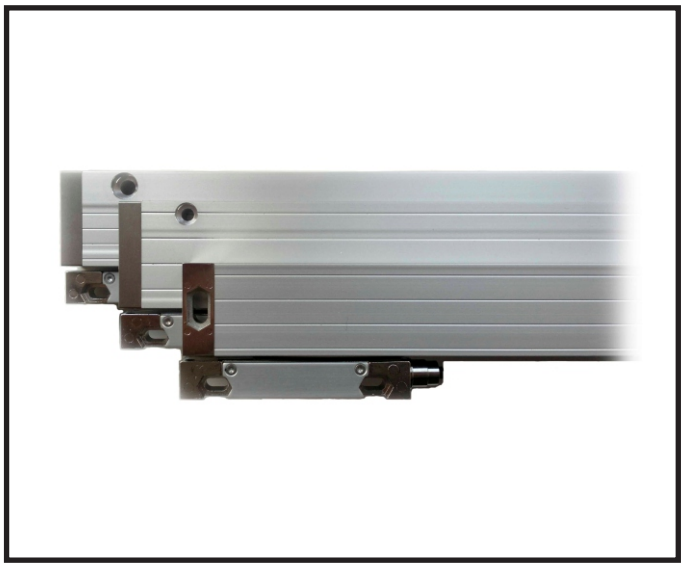
Gurley Models LR18, LR25 and LR35 Incremental Linear Encoders

Motion Type:
Linear

Usage Grade:
Industrial

Output:
Incremental

Max Resolution:
0.1 to 10µm



High Resolution - Industrial Ruggedness

The Models **LR18, LR25,** and **LR35** are optical incremental linear encoders designed for long life in medium to high-performance applications. The compact **LR18** offers measuring lengths up to 1.2 m (48"); and the more robust **LR25** and **LR35** have a maximum measuring length of 3.2 m (126")*. Both models have a reliable internal ASIC to provide resolution as fine as 0.1µm after 4X quadrature decode in the user's circuitry. The output device for the quadrature square waves and index signal is an EIA/RS-422 balanced differential line driver. For users who prefer to provide their own interpolation, analog outputs are available as either 11-µA or 1-V signals.

Precision ball bearings allow the reading head to traverse the glass scale at speeds up to 2 m/s (80 in/s). The system is protected to IP53 by an aluminum extrusion and rubber sealing flaps.

The encoders are interchangeable with several popular competitive brands.

ingenuity@work®

ISO 9001 Certified

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Specifications

	See note	LR18	LR25	LR35
Cross-section, mm (in)		18 x 46 (0.71 x 1.81)	25 x 52 (0.98 x 2.05)	35 x 62 (1.38 x 2.44)
Measuring length ML, mm(in) DCRM ML, mm(in)		70-1240 (3-48)	70-3190 (3-126) 70-3070 (3-121)	1140-3190 (45-126) 1140 – 3190 (45-121)
Overall length, mm (in)		ML + 105 (ML + 4.2)		
Weight, kg (lb)		0.075 + 1.0/m (0.18 +0.03/in)	0.075 + 1.95/m (0.20 + .09/in)	0.075 + 3.60/m (0.20 + .09/in)
Resolution, µm (after user's 4X)	1, 2	0.1, 0.2, 0.5, 1, 2, 5 or 10 µm		
Accuracy (at 20°C)		Grade A: ±3 µm/m (≈ ±36 µin/ft) Grade B: ±5 µm/m (≈ ±60 µin/ft) Grade C: ±10 µm/m (≈ ±120 µin/ft)		
Hysteresis		0.5 µm (20 µin)		
Input power		5V ± 0.3V @ 150mA max for TTL signals 120mA max for analog signals		
Analog output	3	11 µApp (OUT = A) or 1 Vpp (OUT = M)		
Square wave output (OUT = L)		RS-422 line driver on all channels		
Max speed	1	2 m/s (80in/s)		
Max acceleration		30 m/s^2 (1200in/s^2)		
Driving force		3N (12oz)		
Operating temperature		0° to 50°C (32° to 122°F)		
Sealing		IP53; IP64 optional (consult factory)		

NOTES:

1. With resolution = 0.1 µm, maximum operating speed is 0.45m/s. With resolution = 0.5µm, maximum operating speed is 1m/s.
2. With analog output, pitch of Channel A and Channel B signals is 20 µm (order RES = 050) or 40 µm (order RES = 100).
3. With square-wave output, the index signal is ¼-cycle wide, gated to be coincident with the high states of A and B.
4. Channel A (SIN) leads Channel B (COS) when the read head travels from left to right with respect to the scale.
5. For higher speed or lower driving force, consult factory.

As part of our continuing product improvement program, all specifications are subject to change without notice.

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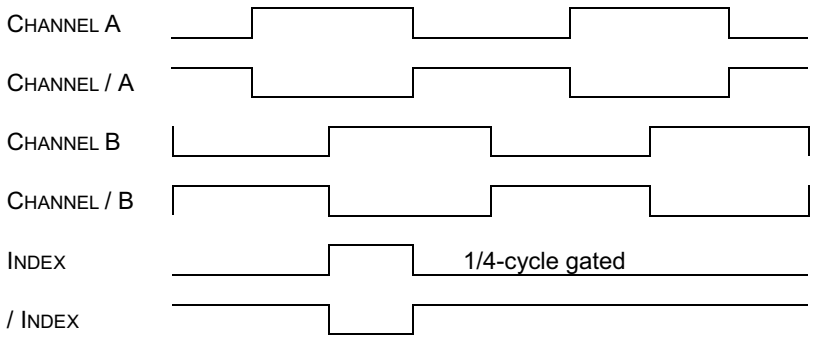
Specifications

INPUT POWER
+5 VDC ±0.3 V @100 mA max.

SQUARE WAVE OUTPUT - OUTPUT CODE L
On all channels: EIA/RS-422 balanced differential line driver, with short circuit protection, may be used single-ended for TTL-compatible inputs. Index is ¼-cycle wide, gated with the high states of channels A and B.



ANALOG OUTPUT - OUTPUT CODE A
Photo-diode output. Signal roll-off at 100 kHz ≤ 3 dB. SIN, COS and INDEX are complemented.
Signal values at 1 kHz (at 20°C):

Peak-to-peak signal amplitudes, +SIN, -SIN, +COS and -COS:	7-16 µA (11 µA nominal)
Amplitude ratio, min channel to max channel:	0.8 to 1.0
Peak-to-peak signal amplitude, INDEX:	2- 8.5 µA
Index width at Vref:	360° ± 180°
Phasing between SIN and COS:	90° ± 10°
Phasing between INDEX peak and SIN:	135° ± 60° (nominally, where +SIN = +COS)

ANALOG OUTPUT - OUTPUT CODE M
The output device is an op-amp referenced to Vref = Vcc/2 ± 0.25 V. Signal roll-off at 100 kHz ≤ 3 dB. SIN, COS and INDEX are complemented. Signal values at 1 kHz with 120Ω load to common (at 20°C):

Peak-to-peak signal amplitudes, +SIN, -SIN, +COS and -COS:	0.9 ± 0.3 V (1 V nominal)
Amplitude ratio, min channel to max channel:	0.8 to 1.0
Peak-to-peak signal amplitude, INDEX:	0.5 ± 0.3 V
Index width at Vref:	360° ± 180°
Phasing between SIN and COS:	90° ± 10°
Phasing between INDEX peak and SIN:	135° ± 60° (nominally, where +SIN = +COS)

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Electrical Connections

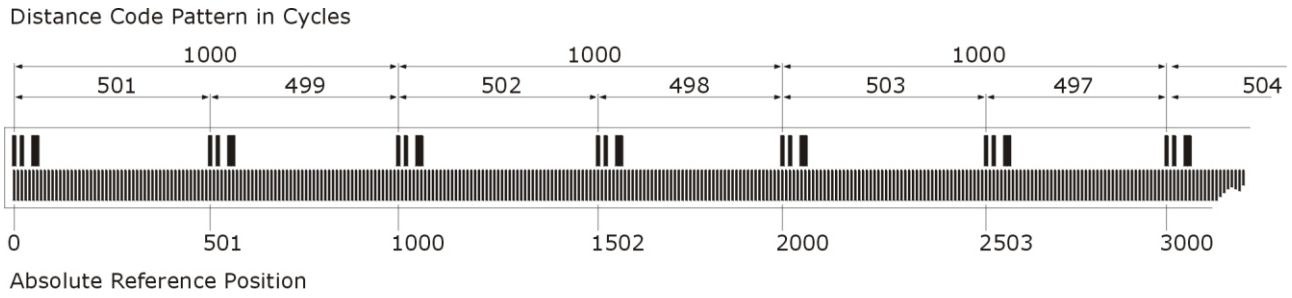
Output Function					
Square waves OUT = L	**Analog 11 µA OUT = A**	**Analog 1 V OUT = M**	Wire Colors Conn. Code **P**	Pin #, DA-15P Conn. Code **Q**	Pin #, DE-9P Conn. Code **S**
A	**SIN**	**SIN**	Yellow	8	4
/ A	**/ SIN**	**/ SIN**	Brown	7	8
B	**COS**	**COS**	Green	5	3
/ B	**/ COS**	**/ COS**	Orange	4	7
IND	**IND**	**IND**	Blue	2	2
/ IND	**/ IND**	**/ IND**	White	1	6
+V	**+V**	**+V**	Red	10	5
COMMON	**COMMON**	**COMMON**	Black	13	9
CASE	**CASE**	**CASE**	Bare (shield)	9	1

Cable: Φ0.2" (Φ5 mm) shielded, 10 conductors (5 twisted pairs), 28 AWG (40/44), gray PVC jacket.

DISTANCE-CODED REFERENCE MARKS

The LRxx encoders include an index signal, which can be located anywhere along the measuring length; its position is specified at the time of order. Once the encoder is installed, the index becomes fixed with respect to the user's machine. This feature allows the user to return to a known starting point.

Since the index signal occurs only once, it may take a while to find. One way to decrease the homing time is with DISTANCE-CODED REFERENCE MARKS (DCRM). Instead of being at a single location, many index marks are placed all along the scale so that the distance between any two adjacent marks is unique. Thus, the distance between any two marks, coupled with knowledge of the direction of travel, provides all the information necessary to determine the absolute position of an index mark. The maximum travel required to determine position is 1000 optical cycles, or 20 mm with a scale pitch of 20 µm. For the mathematics behind DCRM, see the document *Using Distance-Coded Reference Marks On LRxx Series Linear Encoders*. (DCRM not available with 2-µm or 10-µm resolution.)



Another way to minimize homing time is to use Gurley's unique *Virtual Absolute*® technology. This reduces the initialization distance from 20 mm to 0.480 mm and provides these additional benefits:

True absolute position, not just for one index mark, but for all position data.

Built-in-testing to confirm the validity of all position information.

Greatly increased system reliability compared to either an incremental or a conventional absolute encoder.

See the **VL18** data sheet for further information on this exciting new encoder.

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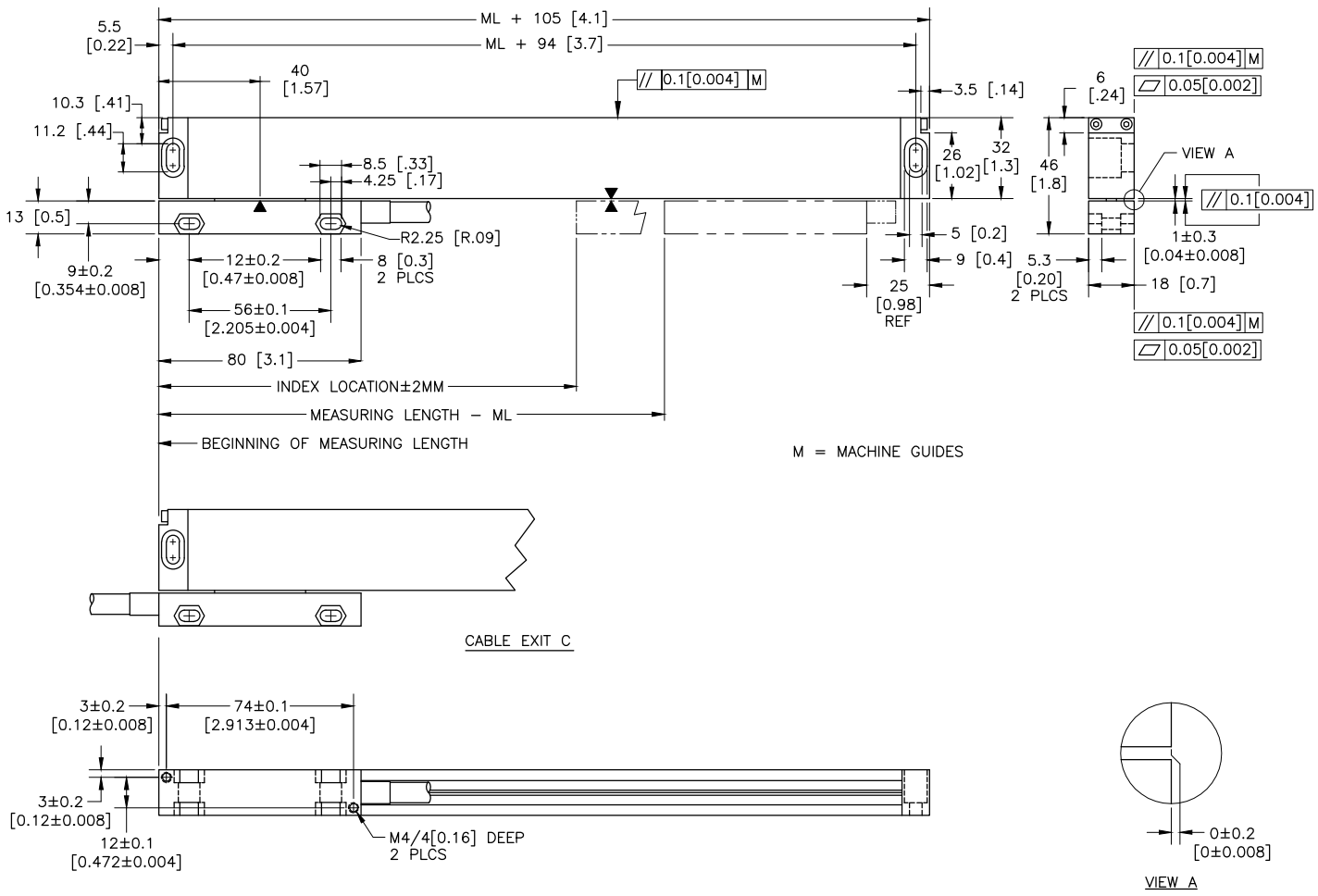
MODEL LR18 LINEAR ENCODER



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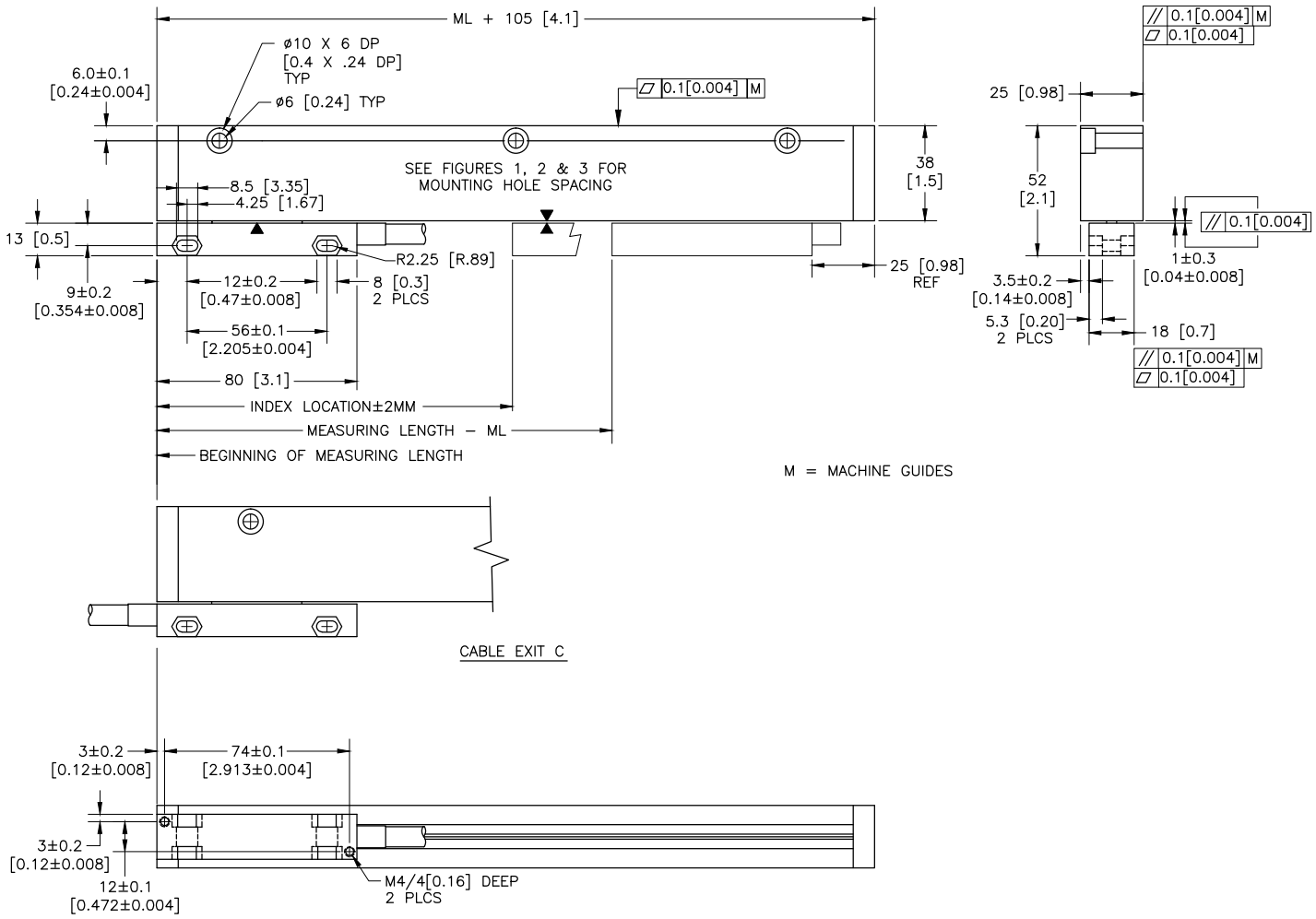
MODEL LR25 LINEAR ENCODER



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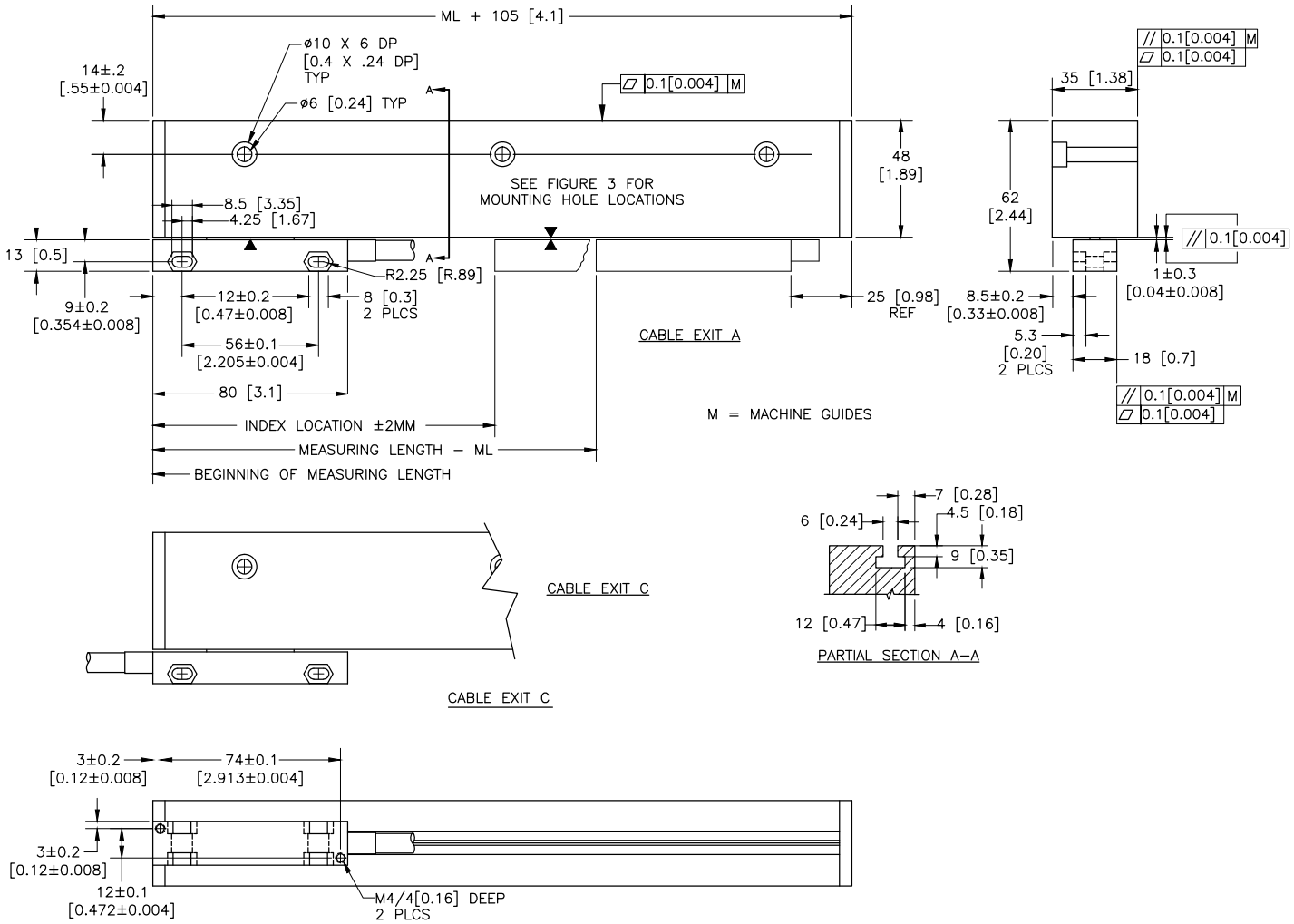
MODEL LR35 LINEAR ENCODER



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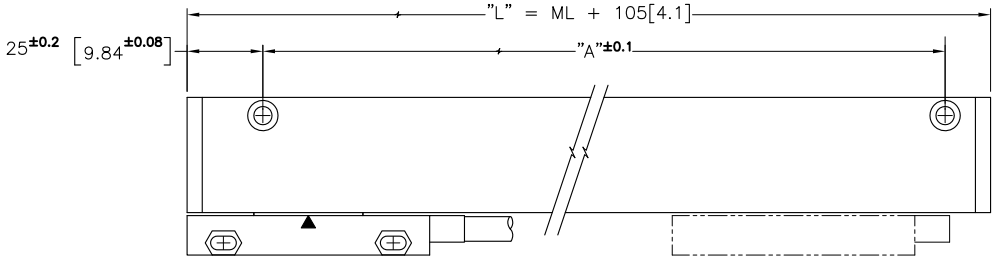
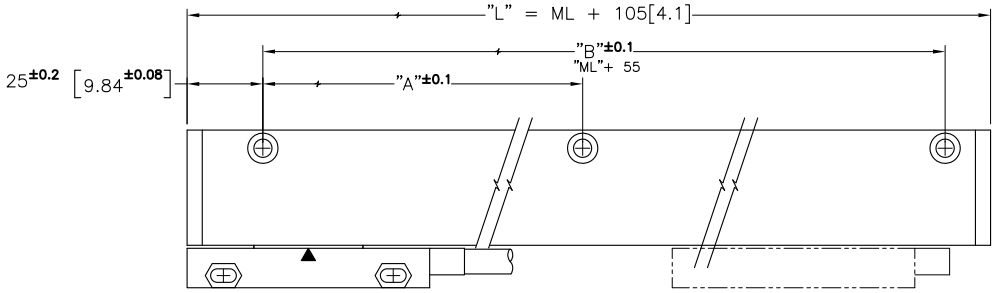
Mounting Holes For LR25 & LR35

FIGURE 1
70 ≤ ML ≤ 170



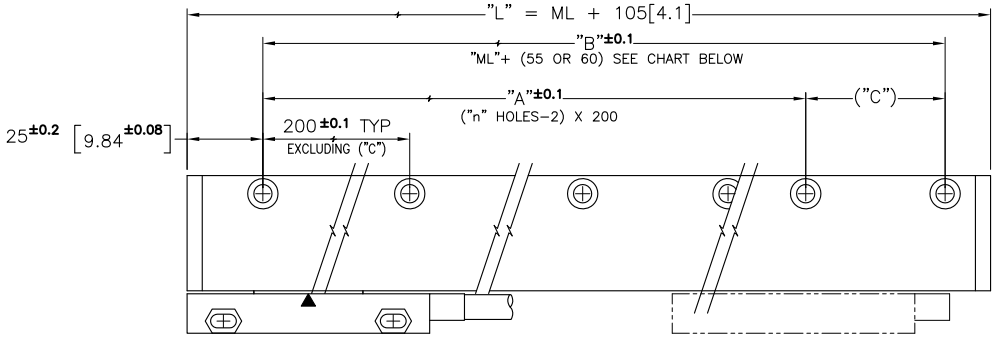
HOLE CHART – FIGURE 1			
ML	# HOLES	"A"	"L"
70	2	125	175
100		155	205
120		175	225
170		225	275

FIGURE 2
220 ≤ ML ≤ 370



HOLE CHART – FIGURE 2				
ML	# HOLES	"A"	"B"	"L"
220	3	140	275	325
270		165	325	375
320		190	375	425
370		215	425	475

FIGURE 3
420 ≤ ML ≤ 3190



"ML"	"B"
<1140	"ML"+55
≥1140	"ML"+60

HOLE CHART – FIGURE 3					
ML	# HOLES	"A"	"B"	("C")	"L"
420	4	400	475	75	525
470			525	125	575
520			575	175	625
570			625	225	675
620	5	600	675	75	725
720			775	175	825
820	6	800	875	75	925
920			975	175	1025
1020	7	1000	1075	75	1125
1140			1200	200	1245
1240	8	1200	1300	100	1345
1340			1400	200	1445
1440	9	1400	1500	100	1545
1540			1600	200	1645
1640	10	1600	1700	100	1745
1840	11	1800	1900	100	1945
1940			2000	200	2045
2040	12	2000	2100	100	2145
2140			2200	200	2245
2240	13	2200	2300	100	2345
2440	14	2400	2500	100	2545
2640	15	2600	2700	100	2745
2840	16	2800	2900	100	2945
3040	17	3000	3100	100	3145
3190	18	3200	3250	50	3295

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Ordering Information

MODEL	RES	ACC	IN	OUT	ML	EXIT	IND	TYPE	CABLE	CONN	SPEC

MODEL

LR18	18 x 46 mm **cross-section**
LR25	25 x 52 mm
LR35	25 x 52 mm

RES - Resolution after user's 4X

001	0.1 μm (≈ 4 μin)
002	0.2 μm (≈ 8 μin)
005	0.5 μm (≈ 20 μin)
010	1 μm (≈ 40 μin)
020	2 μm (≈ 80 μin)
050	5 μm (≈ 200 μin)
100	10 μm (≈ 400 μin)

ACC - Accuracy

A	±3 μm/m
B	±5 μm/m
C	±10 μm/m

IN - Input voltage

5	+5Vdc
C	+12Vdc (OUT = L)

OUT - Output waveforms

A	Analog (11μA); RES = 050 or 100
M	Analog (1V); RES = 050 or 100
L	Square waves, RS-422

ML - Measuring Length

xxxx	mm

EXIT -

A	Cable exits to the right
C	Cable exits to the left

IND - Index location

xxxx	Distance from left end of scale housing to left side of read head, mm
0000	None required
9999	Distance-coded reference marks

TYPE - Of Cable

A	Armored
S	Shielded

CABLE - **xxx** Cable length, inches

060	Standard for ML ≤ 570
120	Standard for 570 < ML ≤ 1240
180	Standard for 1240 < ML ≤2040
240	Standard for 2040 < ML

CONN

P	Pigtails (no connector)
Q	DA-15P
S	DE-9P

SPEC - Special Code

#	Issued at the time of order to cover special customer requirements
N	No special features

ACCESSORIES (order separately)

M01	Mating Connedtor for DA-15P
M06	Mating connector for DE-9P

SPECIAL CAPABILITIES

For special situations, we can optimize catalog encoders to provide higher frequency response, greater accuracy, wider temperature range, reduced torque, non-standard line counts, or other modified characteristics. In addition, we regularly design and manufacture custom encoders for user-specific requirements. These range from high-volume, low-cost, limited-performance commercial applications to encoders for military, aerospace and similar high-performance, high-reliability conditions. We would welcome the opportunity to help you with your encoder needs.

WARRANTY

Gurley Precision Instruments offers a limited warranty against defects in material and workmanship for a period of one year from the date of shipment.

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