

LH70/71/72, LY71/72

Angle display

Quick reference manual



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1. First of all

This manual describes how to use the angle display function of the display unit (LH70 series and LY70 series). Ribbon scale (Digiruler) or commercially available rotary encoder can be used as the encoder that can be used for angle detection. Each setting method is different, but the scaling function is used to correct the angle and display it. The displayable range is ± 360 degrees

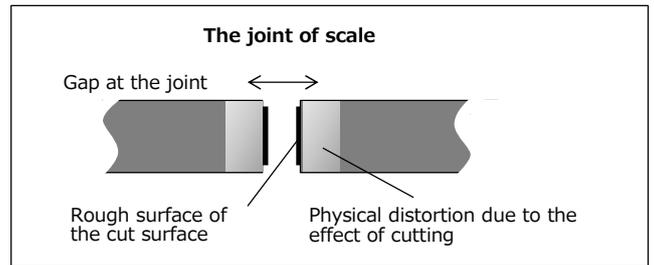
If the selected display resolution is too small for the number of output pulses (angle data) from the encoder, the displayed value will be scattered. For continuous and smooth angle display, it is necessary to consider the number of output pulses from the encoder and the display resolution to be selected.

For encoders with origin, the origin function of the counter can be used.

2. Angle display using Digiruler

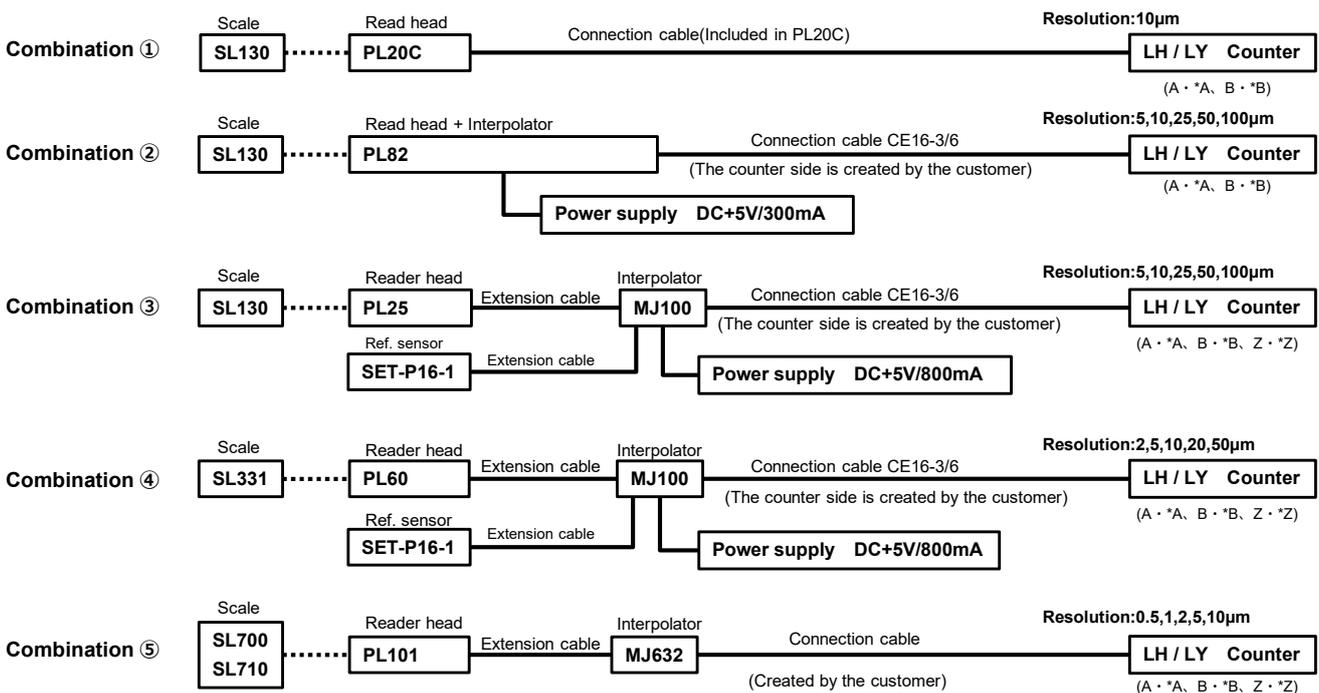
All ribbon scales can be used, but consider the combination depending on the length and radius of the arc to which the scale is actually mounted and the display resolution. The maximum angle that can be displayed on the ribbon scale is 359 degrees. Even if you attach the scale to a 360-degree arc well, an error will occur at the part that straddles the joint.

Error factor at the joint

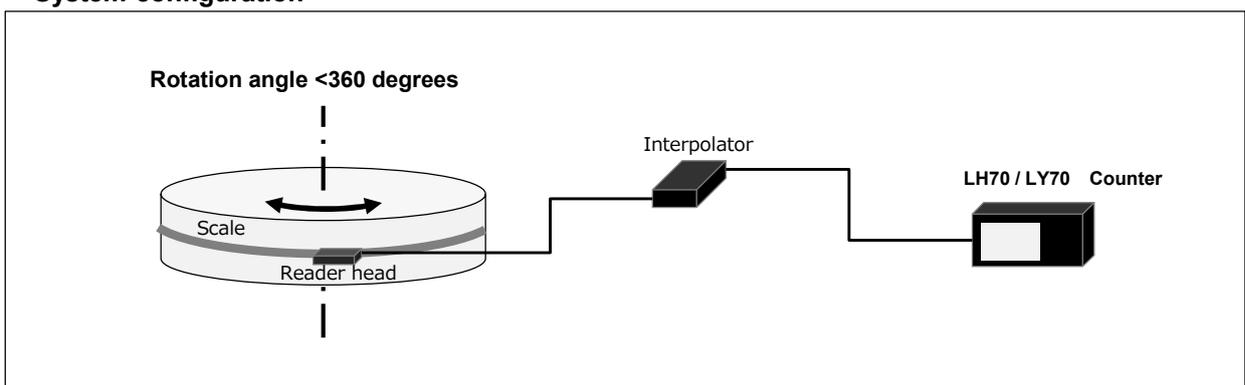


2-1. Combination

Scale	Read head	Extension cable	Interpolator	Connection cable	Counter	Power supply	Reference point	Extension cable (ref.)
SL130	PL20C	-	-	-	LH70 LH71 LH72 LY71 LY72	-	-	-
	PL82	-	Including	-		DC+5V 300mA	-	-
	PL25	CE08-xx CE27-xx	MJ100	CE15-xx		DC+5V 800mA	SET-P16-1	CE16-1 CE16-3
SL331	PL60	CK-T12	MJ632	Created by the customer	DC+5V 200mA	-	-	
SL700	PL101-RA PL101-RHA	CK-T13 CK-T14 CK-T15				Built-in	-	
SL710								



System configuration



2-2. Configurable arc radius

Scaling by internal calculation: Range of 0.1 to 1.0 times

Unit : mm

Scale	Mounting radius r		Output resolution	Display resolution			
	Min.	Max.		10 minutes	1 minute	10 seconds	1 second
SL130	125mm	4774mm	5	-	125~171	125~1031	1032~4774
			10	-	125~343	207~2062	2063~4774
			12.5	Can not be selected			
			20	-	125~687	413~4125	4125~4774
			25	-	125~859	516~4774	-
			50	125~171	172~1718	-	-
			100	125~429	344~3437	-	-
SL331	125mm	1273mm	2	-	-	125~412	413~1273
			2.5	Can not be selected			
			4	Can not be selected			
			5	-	125~171	125~1031	1032~1273
			10	-	125~343	207~1273	-
			20	-	125~687	413~1273	-
			50	125~171	172~1273	1032~1273	-
SL700 SL710	50mm	15915mm	0.2	Can not be selected			
			0.5	-	-	50~103	104~1031
			1	-	-	50~206	207~2063
			2	-	50~68	50~412	413~4125
			5	-	50~171	104~1031	1032~10313
			10	-	50~343	207~2062	2063~15915

Note:

-The ribbon scale has a minimum mounting radius and a maximum effective length of the scale.

-The minimum radius is based on the packing material dimensions, and the maximum radius is based on the maximum effective length of the product.

2-3. How to install

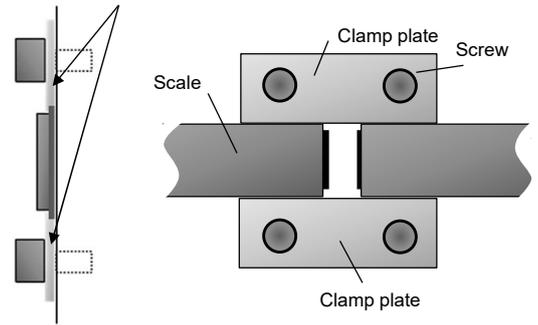
A typical example for pasting scales in parallel is shown below.

SL130 and SL331 have a strong scale base material, so if they are attached to an arc surface, the scale edge may bounce off. It is recommended to fix the base material of the scale with a suitable clamp plate.

For more information on pasting scales, refer to the head unit instruction manual.

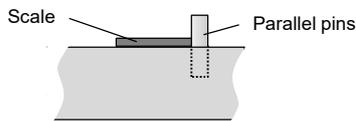
Example of jump prevention

Clamp plate to prevent bounce at the scale edge of SL130, SL331

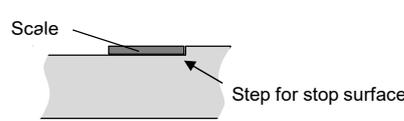


Typical example of how to install

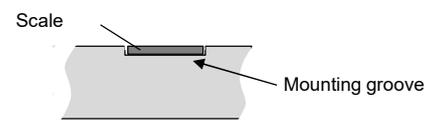
(1) Set up parallel pins on the flat surface and attach the scale. Remove the parallel pin after installation.



(2) Make a stop surface for mounting the scale. Consider the thickness of the scale and the amount of clearance with the reader head.



(3) Provide a mounting groove with a width slightly larger than the scale.



Scale cross section and clearance

SL130	SL331	SL700
<p>Reader head Protective ribbon Scale base Width: 10mm Scale Width: 9mm Clearance 0.8mm</p>	<p>Reader head Protective ribbon Scale base Width: 10mm Scale Width: 9mm Clearance 0.5mm</p>	<p>Reader head PL101 Protective ribbon Scale base Width: 10mm Scale Width: 9mm Clearance 0.35±0.1mm Reader head 25mm 12mm 12.65mm 9mm Thickness: 0.3mm</p>

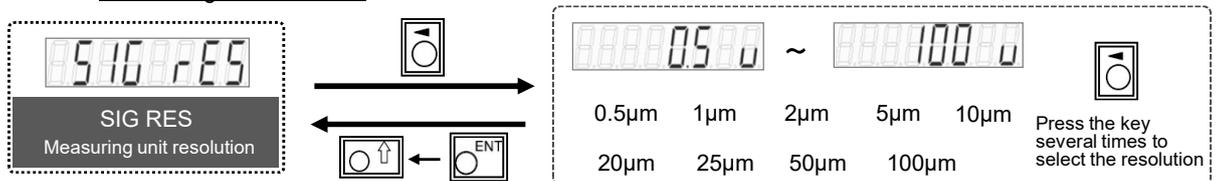
2-4. Setting operation

First of all, in the basic settings, set the length measurement unit resolution to the output resolution of the connected digiruler. For details on the basic settings, refer to the separate initial setup manual of display unit. Then enter the display resolution and mounting radius values in the advanced settings. Compare the mounting radius value with an angle reference device (right angle ruler: 90 degrees), etc., and narrow down the radius value so that the angle error is minimized.

Basic Settings

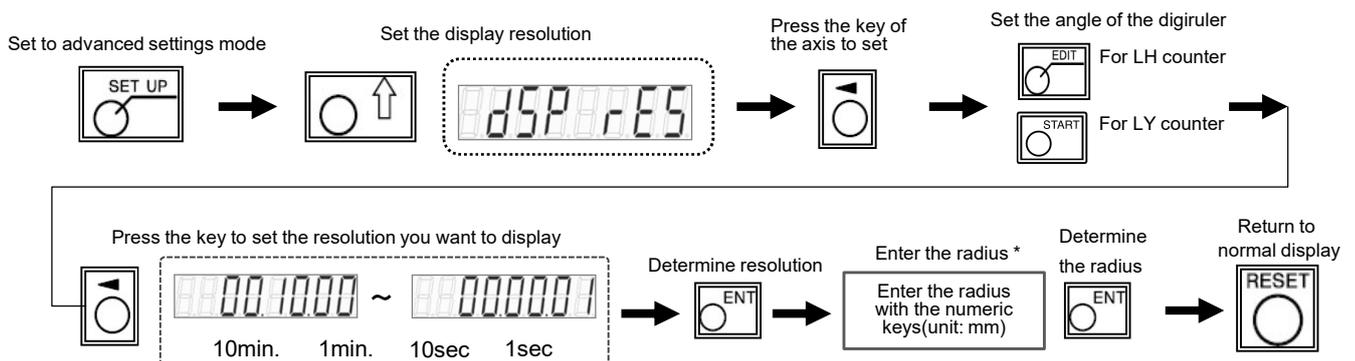
In the basic settings, set the output resolution of the connected digital ruler.

It is not angular resolution.



Advanced Settings

Set to the advanced setting mode and enter the display resolution and radius in the display resolution setting.



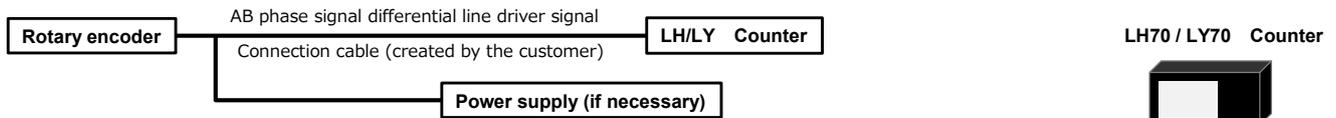
*: If the radius cannot be entered and an error occurs, the angle display for the measurement unit is too small, so increase the radius or coarsen the resolution of the angle display.

3. Angle display using rotary encoder

A rotary encoder with incremental differential line driver output can be connected.
The connection cable must be created by the customer.

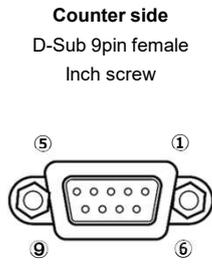
3-1. Combination

Rotary encoder	Connection cable	Power supply	External power supply	Counter
Differential line driver output (A · *A、 B · *B、 Z · *Z)	Created by the customer	DC+5V Max.250mA	Unnecessary (Supplied from the counter)	LH70 LH71 LH72 LY71 LY72
		Other than DC + 5V Max.250mA	Necessary	

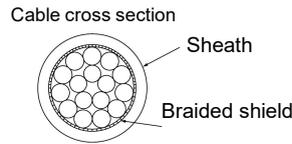


Counter side, connector pin assignment

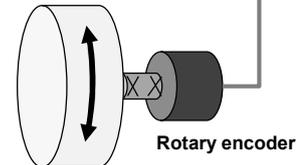
Pin #	Signal
1	A
2	*A
3	B
4	*B
5	Z
6	*Z
7	0V
8	DC+5V±5% Max.250mA
9	0V



Cable
A twisted pair cable is recommended.
Please use A / * A, B / * B, Z / * Z as a pair.



AWG 28 or larger



* DC + 5V / 250mA power can be supplied from the LH70 and LY70 counters.

Conversion table: Number of rotary encoder output pulses for scaling value

Unit: Pulse / 1 rotation

Scaling (magnification)	Display resolution			
	10 minutes	1 minute	10 seconds	1 second
0.10	21600.00	216000.00	1296000.00	12960000.00
0.20	10800.00	108000.00	648000.00	6480000.00
0.30	7200.00	72000.00	432000.00	4320000.00
0.40	5400.00	54000.00	324000.00	3240000.00
0.50	4320.00	43200.00	259200.00	2592000.00
0.60	3600.00	36000.00	216000.00	2160000.00
0.70	3085.71	30857.14	185142.86	1851428.57
0.80	2700.00	27000.00	162000.00	1620000.00
0.90	2400.00	24000.00	144000.00	1440000.00
1.00	2160.00	21600.00	129600.00	1296000.00
1.10	1963.64	19636.36	117818.18	1178181.82
1.20	1800.00	18000.00	108000.00	1080000.00
1.30	1661.54	16615.38	99692.31	996923.08
1.40	1542.86	15428.57	92571.43	925714.29
1.50	1440.00	14400.00	86400.00	864000.00
1.60	1350.00	13500.00	81000.00	810000.00
1.70	1270.59	12705.88	76235.29	762352.94
1.80	1200.00	12000.00	72000.00	720000.00
1.90	1136.84	11368.42	68210.53	682105.26
2.00	1080.00	10800.00	64800.00	648000.00
3.00	720.00	7200.00	43200.00	432000.00
4.00	540.00	5400.00	32400.00	324000.00
5.00	432.00	4320.00	25920.00	259200.00
6.00	360.00	3600.00	21600.00	216000.00
7.00	308.57	3085.71	18514.29	185142.86
8.00	270.00	2700.00	16200.00	162000.00
9.00	240.00	2400.00	14400.00	144000.00
9.999999(10.00)	(216.00)	(2160.00)	(12960.00)	(129600.00)

Recommended

Note:
-If the scaling is increased, the display of the minimum digit becomes rough.
-The scaling setting range is 0.1 to 9.999999 times.

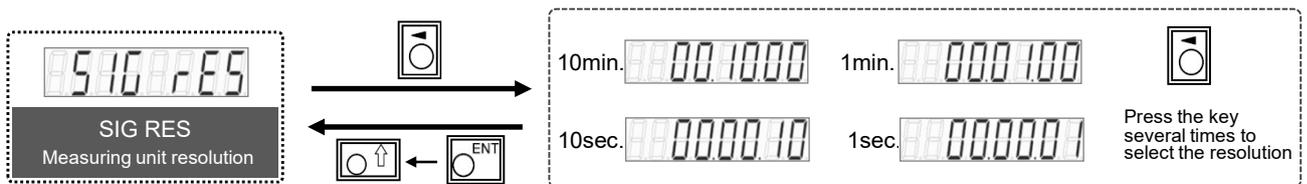
3-2. Setting operation

First of all, in the basic settings, set the measurement unit resolution to the angular resolution that takes into account the output pulse per rotation of the rotary encoder. For details on the basic settings, refer to the separate initial setup manual of display unit.

Next, set the display resolution and scaling value in the Advanced settings. Unless the number of rotary encoder output pulses is the same as the number of pulses converted to minutes and seconds, it is always necessary to correct the number of pulses by scaling. (Factory default scaling: 1.000000)

Basic Settings

Select the measurement unit resolution that can be used in the basic settings. Check the number of output pulses per rotation of the rotary encoder, select the angular resolution that can be set from the table below, and set it.

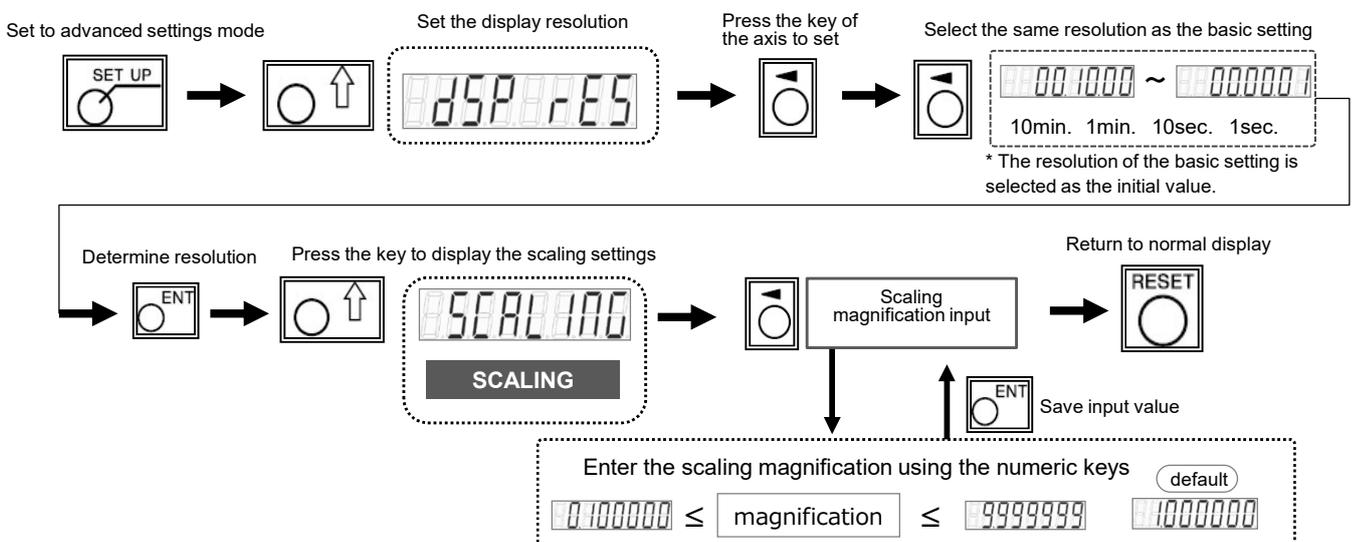


Rotary encoder output pulse number and configurable angular resolution

Classification	Number of output pulses (N / 1 rotation)	Settable resolution	Selection of display resolution
①	$216 \leq N < 2,160$	10min.	10min.
②	$2,160 \leq N < 21,600$	10min. , 1min.	10min. or 1min.
③	$21,600 \leq N < 129,600$	1min. , 10sec.	1min. or 10sec.
④	$129,600 \leq N < 1,296,000$	10sec. , 1sec.	10sec. or 1sec.
⑤	$1,296,000 \leq N$	1sec.	1sec.

Advanced Settings

Enter the advanced settings mode and set the display resolution and scaling.



How to calculate the scaling magnification

$$\text{Magnification} = \frac{P}{\text{Encoder output pulse number (1 rotation)}}$$

P	Measurement unit resolution set in the basic settings
2,160	10min.
21,600	1min.
129,600	10sec.
1,296,000	1sec.