LSP HD

USER GUIDE

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LSPHD Linescanner Head

LAND®
AMETEK®

QUALITY CUSTOMER SOLUTIONS

IMPORTANT INFORMATION - PLEASE READ

Health and Safety Information

Read all of the instructions in this booklet - including all the WARNINGS and CAUTIONS - *before* using this product. If there is any instruction which you do not understand, DO NOT USE THE PRODUCT.

Safety Signs

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or personal injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to the user or users, or result in damage to the product or to property.

NOTE

Indicates a potentially hazardous situation which, if not avoided, could result in damage or loss of data.

Signs and Symbols used on equipment and Documentation

Caution, risk of electric shock.

Caution, attention to possibility of risk of damage to the product, process or surroundings. Refer to instruction manual.

Caution, hot surface.

Protective Conductor Terminal.

Observe precautions for handling electrostatic discharge sensitive devices.

Equipment Operation

Use of this instrument in a manner not specified by LAND may be hazardous. Read **and understand** the user documentation supplied **before** installing and operating the equipment.

The safety of any system incorporating this equipment is the responsibility of the assembler.

Protective Clothing, Face and Eye Protection

It is possible that this equipment is to be installed on, or near to, machinery or equipment operating at high temperatures and high pressures. Suitable protective clothing, along with face and eye protection must be worn. Refer to the health and safety guidelines for the machinery/equipment before installing this product. If in doubt, contact LAND.

Wear Protective Gloves

Wear Protective Clothing

Wear Eye Protection

Wear Ear Protection

Wear Safety Boots

Wear Face Protection

Electrical Power Supply

Before working on the electrical connections, all of the electrical power lines to the equipment must be isolated. All the electrical cables and signal cables must be connected exactly as indicated in these operating instructions. If in doubt, contact LAND.

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Contents

1 INTRODUCTION

Fig. 1-1 LSP$_{HD}$ Head

This User Guide is applicable to the following LSP$_{HD}$ variants:

LSP$_{HD}$ 10	LSP$_{HD}$ 5FL	LSP$_{HD}$ 60	LSP$_{HD}$ 71
LSP$_{HD}$ 11	LSP$_{HD}$ 50	LSP$_{HD}$ 61	
LSP$_{HD}$ 12	LSP$_{HD}$ 51	LSP$_{HD}$ 62	
LSP$_{HD}$ 20	LSP$_{HD}$ 52	LSP$_{HD}$ 63	
LSP$_{HD}$ 21			
LSP$_{HD}$ 22			
LSP$_{HD}$ 23			

The User Guide covers the installation, operation and maintenance of the LSP$_{HD}$ Linescanning Thermometer.

The instructions given in this User Guide guide should be used in conjunction with the documents listed below:

- LSP$_{HD}$ Linescanning Thermometer Installation Guide
- LSP$_{HD}$ System Mountings & Accessories Installation Guide

The LANDSCAN LSPHD SYSTEM uses high speed infrared detectors and precision electronics to provide accurate linescan temperature measurement at high scan rates.

The system is compact, yet rugged, providing reliable operation in the most severe industrial environments.

The **LANDSCAN LSPHD SYSTEM** comprises:

- LSPHD Linescanner Head
- LSPHD Ethernet Cable
- LANDSCAN for Windows Configuration Software
- LANDSCAN WCA Software (Optional)
- I/O Modules (Optional)

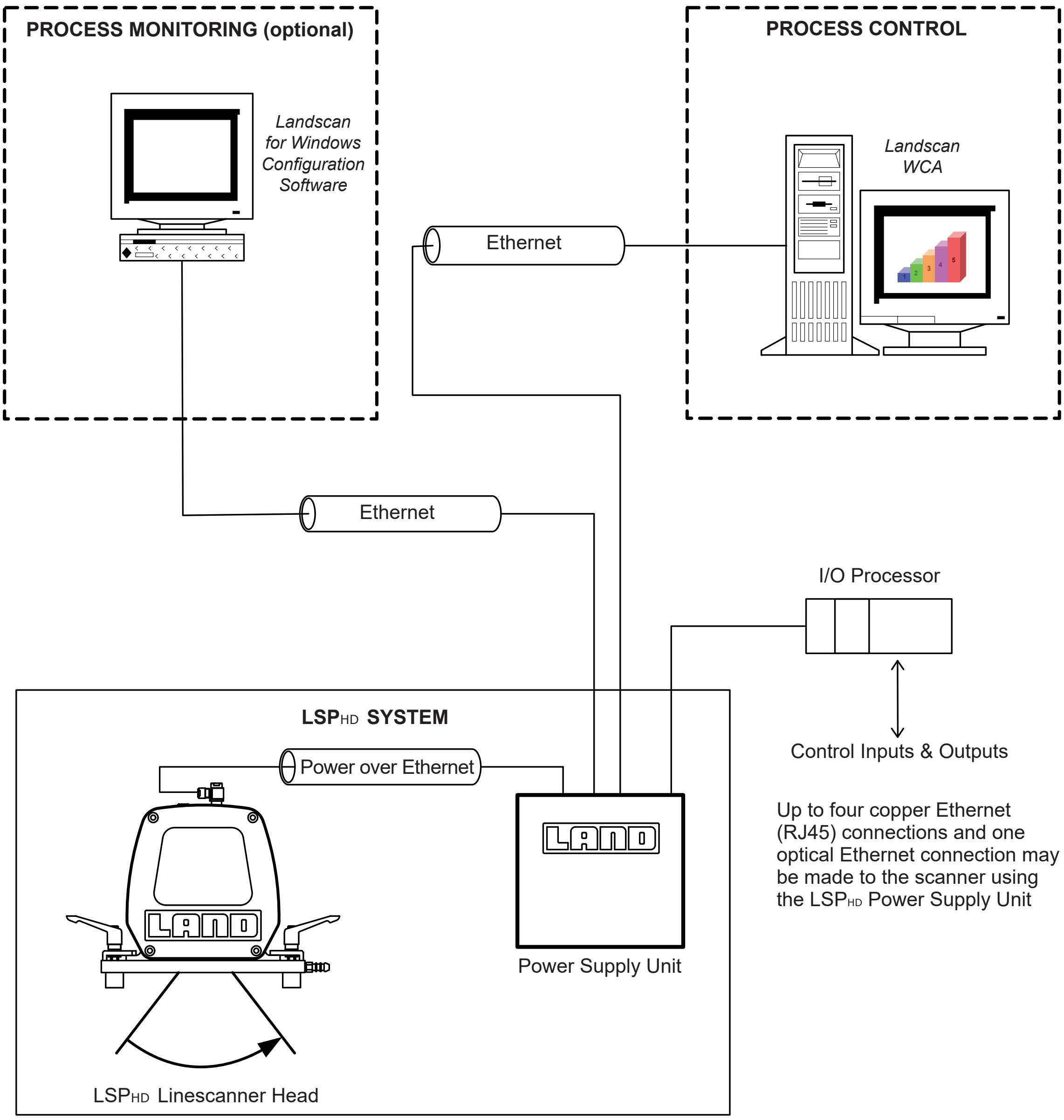
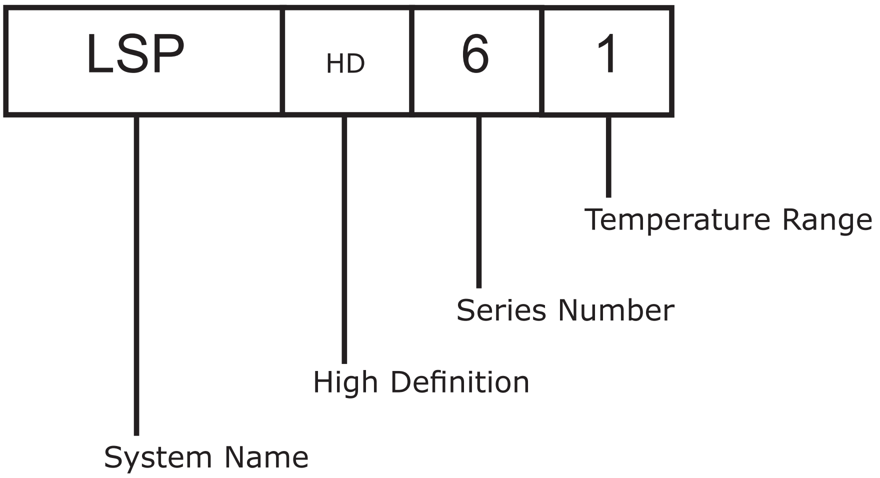


Fig. 1-2 Typical LSPHD System Overview

1.1 Nomenclature

The LSPHD Linescanning Thermometer detail label can be found on the black scanner body section. The label displays the scanner serial number, the model number and the 'CE' conformity mark. The model number indicates specific information about the unit, including 'Series Number' and 'Temperature Range'.

Example:



System Name:	LSP	LSP System
High Definition:	HD	Fast scan rate and High resolution
Series:	6	Operating Wavelength
Temperature Range:	1	See Specifications

1.2 Specifications - LSPHD Series

1.2.1 Common specifications

Ambient temperature range	5 to 60 °C / 41 to 140 °F (in specification) 5 to 70 °C / 41 to 158 °F (operating)
Alignment	Class 2 Laser indicating scan plane and extent Laser scan rate 1 Hz
Internal Ambient Temperature Sensor (IATS)	-10 to 90 °C / 14 to 194 °F
Emissivity range (remote or internally set)	0.20 to 1.00
Sealing	IP65
EMC	EN 61326 Class A [emissions & immunity]
LVD	EN61010-1
Vibration (Any axis)	2 g [10 to 30 Hz] 3 g [30 to 300 Hz]

1.2.2 LSPHD 1 series specifications

		LSPHD 10	LSPHD 11	LSPHD 12
Operating wavelength		1 µm	1 µm	1 µm
Temperature range		600 to 1400 °C 1112 to 2552 °F	700 to 1500 °C 1292 to 2732 °F	800 to 1700°C 1472 to 3092 °F
System Accuracy (1) (5 to 95% of range)		± 2°C / 3.6 °F		
Focus distance (2)		1 m / 39.7 in to infinity (continuously adjustable)		
Field of View (static to 95% of radiance)		500:1 (0.002 radians)		
Repeatability		< 0.5 °C / 0.9 °F		
Temperature Resolution (3) (noise)	< 5% of range	≤ 6 °C / 10.8 °F		
	< 15 % of range	≤ 6 °C / 10.8 °F		
	< 30 % of range	≤ 4 °C / 7.2 °F		
	Above 50 % of range	≤ 1 °C / 1.8 °F		
Scan Angle (4)		80 °		
Scan Rate	Factory set	50 Hz		
	User adjustable	10 to 150 Hz in 1 Hz steps		
Speed of response (Tau - linear output on rising edge)		≤ 1 µs		
Ambient Stability deltaT[indicated] / deltaT[ambient]		≤ 1 °/10 °		

(1) Includes error correction

(2) Focus is factory set to 2 m

(3) 4 line averaging below 15% of range

(4) Scan angle may be set in the range 40 to 80° by the PC software

1.2.3 LSP HD 2 series specifications

	LSP HD 20	LSP HD 21	LSP HD 22	LSP HD 23
Operating wavelength	2.2 µm	1.9 µm	1.9 µm	2.2 µm
Temperature range	200 to 850 °C 392 to 1562 °F	300 to 1000 °C 572 to 1832 °F	400 to 1200 °C 752 to 2192 °F	250 to 1000°C 482 to 1832 °F
System Accuracy (1) (5 to 95% of range)	±2 °C / 3.6 °F			
Focus distance (2)	1 m / 39.7 in to infinity (continuously adjustable)			
Field of View (static to 95% of radiance)	300:1 (0.0033 radians)	500:1 (0.002 radians)	500:1 (0.002 radians)	300:1 (0.0033 radians
Repeatability	< 0.5 °C / 0.9 °F			
Temperature Resolution (3) (noise)				
< 5% of range	≤ 6 °C / 10.8 °F	≤ 6 °C / 10.8 °F	≤ 6 °C / 10.8 °F	≤ 6 °C / 10.8 °F
< 15 % of range	≤ 6 °C / 10.8 °F	≤ 6 °C / 10.8 °F	≤ 6 °C / 10.8 °F	≤ 6 °C / 10.8 °F
< 30 % of range	≤ 2 °C / 3.6 °F	≤ 4 °C / 7.2 °F	≤ 4 °C / 7.2 °F	≤ 4 °C / 7.2 °F
Above 50 % of range	≤ 1 °C / 1.8 °F	≤ 1 °C / 1.8 °F	≤ 1 °C / 1.8 °F	≤ 1 °C / 1.8 °F
Scan Angle (4)	80 °			
Scan Rate — Factory set	50 Hz			
Scan Rate — User adjustable	10 to 150 Hz in 1 Hz steps			
Speed of response (Tau - linear output on rising edge)	≤ 1.5 µs	≤ 1 µs	≤ 1 µs	1.5 µs
Ambient Stability deltaT[indicated] / deltaT[ambient]	≤ 1°/10°			

(1) Includes error correction

(2) Focus is factory set to 2 m

(3) 4 line averaging below 15% of range

(4) Scan angle may be set in the range 40 to 80 ° by the PC software

1.2.4 LSP HD 5 series specifications

	LSP HD 5FL	LSP HD 50*	LSP HD 51	LSP HD 52*
Operating wavelength	5 µm	5 µm	5 µm	5 µm
Temperature range	150 to 750 °C 302 to 1382 °F	150 to 750 °C 302 to 1382 °F	250 to 850°C 482 to 1562 °F	500 to 1100 °C 932 to 2012 °F
System Accuracy (1) (5 to 95% of range)	± 2 °C / 3.6 °F	± 2 °C / 3.6 °F	± 2 °C / 3.6 °F	± 3 °C / 6.4 °F
Focus distance	Fixed at 1200 mm / 47 in			
Target width (static to 95% radiance) Target distance <1200 mm / 47 in Target distance 1200 to 3000 mm / 47 to 118 in	12 mm / 0.5 in Field of view of 100:1 (0.01 radians)			
Repeatability	< 0.5°C / 0.9 °F			
Temperature Resolution(2) (noise) Below 15% of range Above 15% of range	≤ 1.5 °C / 2.7 °F ≤ 1 °C / 1.8 °F	≤ 1.5 °C / 2.7 °F ≤ 1 °C / 1.8 °F	≤ 1.5 °C / 2.7 °F ≤ 1 °C / 1.8 °F	≤ 2.5 °C / 4.5 °F ≤ 2.5 °C / 4.5 °F
Scan Angle (3)	80 °			
Scan Rate Factory set	20 Hz	50 Hz	50 Hz	50 Hz
Scan Rate User adjustable	10 to 150 Hz in 1 Hz steps			
Speed of response (Tau - linear output on rising edge)	≤ 5 µs			
Ambient Stability deltaT[indicated] / deltaT[ambient]	≤ 2°/10°	≤ 2°/10°	≤ 2°/10°	≤ 3°/10°
Settling Time (4)	2 Hours			

*LSP HD 50 and LSP HD 52 as per LSP HD 5FL unless otherwise stated

(1) Includes error correction. Applies only 'in application'

(2) No line averaging. 4LA reduces noise by factor 2

(3) Scan angle may be set in the range 40 to 80 ° by the PC software

(4) For optimum performance, the thermoelectric cooler takes time to stabilise the detector thermally. This process takes longer at higher ambient temperatures.

1.2.5 LSPHD 6 series specifications

		LSPHD 60	LSPHD 61*	LSPHD 62*	LSPHD 63*
Operating Wavelength		3 to 5 µm	3 to 5 µm	3 to 4.2 µm	
Temperature range		20 to 250 °C 68 to 482 °F	50 to 400 °C 122 to 752 °F	100 to 600 °C 212 to 1112 °F	
System Accuracy (1) (5 to 95% of range)		± 2 °C / 3.6 °F			
Focus distance		Fixed at 1200 mm / 47 in			
Target width (static to 95% radiance)					
	Target distance <1200 mm / 47 in	12 mm / 0.5 in			
	Target distance 1200 to 3000 mm / 47 to 118 in	Field of view of 100:1 (0.01 radians)			
Repeatability		< 0.5 °C / 0.9 °F			
Temperature Resolution (2)	Below 15% of range	≤ 1.5 °C / 2.7 °F	≤ 1.5 °C / 2.7 °F	≤ 2.5 °C / 4.5 °F	≤ 2 °C / 3.6 °F
(noise)	Above 15% of range	≤ 1 °C / 1.8 °F	≤ 1 °C / 1.8 °F	≤ 2.5 °C / 4.5 °F	
Scan Angle (3)		80 °			
Scan Rate	Factory set	20 Hz	50 Hz	50 Hz	50 Hz
	User adjustable	10 to 150 Hz in 1 Hz steps			
Speed of response (Tau - linear output on rising edge)		≤ 5 µs			≤ 10µs
Ambient Stability deltaT[indicated] / deltaT[ambient]		< 1 ° / 10 °	< 1 ° / 10 °	< 2 ° / 10 °	< 1 ° / 10 °
Settling Time (4)		2 Hours			

*LSPHD 61, LSPHD 62, and LSPHD 63 as per LSPHD 60 unless otherwise stated

(1) Includes error correction

(2) No line averaging. 4LA reduces noise by factor 2

(3) Scan angle may be set in the range 40 to 80° by the PC software

(4) For optimum performance, the thermoelectric cooler takes time to stabilise the detector thermally. This process takes longer at higher ambient temperatures.

1.2.6 LSPHD 7 series specifications

	LSPHD 71
Operating wavelength	3.4 µm
Temperature range	50 to 350 °C 122 to 662 °F
System Accuracy (1) (5 to 95% of range)	± 2 °C / 3.6 °F
Focus distance	Fixed at 1200 mm / 47 in
Target width (static to 95% radiance)	
Target distance <1200 mm / 47 in	12 mm / 0.5 in
Target distance 1200 to 3000 mm / 47 to 118 in	Field of view of 100:1 (0.01 radians)
Repeatability	< 0.5 °C / 0.9 °F
Temperature Resolution(2) (noise)	
Below 15% of range	≤ 4 °C / 7.2°F
Above 15% of range	≤ 2°C / 3.6°F
Scan Angle (3)	80°
Scan Rate Factory set	50 Hz
User adjustable	10 to 150 Hz in 1 Hz steps
Speed of response (Tau - linear output on rising edge)	≤ 10 µs
Ambient Stability deltaT[indicated] / deltaT[ambient]	≤ 1°/10°
Settling Time (4)	2 Hours

(1) Includes error correction

(2) No line averaging. 4LA reduces noise by factor 2

(3) Scan angle may be set in the range 40 to 80° by the PC software

(4) For optimum performance, the thermoelectric cooler takes time to stabilise the detector thermally. This process takes longer at higher ambient temperatures.

2 INSTALLATION

2.1 Introduction

The equipment specified in this User Guide must be operated, maintained and serviced by suitably trained personnel, capable of carefully following the procedures, warnings and guidelines given. It is advisable that all User Guides and Installation Guides associated with LSPHD System equipment should be read thoroughly and be kept readily available.

> **CAUTION**
>
> Ensure that the LSPHD Head is mounted securely, in a location where the effects of vibration, dust and fumes are kept to a minimum. Ensure that the scanning sight path is not obscured.
>
> The LSPHD 10, 20 & 21 have a focus distance factory set at 2000 mm / 79 in. Refer to Section 2.2 for details of how to change the focus distance.
>
> Choose a mounting location which minimises external heating of the scanner. If the ambient temperature of the unit exceeds the specified maximum, a cooling system (available from AMETEK Land) must be fitted.
>
> If the instrument is to be used in environments where gases resulting from combustion are present, contact AMETEK Land so that the application can be fully assessed before you install the scanner.

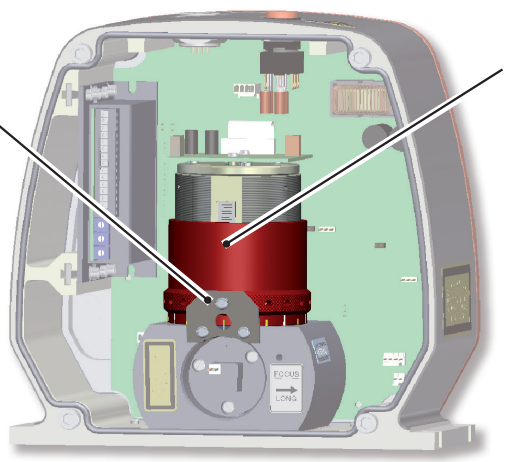


Fig. 2-1 Focus adjustment for the LSPHD 1, LSPHD 11, LSPHD 20, LSPHD 21 and LSPHD 22

2.2 Changing the focus distance (LSPHD 10, LSPHD 11, LSPHD 12, LSPHD 20, LSPHD 21, LSPHD 22 & LSPHD 23 only)

The focus distance of the LSPHD 10, LSPHD 11, LSPHD 12, LSPHD 20, LSPHD 21, LSPHD 22 and LSPHD 23, linescanner head is factory set to 2m / 79in. The focus distance can be user-adjusted in the range 1m / 40in to infinity.

1) Remove the front cover of the scanner (the panel nearest the laser switch).

   Refer to Fig. 2-1. The focus can be adjusted by turning the **Focusing ring**, which is held in place by the **Clamping plate**.

2) Remove the top screw from the **Clamping plate** to free the **Focusing ring**.

3) In order to focus the instrument accurately, the focusing mechanism must first be 'zeroed'. Rotate the **Focusing ring** in the direction of the 'Focus long' arrow (i.e. to the right) until it is wound in fully.

4) Refer to the table below. Rotate the **Focusing ring** to the left for the number of turns required to match the focus distance you want to set.

   The table below gives the focus distances that can be achieved by turning the focusing ring. Each screw hole on the focusing ring is at 0.05 of a turn.

Focus distance m / in	**LSPHD 10 LSPHD 11 LSPHD 12**	**LSPHD 20 LSPHD 23**	**LSPHD 21 LSPHD 22**
	Number of turns from fully wound in		
1.0 / 40	7.70	8.95	8.45
1.2 / 47	6.80	8.00	7.50
1.5 / 59	5.85	7.05	6.60
2.0 / 79	4.95	6.15	5.65
3.0 / 118	4.05	5.20	4.70
4.0 / 157	3.60	4.70	4.25
5.0 / 197	3.35	4.45	4.00
6.0 / 236	3.15	4.25	3.80
7.0 / 276	3.00	4.15	3.70
8.0 / 315	2.95	4.05	3.60
10.0 / 394	2.80	3.90	3.45
Infinity	2.30	3.40	2.95

5) To adjust the focus to a distance other than that quoted in the above table, rotate the focusing ring to the required intermediate position.

6) When you have focused the scanner to the required distance, there will be a hole in the **Focusing ring** that aligns with the hole in the **Clamping plate** (you may need to adjust the Focusing ring slightly). Insert and tighten the screw through the Clamping plate to secure the Focusing ring in position.

7) Replace the cover panel.

   The scanner is now focused.

2.3 Positioning The Scanner

Before installing the scanner, refer to the cautions given in Section 2.1.

The scanner must be installed so that the target plane is parallel to the scanner window.

Refer to Fig. 2-2 (below). The width of the scan (**SW**) is proportional to the distance (**TD**) between the scanner and the target plane. Choose a target distance that will give a scan line that just exceeds the width of the product, as this gives maximum spatial resolution.

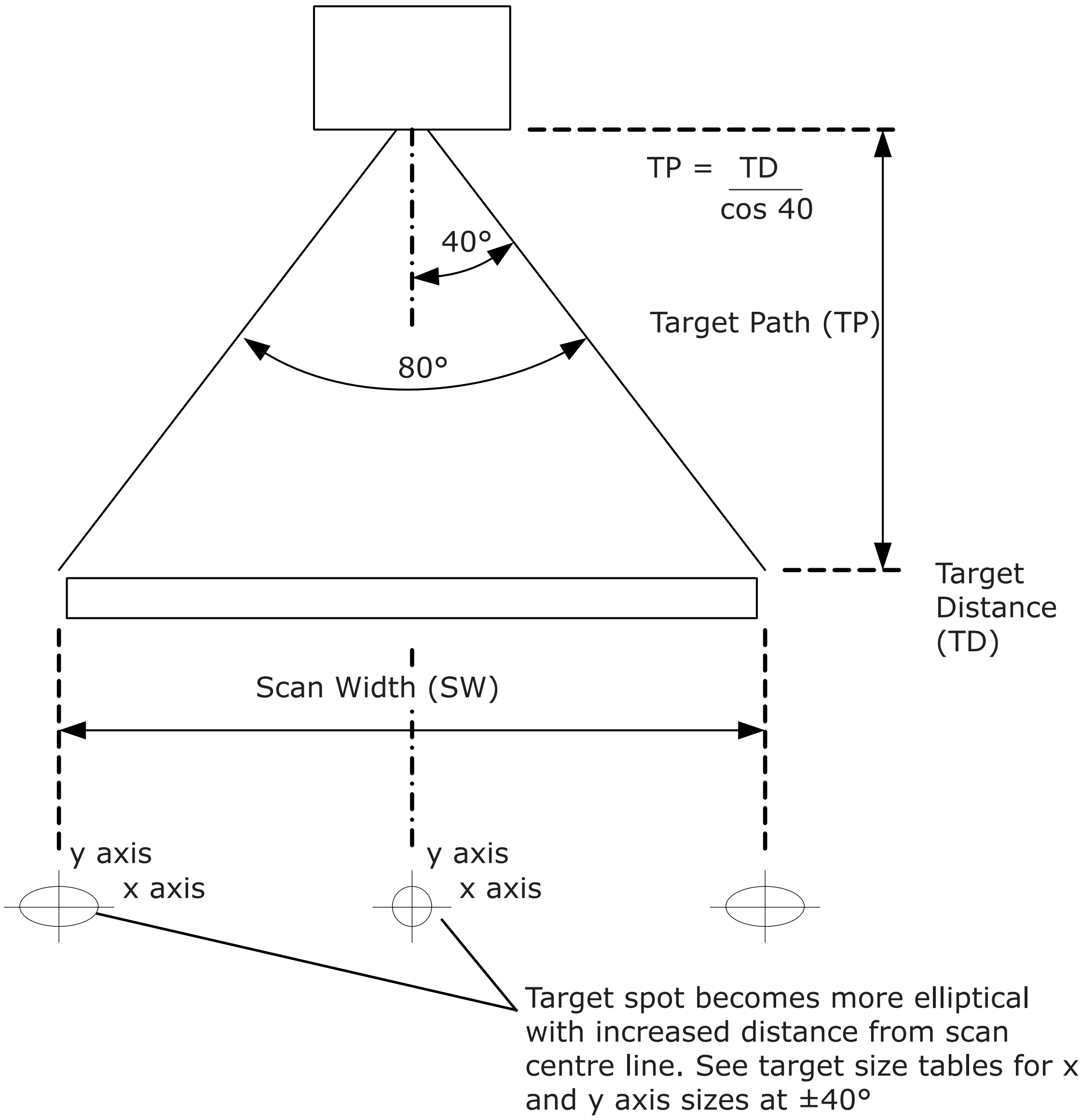


Fig. 2-2 Scan width and target size dimensions

2.4 Scan Widths and Target Size

2.4.1 Scan Width

The full scan angle for the LSP Scanner is 80°, and the Scan Width (SW) can be calculated as:

SW = (TD + 35) x 1.678 mm

or

SW = (TD +1.38) x 1.678 inches

Where 'TD' is the perpendicular Target Distance between the LSP window and the target plane.

At the scan angle extremes (± 40°) the length of the Target Path (TP) between the scanner and the target is:

TP = (TD + 35) / 0.766 mm

or

TP = (TD +1.38) / 0.766 inches

> **Note**
>
> The active scan angle may be set in the range 40 to 80°. See the Landscan Configuration or WCA software guides for further information.

2.4.2 Target Size

The calculated Target Size is strictly only circular at a scan angle of zero degrees, i.e. perpendicular to the instrument.

At all other scan angles, the target spot will be an ellipse. The elliptical target size is shown in the following tables for the scan angle extremes (± 40°).

2.4.3 LSPHD 1 & 2 Target size table

The nominal Target Size (**TS**) is given by:

TS = TD / FoV

Where 'FoV' is the instrument's Field of View

- LSPHD 10, LSPHD 11, LSPHD 12, LSPHD 21 & LSPHD 22 FoV=500:1
- LSPHD 20, LSPHD 23 FoV=300:1

TD		**SW**		**TP**		**LSP**HD **10, LSP**HD **11, LSP**HD **12 LSP**HD **21 & LSP**HD **22** Target Size						**LSP**HD **20** - Target Size **LSP**HD **23**					
Target Distance		Scan Width		Target Path		0° Scan angle		±40° (x axis)		±40° (y axis)		0° Scan angle		±40° (x axis)		±40° (y axis)	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
1000	39.4	1737	68.4	1305	51.4	2.0	0.08	7.8	0.31	6.0	0.24	3.3	0.13	10.0	0.39	7.7	0.30
1250	49.2	2156	84.9	1632	64.3	2.5	0.10	8.7	0.34	6.7	0.26	4.2	0.17	11.5	0.45	8.8	0.35
1500	59.1	2576	101.4	1958	77.1	3.0	0.12	9.6	0.38	7.4	0.29	5.0	0.20	13.0	0.51	10.0	0.39
1750	68.9	2996	118.0	2284	89.9	3.5	0.14	10.5	0.41	8.0	0.31	5.8	0.23	14.4	0.57	11.0	0.43
2000	78.7	3415	134.4	2611	102.8	4.0	0.16	11.4	0.45	8.7	0.34	6.7	0.26	16.0	0.63	12.2	0.48
2500	98.4	4254	167.5	3264	128.5	5.0	0.20	13.1	0.52	10.0	0.39	8.3	0.33	18.7	0.74	14.4	0.57
3000	118.1	5093	200.5	3916	154.2	6.0	0.24	14.8	0.58	11.4	0.45	10.0	0.39	21.6	0.85	16.5	0.65
3600	141.7	6100	240.2	4700	185.0	7.2	0.28	17.0	0.67	13.0	0.51	12.0	0.47	25.0	0.98	19.2	0.76
4000	157.5	6772	266.6	5222	205.6	8.0	0.31	18.3	0.72	14.0	0.55						
6000	236.2	10128	398.7	7832	308.3	12.0	0.47	25.1	0.99	19.2	0.76						
8000	315.0	13484	530.9	10443	410.7												

Notes:

1) The indicated target sizes assume that the focus distance of the instrument equals the target distance.
2) If the instrument is focused at a distance between the 'target distance' and the 'target path', the target size at the scan angle extremes will reduce at the expense of an increase at zero degrees scan angle.

2.4.4 LSPHD 5, 6 & 7 Target size table

The nominal Target Size (**TS**) is given by:

- At target distances *less than* 1200mm / 47 in:
  TS = 12mm / 0.47in
  or
- At target distances *greater than* 1200mm / 47 in:
  TS = TD / FoV

- LSPHD 5, LSPHD 6 & LSPHD 7 FoV=100:1

TD Target Distance		**SW** Scan Width		**TP** Target Path		**LSPHD 5, LSPHD 6 & LSPHD 7** Target Size					
						0° Scan angle		±40° (x axis)		±40° (y axis)	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
200	7.9	394	15.5	261	10.3	12.0	0.47	15.7	0.62	12.0	0.47
500	19.7	898	35.4	653	25.7	12.0	0.47	15.7	0.62	12.0	0.47
750	29.5	1317	51.9	979	38.5	12.0	0.47	15.7	0.62	12.0	0.47
1000	39.4	1737	68.4	1305	51.4	12.0	0.47	17.0	0.67	13.1	0.52
1200	47.2	2073	81.6	1566	61.7	12.0	0.47	20.4	0.80	15.7	0.62
1500	59.1	2576	101.4	1958	77.1	15.0	0.59	25.5	1.00	19.5	0.77
2000	78.7	3415	134.5	2611	102.8	20.0	0.79	34.0	1.34	26.0	1.02
3000	118.1	5093	200.5	3916	154.2	30.0	1.18	51.0	2.00	39.0	1.54
4000	157.5	6772	266.6	5222	205.6	40.0	1.57	68.0	2.68	52.0	2.05

2.5 Alignment and Scan Direction

Each AMETEK Land LSP$_{HD}$ Head has an integral laser unit that can be used to help align the scanner during installation. For instructions on how to use the laser alignment unit, refer to Section 4.0 of this User Guide.

To interpret the scan profile produced by the scanner, the scan direction of the unit must be known. The scan direction is indicated by an embossed arrowhead cast into the top of the scanner casing (See Fig. 2-3).

The design of the scanner mountings ensures that the scanner will always be replaced in the correct orientation, should the scanner be removed from the application for servicing etc.

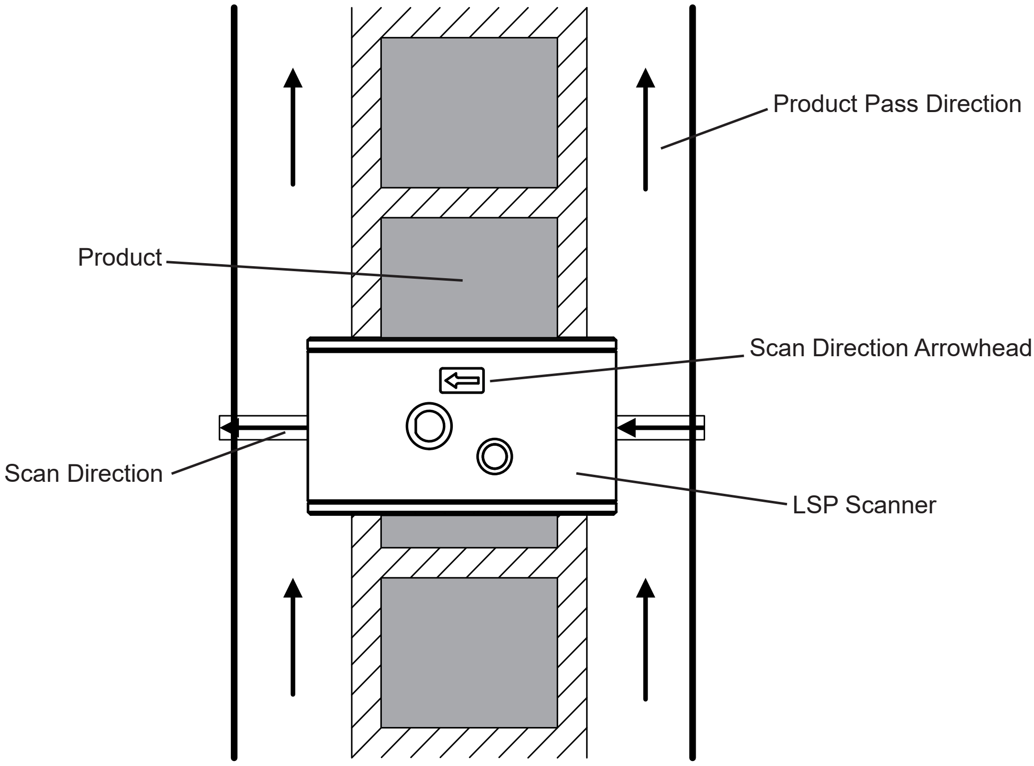


Fig. 2-3 Scan Direction

2.6 Installation Precautions

2.6.1 Vibration

It is highly recommended that the LSPHD Linescanning Thermometer is positioned in a location where vibration is kept to a minimum.

2.6.2 Infrared reflections

All practical targets have some reflectivity within the infrared waveband. This reflectivity increases as the target emissivity reduces (see Section 5.0). Therefore, the scanner sees some radiant heat energy from reflections of surrounding objects, as well as from the target source. This energy is not usually sufficient to have an effect on the measurement, but take care to ensure that objects of similar or higher temperature to the target are not placed where reflected energy may enter the scanner.

2.6.3 Compensating for losses in viewing windows

The emissivity control on the LSPHD can be set to compensate for target emissivity and window losses (such as when using the LSP Sealed to Process Flange). A simple calculation provides the correct setting, as follows:

For example: if viewing a target of emissivity 0.8 through a sapphire window the effective emissivity setting should be the product of the surface emissivity and the transmission of the sapphire. Transmission is 100% minus the reflection loss of each surface (7% + 7%) = 86% . The equivalent emissivity setting to overcome this loss may be calculated as follows:

1 - (losses) / 100 which equals 0.86.

This value should then be multiplied by the value of target emissivity. Hence emissivity setting = 0.86 x 0.80 = 0.69

> **Note**
>
> Ensure you choose an appropriate window material for the spectral response of the LSPHD scanner you have. For more information, contact AMETEK Land.

3 SERVICES

3.1 Electrical connections: Cable requirements

The connection between the Landscan LSPHD Head and Landscan power supply units is via an Ethernet cable.

Three pre-wired cable assemblies are available from LAND:

AMETEK Land Part Nº	Length	Sheath material	Ambient limit	Overall diameter
805038	15 m / 49 ft	PU	105 °C / 221°F	7 mm / 0.26 in
804977	15 m / 49 ft	Teflon	200 °C / 392°F	7 mm / 0.26 in
807087	30 m / 98 ft	PU	105 °C / 221°F	7 mm / 0.26 in

CAUTION

Never disconnect the scanner cable whilst the scanner is powered. Doing so could damage other devices on the same TCP/IP network. Always turn off power at the Power over Ethernet PSU prior to disconnecting the scanner cable.

Note

The scanner end of the cable is labelled 'Scanner' and is a right-angled M12 'D-coded' Ethernet connector.

The power supply end of the cable is a straight M12 'D-coded' Ethernet connector.

3.1.1 Power supply units

- 807105 LSPHD Power Over Ethernet Supply Module
- 805037 LSPHD PSU
- 805140 LSPHD Service Panel

3.1.2 Default Network Settings

IP Address: 10.1.10.100

Subnet: 255.255.0.0

Each scanner is supplied with the IP address set to the default of 10.1.10.100. There is a switch on the digital PCB that allows the last digit of the IP address to be changed.

If the switch is set in position 0, the last digit will be configured by software (this is the default.)

If the switch is in any other position (7 for example), then the address will become 10.1.10.107, with all the other digits set in the software. Software is configured via the Landscan browse utility (Refer to the help file/user documentation supplied with the software).

A maximum of 4 clients may be connected to the scanner at one time.

To reset the IP address back to 10.1.10.10x, press the laser button until the light goes out, then immediately release the button.

3.1.3 Start-up time

The scanner will begin its start-up when connected to an appropriate power source. The scanner takes approximately 2 minutes to boot, during which time it will not operate.

3.2 Water Requirements (Water-Cooled Units Only)

If the LSP Linescanner Head is to be used in an environment where ambient temperatures are above the maximum specified, the AMETEK Land **Water Cooled Air Purge** mounting accessory must be used.

This mounting accessory requires a constant water supply. The special mounting plate has internal water channels with inflow and outflow connections (G1/8 tappings) in the plate edge.

There is no preferred flow orientation. However, if the scanner is mounted in a position where one of the water connectors is higher than the other, then the *lower* connector must be used for the mains water in-flow.

The **Water Cooled Mounting Plate** is supplied fitted with hose connectors suitable for 9.5 mm / 3/8 in bore water hose. The water flow rate required will depend upon each individual application, but 1 litre per minute / 0.26 US gallons per minute is an absolute minimum, with a maximum water temperature of 30 °C / 86 °F.

The maximum water pressure is 586 kPa / 85 psi.

CAUTION

If the scanner is over-cooled to below the local dewpoint, condensation will form on the unit. This situation must always be avoided.

The temperature of the cooling water must be in the range of 15 to 30 °C / 59 to 86 °F.

A constant supply of clean water is recommended, as this reduces the likelihood of blockages within the mounting plate.

3.3 Air Requirements (Air-Purged / Cooled Units Only)

If the LSP$_{HD}$ Linescanner Head is to be used in an environment where high concentrations of dust are likely to be encountered, the AMETEK Land **Air Purge Baseplate** mounting accessory must be used. The baseplate incorporates a cross flow purge for the scanner window. The purge is designed to keep the window free from dust particles, it **will not** clear the instrument sight path.

Connect the air supply via the G3/8 threaded hole at the end of the mounting plate. If possible, ensure that the air purge exit direction is downwards. Make sure that air purge exit is not impeded by mounting structures.

The air purge flow rate depends upon local conditions of the installation and scanner orientation, but a rate of 300 litres per minute / 12.36 ft^3 per minute at an inlet pressure of 1.4 psi / 1 m WG is typically sufficient.

> **CAUTION**
>
> To minimise the risk of permanent damage, use a high quality air supply.
>
> The air used must be dry and free from oil.

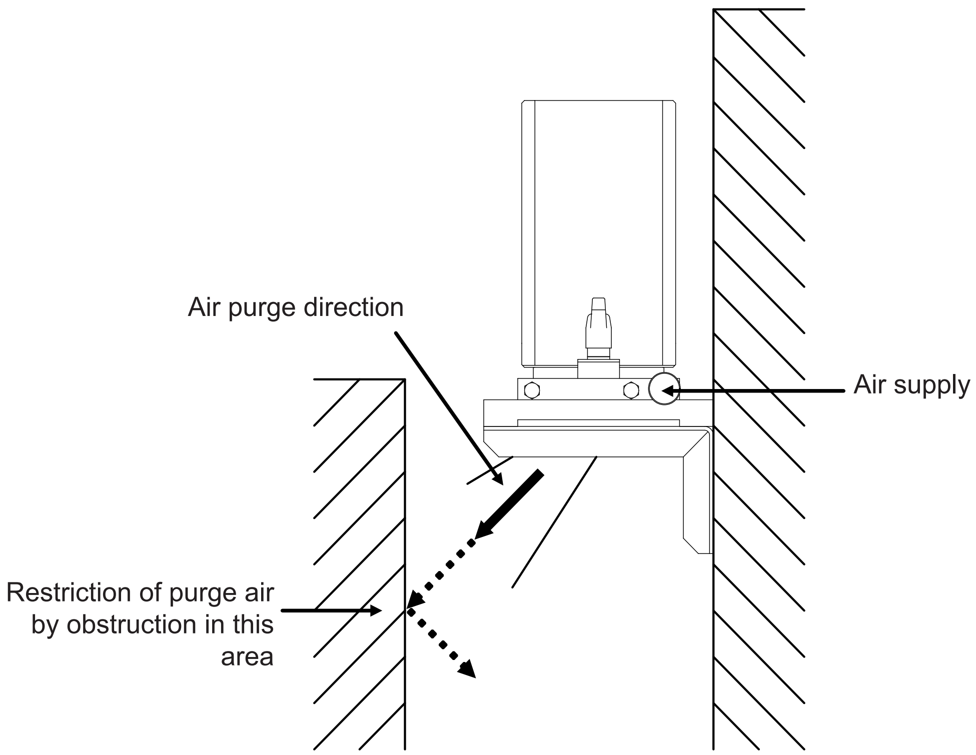


Fig. 3-1 Air Purge

4 LASER ALIGNMENT UNIT

WARNING

CLASS 2 Laser Product.

DO NOT stare into laser beam. (1.0 mW maximum output at 635 nm)

DO NOT look directly towards the scanner window, or into the laser beam during operation.

If the laser is projected onto a highly reflective surface, DO NOT look at the laser stripe from a position where a direct ('mirror-like') reflection may enter the eye.

WARNING

CLASS 2 Laser Product.

DO NOT attempt to disassemble the laser unit or any of its mounting components.

Embedded laser has a maximum output of 3mW with a beam divergence of <5mrad.

CAUTION

Caution - use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

4.1 Using the Laser Alignment Unit

The Laser Alignment Unit is a CLASS 2 laser product.

Be aware of all CLASS 2 Laser Safety Warnings whenever the Laser Alignment Unit is in use.

1) Press the Laser Alignment button. The button is next to the interface connector on the top of the scanner body.

   The scan frequency of the instrument reduces to approximately 1Hz and the Laser Alignment button flashes to indicate that the laser is active. A red stripe of laser light is projected through the window of the scanner, indicating the position and extents of the scan line.

2) Adjust the scanner position as required so that the product almost fills the width of the scan defined by the laser.

   > **Note**
   >
   > When the Laser Alignment Unit is active, the scanner does not measure the target temperature.

3) To switch off the laser, press the flashing Laser Alignment button.

   When the Laser Alignment unit is switched off, the scanner stabilises for approximately 60 seconds. The scanner will then begin normal operation and temperature information is available.

Alternatively, the Laser Alignment facility can be operated remotely from the Landscan Software.

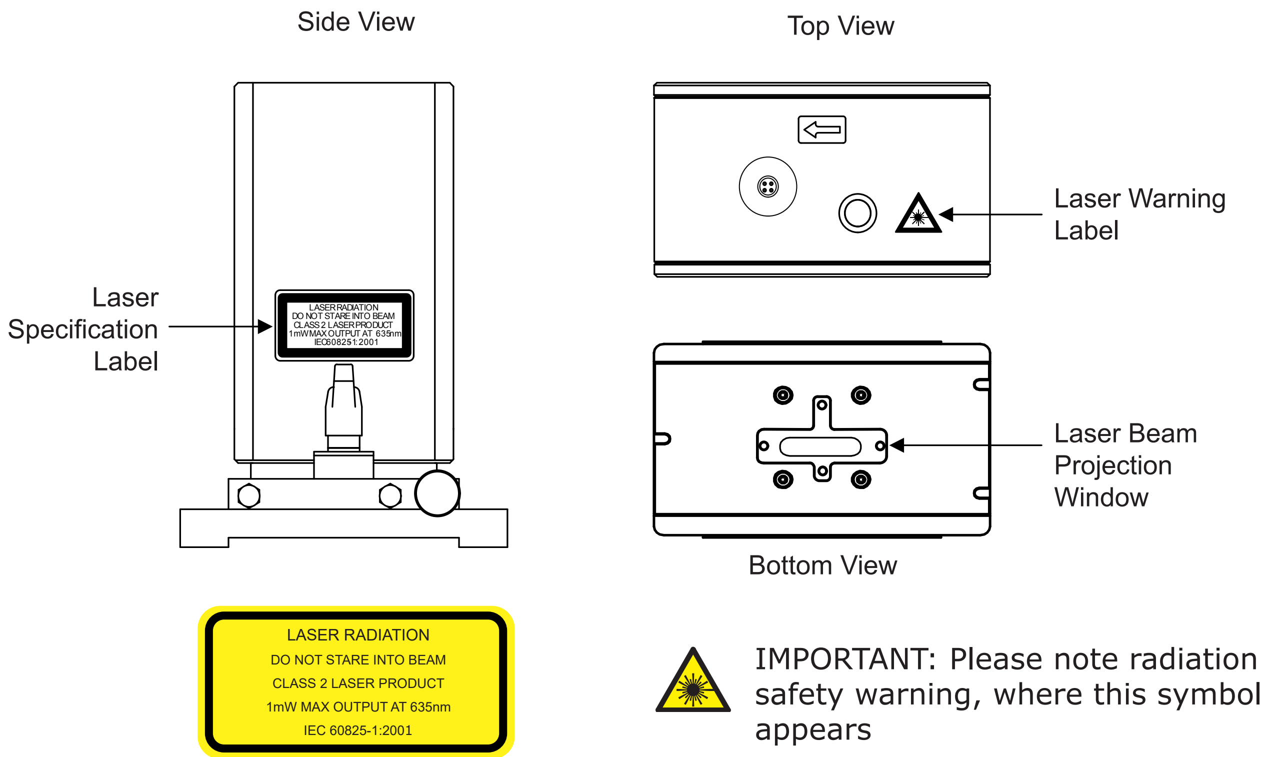


Fig. 4-1 Laser Warnings

5 EMISSIVITY

In order to obtain accurate temperature measurements, the emissivity value of the target surface must be known.

This section of the User Guide contains emissivity values of the most commonly measured materials for each LSPHD Linescanner.

If you have a query regarding the emissivity of the target in your measurement application, contact AMETEK Land.

5.1 Setting the Emissivity value

By default, the emissivity value is set remotely via the Landscan Configuration Software or by Landscan WCA software, if this option is used.

For further information, see the relevant User Guide.

Alternatively, the emissivity setting can be set to a fixed value using the procedure below.

1) Unscrew the four bolts holding the scanner side plates to the body using a 5mm allen/hex key.
2) Notice that the two sides of the scanner are dissimilar and identify the 'open' side where the external parts of the optical system can be clearly seen (Fig. 5-1).

Fig. 5-1 LSP HD Optical System

3) On the 'open' side of the scanner, find the jumper marked JM3 towards the right edge of the PCB (shown inside green circle below). Remove the jumper from the PCB.

Fig. 5-2 Location of Jumper JM3

4) Turn the scanner around 180°. You should now be looking at the side with a PCB much closer to the front edge of the casing. Locate the pins marked LK3, again towards the right hand side of the PCB (Fig. 5-3). Note that these pins are located on the exposed part of the second layer of PCB. Replace the jumper removed in step 3 on the TOP TWO of the three pins of LK3 marked 'Internal Emissivity'.

Fig. 5-3 Location of LK3

5) The scanner's emissivity can now be set using the two identical rotary switches that can be seen towards the middle of the PCB (Fig. 5-4).

Fig. 5-4 Location of Emissivity rotary switches

The left switch sets the first decimal place, the right switch sets the second decimal place. For examples, see the table below.

Left switch setting	Right switch setting	Emissivity setting
8	5	0.85
7	2	0.72
0	0	1.00

5.2 LSP$_{HD}$ 1 Series

Metals		Emissivity
Aluminium		0.13
	oxidised	0.40
Chromium		0.43
	oxidised	0.75
Cobalt		0.32
	oxidised	0.70
Copper		0.06
	oxidised	0.85
Gold		0.05
Iron & Steel		0.35
	oxidised	0.85
Lead		0.35
	oxidised	0.65
Magnesium		0.27
	oxidised	0.75
Molybdenum		0.33
	oxidised	0.80
Nickel		0.35
	oxidised	0.85
Palladium		0.28
Platinum		0.27
Rhodium		0.25
Silver		0.05
	oxidised	0.10
Tin		0.40
	oxidised	0.60
Titanium		0.55
	oxidised	0.80
Tungsten		0.39
Zinc		0.50
	oxidised	0.60

5.3 LSP$_{HD}$ 2 Series

Metals		Emissivity
Aluminium	0.09	
	oxidised	0.40
Chromium		0.34
	oxidised	0.80
Cobalt		0.28
	oxidised	0.65
Copper		0.05
	oxidised	0.85
Gold		0.02
Iron & Steel		0.30
	oxidised	0.85
Lead		0.28
	oxidised	0.65
Magnesium		0.24
	oxidised	0.75
Molybdenum		0.25
	oxidised	0.80
Nickel		0.25
	oxidised	0.85
Palladium		0.23
Platinum		0.22
Rhodium		0.18
Silver		0.04
	oxidised	0.10
Tin		0.28
	oxidised	0.60
Titanium		0.50
	oxidised	0.80
Tungsten		0.39
Zinc		0.32
	oxidised	0.55

5.4 LSP$_{HD}$ 5 Series

Glass		Emissivity
Thickness		
	1.0mm	0.90
	1.5mm	0.95
	>2.0mm	0.96

5.5 LSPHD 6 Series

Refractories		Emissivity
Alumina		0.90
Red brick		0.90

Alloys		Emissivity
Brass	*oxidised*	0.61
Inconel		0.28
	oxidised	0.85
Monel	*oxidised*	0.45
Nichrome	*oxidised*	0.90

Metals		Emissivity
Aluminium	*oxidised*	0.30
Copper	*oxidised*	0.85
Iron & Steel	*oxidised*	0.85
Lead	*oxidised*	0.63
Molybdenum	*oxidised*	0.80
Titanium		0.30

Miscellaneous		Emissivity
Alumina		0.90
Asbestos		0.90
Asphalt		0.90
Carbon		>0.90
	Graphite	0.85
	Soot	0.95
Cement & Concrete		0.90
Cloth		0.85
Glass	*@>3mm thickness*	>0.90
Paper		0.90
Polypropylene/Polyethylene		
	@2mm thickness	0.90
	@>5mm thickness	0.96

5.6 LSPHD 7 Series

PVC		Emissivity
Thickness	0.05mm	0.53
	0.10mm	0.70
	0.20mm	0.82
	0.30mm	0.85
	0.40mm	0.88
	0.50mm	0.91
	0.75mm	0.94
	>1.0mm	0.96

Polypropylene		Emissivity
Thickness	0.025mm	0.58
	0.05mm	0.68
	0.10mm	0.79
	0.20mm	0.88
	0.30mm	0.91
	0.40mm	0.93
	0.50mm	0.94
	>0.75mm	0.96

Polyethylene		Emissivity
Thickness	0.025mm	0.58
	0.05mm	0.68
	0.10mm	0.79
	0.20mm	0.88
	0.30mm	0.91
	0.40mm	0.93
	0.50mm	0.94
	>0.75mm	0.96

PET		Emissivity
Thickness	0.10mm	0.59
	0.20mm	0.80
	0.30mm	0.85
	0.40mm	0.88
	0.50mm	0.93
	0.75mm	0.95
	>0.90mm	0.96

6 SETTING THE SCAN FREQUENCY

The majority of scanners are supplied with the scan frequency set to 50 Hz. LSPHD 5FL scanners are set to 20 Hz.

However, you can set the scan frequency to suit your application. The scan frequency can be set in the range 10 to 150 Hz, in 1 Hz increments, from the Landscan software.

The scan frequency can also be set via a switch in the scanner head.

6.1 Changing the Scan Frequency setting using the internal switch

CAUTION

Remove the scanner plug ***before*** removing the scanner end plate. This ensures that the unit is electrically isolated.

Observe precautions for handling electrostatic discharge sensitive devices

Static-sensitive parts are incorporated in the scanner.

The following tools are required:

- 5 mm hexagon key
- 3 mm flat-blade screwdriver (plastic).

1) Remove the scanner interface plug. This ensures that the scanner unit is electrically isolated.
2) When viewed from the top of the scanner, the end plate that you need to remove is the one nearest the scan direction arrow embossed into the scanner body. (See Fig. 6-1 overleaf)
3) Remove the four M6 cap-head screws and spring washers from the end plate. Open the scanner to access the internal circuitry.
4) Locate the 'Speed' jumper on the right-hand side of the PCB and move it from 'External' to 'Internal'.
5) Refer to Fig. 6-1 to locate the scan frequency switch. Use a plastic bladed screwdriver to set the dial to the required mark (see the Scan Frequency Table in Section 6.2). Make sure that all other components are undisturbed.
6) Check that the end plate seal is intact and is correctly seated into the seal recess.
7) Position the end plate, refit and evenly tighten the four spring washers and M6 cap-head screws.

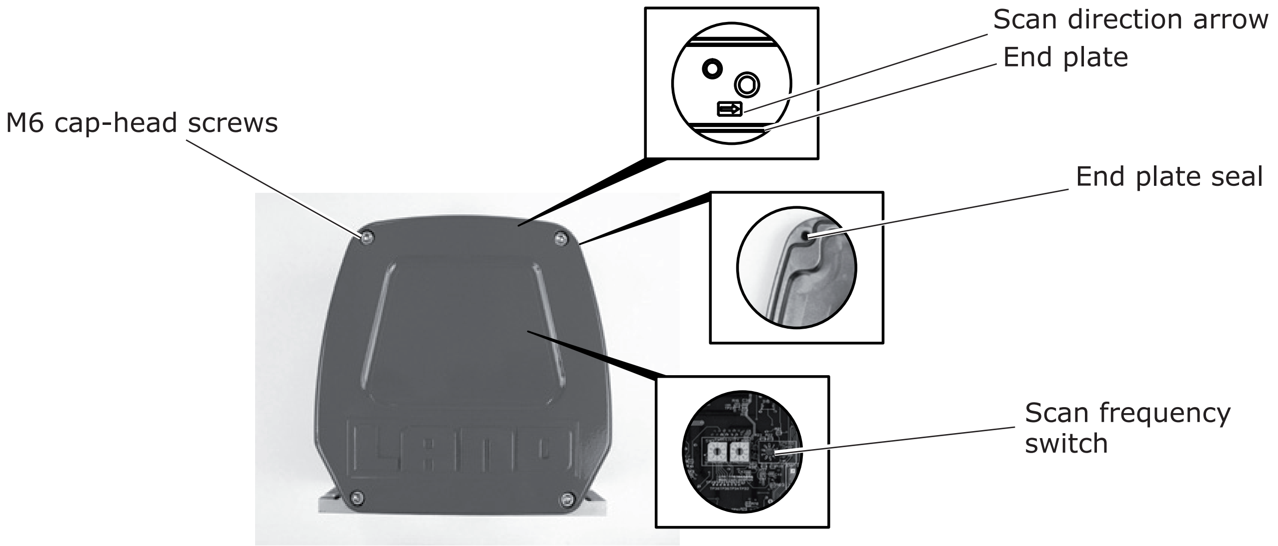
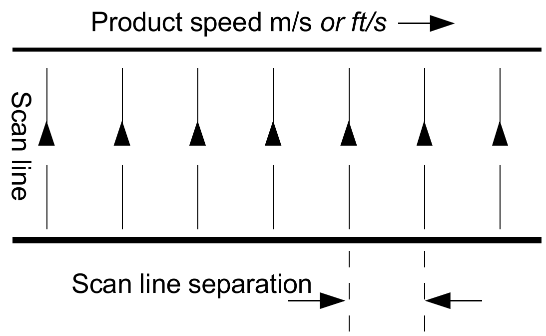


Fig. 6-1 Scan Frequency Setting

6.2 Scan Frequency Table

Switch Position	Nominal Scan Frequency (Hz)
1	20
2	40
3	60
4	80
5	100
6	120
7	120
8	150
9	N/A
0	N/A

6.3 Scan Line Separation



$$\text{Scan Line Separation} = \frac{\text{Product Speed}}{\text{Scan Frequency}} \quad \text{m / ft}$$

Fig. 6-2 Scan Line Separation

When you have determined the required scan frequency, choose the scan rate that either closely matches or exceeds the required rate.

It is not good practice to simply select the scanner's maximum scan rate regardless of process requirements. The reasons for this are outlined below:

Parameter	High Speed	Low Speed
Scan line separation	Closely spaced	Widely spaced
Lateral resolution	Lower resolution	Higher resolution
Disk space for file storage	Greater space required	Less space required
Processor requirements	Higher	Lower

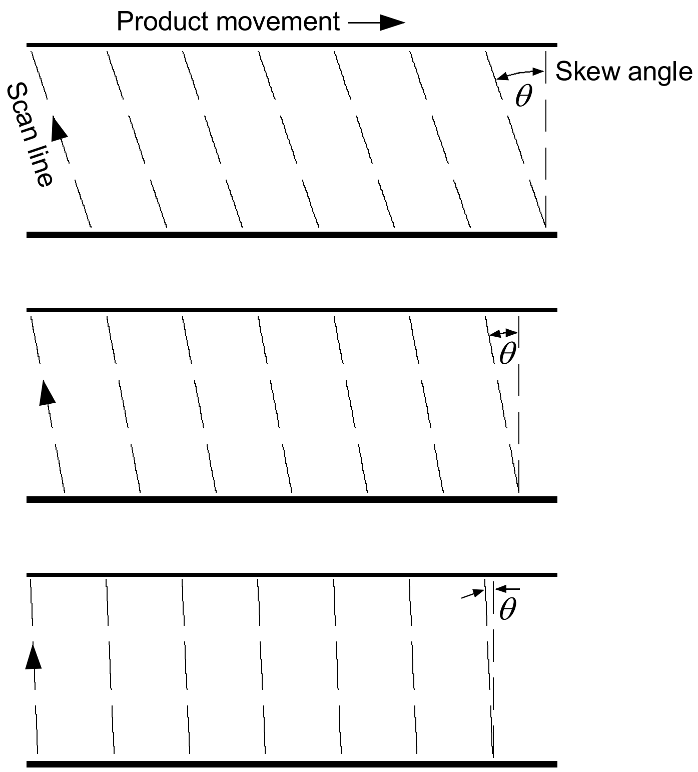
6.4 Data Storage Requirements

Data is generated at a rate of approximately 2.5 kB per scan line, with a minimum requirement of 440 kB for file headers. Therefore, at a scan frequency of 50 Hz, each one minute measurement period will require 7.94 MB of data storage space.

Landscan WCA software allows you to select a reduced number of lines for storage (see the Landscan WCA Software Online Help).

6.5 Skew Angle

When a linescanning thermometer is scanning across a moving product travelling along a line, setting the scan frequency too low may cause the scan line to be excessively tilted, or 'skewed'. When the product speed is high and the scan frequency is low, the skew is more apparent, and results in an inaccurate indication of product width. Refer to Fig. 6-3 below.



Example 1 - A greater skew angle is created when high product speeds are combined with low scan frequencies.

Note: During product width calculations, the apparent width is displayed greater than the actual width.

Example 2 - When high product speeds are combined with medium scan frequencies, the skew angle is reduced when compared to Example 1.

Example 3 - When high product speeds are combined with high scan frequencies, the skew angle is negligible when compared to Example 1.

The scan skew angle is given by:

$$\theta = \mathrm{TAN}^{-1}\left[\frac{\text{product speed}}{(2\,\pi\,d)\,\text{scan frequency}}\right] = \mathrm{TAN}^{-1}\left[\frac{\text{product speed}}{\text{scan speed}}\right]$$

e.g. At a scan frequency of 50 Hz, a target distance (D) of 2 m and product speed of 10 m/s .... θ = 0.91°

$$\text{Apparent (measured) product width} = \frac{\text{actual product width}}{\text{Cos } \theta} \quad \text{(ignoring edge correction errors)}$$

Fig. 6-3 Skew Angle

7 INTERNAL AMBIENT TEMPERATURE SENSOR

The Internal Ambient Temperature Sensor (IATS) is designed to monitor and forewarn the operator of possible instrument damage due to overheating.

Overheating can be caused by high ambient temperatures, or interrupted and reduced flow of coolant.

An 'early warning' level is set to 50 °C / 122 °F. This gives an indication of possible over-temperature within the instrument.

The maximum operating limit for the LSPHD Linescanner Head is 60 °C / 140 °F.

If the indicated internal temperature exceeds the stated limit, take action immediately to provide additional cooling to the instrument. If additional cooling cannot be provided, the instrument must be removed from the source of the excessive ambient temperature in order to reduce the likelihood of any permanent damage.

The IATS can be accessed via the Landscan Configuration Software or Landscan WCA.

8 MAINTENANCE

The LSPHD Linescanning Thermometer is specifically designed to minimise the need for regular maintenance.

The recommended maintenance routine involves periodic checks on unit services and ensuring that the scanner viewing window is kept clean and free from contamination.

8.1 Air Purge Services

The air purge system reduces the amount of dust or dirt reaching the viewing window of the scanner. The effectiveness of the purge is dependent upon the air flow rate and the nature of any airborne dirt.

Check the cleanliness of the window on a regular basis as part of your local maintenance schedule. If the contamination rate is too high, then it may be necessary to increase the purge flow rate.

It is of the utmost importance that the air supply to the purge system is of high quality and is supplied clean and dry, otherwise window contamination may result, and the diffuser within the purge unit may become blocked.

If the viewing window becomes dirty, clean it with a soft clean cloth. If stubborn deposits are found, moisten the cleaning cloth with a mild detergent.

If the scanner viewing window gets damaged, the unit must be returned to AMETEK Land for a window replacement.

8.2 Water And Air Cooling Services

The main problems associated with the water and air cooling systems are inadvertent supply shut-off and over-cooling. Check the flow rate on a regular basis as part of your local maintenance schedule. Use a flow rate monitor and alarm system.

Over-cooling causes condensation to form on the unit. To prevent this happening, make sure that the water or air supply temperature is above the local dew-point temperature.

8.3 Plate Mounted Blower Unit

Refer to the Plate Mounted Blower Unit User Guide (770-073) for details of maintenance for this unit.

END OF SECTION

9 INSTALLATION ACCESSORIES

A range of installation accessories is available from AMETEK Land to aid installation of the LSP$_{HD}$ Linescanning Thermometer and to ensure that the equipment is compatible with the intended application environment.

For detailed information on installation accessories, refer to the LSP$_{HD}$ System Mountings and Accessories Installation Guide, which is supplied with each accessory.

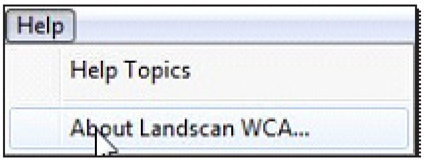
10 SOFTWARE VERSION INFORMATION

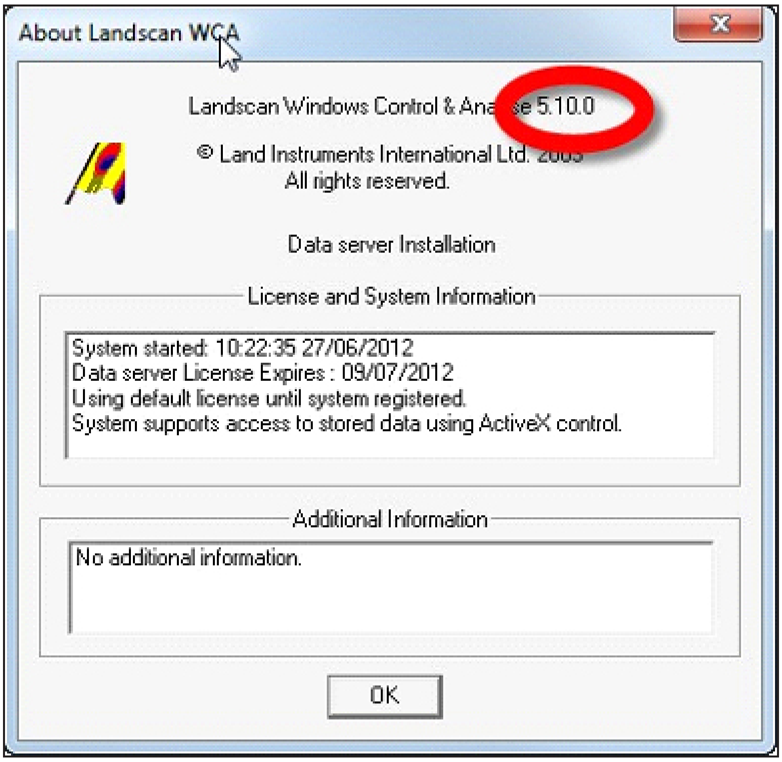
This section of the User Guide gives you instructions on how to read the version information on WCA, LSP, LSP-HD and IO devices.

10.1 Reading the WCA program version

1) In the Landscan WCA software, open the **Help** menu and select the **About Landscan WCA...** option.

   The **About Landscan WCA** window displays the version information, as shown in Fig. 10-1.





10.2 Reading the LSP-HD Scanner version information

1) In the Landscan WCA software, open the **Diagnostics** menu (Fig. 10-2) then select **LPU/LSC**.

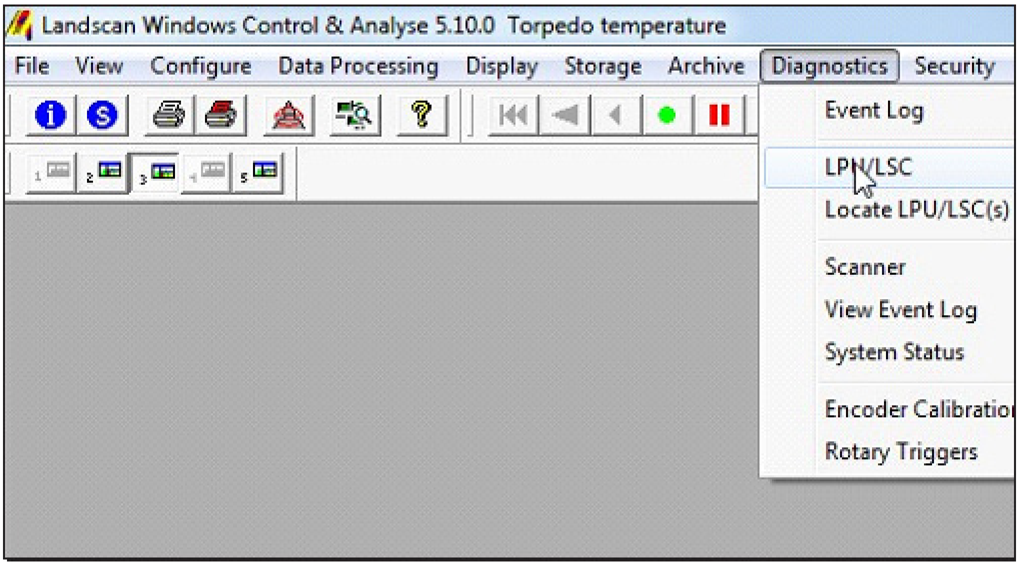


Fig. 10-2 Diagnostics Menu

The **LPU/LSC Diagnostics** window is displayed (Fig. 10-3).

2) Make a note of the Scanner **Version Information** for each **Station number**, as shown in Fig. 10-3.

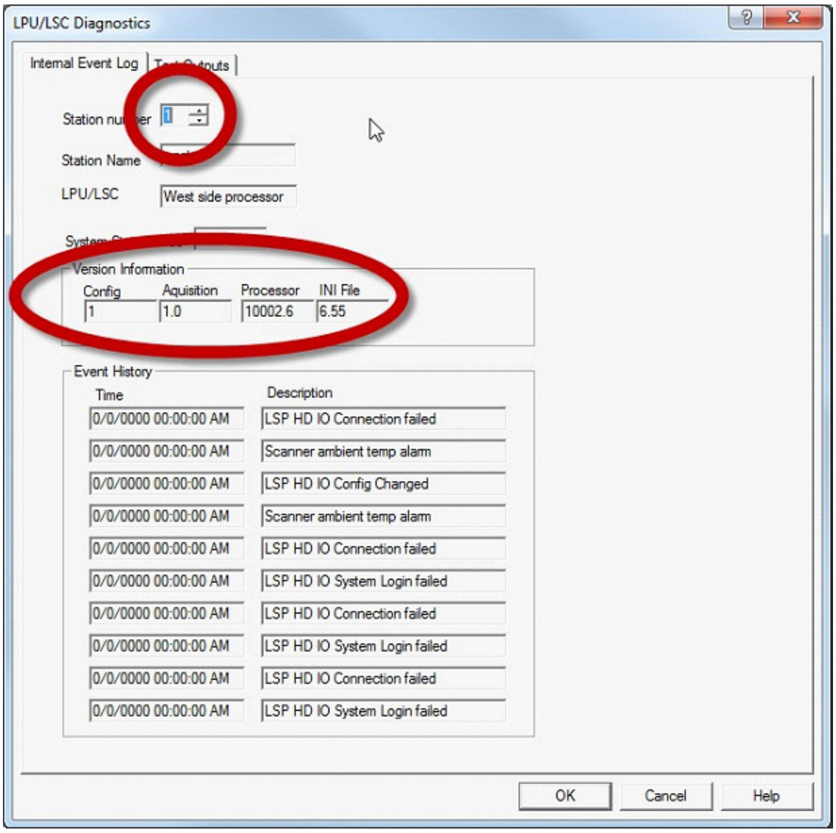


Fig. 10-3 LPU/LSC Diagnostics Window

10.3 Reading the IO version information

1) For IO users *up to and including WCA version 5.9*, read the version from the label printed on the IO unit (As shown in Fig. 10-4 below).
   For users with *WCA version 5.10.0 (or later)*, go to step 2.

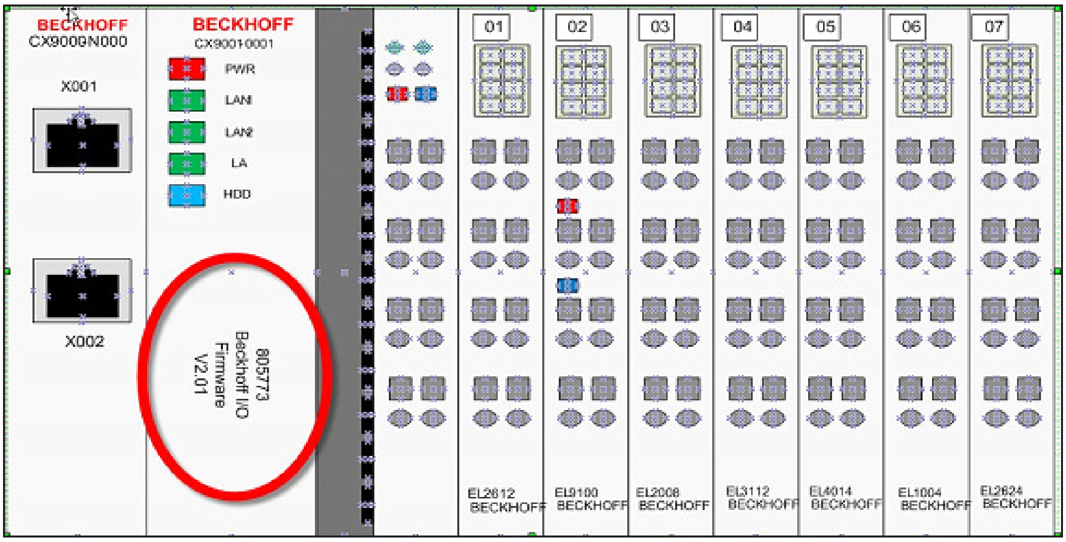
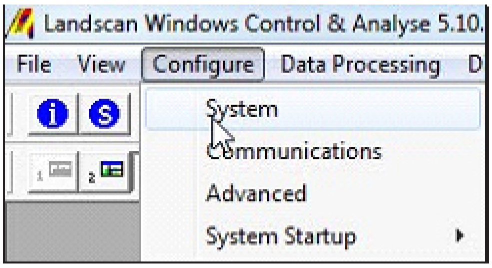


Fig. 10-4 IO Version Information for WCA up to and including Version 5.9

2) For users of WCA version 5.10.0 or later, select the **Configure System** file menu option.
3) Now select each **IO System Nº** and make a note of the Version number, as shown in Fig. 10-5 below.



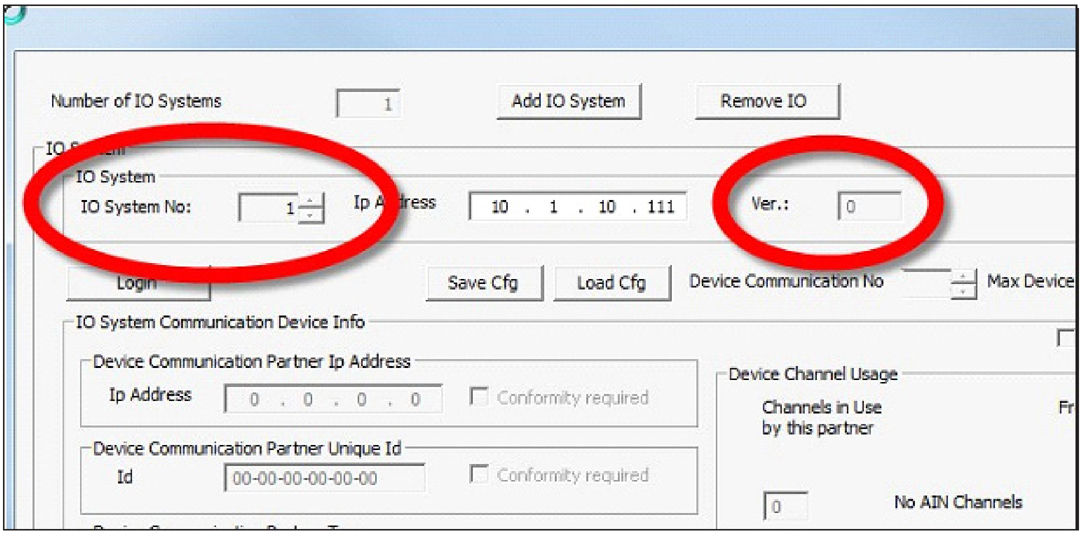


Fig. 10-5 IO Version Information for WCA Version 5.10 and later

LSPHD

HIGH RESOLUTION NON-CONTACT
INFRARED LINESCANNERS

LAND
AMETEK

Land Instruments International
Dronfield, S18 1DJ,
England
Tel: +44 (0) 1246 417691
Email: land.enquiry@ametek.com
www.ametek-land.com

AMETEK Land - Americas
150 Freeport Road, Pittsburgh,
PA 15238, U.S.A.
Tel: +1 (412) 826 4444
Email: irsales@ametek.com
www.ametek-land.com

AMETEK Land China Service
Part A1 & A4, 2nd Floor #1
No. 26 Fute 3rd Road East,
Pilot Free Trade Zone 200131
Shanghai, China
Tel: +86 21 5868 5111 ext 122
Email: land.enquiry@ametek.com
www.ametek-land.com

AMETEK Land India Service
Divyasree N R Enclave,Block A,
4th Floor, Site No 1, EPIP Industrial Area
Whitefield, Bangalore- 560066 Karnataka,
India
Tel: +91 - 80 67823240
Email: land.enquiry@ametek.com
www.ametek-land.com

For a full list of international offices, please visit our website www.ametek-land.com

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