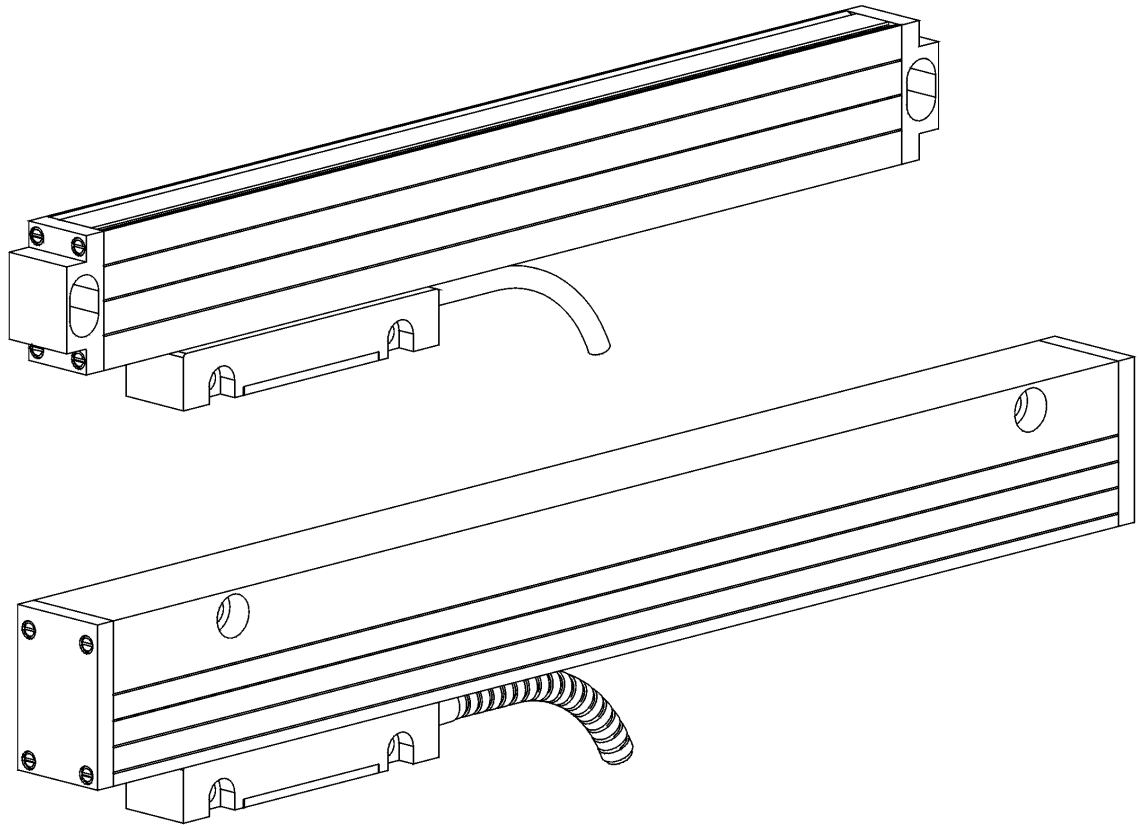


Model LE18 & LE25
Enclosed Linear Optical Encoders

INSTALLATION MANUAL

First Edition

June 1999




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General Applications Information

Gurley Precision Instruments LE18 and LE25 series linear encoders share a common precision glass measuring scale and read head design. The read head carriage is supported on precision ball bearings to maintain carriage alignment and low friction operation. The LE18 has a smaller cross section housing extrusion which permits its use in more restricted areas, while the larger cross section of the LE25 scale's housing extrusion permits multiple support points and greater overall measuring lengths.

The LE18 scale is designed to be supported only at the ends when mounted. In order to support its own weight without excessive sag in the middle, it must be mounted with the cross sectional long axis of the scale extrusion mounted vertically, like so: . If installation requirements are such that the cross section long axis is horizontal, the encoder must be supported along its entire mounting surface.

The LE25 scale may be mounted with the long axis of the extrusion in either direction.

For most accurate operation, either encoder type should be installed as close as practical to the line of measurement or machine tool path, and all scale support points must be utilized. The scale and read head must be mounted to surfaces which are both flat and parallel to the direction of motion.

Linear motion cannot be guided or constrained by the encoder itself. It must be provided by the machine ways, linear bearings, or slides to which the encoder is mounted.

When mounted properly, the read head is designed to compensate for the inevitable minor misalignments and nonlinear motion errors of up to 0.2 mm (0.008") without loss of accuracy. However, it cannot tolerate gross installation errors or fundamentally nonlinear motion. Any combination of pitch, roll, yaw, or non-parallel motion exceeding this amount will cause reading errors. Nearly all linear motion devices are capable of generating motion and forces which far exceed the encoder's ability to compensate, and if misaligned are likely to result in permanent damage to the encoder read head or scale.

Protective sealing lips are provided to guard the internal parts of the encoder against moderate amounts of dust, debris, and the like to IP level 53. In order for this protection to be effective, the scale and read head must be mounted with the protective flaps facing away from sources of contamination. If necessary, additional protection in the form of user-provided auxiliary covers, shrouds, or splash guards must be considered.

If the encoder will be exposed to high velocity machining chips, pressurized air, splashing or pressurized coolant, or washdown, it can be equipped with fittings for compressed air which will provide protection to IP 64. Consult the factory for further information on this option.

It is recommended the scale housing be attached to the moving part of the machine and the read head to the stationary part, providing a fixed and simplified routing for the electrical cable. Minimum cable bend radius in a fixed configuration is 20 mm (0.75"). Where the read head cannot be held stationary, the minimum cable bend radius is limited to 70 mm (2.75") to permit continuous flexing.

Mechanical Installation

1. The encoder should be removed from its shipping box and held at room temperature for at least four hours before installation.
2. Figures 1 and 2 depict the LE18 and LE25 outline dimensions respectively, and their tolerances for flatness, parallelism, and perpendicularity as installed.
3. Check the machine mounting surfaces to ensure that the installation tolerances can be met. Some out-of-tolerance conditions can be corrected by using shims at each mounting point. Metal shims are recommended for temperature compatibility.
4. Drill and tap mounting holes for the scale housing and the read head per Figure 3 or 4, depending on model selected. Refer to Figure 5 for extrusion mounting hole pattern dimensions if the LE25 has been selected. Remove all burrs and machining debris.

Note: *Do not use the mounting holes in the scale housing, end caps or read head as pilot holes for drilling; this may damage the encoder!*

5. Remove the red transportation plate that secures the read head to the scale housing extrusion during shipping. Do not remove the gapping shim at this time.
6. Thoroughly clean all mating surfaces of the encoder housing, read head, and machine.
7. Mate the encoder housing to the machine mounting surface and loosely attach its mounting screws.
8. Place the machine and read head at the approximate midpoint of travel. Adjust the encoder scale housing until the read head mounting holes line up with the previously drilled holes in the machine and loosely attach the read head mounting screws. Check for parallelism and snug the scale housing mounting screws.
9. Tighten the read head mounting screws to 2.0-2.5 Nm (18-22 in-lb) and remove the gapping shim.
10. Tighten the scale housing mounting screws to 2.0-2.5 Nm (18-22 in-lb).
11. Carefully run the encoder to the limits of travel while closely observing that the gap between the read head and housing remains 1 ± 0.2 mm (0.040 ± 0.008 ""). If at any point in its operation the gap exceeds the tolerance, immediately stop and correct the condition before proceeding.
12. It is recommended that positive mechanical stops be located on the machine to protect the encoder from overtravel and consequent damage to internal parts.

Electrical Interface and Checkout

Check the +5V power supply for proper voltage and polarity before connecting the encoder. If the encoder interface cable is longer than 3 m (10 ft), you may wish to test the power supply using a 33 Ω , 1 Watt dummy load resistor which helps measure the IR voltage drop on the cable. The voltage measured directly across this resistor must be 5 ± 0.2 VDC to guarantee proper encoder operation.

Connect the encoder cable in accordance with the pinouts provided in the LE18 encoder data sheet or Table 1, below. The bare wire connects to the encoder case and cable shield.

CODE	P	Q	S
CONNECTOR	NONE	DA-15P	DE-9P
FUNCTION	COLOR	PIN	PIN
A	YEL	8	4
/A	BRN	7	8
B	GRN	5	3
/B	ORG	4	7
Z	BLU	2	2
/Z	WHT	1	6
+V	RED	10	5
GND	BLK	13	9
CASE	BARE	14	1

Table 1 - Standard Electrical Connections

Connect the cable to your CNC, digital readout, or counter. Verify Zero index position and correct up and down counting sense. If possible, reset the counter while the encoder is held against a mechanical stop, move away from the stop, cycle the scale back and forth at a rate consistent with your machine's maximum operating velocity, and return to the mechanical stop to verify no extraneous counts have been accumulated or lost.

Although unbuffered complementary photodiode outputs are offered for backward compatibility with competitive products, Gurley's 50X internal electronic enhancement of the scale pitch provides a final measuring step down to 0.1 μm without a separate "interpolator box". Besides offering cost effectiveness and ease of installation, this means it is now unnecessary for any reason to forego the RS-422 differential data transmission standard widely regarded as the most reliable, speedy, and noise immune method of delivering incremental encoder signals.

Note: For encoders with 0.1 or 0.2 μm resolution, your counter/controller must be able to detect and evaluate quadrature edges as close as 50ns (20MHz count rate) in order not to miss any counts!

For RS-422 line driver output, channel A leads channel B when the read head travels from left to right (towards the cable exit with respect to the scale). The Zero index signal is 1/4 cycle wide, gated to be coincident with the high states of channels A and B. Differential line drivers on all channels incorporate an internal thermal shutdown feature to survive extended duration output short circuits and may be used single ended for TTL compatible inputs (insulate and ignore unused outputs). Output levels typically swing to within 2 volts of the positive supply rail and will sink or source up to 70 mA. The standard Gurley interface cable supplied with the encoder is custom manufactured to be highly flexible and suited to the encoder's operating currents and data transmission schemes. It consists of 5 twisted pairs of 28 AWG stranded wire inside an overall shield comprised of foil, braid and drain wire with outer PVC jacket.

It is recognized that preferred electronic interfaces vary widely by vendor, and change over time. See Figure 6 for recommended interface circuit techniques and consult with factory for additional applications assistance if necessary.

Removing the Read Head

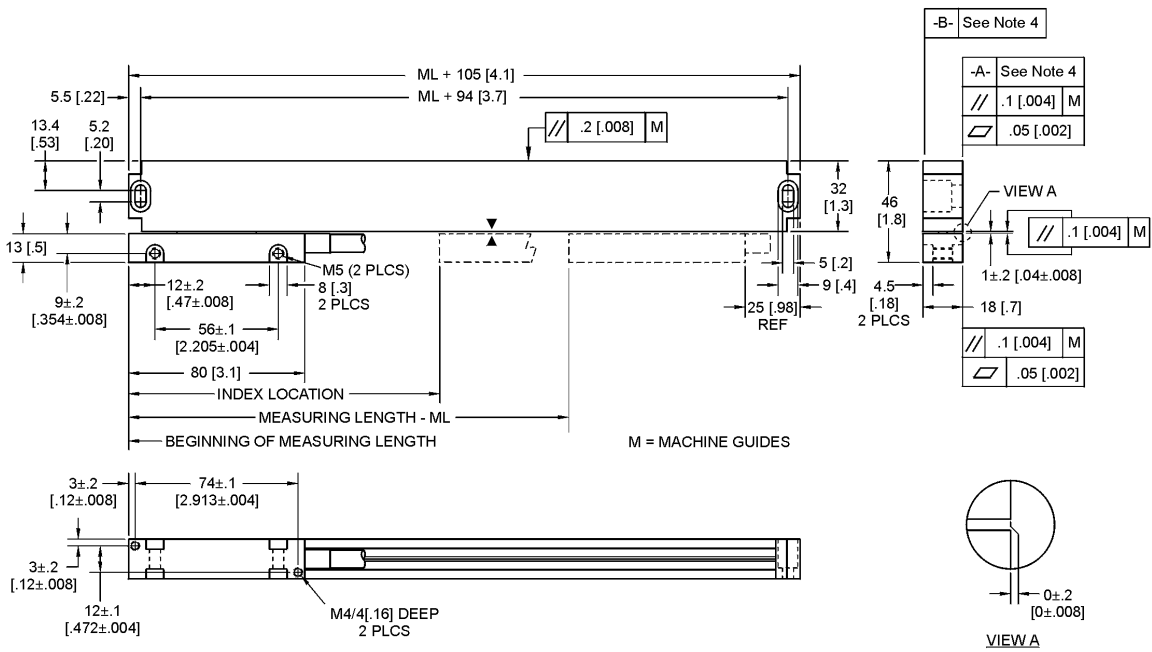
It may be desirable to remove the encoder read head for cleaning, preventive maintenance inspections, troubleshooting, or repair:

1. Refer to Figure 7. Remove the four screws holding the left end cap to the housing. It is strongly recommended to access the read head from the left (label on extrusion visible and rubber flaps down), because replacing the read head from this side later is much less likely to result in damage to the read head.
2. Pull off the end cap. It may stick and require some prying to break the silicone adhesive seal. Make sure the two rubber sealing lips are not pulled out with the end cap. Brush or vacuum away any loose adhesive to prevent fouling of the scale.
3. Remove the read head assembly by sliding the unit straight out of the housing. Note the read head assembly consists of a guide carriage subassembly with sprung drive ball, and an electronic sensor subassembly, tied together by electrical wires.

Replacing the Read Head

To replace the read head assembly:

1. Refer to Figure 7. The read head assembly must be oriented such that the cable exits to the right when viewing the housing from the front (label visible, rubber flaps down). If encoder mounting surface option "B" has been selected at the time of order, the opposite is true and the cable exits to the left.
2. The sensor assembly must be seated on the drive ball of the guide carriage assembly. Locate the dimple on the bottom of the sensor assembly and mate it gently with the drive ball of the carriage assembly, without introducing extra twists in the wires.
3. While holding the two subassemblies together slide them into the housing such that the ball bearings on the electronic assembly straddle and ride along the glass scale. A gentle squeezing together of the two units may be required to insert them into the housing. Once the unit has been correctly started it will slide freely all the way onto the glass scale inside the scale housing extrusion.
4. The carriage assembly will separate and divide the two rubber flaps as the read head unit is inserted. Slide the read head along the length of the scale to determine that the motion is smooth and unobstructed.
5. Replace the end cap. A thin bead of silicone adhesive, such as General Electric type RTV 103, may be added along the end of the aluminum housing for sealing purposes.
6. Replace and tighten the four screws holding on the end cap, and check the encoder for proper operation.



NOTES:

1. ALL DIMENSIONS IN MM [IN].

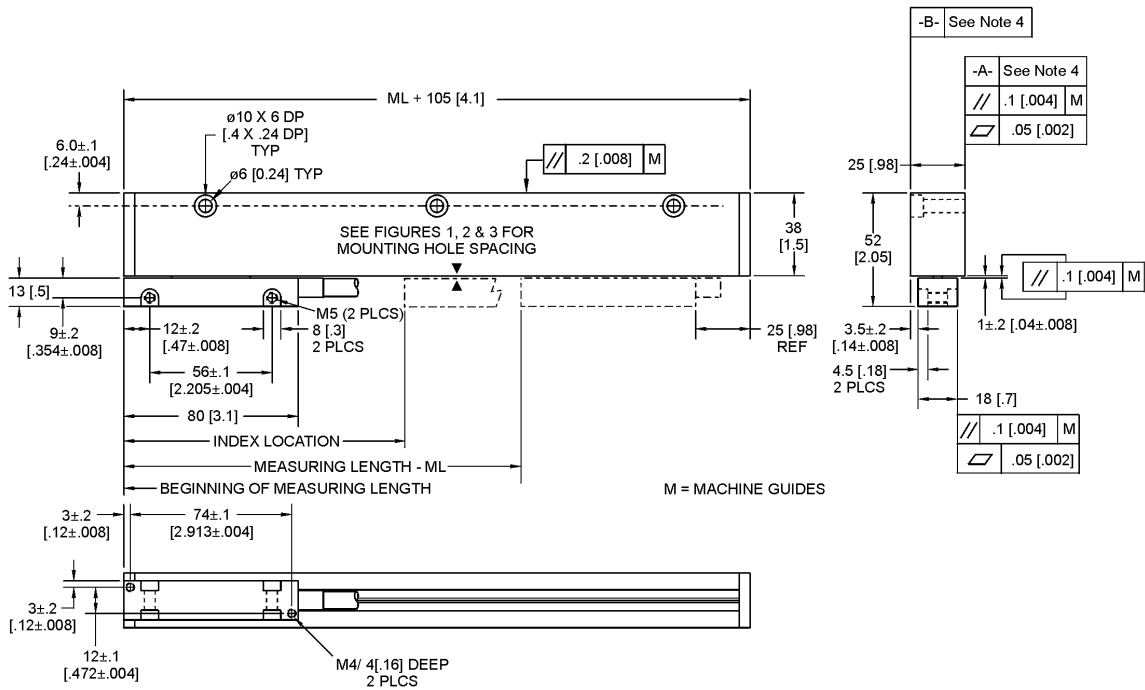
2. STANDARD MEASURING LENGTH (ML) AND CABLE LENGTHS:

MM	70	120	170	220	270	320	370	420	470	520	570	620	720	820	920	1020	1140	1240
IN	2.8	4.7	6.7	8.7	10.6	12.6	14.6	16.5	18.5	20.5	22.4	24.4	28.3	32.3	36.2	40.2	44.9	48.8
CABLE, INCHES	60												120					

3. READING HEAD HAS 3.5MM [0.13] OVERTRAVEL AT EACH END.

4. MOUNTING AGAINST SURFACE A IS STANDARD. TO REVERSE THE CABLE EXIT DIRECTION, SELECT MOUNT OPTION B; THE ENCODER WILL BE MANUFACTURED SO THAT IT CAN BE MOUNTED AGAINST SURFACE B. ALL ALIGNMENT TOLERANCES ARE WITH RESPECT TO THE MOUNTING SURFACE.

Figure 1 - LE18 Outline Drawing



NOTES:

1. ALL DIMENSIONS IN MM [IN].
2. STANDARD MEASURING LENGTH (ML) AND CABLE LENGTHS:

MM	70	120	170	220	270	320	370	420	470	520	570	620	720	820	920
IN	2.8	4.7	6.7	8.7	10.6	12.6	14.6	16.5	18.5	20.5	22.4	24.4	28.3	32.3	36.2
CABLE, INCHES	60											120			

MM	1020	1140	1240	1340	1440	1540	1640	1840	2040	2240	2440	2640	2840	3040	
IN	40.2	44.9	48.8	52.8	56.7	60.6	64.6	72.4	80.3	88.2	96.1	103.9	111.8	119.7	
CABLE, INCHES	120			180						240					

3. READING HEAD HAS 10 MM [0.4] OVERTRAVEL AT EACH END.
4. MOUNTING AGAINST SURFACE A IS STANDARD. TO REVERSE THE CABLE EXIT DIRECTION, SELECT MOUNT OPTION B; THE ENCODER WILL BE MANUFACTURED SO THAT IT CAN BE MOUNTED AGAINST SURFACE B. ALL ALIGNMENT TOLERANCES ARE WITH RESPECT TO THE MOUNTING SURFACE.

Figure 2 - LE25 Outline Drawing

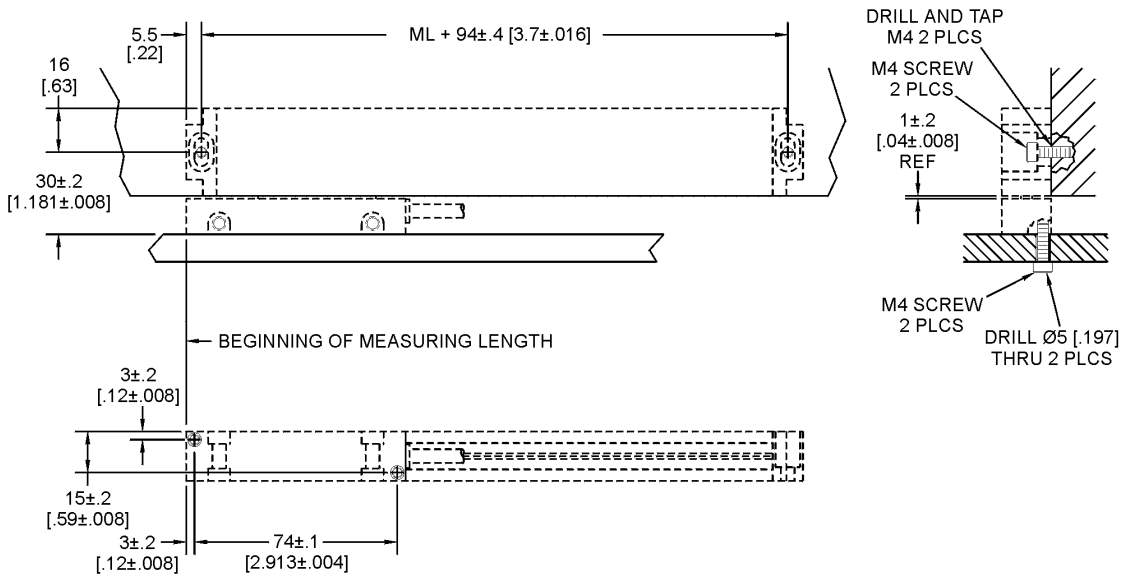
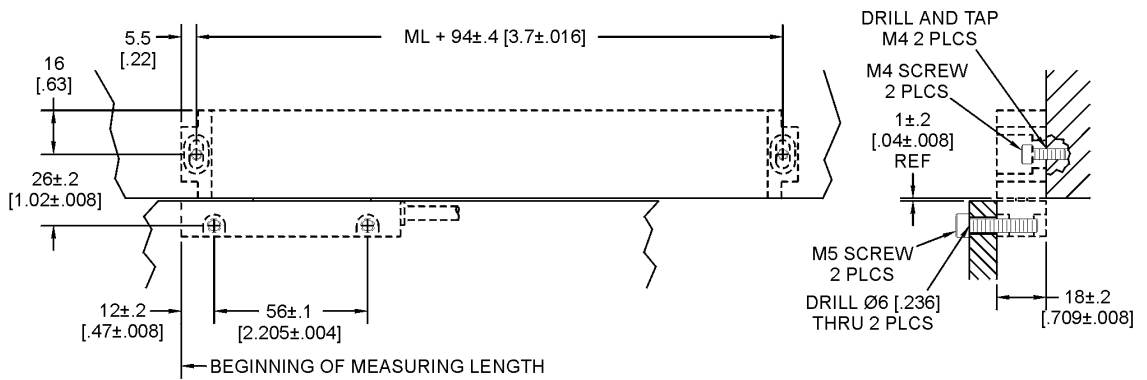
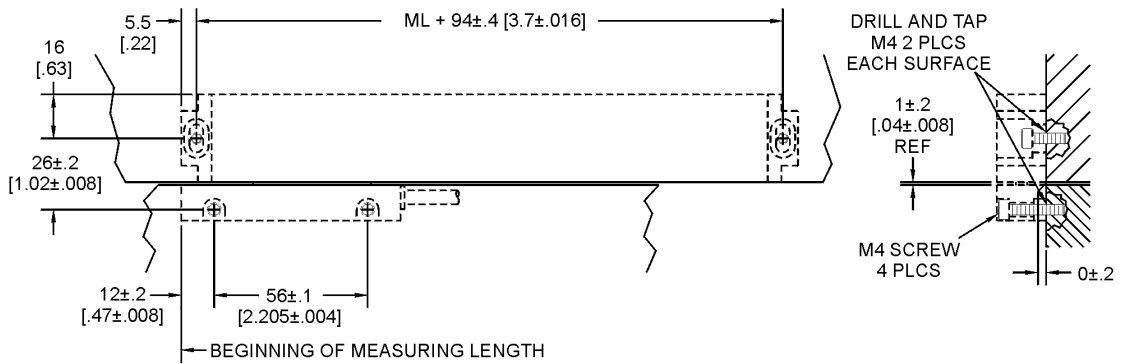
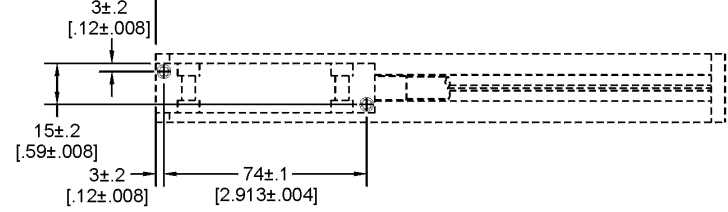
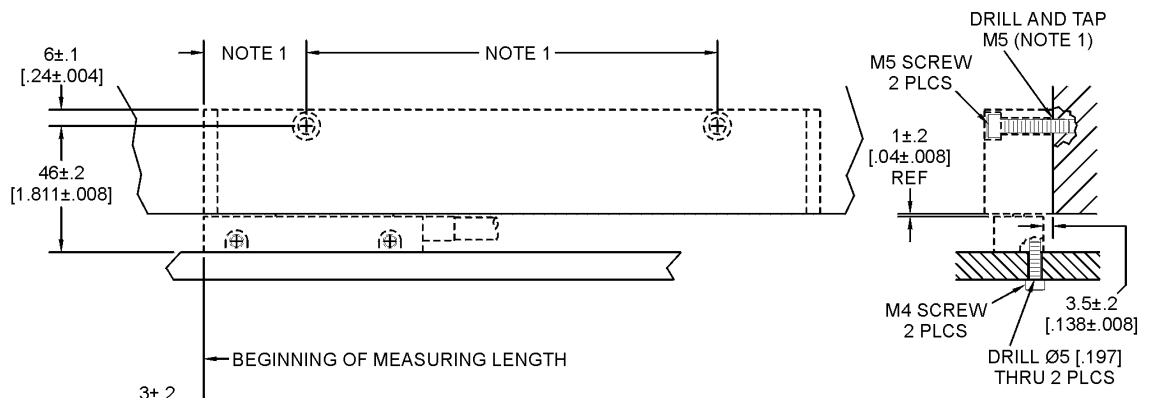
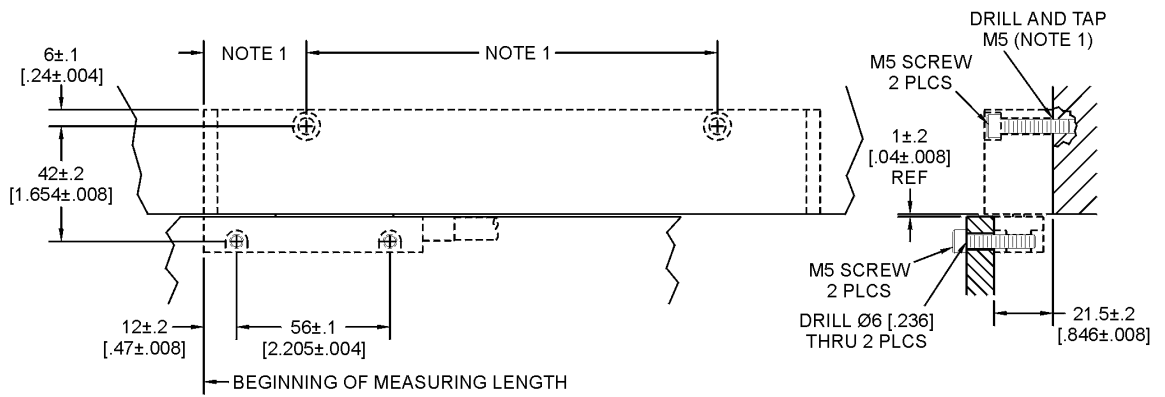
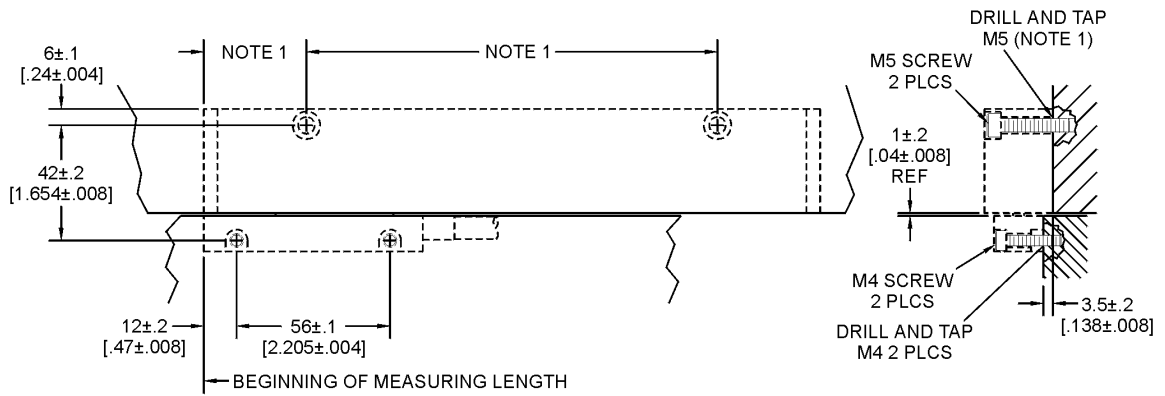


Figure 3 - LE18 Mounting Methods



NOTES:
 1. REFER TO FIGURE 5 FOR NUMBER AND LOCATION OF HOLES.

Figure 4 - LE25 Mounting Methods

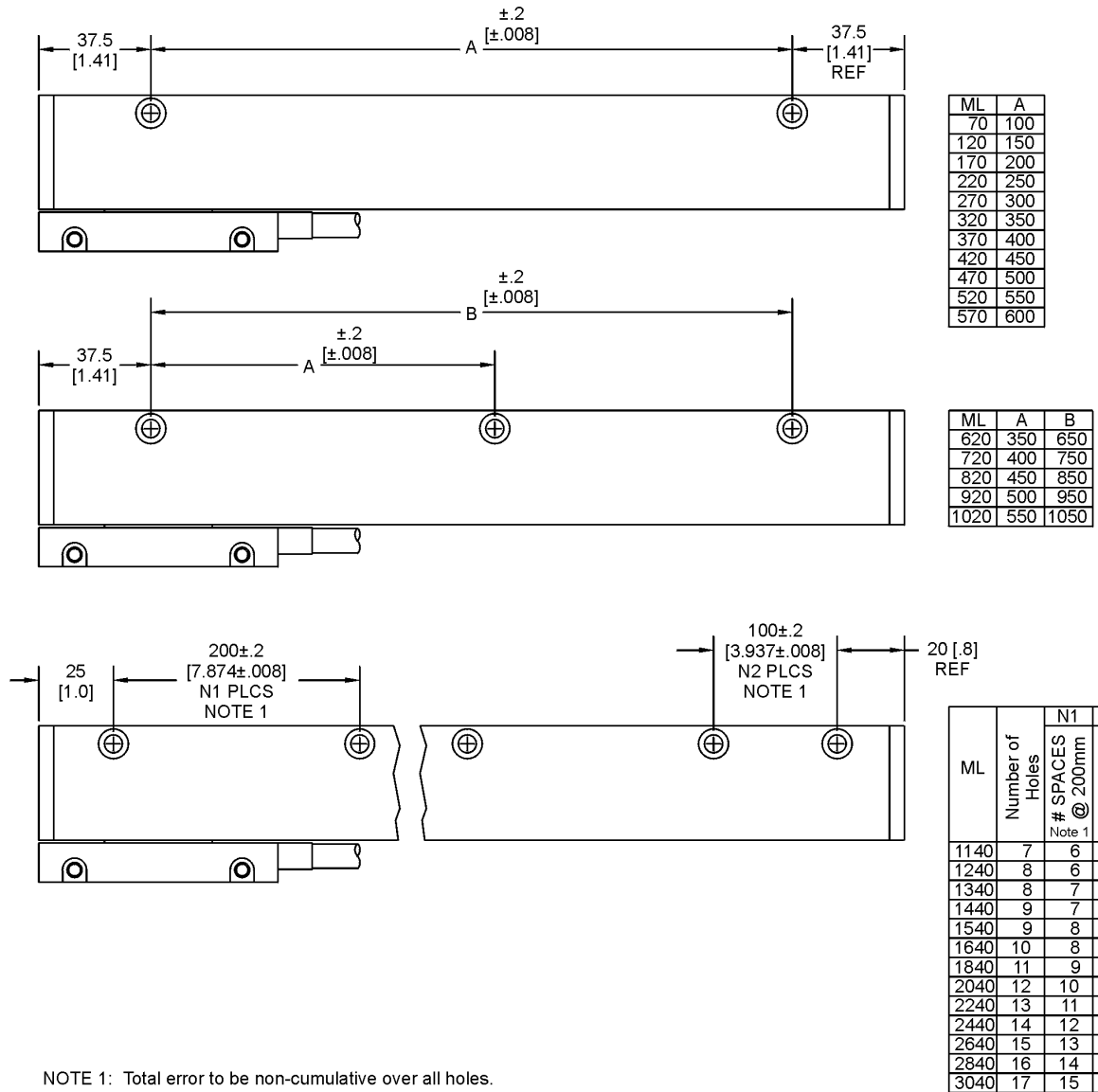


Figure 5 - LE25 Extrusion Mounting Hole Patterns

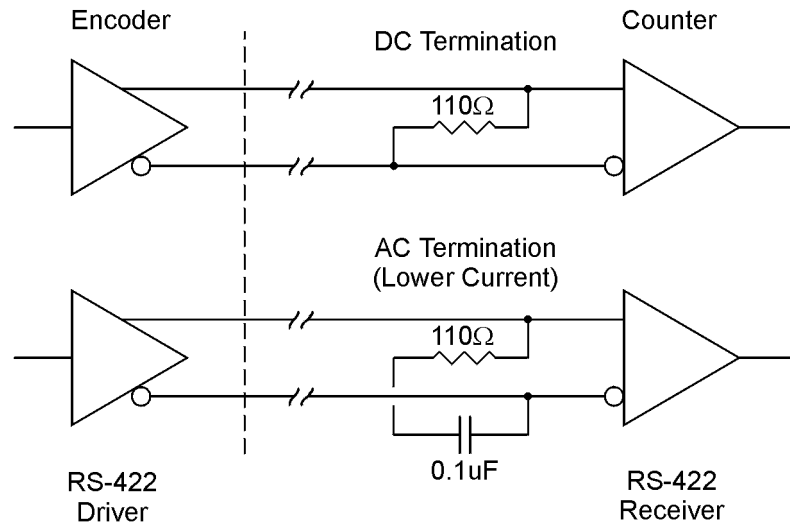


Figure 6 - Electrical Interface Options

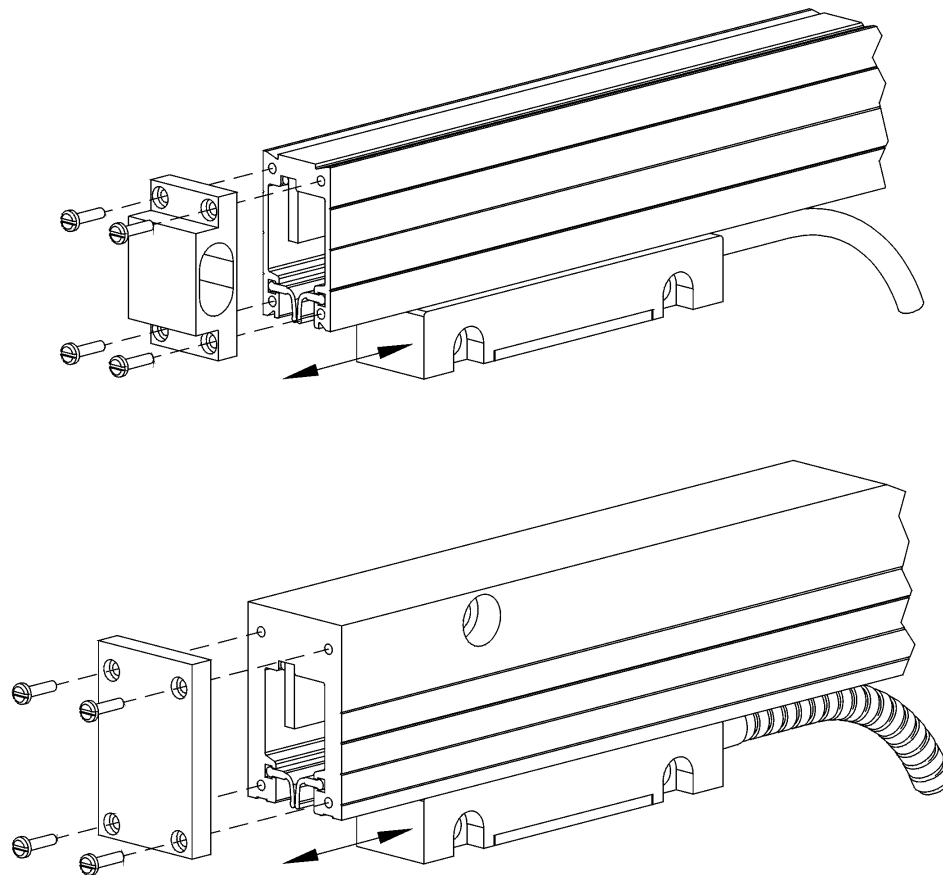


Figure 7 - Read Head Removal and Replacement

Warranty and Return Policy

Gurley Precision Instruments (GPI) does not warrant that the hardware will work properly in all environments and applications, and makes no warranty and representation, either implied or expressed, with respect to the quality, performance, merchantability, or fitness for a particular purpose of any software or documentation. GPI reserves the right to make changes to the hardware and to Installation Manual content without obligation to notify any person or organization of the revision or change.

GPI warrants its products to conform to their published specifications and to be free from defects in material and workmanship for a period of one year from date of shipment. This Limited Warranty is extended to the original end user and covers parts and labor. Any product returned under warranty is subject to inspection and testing at GPI. User must return the product, freight prepaid, to the factory. GPI, at its option, will repair or replace any product found defective, free of charge. Return freight charges are collect to the user.

This warranty is void if damage was caused by unreasonable or improper use, including failure to comply with manufacturer's installation and operation instructions. Damage from shipping is specifically excluded from warranty.

This warranty is exclusive and GPI makes no other representation of any other kind, expressed or implied, with respect to the product, including its merchantability or fitness for a particular purpose. Buyer's exclusive remedy to claims arising under this Warranty shall be the repair or replacement of the product, or damages which will not exceed the purchase price of the product. In no event, including claims of negligence, shall GPI be liable for incidental or consequential damages.

All brand and product names are the trademarks of their respective owners.

As part of our continuing effort to improve our customer service, we have established an **RMA NUMBER SYSTEM** for returned goods. If you have to send any products to us for any reason, please observe the following procedure:

1. Before you ship us anything, call your salesperson for an RMA number. Please have the model and serial number available.
2. Make sure your product is properly packed so it is not damaged in shipment.
3. Before you seal the box, write the RMA number on a piece of paper and put it *inside* the box so it's the first thing we see when we open it.
4. Also write the RMA number on the *outside* of the box, next to the address label. Use a black felt-tipped marker.
5. If you contact us about the returned item or items, please refer to the appropriate RMA number for quickest service.

Thank you for your cooperation.