LDS Series

LASER SCALES FOR POSITIONING APPLICATIONS

Model LDS-2000 Laser Doppler Scale

Precision Positioning with Environmental Compensation

FEATURES

- High accuracy and high resolution.
- No need for periodic calibration.
- Non-Contact eliminates parts wear.
- Freedom locate point of measurement close to measured object reduces Abbe Error.
- Orthogonality of positioning system determined by mirrors not X-Y stages when using flat mirror target.
- Electronics flexibility with variable increment and automatic temperature compensation.
- No mounting stress on scale.
- No thermal expansion on scale.
- No need for machined fiat surface for mounting scale saving installation costs.
- Higher loop gain possible for closed loop servo control.
- Optional hermetic seals for hostile environments.
- Rejection of vibration in two or three planes reduces structural resonance effects.

DESCRIPTION

The LDS-2000 Laser Doppler Scale (LDS) with Automatic Temperature, Pressure and Material Thermal Expansion Compensation provides high speed, high accuracy and long range positioning for single or multiple axis applications, such as linear motors, large gantry machines, CNC machine tools, CMM's, precision stages, Supermi-crometers, and other linear measurement devices. The LDS is compact, easy to install, easy to align, has less Abbe off-set, no cross coupling, and is cost effective.

The LDS is compatible with all mainstream controller feedback systems, and the laser head is insensitive to dirt, oil, and hostile environments.

The LDS Laser Head reflects a modulated laser beam off a movable target. The beam is detected and processed for displacement information used by your system controller to determine position.

Installation is made easy with only four components; **the laser head, the retroreflector, the processor module,** that produces either AQuadB Square Waves or Up/Down Pulses and the **IACTM Automatic Temperature/ Material Compensation System.** The LDS-2000 can directly replace glass scales and other positioning devices in your existing systems. Optional cards include RS232, and Sinusoidal outputs.

SYSTEM COMPONENTS

L-109 Laser Head-HeNe Laser head, ruggedized for direct installation in machine tool and other positioning applications. Contains HeNe Tube, Optics and a Photodetector Receiver. Outputs to IPS 1 Processor Module.

IPS1 Processor Module - Contains the electronics for signal processing and generation of the AQuadB Square Waves and Up/Down Pulses. Receives signal directly from the Laser Head. The processor mounts in the P-108 AC Powerfeed and Enclosure. The standard output is Up/Down Pulses. For AQuadB instead of Up/Down Pulses, please specify at time of order. The board also provides an error signal that is a TTL level output, which is LOW to indicate that the laser signal is low and HIGH to indicate that the laser signal level is sufficient for normal operation. An Optional Error Signal/ Warning Signal Latching Relay is also available. See IEWR Relay for Warning and Error

R-102A Retroreflector - 1/2" diameter retroreflector without post or base. Used to return the laser beam back to the Laser Head receiving aperture on a path parallel to the input beam, regardless of the angle of incidence. Movement of the retroreflector determines displacement measurement.

IATCM Automatic Temperature/ Pressure Compensation (Master) -Consists of an Air Pressure Sensor, an Air Temperature Sensor, a Material Temperature Sensor, and a CPU controlled board. The values of Pressure, Temperature and Material Temperature are used to calculate the compensation factor. The Material Thermal Expansion Coefficient is loaded into the CPU through the RS-232 port on your PC. Software is provided to change the

Material Thermal Expansion Coefficient, which corresponds, to the material to be machined. A second material temperature sensor, Model IMS is also available as an option. Each IATCM can control up to 5 Model IATCS Slave units.

LD-21R Cable Set - Connects the Laser Head to the IPS 1 Processor Module. If P-108L Powerfeed Enclosure is used, specify **LD-21L Cable Set.**

P-108 AC Powerfeed and Enclosure – Power source for the Laser Head and the IPS 1 Processor Module, that is mounted in the P108 enclosure. Supplies +15V and ±5V, input connectors and a terminal strip, for connection to your controller. P-108AC has SMA/SMB input connectors. The IDI Driver Module for the electro-optics in the laser head is also mounted in this box. See also the P-108L version. Any power enclosure can be set up for 2-axis operation with two laser heads. Please specify at time of order.

OPTIONS AND ACCESSORIES

ICB Counter Board - The Counter Board when installed, resides on the IPS1 Processor Module, and converts the signal information to BCD output for use with the D-101 10 Digit LED Display This board must be present when a D-101 Display is used. The RS-232 Port is also located on this board. The full duplex port will provide information on displacement as well as allow Material Thermal Expansion Coefficient data to be loaded.

D-101 10 Digit LED Display - Provides information on positioning without the need for a computer or a controller. Connects to the P-108 AC Powerfeed and Enclosure and allows readings from the system to be viewed easily from distances. Inches or mm format. Requires ICB Counter Board to be installed on the IPS1 Processor Module located in the P-108 Enclosure. See ICB Counter Board.

IHS Reference Mark for Home Positioning - An electro-optical device used to determine home position. A knife-edge connected to the carriage is passed through an IR light beam, and a TTL output pulse is sent to your controller to set the desired function. Position repeatability is better than 1 µm.

IATCS Automatic Temperature/Pressure Compensation (Slave) - The slave receives ATC information from the IATCM Master for use by the controller for the compensation of the selected axis. One slave is required for each axis that requires the compensation after the installation of the IATCM Master.

IPD2 Divide by 8 Board - Increases resolution to 3.11 microinches. Generates 8 additional output pulses for each pulse received from the laser at the standard resolution of 24.914155 microinches per pulse, changing the resolution to 3.11 microinches per pulse. Maximum velocity is 24 ips. Maximum error is ± 1 least count. Connects to the IPS1 Processor Module and Mounts in P-108 AC Powerfeed and Enclosure.

IPD1 Divide by 64 Board - Increases resolution to 0.39 microinches. Generates 64 additional output pulses for each pulse received from the laser at the standard resolution of 24.914155 microinches per pulse. Maximum velocity is 3.2 ips and maximum pulse rate is 10 MHz. Maximum error is ± 1 least count. Connects to the IPSl Processor Module and Mounts in P-108 AC Powerfeed and Enclosure.

IPPS Sinusoidal Output - Board that provides a sine wave output as required by some models of Fanuc, Siemens, and other controllers. Connects to IPS1 Processor Module, and also requires the IPC3 Board. The quadrature sine/ cosine wave signals are approximately 1V peak to peak at 120 Ohm termination. The period of the sine wave is 40.513167 micrometers and the maximum frequency is 100 kHz.

ER-400 Extended Range - Extends the range of the laser system to 400 inches.

ER-2000 Extended Range - Extends the range of the laser system to 2,000 inches.

L-109N Narrow Beam Laser Head - Similar to the L-109, but can be used with flat mirror targets. The narrow beam is designed for simultaneous x-y measurement across flat mirror surfaces. Due to the divergence of the beam, alignment with the flat mirror is relatively easy Typical beam diameter is 0.5mm, and the beam divergence is 1 mrad.

L-109R Extended Lateral Range Laser Head - 8mm-beam laser head, ruggedized for direct installation in machine tool and other positioning applications. Contains HeNe Tube, Optics and a Photodetector Receiver. The larger diameter 8mm beam tolerates more lateral movement in machine travel.

L-110 Extended Range Laser Head -20mm beam laser head, ruggedized for direct installation in machine tool and other positioning applications. Contains HeNe Tube, Optics and a Photodetector Receiver. The larger diameter 20mm beam tolerates more lateral movement in machine travel. Maximum range is 100 meters. The dimensions of this laser head are slightly larger than the L-109 Series.

LD57PL Laser Head Gun Barrel-Laser Head Gun Barrel Attachment - 3" tube that attaches to the front of the laser head to provide protection against oil and flying debris.

LD57PR Retroreflector Gun Barrel -

Retroreffector Gun Barrel Attachment - 3" tube that attaches to the front of the retroreflector to provide protection against oil and flying. debris.

LD51S 90 degree beam bender - Fixed 90 degree mirror those attaches to front of Laser Head.

P-108L AC Powerfeed and Enclosure with Terminal Strip, Lemo Connectors - Same as P-108, but uses Lemo Connectors for the power system instead of SMA/SMB type. The Lemo Connectors provide a higher strain relief, and are ideal for more rugged applications. Specify **LD-21L** Cable if this option is used.

LHS1 Hermetically Sealed - Sealed Laser Head with the exception of the connectors.

IPPS Sinusoidal Output - Board that provides a sine wave output as required by some models of Fanuc, Siemens, and other controllers. Connects to IPS 1 Processor Module, and also requires the IPC3 Board. The quadrature sine/cosine wave signals are approximately IV peak to peak at 120 Ohm termination. The period of the sine wave is 40.513167 micrometers and the maximum frequency is 100 kHz.

IEWR Relay for Warning and Error - This relay can be used for the Error Signal, Warning Signal, or both. The IPS 1 processor board will allow two of these relays to be used, one for each function. The relay is triggered by the Error Signal/ Warning Signal and is latched for 200 msec. The relay is open when there is an error condition, and it is closed 200 msec after the error condition is removed. The rise time is 5 msec. The maximum contact Voltage is 60V, and the maximum current is 0.5A.

IMS - Additional Material Sensor. Adds a second material sensor to the IATCM that is averaged with the primary material sensor.
Loading the Thermal Expansion Coefficient into the Firmware
The IATCM requires that a PC be used to load the Material Thermal Expansion Coefficient into our firmware through the RS-232-C port. For normal operation, the PC is not required. Optodyne uses real time hardware compensation as opposed to slower software

SYSTEMS CONFIGURATION

There are two basic systems available, the **LDS-2000,** and the **LDS-2000OEM.**

The **LDS-2000** System includes the system power and the following components. The D-101 10 Digit Display is optional depending upon your application.

- *L-109 Laser Head*
- *IPS1 Processor Board and Driver*
- *R-102A 0.5" dia, Retroref lector*
- *IATCM Automatic Temperature/Pressure/ Material Compensation (Master)*
- *LD-21R Cable Set*
- *P-108 AC Powerfeed and Enclosure*
- *D-101 10 Digit LED Display (optional)*

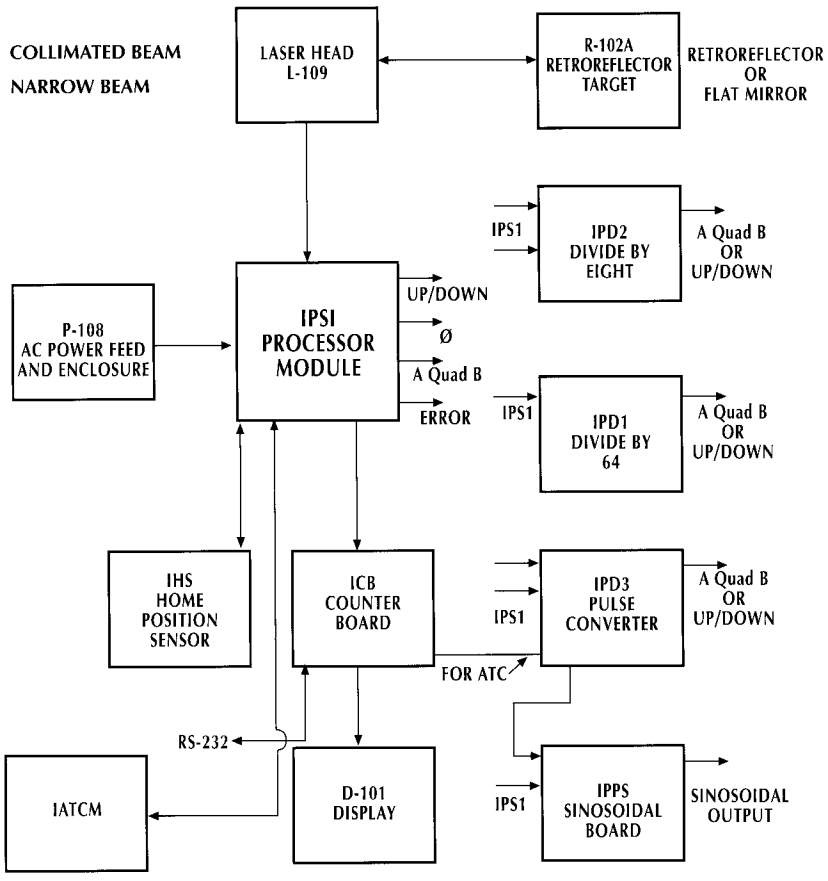
The **LDS-2000OEM** System is designed for applications where the laser system is built directly into your product, and requires you to supply the power for the laser head, the processor board, and driver. The following components are included with this system:

- *L-109 Laser Head*
- *IPSI Processor Module and Driver*
- *R-102A 0.5" dia, Retroreflector*
- *IATCM Automatic Temperature/Pressure/ Material Compensation (Master)*
- *LD-21R Cable Set*

The P-108 AC Powerfeed and Enclosure is not included with the OEM Version. This item can be added as an option if your installation does not have the necessary power requirements for the system.

See System Options for additional components that can be added or substituted in this system.

Block Diagram Model LDS-2000



SPECIFICATIONS:

L-109 Laser Head:
Power: 0.5 mw HeNe
C1ass:II 1121 CFR 1040.10, 1040.11
Alignment Tolerance: lateral ±0.05 inches
Wavelength: 632.8 nut
Weight: 2 lb.
Warm-up Time: 20 minutes

Resolution/Slew Rate:
IPS1 Processor Card:
25 microinches (0.6 µm), slew 160 ips
1PD2 Divide by 8 Board:
3.1 microinches (0.078 µm), slew 24 ips
IPDI Divide by 64 Board:
0.38 microinches (0.009 µm), slew 3.2 ips
Output:
Up/Down Pulses
AQuadB Square Waves
(Differential Output available)

Stability: 0. l ppm
Accuracy: 1 ppm (typical)

Maximum Range:

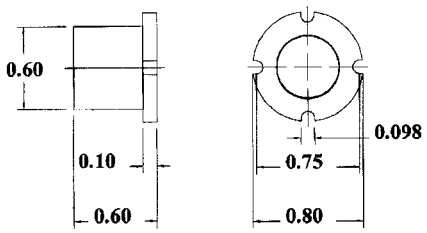
L-109 Laser Head:	40 inches
With -ER-400 Option	400 inches
With -ER-2000 Option	2,000 inches
L-110 Laser Head	100 meters

Maximum Speed:
<160 ips (4 m/s) with IPSI Processor Card

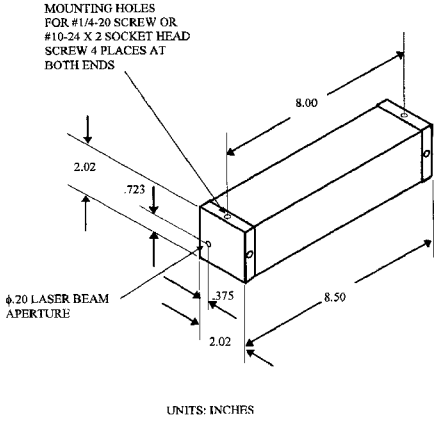
LDS-2000 OEM System Power Requirements:
15VDC, 2.5A
5VDC, 0.5A
-5VDC, 0.lA

Maximum Acceleration:
Laser Head 8g
Retroreflector 100,000g

P-108 AC Powerfeed and Enclosure



R-102A Retroreflector



L-109 Laser Head

HIS Home Position Signal

Output:	TTL Square Wave
Termination:	120 Ohms
Rise Time:	15 nsec
Pulse Width:	5 msec
Repeatability:	< lµm

Operating Environment:
Temperature 60 to 90° F
Altitude 0 to 10,000 ft
Humidity 0 to 95% non-condensing

Dimensions System Components:
IPS1 Processor Card:
7 x 4.5 x 0.75 inches
ID1 Driver Module:
4.5 x 2 x 1 inches
L-109 Laser Head:
2 x 2 x 8.5 inches
L-110 Laser Head:
3 x 3 x 9.5 inches

R-102A Retroreflector Dimensions:
Diameter: 0.5 inches
Weight: 0.05 oz.

Application Support
Engineering support is provided by Optodyne's qualified team of engineering professionals to assure that your application receives full benefit from the Laser System

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