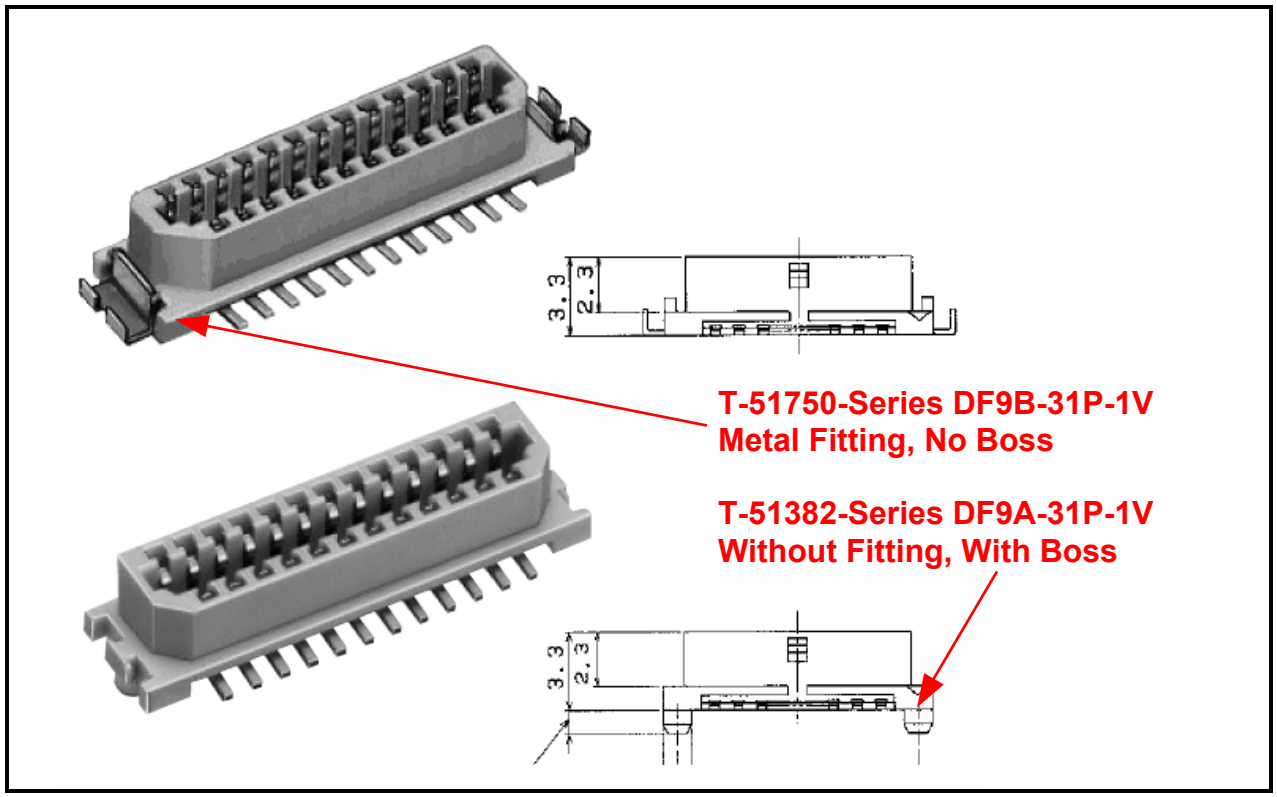
5.2. The T-51382-series offered alternative display resolutions based upon the polarity of the Vsync and Hsync signals. The display modes are: VGA-480, VGA-400, VGA-350, and freedom-mode. In these modes, the 640x480 display centers the smaller format on the screen with black bars to the top and bottom. The T-51750-series does not provide this function.

5.3. The T-51750-series use the Hirose DF9B-31P-1V and T-51382-series use the Hirose DF9A-31P-1V. Both are male, 31-pin, 1 mm pitch connectors with unique orientation keying. The difference between the two part numbers are connector features:

DF9A-31P-1V – Has a mounting boss, but no mating retention features.

DF9B-31P-1V – Does not have a mounting boss, but has a metal fitting for positive retention. Please see Figure 2.

Figure 2 -- Hirose DF9-series Connector Differences



5.4. The T-51750 uses a JST BHR-02(8.0)VS-1N CCFL connector. The JST USA catalog part numbering (see the following table) for the BH-series crimp connector leads to the conclusion the CCFL connector part number is incorrect and should be BHR-03VS-1. The difference in part numbers is due to the catalog used (Japan versus USA). The BHR-03VS-1 is a plastic housing; the end user must insert crimp pins.

Circuits	Pitch mm(in.)	Model No.	Dimensions mm(in.)		Q'ty / bag
			A	B	
2	4(.157)	**BHR-02VS-1**	4.0(.157)	9.8(.386)	1,000
	8(.315)	**BHR-03VS-1**	8.0(.315)	13.8(.543)	1,000
	12(.472)	**BHR-04VS-1**	12.0(.472)	17.8(.701)	1,000
3	4(.157)	**BHR-03VS-1**	8.0(.315)	13.8(.543)	1,000
4	4(.157)	**BHR-04VS-1**	12.0(.472)	17.8(.701)	1,000

Material
Nylon 66, UL94V-0, natural (white)

The difference in part numbering schemes creates confusion. JST Japan eliminates this confusion by describing the part as follows:

BHR-number of circuits(pin pitch)VS-1N

This system describes a 2 conductor crimp connector with 8.0 mm pin pitch. The mating connector then is the SM02(8.0)B-BHS-1-TB. . The inverter should use these female, surface mount connectors. Please note the SM02(8.0)B-BHS-1-TB part number is valid in JST literature.

The T-51382-series used JST BHR-03VS-1 connectors with two circuit pins populated. This is the same connector as the T-51750-series.

5.5. Due to the connector match, CCFL running voltage, and current draw, the same inverter for the T-51382 can be used to run the T-51750. Inverter Sources for the T-51750 include:

TDK CXA-071	12 V input, analog voltage dimming inverter with open-lamp detection and output signal.
ERG LD3051	12 V input, analog voltage or pulse width modulation dimming inverter with output control.
ACI AC7-12-1392	12 V input, analog voltage dimming inverter with optional features for ON/OFF control, light sensing, and serial communication.

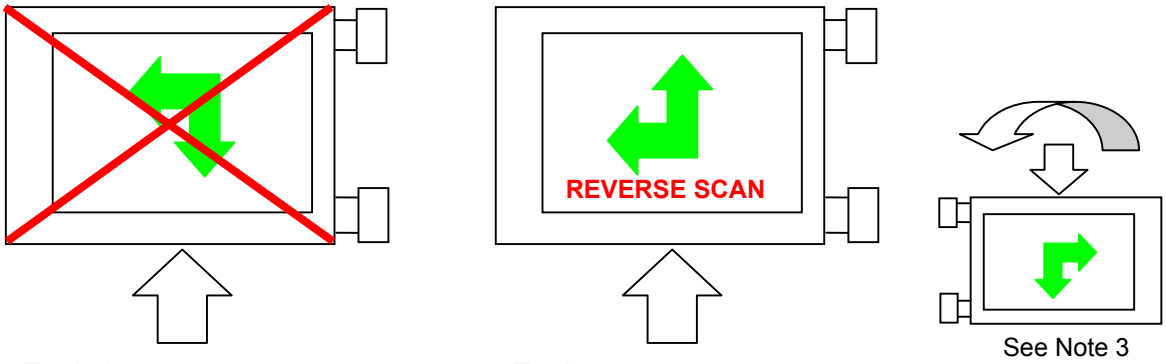
5.6. The T-51750 is compliant with the Video Electronics Standards Association (VESA) Generalized Timing Formula (GTF). Please note that some of the signal timing definitions have changed for the horizontal and vertical synchronization signals and data enable signal. Investigate timing differences as the principal cause of any failure to “plug and play” when switching from the T-51382 to the T-51750. DENA timing is critical as it centers the image on the display.

6. T-51750-SERIES & T-51382-SERIES I/O DIFFERENCES

6.1. Both display families use the same Hirose DF9-family connector. The differences between the displays are pins 30 and 31. T-51812 used pin 30 to control left / right scan and pin 31 controlled up / down scan. For the T-51750, the separate left / right and up / down scan controls are removed. A single pin, pin 31 REV, controls forward or reverse scan. Pin 30 is a test pin; do not connect.

6.2. Asserting the scan direction select pin (PIN 31 REV) and rotating the T-51750 display creates 12:00 viewing direction. See Figure 3. Optrex defines viewing direction as that with highest contrast ratio (this may not coincide with largest viewing angle).

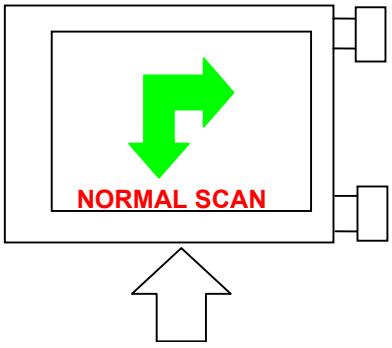
Figure 3 -- T-51750 & T-51382 Scan Direction Select



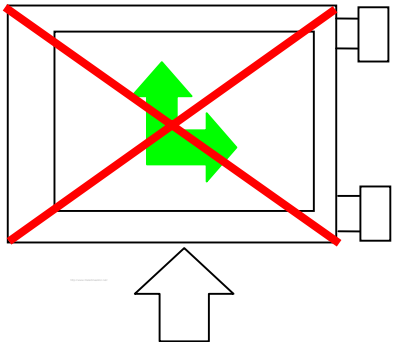
T-51382
Pin 30 R/L – Low (Scan Right to Left)
Pin 31 U/D – Low (Scan Top to Bottom)
T-51750
N/A

T-51382
Pin 30 R/L – Low (Scan Right to Left)
Pin 31 U/D – High (Scan Bottom to Top)
T-51750
Pin 31 REV – High (Reverse Scan)

See Note 3



T-51382
Pin 30 R/L – High (Scan Left to Right)
Pin 31 U/D – Low (Scan Top to Bottom)
T-51750
Pin 31 REV – Low (Normal Scan)



T-51382
Pin 30 R/L – High (Scan Left to Right)
Pin 31 U/D – High (Scan Bottom to Top)
T-51750
N/A

Notes:
1. Red X's indicates T-51382 features not available on T-51750.
2. All displays have the same digital image input. The only difference is the scanning direction. The 90° corner of the green arrows indicates the scan starting points.
3. Rotating the display 180° and using the reverse scan creates 12:00 viewing direction with normal image orientation.

7. T-51750-SERIES & T-51382-SERIES OPTICAL DIFFERENCES

7.1. shows the optical performance differences between the two displays. The optical performance of the T-51750 is superior to that of the T-51382.

Table 3 -- T-51750 to T-51382 Optical Differences

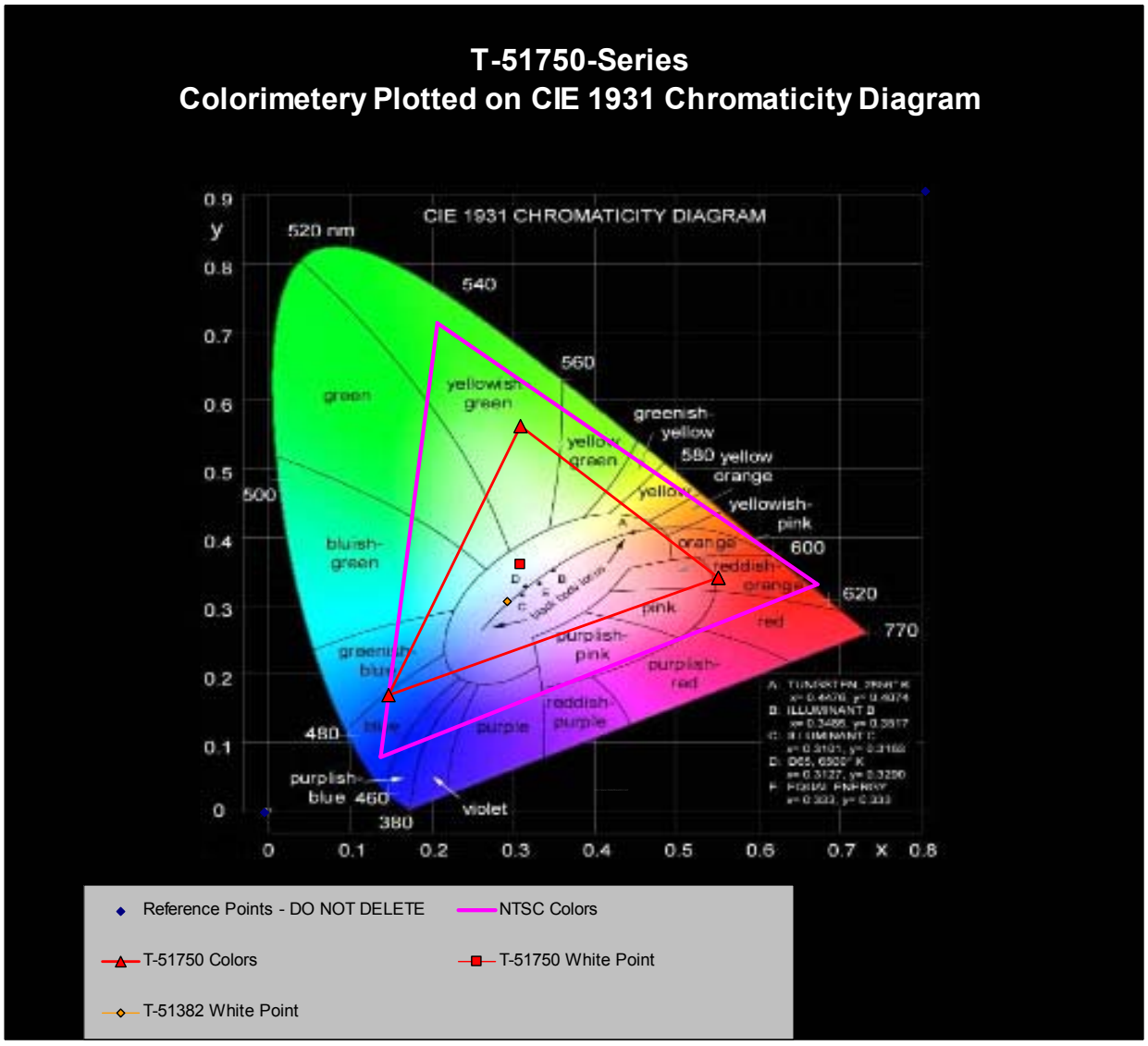
	T-51750	T-51832			
	-AA & -AB	-AA	-AC	-AD	Notes
Minimum Luminance	300 Cd/M^2	Not Rated		350 Cd/M^2	
Typical Luminance	400 Cd/M^2	300 Cd/M^2		400 Cd/M^2	
Minimum Contrast Ratio	150:1	100:1	120:1		
Typical Contrast Ratio	300:1	120:1	180:1		
Vertical Viewing Angle UP	30°	15°	40°		
Vertical Viewing Angle DOWN	60°	35°	55°		
Horizontal Viewing Angle RIGHT & LEFT	55°	55°	60°		
Response Time	31 mS	80 mS			T-51382 values are maximums
Haze	5%	Not Rated			See 7.2 and 7.3
Luminance Uniformity	0.7	Not Rated			

7.2. Optrex has introduced new specifications for HAZE and LUMINANCE UNIFORMITY for the T-51750. The HAZE specification applies to the –AA version and not the –AB.

7.3. Haze describes the amount of reflection in the specular direction without creating a virtual image of the source. A specular surface is mirror-like in its reflections; virtual images occur at some viewing angles. The T-51750GD065J-FW-AB is not rated for haze since its anti-reflective polarizer exhibits specular reflection.

7.4. Optrex has now added the CIE 1931 color coordinates of the red, green, and blue pels in addition to the white point. The T-51750 white chromaticity is shifted relative to the T-51382 due to the new color filter and CCFLs. Figure 4 shows the chromaticity coordinates relative to their colors. The display color gamut is 40.7% of the NTSC color triangle.

Figure 4 – T-51750-Series Colorimetry



8. T-51750-SERIES & T-51382-SERIES PACKAGING DIFFERENCES

8.1. T-51750-series displays are packaged 20 units per carton. The carton size is 483 mm x 356 mm x 229 mm. Carton weight is 5.9 Kg.

8.2. The T-51382-series are packaged 30 units per carton. The carton size is 680 mm x 440 mm x 250 mm. Carton weight is 13 Kg.

9. CONCLUSIONS

9.1. Optrex intends continuous updates to this document to ensure it is accurate and current. Optrex welcomes comments that improve the document or correct errors. Direct questions and comments to skelley@optrexusa.com.

Document Approvals

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