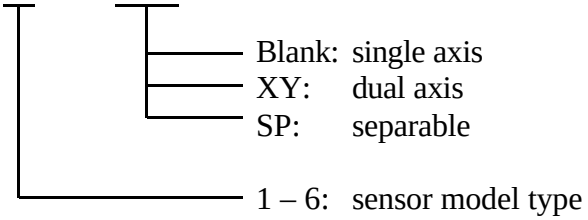
Section 1 LDM 300 series laser scanner

1 – A Specifications

Model #'s LDM- 30 ( ) H – ( ) ( )



Light source:	Invisible laser diode	780 nm
	Class IIIb	1 mW
	Visible laser diode	670 nm
	Class II	1 mW
Scan Frequency:	400 scans/ second	
Emission indicator:	Yellow LED on sensor	
Alignment terminal:	Square wave output (separable sensors only)	
Housing:	Dust proof	
Operating temperature:	0 - 45° C (32 - 113° F)	
Operating humidity:	35 – 85% (no condensation)	

Net Weight:

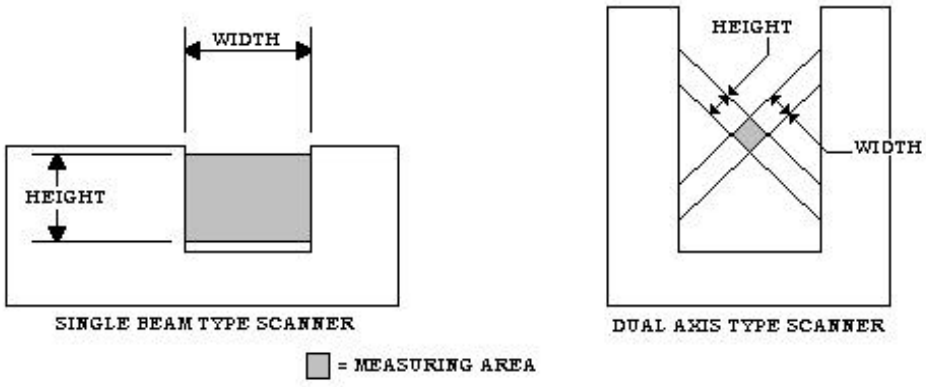
LDM – 301H	1 kg	(2.2 lbs.)
LDM – 302H	1	(2.2)
LDM – 303H	1	(2.2)
LDM – 304H	5	(11.0)
LDM – 305H	15	(33.0)
LDM – 306H	20	(44.0)
LDM – 301H – XY	2	(4.4)
LDM – 302H – XY	2	(4.4)
LDM – 303H – XY	2	(4.4)
LDM – 304H – XY	14	(30.8)
LDM – 305H – XY	50	(110.0)
LDM – 306H – XY	70	(154.0)

1 – B Operating Parameters

Measurement Range:

LDM – 301H, XY	0.02 – 1 mm	(0.0008 – 0.040 in)
LDM – 302H, XY	0.04 – 5	(0.002 – 0.200)
LDM – 303H, XY, SP	0.30 – 30	(0.012 – 1.180)
LDM – 304H, XY, SP	0.50 – 90	(0.020 – 3.600)
LDM – 305H, XY, SP	1.00 – 180	(0.040 – 7.200)
LDM – 306H, XY, SP	2.00 – 300	(0.080 – 12.00)

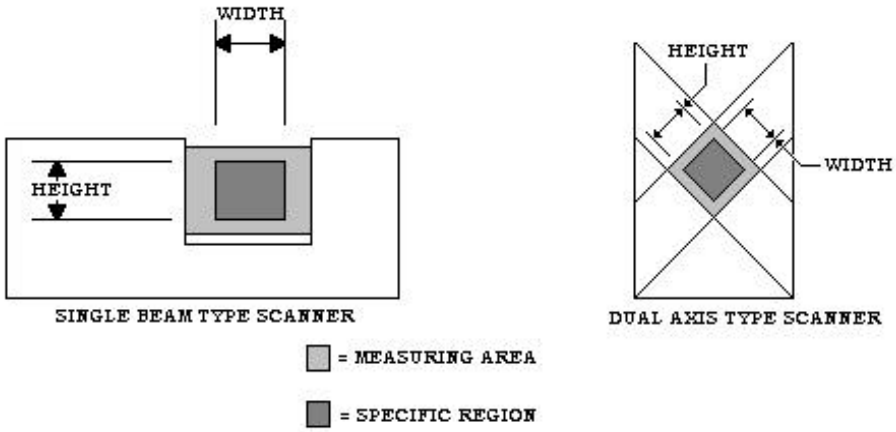
Measurement Area: Height and Width of the laser beam that an object can be placed in For measurement



Measurement Area: (Width x Height)

LDM – 301H	1 x 2 mm	(0.040 x 0.080 in.)
LDM – 302H	3 x 6	(0.120 x 0.240)
LDM – 303H, SP	70 x 30	(2.800 x 1.180)
LDM – 304H, SP	120 x 90	(4.800 x 3.600)
LDM – 305H, SP	284 x 180	(11.36 x 7.200)
LDM – 306H, SP	450 x 300	(18.00 x 12.00)
LDM – 301H – XY		
LDM – 302H – XY	1 x 2	(0.040 x 0.080)
LDM – 303H – XY	30 x 30	(1.180 x 1.180)
LDM – 304H – XY	90 x 90	(3.600 x 3.600)
LDM – 305H – XY	180 x 180	(7.200 x 7.200)
LDM – 306H – XY	300 x 300	(12.00 x 12.00)

Specific Region: Optimum accuracy will be obtained within this area.



Specific Region: (Width x Height)

LDM – 301H, XY	1 x 2 mm	(0.040 x 0.080 in.)
LDM – 302H, XY	3 x 3	(0.120 x 0.120)
LDM – 303H, XY, SP	20 x 20	(0.800 x 0.800)
LDM – 304H, XY, SP	60 x 60	(2.360 x 2.360)
LDM – 305H, SP	80 x 130	(3.150 x 5.120)
LDM – 306H, SP	100 x 200	(3.940 x 7.870)
LDM – 305H – XY	130 x 130	(5.120 x 5.120)
LDM – 306H – XY	200 x 200	(7.870 x 7.870)

Repeatability:

LDM – 301H, XY	± 0.3 μ m	(0.000011 in)
LDM – 302H, XY	± 0.3	(0.000011)
LDM – 303H, XY, SP	± 0.3	(0.000011)
LDM – 304H, XY, SP	± 2.0	(0.00008)
LDM – 305H, XY, SP	± 3.0	(0.0001)
LDM – 306H, XY, SP	± 3.0	(0.0001)

Measurement Accuracy:

LDM – 301H, XY	± 1μ m	(0.00004 in)
LDM – 302H, XY	± 1	(0.00004)
LDM – 303H, XY, SP	± 2	(0.00008)
LDM – 304H, XY, SP	± 5	(0.0001)
LDM – 305H, XY, SP	± 10	(0.0004)
LDM – 306H, XY, SP	± 30	(0.0012)

1 – C Sensor alignment – Separable type sensors

1. Set – up

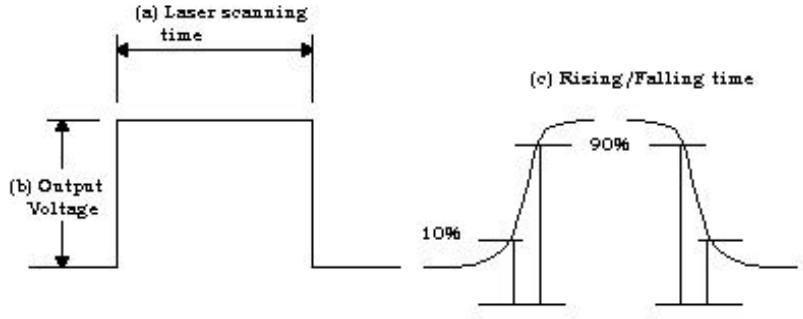
- Place the transmitter and receiver units on a flat surface making sure that they are on the same plane.

  Maximum separation between transmitter and receiver:

LDM – 303H – SP	254 mm	(10 in.)
LDM – 304H – SP	889	(35)
LDM – 305H – SP	3.5 m	(140)
LDM – 306H – SP	4.0 m	(160)

- Connect an oscilloscope to the output terminals on the end of the receiver unit.

- Turn power to the laser sensor on and physically adjust the transmitter unit so that the signal on the oscilloscope matches the one indicated below.



(a) Laser scanning time = approx. 400 µsec.
(b) Output Voltage = approx. 8 V
(c) Rising/ Falling time = 4 µsec or less

- Set the measurement mode to 0 (zero)

- When the transmitter and receiver are aligned, the display will read the full aperture size.
  Example: LDM – 303H – SP 30 mm (1.18110 in.)

- After the alignment is complete return the mode switch to the original position.

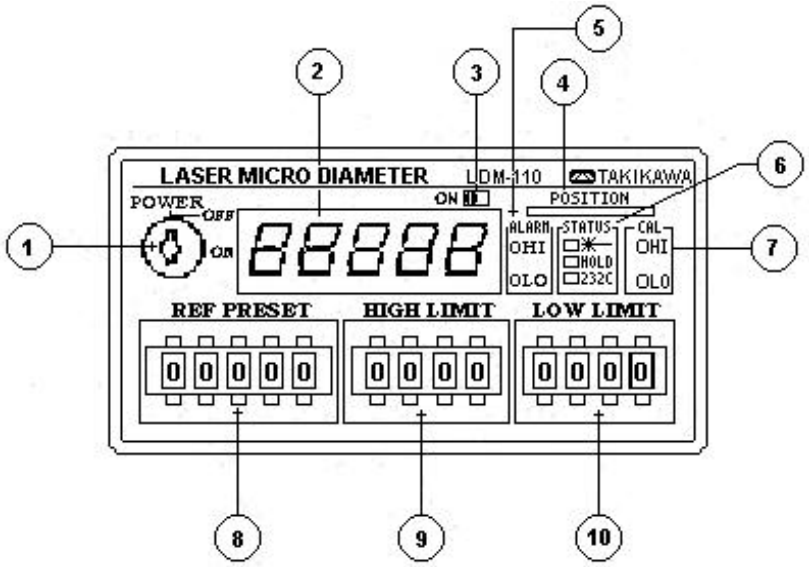
Section 2 LDM processors

2 – A LDM – 110 and LDM – 110EX Specifications

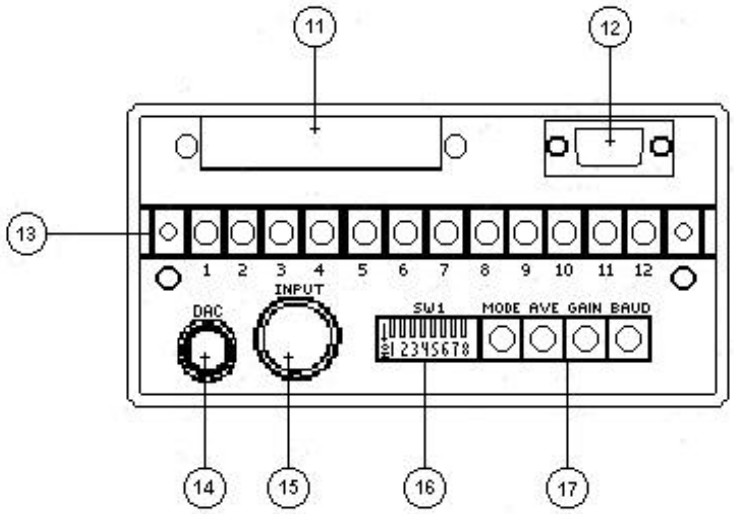
Power source:	90 – 240 VAC 50 – 60 Hz, less than 11 VA
Analog Output:	± 10 VDC (selectable gain) 12-bit resolution 100-ohm output impedance Absolute or deviation value
Hi / Lo Limit Output:	(2) 250 VAC 2 amps
Error Output:	(1) 250 VAC 2 amps
Operating Temperature:	0 - 45°C (32 - 113°F)
Operating Humidity:	35 – 85% (no condensation)
Net Weight:	1.5 kg (3.3 lbs)
Scan Averaging:	1 – 2048 (12 steps)
Display Resolution:	5 digits
Communications:	RS – 232C interface BCD (optional) DAC Port
Cable length between Processor and scanner:	5 meters standard (longer cables available)

2 – B Controls and Connections

LDM – 110 Processor

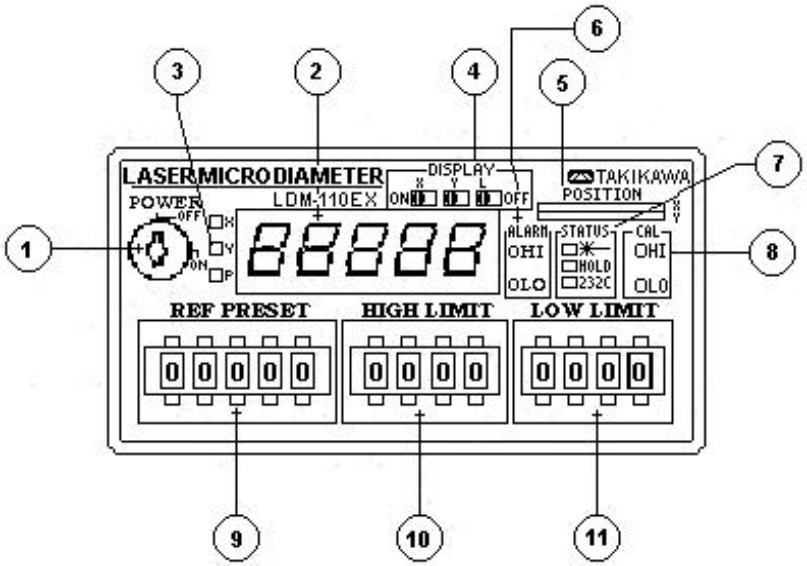


1. Keyed power switch
2. Main Display: 5 Digit display of measured value or error codes.
3. Digit Inhibit: Turns the last digit of the Main display On or Off
4. Position Indicator: 8 Segment LED bar graph. **(Page 12)**
5. Alarm Indicator: High/ Low limit visual alarm **(Page 12)**
6. Status: Indicator Lights for Laser on, Hold and RS – 232C **(Page 12)**
7. Cal Switch: Used for Calibration of the unit **(Page 13)**
8. Ref Preset: Nominal Value input **(Page 13)**
9. High Limit: Upper Tolerance input **(Page 13)**
10. Low Limit Lower Tolerance input **(Page 13)**

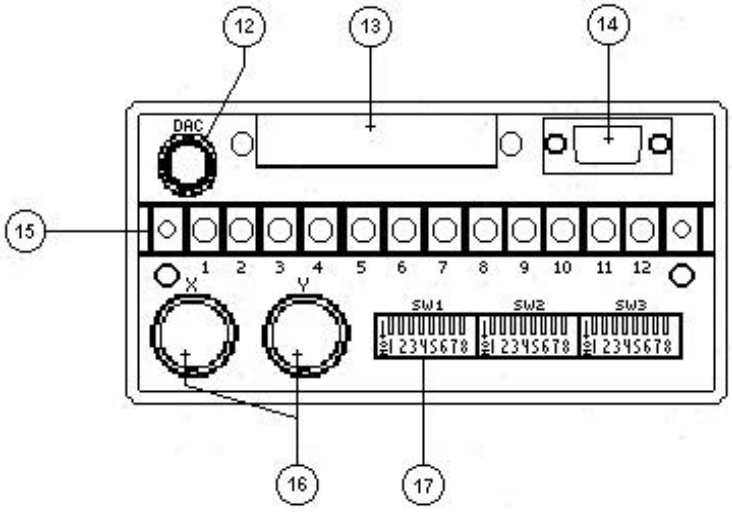


11. BCD (optional)	37 pin connector **(Page 24)**
12. RS – 232C Interface	9 pin connector **(Page 19)**
13. Terminal Block	**(Page 11)**
14. DAC port:	For use with DAC – 86B Diameter Controller.
15. Sensor connector:	Input connector from laser sensor
16. DIP switch	8 Bit switch **(Page 16)**
17. Rotary switches	Four 16 position switches for mode, average analog gain, and baud rate. **(Page 14)**

LDM – 110EX Processor



1. Power Switch: Key operated
2. Main Display: 5 Digit display of measured value And error codes
3. Channel displayed indicator: X, Y, Process **(Page 12)**
4. Display Switches: X, Y, Digit inhibit **(Page 12)**
5. Position indicators (2) 8 Segment bar graphs **(Page 12)**
6. Alarm Indicator: Hi / Lo Limit visual alarms **(Page 12)**
7. Status: Indicator lights for Laser on, Hold, and RS – 232C. **(Page 12)**
8. Cal Switch: Used for calibration of unit **(Page 13)**
9. Ref Preset: Nominal value input **(Page 13)**
10. High Limit: Upper tolerance input **(Page 13)**
11. Low Limit: Lower tolerance input **(Page 13)**



12. DAC Port:	For use with DAC – 86B
13. BCD (Optional):	37 pin connector **(Page 24)**
14. RS – 232C Interface:	9 pin connector **(Page 19)**
15. Terminal block:	**(Page 11)**
16. Sensor connectors:	Inputs for laser sensors
17. DIP switches	SW1, SW2, and SW3 **(Pages 16, 17, & 18)**

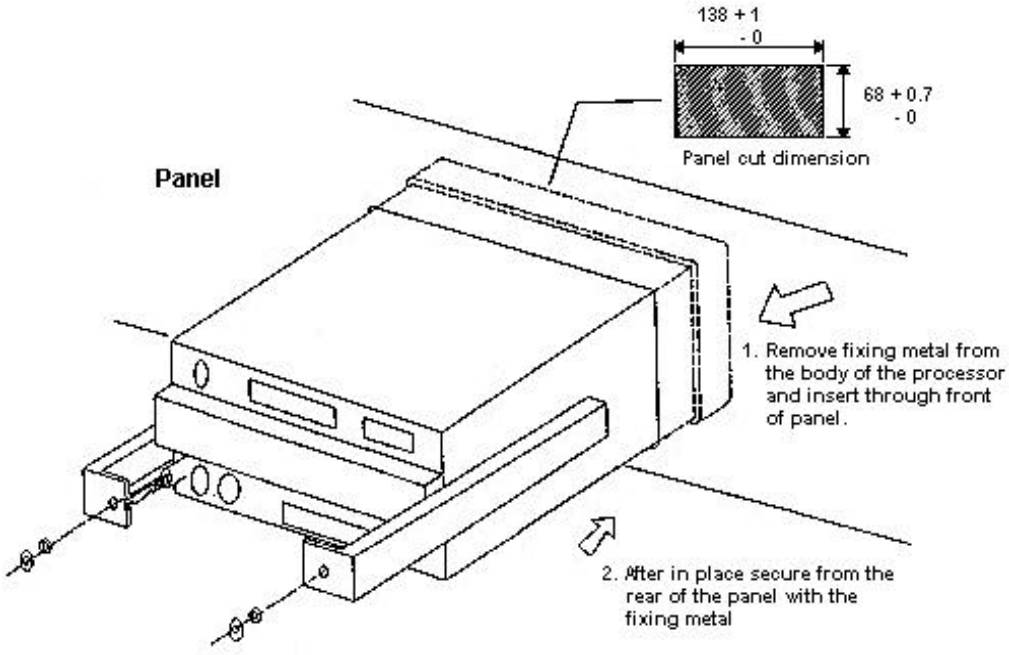
2 – C LDM processor panel mount requirements

1. Select a spot on the panel to install the LDM – 110 NOTE: select a spot that will not block the ventilation holes on the sides of the processor.

2. Cut a 5.433” (+ 0.039 – 0) Wide by 2.677” (+ 0.027 – 0) High in panel.

3. Remove the metal Terminal block cover and 2 fixing metal brackets.

4. Insert the LDM – 110 in the opening through the front of the panel. Re attach and tighten 2 fixing metal brackets.



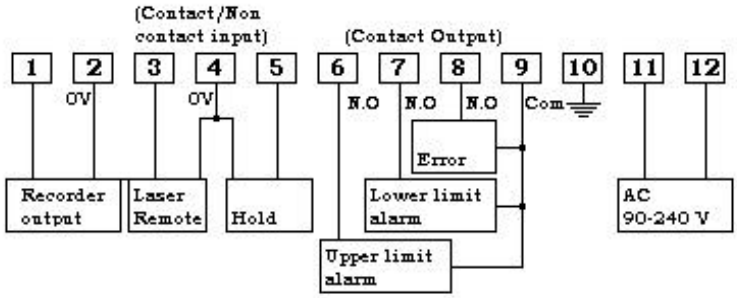
5. With the power off connect the sensor unit to the processor with the cable provided.
   CAUTION: Never attempt to connect or disconnect the sensor cable or make Any terminal strip connections with the power on!!

6. Make sure that the LDM unit is grounded.

7. Make any necessary connections to the terminal block (Refer to section 5 for terminal block configurations.

8. On separate type sensor unit align beam (Refer to section 1 – C)

2 – D Terminal Block Connections



1 Recorder output ± 10 V max resolution 12 bits

2 GND (ground) for recorder output

3 Laser remote terminal. Laser output after short circuit of terminals 3 and 4 exceeds 3 seconds

4 Laser remote terminal. Common for Hold terminal

5 Hold terminal. Measured value hold condition will occur when terminals 4 and 5 are short-circuited.

6 Upper limit alarm output: When upper tolerance is violated output of 250 VAC 2 amp (Resistance load) is present.

7 Lower limit alarm output: When lower tolerance is violated output of 250 VAC 2 amp (Resistance load) is present.

8 Error contact output: When an error occurs an output of 250 VAC 2 A (Resistance load) is present.

9 Common terminal for terminals 6, 7, and 8

10 Frame ground terminal for power supply

11 Power supply terminal: AC 90 – 240V, Free power supply, Voltage variation within ± 10% 50/60 Hz under 14VA

12 Power supply terminal

Section 3 Processor controls and their functions

3 – A Front panel

Display channel indicator:
(LDM – 110EX only)

3 LED's signifying which channel is selected: X, Y, or Process.

Display selection switches:
(LDM – 110EX only)

Used to select which value, X, Y, or processing is to be displayed. The LD switch turns on and off the last digit of the main display. The below table shows the positions of the X and Y switches for the different display modes.

Switch Position		
X	Y	Display mode
Off	Off	Previous display mode (X or Y)
On	Off	X axis is displayed
Off	On	Y axis is displayed
On	On	Processed value is displayed

Position indicator:

Indicates the position of an object in the laser beam using an 8-segment bar graph. The LDM – 110EX has two bar graphs, one for the X-axis and one for the Y-axis. NOTE: The object to be measure must be in the center of the beam for the reading to be accurate.

Alarm indicators:

2 LED's 1 for high limit and one for lo limit, that will illuminate when their respective tolerance is exceeded.

Status indicators:

Laser on: Indicates whether the scanning unit laser is on or off. When the laser on LED is lit and the yellow light on the scanning unit is on the Laser is on.

Hold: When light is on processor is inactive. This will happen when the laser is unstable and having a hard time determining which edge is the edge to be measured.

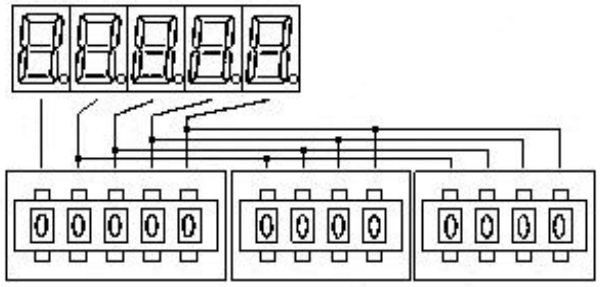
RS – 232C: When on all manual settings on the processor are inactive, they are controlled through the RS – 232C port via an external device.

Cal Switch:

These switches allow the processor to be calibrated in the field. See section 5 – A for calibration procedure.

Ref. Preset and Upper/ Lower tolerance inputs:

These thumb wheel switches are used for setting the Center value, Upper limit tolerance, and Lower limit tolerance. The Center value, or Ref. Preset, is set using the five thumb wheel switches (One for each digit of the Main display). The Upper and Lower tolerances are set using the two 4 digit High and Low limit thumb wheel switches (One for each of the last 4 digits of the main display.



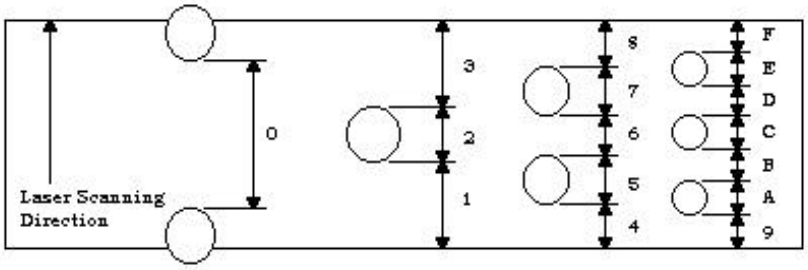
Ref Preset High Limit Low Limit

3 – B LDM – 110 Rotary switches

The Mode, Average, Gain, and Baud rate can be adjusted via the respective rotary switch on the back of the LDM – 110. A rotary switch is illustrated below. To change the setting turn the center of the switch with a small screwdriver so the arrow is pointing toward the setting number or letter required for the application.

Rotary Switch

Setting the Measurement Mode: Select the appropriate measurement mode from the diagram bellow and set the MODE rotary switch to the corresponding number or letter.



Setting the Average time: The LDM laser sensor scans at a frequency of 400 scans per sec. Each scan is a complete measurement, but required accuracy and throughput speed or the product determines the number of scans to be averaged.

Both the measured value and alarm output are calculated using simple average (# of scans).

Deviation output via the analog port is calculated using the moving average and is updated every 2.5 ms.

Scan averaging can be adjusted via the AVE rotary switch. Settings are as follows:

Switch position	# of Scans
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
A	1024
B	2048

Analog Output Gain:

Use the GAIN rotary switch to set the gain to one of the following settings.

In normal measurement mode, the analog voltage will track the displayed data. In deviation mode, the range is ± 10 VDC.

Switch position	Gain
1	0.0000393 in./volt
2	0.0003937
3	0.003937
4	0.03937
5	0.3937
6	3.937
7	39.37

Baud Rate:

To set the Baud rate select the appropriate rate and set the BAUD rotary switch to the corresponding number.

Switch Position	Baud Rate
1	150 BPS
2	300
3	600
4	1200
5	2400
6	4800
7	9600
8	19200

3 – C Dip Switches

Dipswitch (SW1) LDM – 110, 110EX

Switch	Position		Function
1	Off		Normal Condition
2	On		Analog output Absolute
	Off		Analog output Deviation
	NOTE: When 1 & 2 are both on, the unit is in self diagnostic Mode.		
3	On		Zero suppress
	Off		No zero suppress
4 & 5	4 Pos.	5 Pos	Decimal position
	Off	Off	0.0000
	On	Off	00.000
	Off	On	000.00
	On	On	0000.0
6	On		Display refresh every 2.5 seconds
	Off		Display refresh based on averaging
7	On		Error contact closed (no object)
	Off		Error contact open (no object)
8	On		No edge monitoring
	Off		Edge monitoring (normal operation)

Dipswitch (SW2) LDM – 110EX

Switch 1 and 2: Process display selection

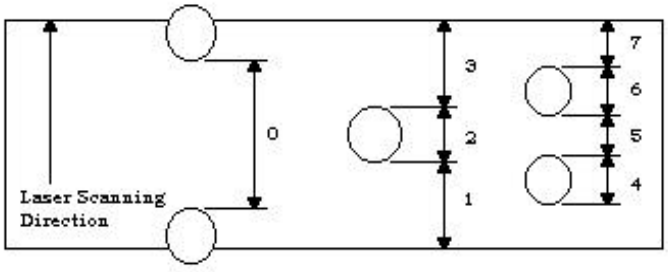
Switch position		
1	2	Mode
Off	Off	Average (X+Y)/2
On	Off	Difference X-Y
Off	On	Ratio X/Y
On	On	Large diameter

Switches 3, 4, and 5: X-axis measuring mode (see illustration at bottom of page)

Switch position			
3	4	5	Mode
Off	Off	Off	0
On	Off	Off	1
Off	On	Off	2
On	On	Off	3
Off	Off	On	4
On	Off	On	5
Off	On	On	6
On	On	On	7

Switches 6, 7, and 8: Y-axis measuring mode.

Switch position			
6	7	8	Mode
Off	Off	Off	0
On	Off	Off	1
Off	On	Off	2
On	On	Off	3
Off	Off	On	4
On	Off	On	5
Off	On	On	6
On	On	On	7



Measuring mode selection

Dipswitch (SW3) LDM – 110EX

Switches 1, 2, and 3: Scan Average

Switch position			
1	2	3	Scans
Off	Off	Off	1
On	Off	Off	20
Off	On	Off	100
On	On	Off	200
Off	Off	On	400 (1 second)
On	Off	On	800
Off	On	On	1000
On	On	On	2000

Switches 4, 5, and 6: Analog output gain

Switch position			
4	5	6	Inch/volt
Off	Off	Off	N/A
On	Off	Off	0.000039
Off	On	Off	0.000394
On	On	Off	0.00394
Off	Off	On	0.0394
On	Off	On	0.394
Off	On	On	3.94
On	On	On	39.4

Switches 7 and 8: Baud rate (RS – 232C)

Switch position		
7	8	Baud (BPS)
Off	Off	300
On	Off	2400
Off	On	4800
On	On	9600

Section 4 Communications

4 – A RS – 232C Interface

Specifications:

Communication:	full duplex
Synchronous system:	start – stop synchronous
Transmission code:	ASCII
Data bit length:	8 bits
Stop bit length:	1 bit
Parity check:	none
Baud rate: (LDM – 110)	150, 300, 600, 2400, 4800, 9600, 19200
(LDM – 110EX)	300, 2400, 4800, 9600
Connector:	D – SUB 9 – Pin

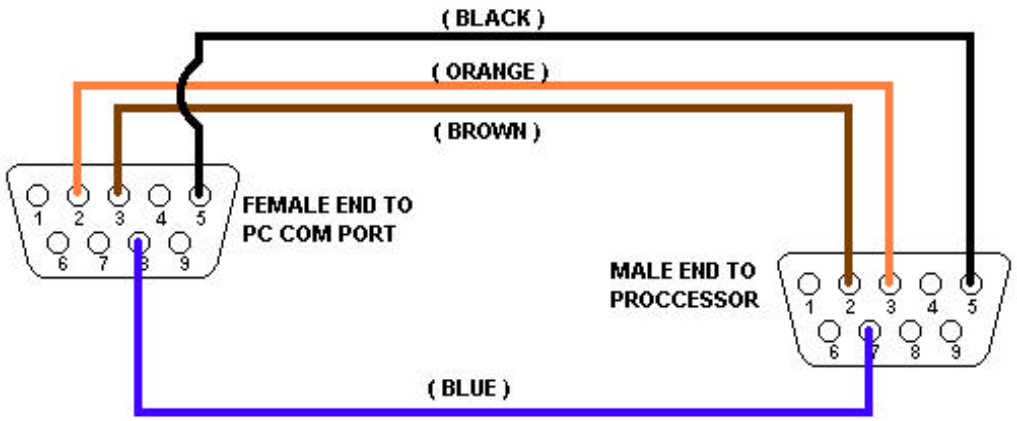
Note: The maximum baud rate at which bi-directional communication can be performed is 9600 BPS.

Connector pin out:

Transmit data (Tx):	Pin 3
Receive data (Rx):	2
Signal ground	5
Transmission request (RTS)	7

Note: Pins 1, 4, 6, and 9 are not used

SERRIAL CABLE CONFIGURATION



Internal/ External Control via RS – 232C

Upon power upon the laser controller, the internal mode is selected automatically. This permits readout of dimensional data and control values via RS – 232C, but does not permit control of the unit via RS – 232C.

When the unit is placed in external mode, all data, both control and dimensional, can be set via RS – 232C. When the processor is in external mode the RS – 232C status indicator on the front panel is illuminated and on board controls is inhibited.

Programming via RS – 232C using a PC hyper terminal.

1. Connect the serial cable to the RS-232C port on the back of the LDM-110/ 110EX and the Com 1 port on the PC.

2. Click on Start and open the program menu, open the accessories menu and select the hyper terminal folder (Some windows applications have a separate folder in the accessories menu for the hyper terminal, in other applications the hyper terminal folder is located in the communications folder in the accessories menu.). When the hyper terminal folder is open double click on the hyper terminal icon opening it.

3. A window will open asking for a file name, enter a name, for example; Laser demo, and click OK. A new window will open asking for a phone number. At the bottom of this window open the pull down menu for “Connect using” and select “Direct to Com 1” and click OK.

4. The properties for Com 1 will open, the settings should be as follows:
   Bits per second: 9600
   Data Bits: 8
   Parity: None
   Stop Bits: 1
   Flow Control: Hardware

   When done click OK.

5. Set the baud rate on the LDM-110/ 110EX to 9600. To do this the rotary switch on the back of the LDM-110 marked “BAUD” above it must be set to the number 7 position. On the LDM – 110EX switches 7 and 8 of dip switch (SW3) most both be in the On position.

7. To make changes to the settings through the hyper terminal the LDM-110/ 110EX must be in the External mode. To switch the mode type in a capital C ↵, the RS-232c light on the front of the LDM processor will come on. The processor is now in the external mode and the settings can be changed through the hyper terminal, however this also locks out the settings panel on the front of the processor and any settings entered in the panel will be ignored.

8. To retrieve the measured value through the hyper terminal type in a capital R ↵, this will give a read out of what the measured value was at the time the command was entered. To get the continuous value, otherwise known as live data, enter a capital F ↵, to freeze the data type in another capital F ↵.

9. The Center value (Ref Preset), High limit, and Low limit can be set on the LDM-110/ 110EX through the hyper terminal. To set these values enter the following commands with all letters lower case and the numbers in the place of the # signs:
    a. To set the Ref Preset enter p # # # # # ↵. For example to set the value to 0.0500 enter p00500↵.
    b. To set the High Limit enter h # # # # ↵
    c. To set the Low Limit enter l # # # # ↵

Other programming commands

Analog gain: (g # ↵) To set the gain type a lower case g followed by the corresponding code number from below and hit carriage return.

LDM – 110/ 110EX	
Code #	Gain
1	0.0000393 in./ volt
2	0.0003937
3	0.003937
4	0.03937
5	0.3937
6	3.937
7	39.37

Scan Average: (a # ↵) To set the scan average type in a lower case a followed by the code number from the respectable table below.

LDM - 110	
Code #	# Of scans
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
A	1024
B	2048

LDM – 110EX	
Code #	# Of scans
0	1
1	8
2	16
3	32
4	256
5	512
6	1024
7	2048

Mode:

LDM – 110

m # ↵: To set the mode on the LDM – 110 type in a lower case m followed by the corresponding code number from section and press carriage return.

LDM – 110EX

m # # # ↵: To set the mode on the LDM – 110EX type in a lower case m followed by the code number for the Y axis mode (0 – 7) from section, the code number for the X axis mode (0 – 7) from section, and the code number for the P display mode (0 – 3) from the table below followed by carriage return.

Code #	P display
0	Average (X + Y)/ 2
1	Difference (X – Y)
2	Ratio (X/ Y)
3	Large dia. measuring

Display mode: To set the display mode on the LDM – 110EX type in a lower case x, y, or d followed by carriage return (x = X axis display, y = Y axis display, and d = process display).

Interrogation commands: The first letter of these commands is all capital letters. When entered in it will return the setting code from the previous settings in this section.

P:	Reference value		# # # # #
H:	High limit		# # # #
L:	Low limit		# # # #
G:	Analog gain		#
M:	Mode value	(LDM – 110)	#
		(LDM – 110EX)	# # #
X:	X-axis value (LDM – 110EX)		# #. # # #
Y:	Y-axis value (LDM – 110EX)		# #. # # #
D:	Process value (LDM – 110EX)		# #. # # #
R:	Measured value		# #. # # #

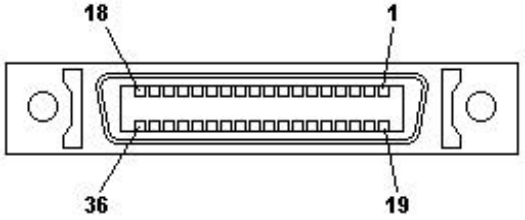
Note: The decimal point position in codes X, Y, D, and R is returned in the position set by dipswitch SW1.

4 – B BCD (optional)

Specifications:

Connector:	FDC – 37
Output IC:	74LS06
Data:	Parallel 6 digits
	Negative logic

Connector signal alignment:

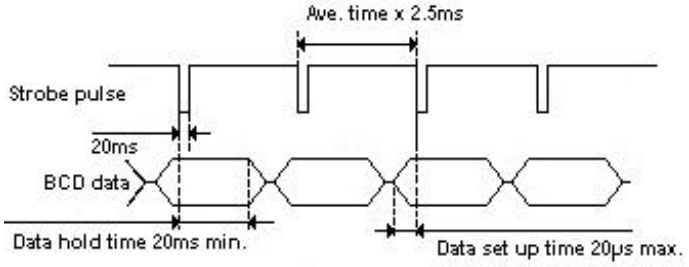


Display digit 1 2 3 4 5 6(No display)

Pin	Digit – signal	Pin	Digit - Signal	Pin	Digit - Signal	Pin	Digit - Signal
1	6 – 1	10	2 – 1	19	NC	28	Com
2	6 – 4	11	2 – 4	20	6 – 2	29	2 – 2
3	5 – 1	12	1 – 1	21	6 – 8	30	2 – 8
4	5 – 4	13	1 – 4	22	5 – 2	31	1 – 2
5	Com	14	Com	23	5 – 8	32	1 – 8
6	4 – 2	15	Com	24	4 – 1	33	Strobe
7	4 – 8	16	NC	25	4 – 4	34	Com
8	3 – 2	17	NC	26	3 – 1	35	NC
9	3 - 8	18	NC	27	3 - 4	36	NC

Com = Signal common NC = No connection

Timing Chart



Note: BCD data zero suppressed is (F) hex. Strobe pulse length change is available.

Section 5 Test Procedures and Diagnostics

5 – A Calibration

LDM – 110

All units are calibrated at Takikawa Engineering using XXX gage pins traceable to NIST. If you need to recalibrate the unit for a specific application, please follow these instructions.

Note: Two XXX gage pins will be required. Normally, these encompass the full measurement range of the laser sensor.

Recommended gage pin sizes for Calibration:

Model:	LDM-301H	LDM-302H	LDM-303H	LDM-304H	LDM-305H	LDM-306H
Cal H:	1 mm	2 mm	10 mm	40 mm	100 mm	200 mm
	0.0394 in.	0.0787 in.	0.3937 in.	1.575 in.	3.9370 in.	7.8740 in.
Cal L:	20 μm	100 μm	0.3 mm	2 mm	20 mm	40 mm
	0.00078 in	0.0039 in.	0.0118 in.	0.0787 in.	0.7874 in.	1.575 in.

1. Select the large pin (example: 0.5000 inch).
2. Set Reference preset to pin size (in this example 05000).
3. Place the large pin in the center of the laser beam.
4. Using a small blunt instrument, depress the CAL H switch on the front panel of the LDM processor and hold it. 8.8.8.8.8 will be displayed and will then switch to the pin size (0.5000). When the pin size is displayed release the switch.
5. Remove the large pin and replace it with a small pin (example: 0.0200 inch)
6. Repeat steps 2 through 4 using the small pin and the CAL L switch.
7. The calibration procedure is now complete

LDM – 110EX

1. Configure the display selection switches on the front panel so that the X-axis is displayed. (X – On, Y – Off)
2. Perform above calibration procedure for the X-axis.
3. When X-axis is complete repeat procedure switching to the Y-axis.

Resetting the LDM – 110/ 110EX processor to Factory Calibration.

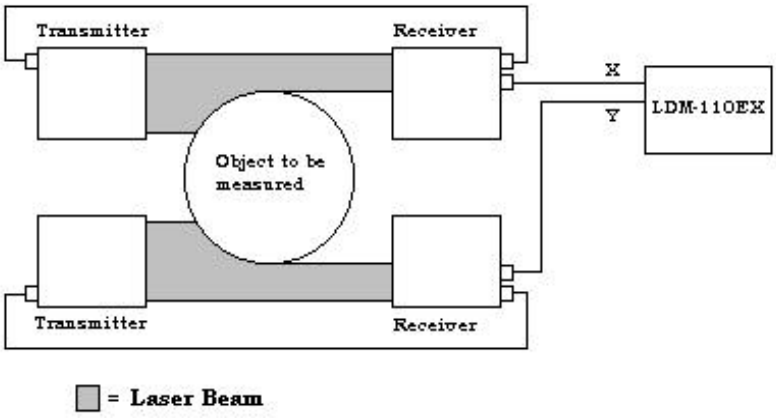
1. Switch the power off
2. Using a small blunt instrument, depress both the CAL H and CAL L switches simultaneously and hold.
3. Switch on the power, with the switches depressed the display should show 8.8.8.8.8. and then switch to a series of dashes, - - - - -. When the dashes are displayed release the switches. The factory calibration is now restored.

Changing the LDM processor from absolute to deviation display value.

When the LDM processor is first turned on, the display shows the absolute value. This is the default display value. To switch the display to the deviation mode, adjust the REF Preset to read all zeros (00000) and then depress the Cal L button and hold until all zeros are displayed. To switch back to the absolute value, depress and hold the Cal H button.

5 – B Large Diameter Measurement

Measurement of very large diameters can be made easily using two separable laser sensors and a single LDM – 110EX processor.



Set the LDM – 110EX as follows:

- Process display to large diameter measuring (Dipswitch SW2 switches 1 and 2 should be in the on position.).
- X axis measuring mode to mode 0 (Dipswitch SW2 switches 3, 4, and 5 should all be in the off position)
- Y-axis measuring mode to mode 0 (Dipswitch SW2 switches 6, 7, and 8 should all be in the off position.)

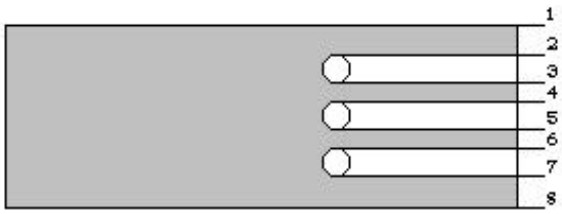
Calibration for large diameter measurement:

1. Confirm that the above settings are correct also set the decimal position according to the diameter to be measured.
2. Set the Ref. Preset to the exact size of the object to be used for calibration.
3. Place the object in the measuring area, making sure that it is in both beams, and push either the CAL H or CAL L with a small blunt object and continue to hold it until the reference value is displayed.
4. Perform the above procedure for both high and low calibration points.
5. The system calibration is now complete.

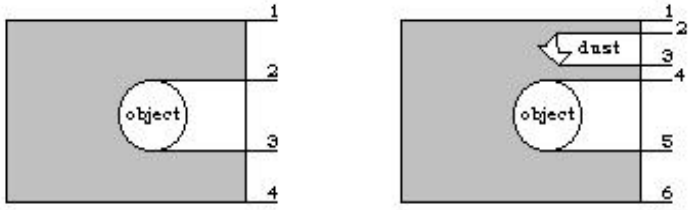
5 – C Edge Monitoring

What is an Edge? An edge is an electrical pulse generated at light to dark and dark to light transitions. Normally, up to three objects can be located in the beam at one time. Using the top and bottom edges of the beam itself, the maximum number of edges available is eight.

Example:



Under normal measurement conditions there is never a change in the edge count unless dust, water drops, or other airborne particulates enter the beam.



If this condition exists, the edge count will change, in this case from 4 to 6, affecting the displayed data and any feedback control.

The edge monitoring function monitors the number of edges at all times. If a change occurs, due to dust etc. entering the beam, the control goes into hold status until the condition is corrected. The HOLD indicator on the processor display illuminates alerting the operator that there is a foreign object in the measurement area. When the condition is corrected the system returns to normal operation and the HOLD light is extinguished.

Note: The edge monitoring function can be turned off using switch 8 of Dipswitch SW1.

5 – D Self-Diagnostic Mode

The self-diagnostic mode can be activated by setting switches 1 and 2 on Dipswitch SW1 to the on position. This setting will be saved on power up.

In this mode the system will check for presence of dust and other airborne contaminants on the sensor windows. When in self-diagnostic mode all objects should be removed from the laser beam.

If all conditions are normal LLL will be displayed. If there is dust present, E-10 will be displayed and the error contact (terminals 8 and 9) will be closed. At this time contaminants should be cleaned from the windows using alcohol and a lint free cloth.

If E-10 is still displayed after cleaning return switches 1 and 2 of dipswitch SW1 to their original position. If E-12 is displayed follow instructions on the error code table below.

Error Codes

Code	Indication	Cause	Solution
E – 10	Self diagnostic no good	Refer to section 16 G	
E – 12	No edge signal	Laser remote off	Laser remote on
		Laser cutoff and/or dust on window	Clean windows
		Sensor cable not connected	Connect cable
		Scanning motor NG Laser diode NG Photo diode NG Cable NG	Return to factory
E – 14	Edge count NG	Water/ dust in air	Air purge required
		Dust on windows	Clean windows
E – 40	RS – 232C error	Program NG Baud rate wrong	See section 12D
E – 41			
E – 42			
E – 50	Calibration NG	Cal data NG	Restore factory cal see section 14E
E – 51	Display switch setting NG	Both X and Y are off	Reset and turn power on
E – 52	Y = 0 at P display	No object in Y axis	Place object in beam
E – 53	P < 0 at large dia.	Cal for large dia.	See section 14E. 1

NOTE: If an E – 12 condition exists disconnect all power before attempting to solve the problem. Failure to do so may damage the instrument.