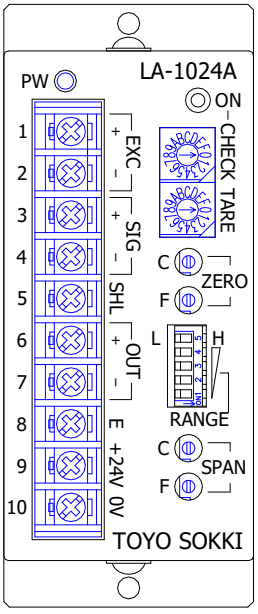
LOAD CELL AMPLIFIER

MODEL　L A – 1 0 2 4 A

OPERATION MANUAL



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MA4-00279-R1 (2020/5)

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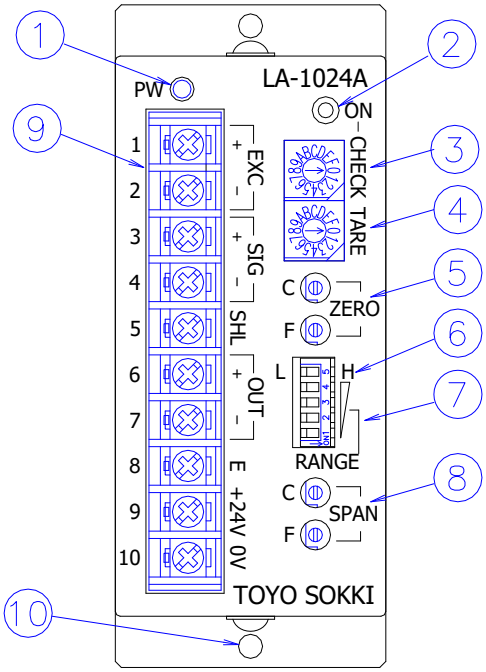
§1. Summary

This unit is an instrumentation amplifier which amplifies signal from a strain gauge transducer and outputs 0～±5V voltage signal (Max.±10V depending on input signal intensity) or 4～20mA current signal. (Output signal type is specified at the time of ordering)
The power supplied voltage is DC24V. The output signal are isolated from the input power by the built in DC/DC converter.

§2. Appearance and Each name

Appearance of this unit



① POWER (LED)	LED for indicating power ON
② CHECK (CAL SW)	Pseudo input signal generation switch
③ CHECK	Pseudo input signal setting, 16 position rotary switch
④ TARE	For Tare subtraction, 16 position rotary switch
⑤ ZERO	Zero point adjustment trimmer (Coarse / Fine:15 rotation)
⑥ GAIN MODE	Low/High (set H: Input signal 0.3～0.8mV/V when output 10V)
⑦ RANGE	Amplification adjustable DIP switch (4 steps setting)
⑧ SPAN	Span adjustment trimmer (Coarse / Fine : 15 rotation)
⑨ TERMINAL	7.62mm pitch 10P terminal for Load Cell, Analog output and Power
⑩ MOUNTING HOLES	Fixing hole 2 -Φ4.0mm

※ This unit can be in a shape of current output type (LA-1024A-1) or voltage output type (LA-1024A-2) depending on the specification at the time of ordering. Filter characteristic can be selected from 5Hz, 10Hz, 20Hz, 50Hz, 100Hz, 200Hz, 500Hz or 1kHz in addition to the standard fc=2Hz. Modification of sensor excitation voltage and filter characteristic is option at the time of shipment. Before use, check the nameplate on the side of the main unit to confirm whether the specified specifications are correct.

§3. Operation

This unit is equipped with current output or voltage output. Voltage output can be bipolar and can be output up to ±5V. (Max.±10V depending on input condition)

3－1） TARE (Tare setting, 16 position rotary switch)

This switch can be used to cancel the unbalanced voltage equivalent to Tare amount when Tare amount is too large to achieve zero adjustment. The setting is 16 positions from 0 to F and can be set at about 0.15mV/V step. (0mV/V～2.25mV/V) The larger the setting value, the larger Tare cancellation amount.

When you want to adjust the output to 4mA or 0V (with Tare load applied), set a coarse [ZERO] trimmer at the center position beforehand and turn a [TARE] rotary switch to set the output value to the lowest level.

If the weight of Tare load is known in advance, equivalent output level of Load Cell weighing Tare load can be calculated using the following formula to determine the code of TARE rotary switch.

$$\text{Equivalent LC output of Tare (mV/V)} = \frac{\text{Tare load weight}}{\text{Load Cell rated capacity}} \times \text{Load Cell rated output (mV/V)}$$

Code	Tare amount	Code	Tare amount	Code	Tare amount	Code	Tare amount
0	0 mV/V	4	0.6 mV/V	8	1.2 mV/V	C	1.8 mV/V
1	0.15 mV/V	5	0.75 mV/V	9	1.35 mV/V	D	1.95 mV/V
2	0.3 mV/V	6	0.9 mV/V	A	1.5 mV/V	E	2.1 mV/V
3	0.45 mV/V	7	1.05 mV/V	B	1.65 mV/V	F	2.25 mV/V

3－2） ZERO (Zero point adjustment trimmer)

This is a zero adjustment trimmer to set the output voltage to 4mA or 0V when there is unbalance voltage of Load Cell or voltage of Tare load. There are a coarse adjustment trimmer and a fine adjustment trimmer.
Adjustment range of zero trimmer is approximately ±0.2mV/V.
If zero adjustment cannot be achieved within this range, use a [TARE] rotary switch.

3－3） GAIN MODE, RANGE (Amplification range DIP switch)

Set the amplification range of current or voltage to the desired degree of output of a maximum load.
Amplification range is adjustable in 8 steps by combining [GAIN MODE (H/L)] and [RANGE (1～4)] DIP switch. Set only one bit of the [RANGE (1～4)] DIP switch. Amplification will be larger as a range number becomes larger. Necessary setting of [GAIN MODE] and [RANGE] is determined by the following formula. Please refer the Table below.

$$\text{LC output of maximum load (mV/V)} = \frac{\text{Maximum load}}{\text{Load Cell rated capacity}} \times \text{Load Cell rated output (mV/V)}$$

$$\text{Required amplification} = \frac{\text{Desired output voltage at maximum load (mV)}}{\text{Load Cell output of maximum load (mV/V) x EXC (V)}}$$

※EXC is applied voltage to Load Cell = 10V, 5V or 2.5V

Required amplification corresponding to [GAIN MODE] and [RANGE] Dip switch

GAIN MODE	RANGE (1～4)	Amplification			Necessary LC output amount (mV/V)	
		(EXC=10V)	(EXC=5V)	(EXC=2.5V)	for 5V,20mA output	for 10V output
L	1	150～ 227	300～ 454	600～ 908	3.34～2.20	———
	2	210～ 319	420～ 638	840～ 1276	2.39～1.57	———
	3	299～ 455	598～ 910	1196～ 1820	1.67～1.10	3.34～2.20
	4	419～ 638	838～1276	1676～ 2552	1.19～0.79	2.39～1.57
H	1	598～ 911	1196～1822	2392～ 3644	0.83～0.55	1.67～1.10
	2	837～1276	1674～2552	3348～ 5104	0.59～0.40	1.19～0.79
	3	1196～1823	2392～3646	4784～ 7292	0.41～0.28	0.83～0.55
	4	1674～2552	3348～5104	6696～10208	0.29～0.20	0.59～0.40

3 – 4） SPAN (SPAN adjustment trimmer)

This is a span adjustment trimmer for amplifying signal of current or voltage. There are a coarse adjustment trimmer and a fine adjustment trimmer.
Rotate a trimmer clockwise (CW) to increase amplification, counterclockwise (CCW) to decrease it. Rotate a coarse adjustment trimmer fully counterclockwise (CCW) can reduce the output to about 70% of the maximum.
If adjustment cannot be completed within this range, change the [GAIN MODE (L/H)] and [RANGE (1～4)] DIP switch setting.

3 – 5） CHECK (Pseudo input signal setting rotary switch)
(Pseudo input signal generating push switch)

By pressing a [CHECK] button switch, a pseudo input signal can be generated and added to the input signal. A pseudo input signal is generated while the button is pressed. The pseudo input signal can be set at about 0.15mV/V step by 16 position rotary switch.
After calibration of the scale is completed, with no load (output is 4mA or 0V), pressing a [CHECK] button switch (keep pressing it) and turn a [CHECK] rotary switch to set the output to be 75% or more of measured value of the maximum load.
By making a note of the rotary switch setting position and the output value, it can be used as a secondary calibration value.
Even if the span trimmer is touched after calibration, the span amount can be re-calibrated based on this secondary calibration value.

It is recommended to write a secondary calibration value (CHECK) and a rotary switch setting position (POS) in the nameplate attached to the main body, since there are blank spaces to fill for.

§4. Calibration

Calibrate the output level to 4mA or 0V with no load on Load Cell, and calibrate the output level to the desired current or voltage with maximum load on Load Cell. The voltage output is a bipolar output. If the span amount is more than 0.6mV/V, output ±10V is possible. Calibration operation is based on “actual load calibration” using a known weight such as a reference weight.

4 – 1) Necessary setting prior to calibrate

1). Amplifier gain setting (GAIN MODE, RANGE setting)

Set the amplification range for the desired output level. Calculate Load Cell output of maximum load and select the corresponding [GAIN MODE(H/L)] and [RANGE (1～4)]. For a calculation method of Load Cell output of maximum load, refer to section 3-3).

4 – 2) Calibration method with actual load

1). Put nothing on Load Cell (only the initial Tare load is applied)
2). Turn a [TARE] rotary switch to set the position where the output is closest to 4mA or 0V.
3). Turn a [ZERO] trimmer (Coarse, Fine) to adjust the output to 4mA or 0V.
4). Place a known weight such as a reference weight on Load Cell and turn a [SPAN] trimmer (Coarse, Fine) to adjust to the desired output current or output voltage.
5). Remove a known weight such as reference weight from Load Cell.
6). Confirm that the output value is 4mA or 0V. If not, repeat from step 3) above.

※ If calibration operation cannot be done properly, refer to section §5 of troubleshooting and take measures.

§5. Troubleshooting

If this unit is malfunctioning, please contact us if the problem cannot be resolved by the following measures. At this time, please inform us of the model name, product serial number, the malfunction symptoms and usage as much as possible.

5 – 1) Basic check point

1). Check whether the power supplied voltage DC+24V (DC20～27V) is normal and stable
2). Check whether the terminals are connected securely

5 – 2) What to do if the desired calibration is not achieved

1). Zero adjustment cannot be done.

If the output is more than 4mA or 0V even if a [ZERO] trimmer is turned fully counterclockwise (CCW), increase a [TARE] rotary switch setting.
If the output is less than 4mA or 0V even if a [ZERO] trimmer is tuned fully clockwise (CW), decrease a [TARE] rotary switch setting.

2). When span adjustment, the desired output current or output voltage cannot be set.

If the output is below the desired value even if a [SPAN] trimmer is turned fully clockwise (CW), change a [GAIN MODE] and [RANGE] DIP switch and increase the amplification by one step.
If the output exceeds the desired value even if a [SPAN] trimmer is turned fully counterclockwise (CCW), change a [GAIN MODE] and [RANGE] DIP switch and decrease the amplification by one step.
Eight steps can be set according to the [GAIN MODE] and [RANGE] DIP switch setting. If the desired output is not obtained even if trying a DIP switch setting, check whether Load Cell output satisfies the sensitivity adjustment range of this unit.

3). Output current is out of range of 0～20mA or the output voltage is out of range of ±10V even though it is not overloaded.
① When a part of Load Cell cable is disconnected. (Ref: Section 5-4-1)
② A [TARE] rotary switch setting is inappropriate. (Ref: Section 5-2-1)
③ A [GAIN MODE] or [RANGE] DIP switch setting is inappropriate. (Ref: Section 5-2-2)
④ When Load Cell becomes defective. (Ref: 5-4)

5 – 3） Judgement if this unit is malfunction

1). Check excited voltage of Load Cell

Checking the excited voltage between terminal No.1 (+EXC) and No.2 (-EXC) is stable at 10V±0.5V*. If it is not stable, a power supply circuit inside this unit may be defective.
(*10V±0.5V is for standard. EXC=5V±5% or EXC=2.5V±5% as option)

2). Short output voltage of Load Cell (jumper between terminal No.3 (+SIG) and No.4 (-SIG)). In other words, the input voltage to this unit is made zero.

At this time, set a [TARE] rotary switch to 0 once. In this state, the voltage which adjusted by a [ZERO] trimmer is output, so the output does not become 0V, but it can check whether the output is stable.
If it is not stable, this unit may be defective. If it is stable, check Load Cell side.
Please restore the setting of a [TARE] rotary switch to the original position after checking.

5 – 4） Check Load Cell

Since Load Cell is composed of a bridge circuit, it is possible to make a rough judgement by measuring the input / output resistance and insulation resistance.
＊ Please be sure to turn OFF this unit before checking Load Cell.

1). Failure judgement method by Load Cell resistance value.
a. Remove all Load Cell cables.
b. Measure the bridge resistance of Load Cell with a tester and check if there is any abnormality in the input / output resistance.

2). Failure judgement method based on Load Cell insulation resistance
a. Remove all Load Cell cables.
b. Measure the insulation resistance between shield and each cable of Load Cell at a voltage within 50V.
In addition, the insulation resistance between a metal case of Load Cell and each cable other than shield is also measured at a voltage within 50V.
c. If the insulation resistance is 1000MΩ or more, Load Cell is mostly good.

§6. Installation and connection method

6 – 1) Installation environment, etc.

1). The operating temperature range of this unit is 0 to 40℃.
Consider installing in a place not exposed the direct sunlight.
2). This unit is supplied voltage power, DC24V (DC20 to 27V).
Note that connecting to a different voltage may cause failure or damage.
3). Please fix this unit using the base plate with 2-Φ4

6 – 2) Terminal connecting

Wiring to this unit is done with 7.62mm pitch 10pin terminal block. The shield line of each cable shall be grounded by either this unit or each connected instrument, so that there is no ground loop.

1). Input / Output signal and Power line connection

7.62mm pitch terminal block

No.	Connection signal	
1	+EXC	Excitation voltage to Load cell (+)
2	−EXC	Excitation voltage to Load cell (−)
3	+SIG	Signal input from Load cell (+)
4	−SIG	Signal input from Load cell (−)
5	SHL	Shield line of Load Cell cable
6	+OUT	Signal output (+)
7	−OUT	Signal output (−)
8	E	Grounding
9	+24V	Power line DC+24V
10	0V	Power line DC0V

The shield line of the signal output should be grounded on the receiving device side.

Applicable crimp terminal: Crimp terminal for M3 up to 6mm width

2). Precautions for connection

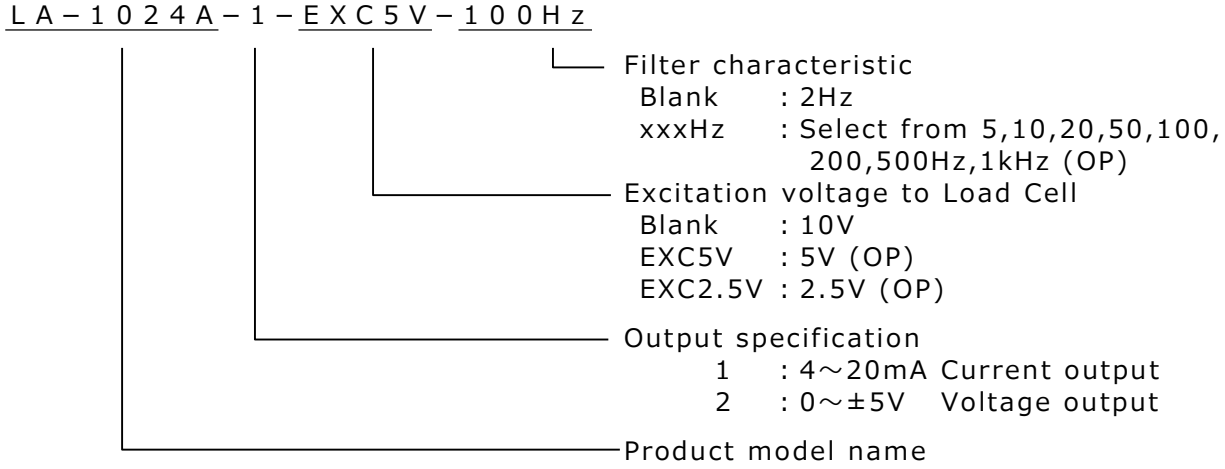
a. Ground the shield line of each cable on either this unit or the connected instrument.

b. Since the cable wiring color of Load Cell (transducer) differs depending on the manufacturer, check the wire color with Test Report attached to Load Cell.

c. In general Load Cell, shield line of Load Cell cable is not connected to a metal case of Load Cell. If the ground potential of this unit is different from the potential of Load Cell metal case, it is easily affected by inductive noise.
Therefore, make sure that Load Cell mounting base is at the same potential as metal case of this unit by a grounding cable.

§7. List of Models and Accessories

7 – 1) Model



※Modification of Load Cell excitation voltage and filter is optional (OP) at the factory.

7 – 2) Accessories

Operation manual	1 copy

§8. Specifications

8 – 1) Power supply part for Load Cell

1). Excitation Voltage	DC10V±5% Can be changed to 5V or 2.5V at TOYO factory
2). Number of Connectable sensors	4 sets of 350Ω type Load Cell (120mA maximum) (EXC=5V: 60mA maximum, EXC=2.5V: 30mA maximum)

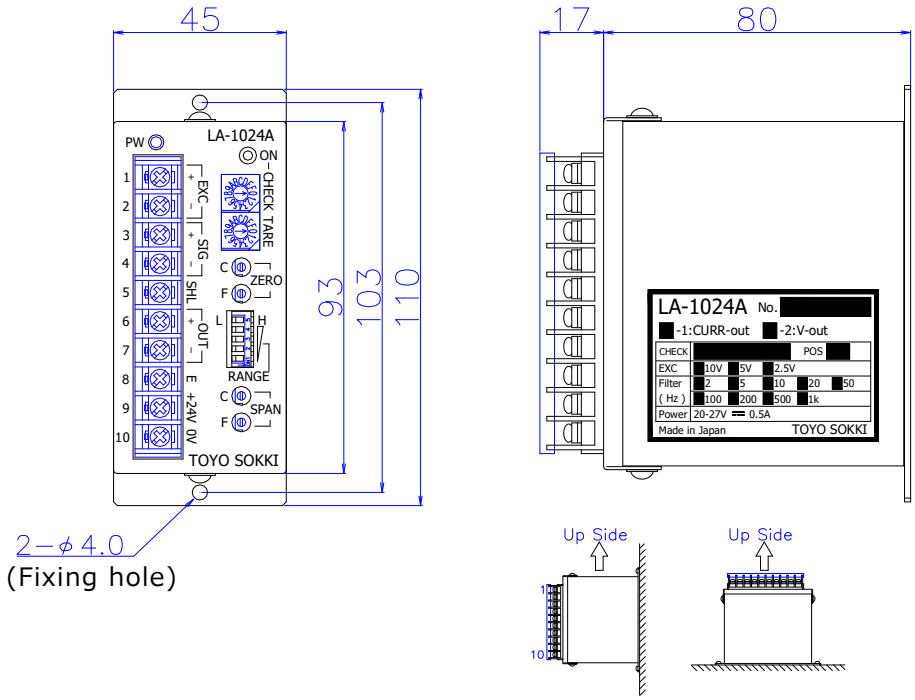
8 – 2) Amplifire part

1). Input range	±3.3mV/V (sum of tare amount and measuring weight)
2). Initial tare elimination	2.25mV/V (0.15mV/V step by 16 position rotary switch)
3). Zero adjustment	approx. ±0.2mV/V Multi-turn trimmer adjustment (Coarse, Fine adjustment: 15 rotations each)
4). Sensitivity adjustment	Amplification variable range: x 1667 to x 151 (twice the above at EXC=5V, 4 times at EXC=2.5V) Span of 0.3～3.3mV/V can output 4～20mA or 0～5V (if span of 0.6mV/V or more, 0～10V can be output) Standard sensitivity : Output 0～5V or 4～20mA when EXC=10V, 0～1mV/V input, Gain=500
Gain Mode	High / Low (DIP switch)
Range	4 steps (DIP switch)
Span	Multi-turn trimmer adjustment (Coarse, Fine adjustment: 15 rotations each)
5). Output signal	
Current output	4 to 20mA, load resistance 510Ω or less (LA-1024A-1)
Voltage output	0 to ±5V, load resistance 2kΩ or more (LA-1024A-2) Voltage output is bipolar output. able to output ±10V with span 0.6mV/V or more
6). Non linearity	±0.05%FS (±0.1%FS when EXC=2.5V)
7). Filter Characteristic	fc=2Hz(-3dB) as standard, -12dB/oct. Low pass filter fc= 5, 10, 20, 50, 100, 200, 500Hz, 1kHz as option
8). Temperature coefficient	
Zero	±0.01% FS/℃ typ. (at standard sensitivity) (twice the above at EXC=5V, 4 times at EXC=2.5V)
Sensitivity	±0.01% FS/℃ typ. (±0.02% FS/℃ typ. at EXC=2.5V)
9). Check function	A pseudo input signal can be generated by pushing a [CHECK] button switch. It is added to the input signal. Can be set to about 2.25mV/V in about 0.15mV/V step. (temperature coefficient: 25ppm/℃ maximum)

8 – 3) General

1). Power stability	±0.02% FS (Power voltage fluctuation within±10%)
2). Power supplied voltage	DC24V (DC20～27V)
3). Current consumption	approx. 0.5A
4). Operating Temp./Humidity	0～+40℃、20～85% R.H. without condensation
5). Store Temp./Humidity	−20～+60℃、20～85% R.H. without condensation
6). Mass	approx. 0.4kg
7). Mounting method	Wall mount method Fix with M3 screw using 2-Φ4 of the base bracket

§9. Dimensional Drawing



§10. Functional block diagram