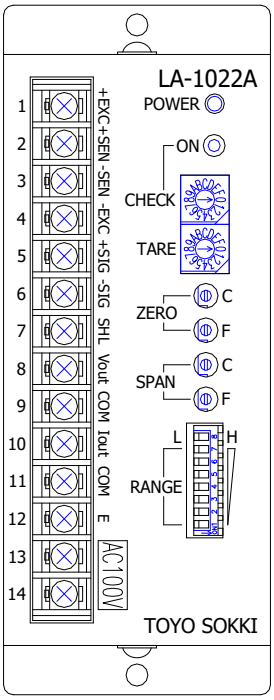
LOAD CELL AMPLIFIER

MODEL　L A – 1 0 2 2 A

OPERATION MANUAL



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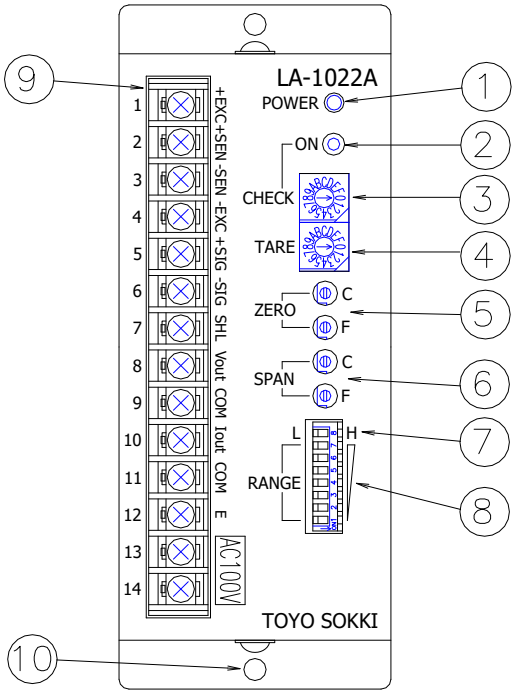
This document is translated from MA4-00259-R2 (Japanese)

§1. Summary

This unit is a low drift instrumentation amplifier which amplifies a signal from a strain gauge transducer and outputs voltage signal and current signal simultaneously.
Also this unit has a remote sensing function to reduce measurement error caused by a sensor cable.
Applying voltage to Load Cell or a sensor is selected from 10V, 5V, 2.5V at the time of ordering.
The power supplied voltage is AC100V as standard or DC24V which specified as option at the time of order.

§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 adjustment trimmer (Coarse / Fine:15 rotation)
⑥ SPAN	Span adjustment trimmer (Coarse / Fine:15 rotation)
⑦ GAIN MODE	Amplification range DIP switch (Low/High)
⑧ RANGE	Amplification range adjustable DIP switch (7 steps setting)
⑨ TERMINAL	7.62mm pitch 14P terminal for Load Cell, Analog output and Power
⑩ MOUNTING HOLES	Fixing hole 2 -Φ4.5mm

§3. Operation

This unit outputs voltage signal and current signal. Voltage output is bipolar and can be output up to ±5V. (Max. ±10V depending on intensity of input signal from a sensor)

Current output 4～20mA is available only when voltage output is set to 0～5V. Combination other than 4～20mA / 0～5V is impossible.

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 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 and Tare amount by [TARE] rotary switch

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 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 voltage to the desired degree of output of a maximum load. Amplification range is adjustable in 9 steps by combining [GAIN MODE (H/L)] and [RANGE (1～7)] DIP switch. Set only one bit of the [RANGE(1～7)] 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.

※Remind that amplification level is same at setting [GAIN MODE=H]、[RANGE (1～5)] and [GAIN MODE=L]、[RANGE (3～7)]. It means amplification range is in 9 steps in total.
※If output voltage is set to 10V, [GAIN MODE] should be set to H.

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

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

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

GAIN MODE	RANGE (1～7)	Amplification			Necessary LC output amount (mV/V)	
		EXC=10V	EXC=5V	EXC=2.5V	for 5V,20mA output	for 10V output
L	1	151～225	302～454	604～909	3.30～2.23	———
	2	210～316	420～636	839～1275	2.38～1.59	———
	3	300～453	600～911	1199～1824	1.66～1.11	———
	4	420～636	840～1277	1679～2556	1.19～0.79	———
	5	600～911	1202～1828	2402～3658	0.83～0.55	———
	6	841～1278	1684～2563	3366～5128	0.59～0.40	———
	7	1203～1831	2410～3671	4819～7344	0.41～0.28	———
H	1	300～453	599～909	1197～1821	———	3.30～2.21
	2	419～635	839～1275	1677～2553	———	2.38～1.58
	3	599～909	1199～1824	2397～3651	———	1.66～1.11
	4	839～1274	1679～2556	3357～5114	———	1.19～0.79
	5	1199～1824	2402～3658	4802～7318	———	0.83～0.55
	6	1680～2558	3366～5128	6730～10259	0.29～0.20	0.59～0.40
	7	2405～3333	4819～6666	9636～13333	0.20～0.15	0.41～0.30

3 – 4） SPAN (SPAN adjustment trimmer)

This is a span adjustment trimmer for amplifying signal of 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 (1～7)] 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 only 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 0V), pressing a [CHECK] button switch (keep pressing) 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 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.

3 – 6） Remote sensing function

When using a longer sensor cable, the resistance of a cable is not negligible and the resistance vary if environment temperature vary. Fluctuation of the resistance will cause fluctuation of voltage drop and fluctuation of applied voltage to a sensor and result in measurement error. Remote sensing function helps to decrease a measurement error. This function requires a sensor cable of 6core wire. If 4core wire cable is used, set two attached metal plates as they are at the time of shipment. If 6core wire cable from Load Cell with remote sensing is used, remove two metal plates from terminal and make a remote sensing function effective.

!CAUTION
In case of not using a remote sensing function, make it sure to set two attached metal plates to make electrical short between +SEN and +EXC terminal also between -SEN and -EXC terminal. Otherwise a remote sensing circuit in this unit does not work correctly and will abnormal voltage is applied to a sensor and might damage a sensor of Load Cell or this unit.

§4. Calibration

Calibrate the output level to 0V with no load on Load Cell, and calibrate the output level to the desired voltage with maximum load on Load Cell. Current output 4～20mA is available when voltage output is adjusted to 0～5V. 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 to the desired output level. Calculate Load Cell output of maximum load and select the corresponding [GAIN MODE(H/L)] and [RANGE (1～7)]. 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 0V.
3). Turn a [ZERO] trimmer (Coarse, Fine) to adjust the output to 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 voltage.
5). Remove a known weight such as reference weight from Load Cell.
6). Confirm that the output value is 0V. If not, repeat from step 3) above.

※. If calibration operation cannot be done properly, refer to section §5 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. The model name of Load Cell or a sensor connected to this unit should be also informed.

5 – 1) Basic check point

1). Check whether the power supplied voltage AC100V or DC24V is normal and stable.
2). Check whether the terminals are connected correctly and firmly.

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

1). Zero adjustment cannot be done.

Zero adjustment range is ±0.2mV/V
If the output is more than 0V even if a [ZERO] trimmer is turned fully counterclockwise (CCW), increase a [TARE] rotary switch setting.
If the output is less than 0V even if a [ZERO] trimmer is tuned fully clockwise (CW), decrease a [TARE] rotary switch setting.

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

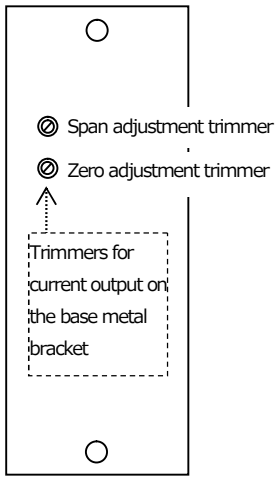
If the output is below the desired value even if a [SPAN] trimmer is turned fully clockwise (CW), change a [GAIN MODE] and [RANGE] DIP switch and increase the amplification by one step.
If the output exceeds the desired value even if a [SPAN] trimmer is turned fully counterclockwise (CCW), change a [GAIN MODE] and [RANGE] DIP switch and decrease the amplification by one step.
9 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.
Choose only one step of the setting of [RANGE (1～7)]

3). Output current is out of range of 4～20mA 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 5-5)
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: 5-5)

5 – 3) Fine tuning of zero and span amount of current output

Current output 4～20mA is adjusted when voltage output is set to 0～5V.
If re-tuning of current output is necessary, take measures as follows. But combination other than 0～5V/4～20mA is impossible.
There are two holes for adjustment trimmers on the base metal bracket.
If this unit is installed in a control panel, it is necessary to remove this unit from it.

Span adjustment trimmer of current output (1 rotation)
Zero adjustment trimmer of current output (1 rotation)



① Tune a zero adjustment trimmer to set current output to 4mA when output voltage is 0V
② Tune a span adjustment trimmer to set current output to 20mA when output voltage is 5V

Current output is adjusted properly at the shipment in TOYO factory. It is not necessary to re-adjust it. But current output is not appropriate even if re-adjusting has been done, please contact us.

5 – 4） Judgement if this unit is malfunction

1). Check excited voltage of Load Cell

Checking the excited voltage between terminal No.1 (+EXC) and No.4 (-EXC) is stable at 10V ±0.5V*. If it is not stable, a power supply circuit inside this unit may be defective. (*10V is for standard. EXC=5V±5% or EXC=2.5V±5% as option)

2). Short the output voltage of Load Cell (making an electric short between terminal No.5 (+SIG) and No.6 (-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, an amplification circuit in 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 – 5） 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.
① Remove all Load Cell cables.
② 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
① Remove all Load Cell cables.
② 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.
③ 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 operated with power supplied voltage AC100V±10%, or DC24V (DC20 to 27V) specified as option.
   Note that connecting to a different voltage may cause failure or damage.
3) Please fix this unit with M4 screw using hole 2-Φ4.5 of the base bracket

6 – 2） Terminal connection

Wiring to this unit is done with 7.62mm pitch 14pin 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). Load Cell, Analog output and Power supply connection

7.62mm pitch terminal block

No.	Connection signal			
1	+EXC	Excitation voltage to Load cell (+)		
2	+SEN	Remote sense input (+)		
3	−SEN	Remote sense input (−)		
4	−EXC	Excitation voltage to Load cell (−)		
5	+SIG	Input signal from Load cell (+)		
6	−SIG	Input signal from Load cell (−)		
7	SHL	Shield line of Load cell cable		
8	Vout	Voltage output signal (+)		
9	COM	Voltage output signal (−)		
10	Iout	Current output signal (+)		
11	COM	Current output signal (−)		
12	E	Grounding		
13	AC	Power AC100V	+24V	Power DC +24V (option)
14	AC		0V	Power DC 0V (option)

COM(#9, #11) are common.
The shield line of the output signal should be grounded on the receiving device side.

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

2). Precautions for connection

① Terminal of +EXC and +SEN / -EXC and -SEN is connected by two metal plates at the time of shipment. If using a 4core cable of Load Cell and not using remote sensing function, make it sure to two attached metal plates are connected as they are at the time of shipment. If using a 6core wire cable, remove two metal plates from terminal and make remote sensing function effective.

② Remote sensing of this unit is effective when a resistance of Load Cell cable less than 10Ω (20Ω, cable length to and from). General AWG24 wire of 100m length has a resistance about 9Ω. Use a Load Cell cable as thick as possible.

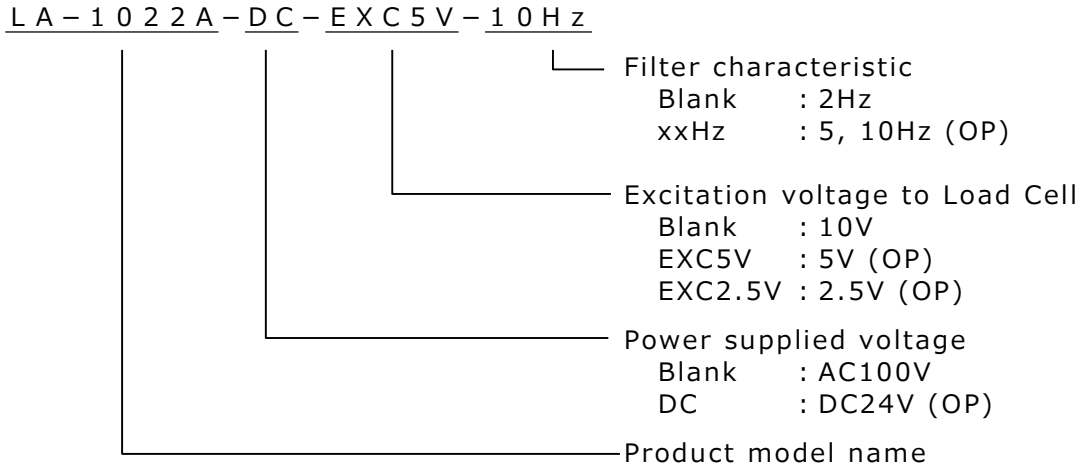
③ Ground the shield line of each cable on either this unit or the connected instrument.

④ Since cable wiring color of Load Cell (transducer) differs depending on the manufacturer, check the wiring color with Test Report attached to Load Cell.

⑤ 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 easy to be 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 Power supplied voltage, Excitation voltage and Filter characteristics is optional (OP) at the factory.

7 – 2) Accessories

Metal plate for shorting	2 pcs (attached to the terminal)
Operation Manual	1 copy

§8. Specifications

8 – 1) Power supply part to Load Cell or a sensor

1). Excitation Voltage	DC10V±5% DC5V or DC2.5V is optional at the time of ordering.
2). Number of Connectable sensors	4 sets of 350Ω type Load Cell (120mA maximum) (EXC=5V: 60mA maximum, EXC=2.5V: 30mA maximum)
3). Correction of voltage drop	Remote sensing function Resistance of Load Cell cable (to and from) should be less than 20Ω

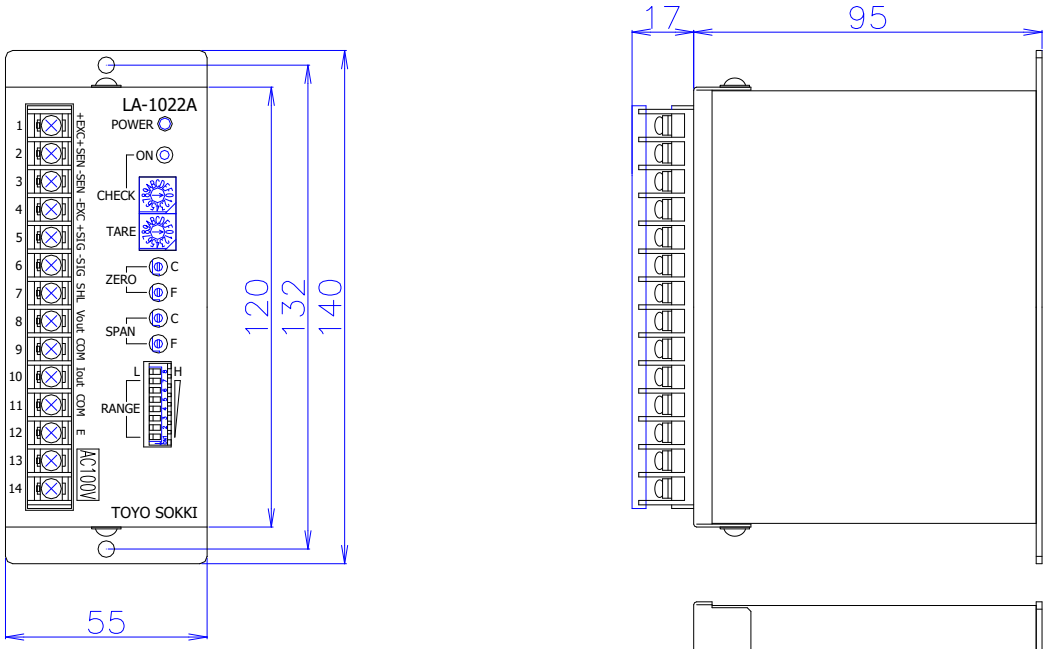
8 – 2) Amplifire part

1). Input range	±3.3mV/V (sum of tare amount and measuring weight)
2). Initial tare elimination	0～2.25mV/V (0.15mV/V step by 16 position rotary switch)
3). Zero adjustment range	approx. ±0.2mV/V Multi-turn trimmer adjustment (Coarse, Fine adjustment: 15 rotations each)
4). Sensitivity adjustment	Amplification variable range: x3333 to x151 (twice the above at EXC=5V, 4 times at EXC=2.5V) Span amount 0.15～3.3mV/V can output 4～20mA or 0～5V (If span amount is 0.3mV/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 times
Gain Mode	H(0.15～0.3 mV/V) / L(0.3～3.3 mV/V) (DIP switch)
Range	7 steps (DIP switch)
Span	Multi-turn trimmer adjustment (Coarse, Fine adjustment: 15 rotations each)
5). Voltage output	0～±5V (Load resistance 2kΩ or more) Bipolar output If span amount is 0.3mV/V or more, output 0～±10V is possible.
6). Current output	4～20mA when voltage output 0～5V (Load resistance 510Ω or less)
7). Simultaneous output	Output voltage and current simultaneously. There is 0.2% error of conversion of voltage to current. (Two trimmers on the base metal bracket are reserved to fine tune zero and span of current output)
8). Non linearity	±0.05%FS (±0.1%FS when EXC=2.5V)
9). Filter Characteristic	fc = approx.2Hz (-3dB) as standard, -12dB/oct. Low pass filter fc = 5, 10Hz as option at the time of ordering
10). Temperature coefficient	
Zero	±0.005% FS/℃ typ. (at standard sensitivity) (Twice the above at EXC=5V, 4 times at EXC=2.5V)
Sensitivity	±0.005% FS/℃ typ. (±0.01% FS/℃ typ. at EXC=2.5V)
11). Check function	A pseudo input signal can be generated by pushing the CHECK button switch. It is added to the input signal. 0～2.25mV/V (0.15mV/V step by 16 position rotary switch) (Temperature coefficient: 25ppm / ℃ maximum)

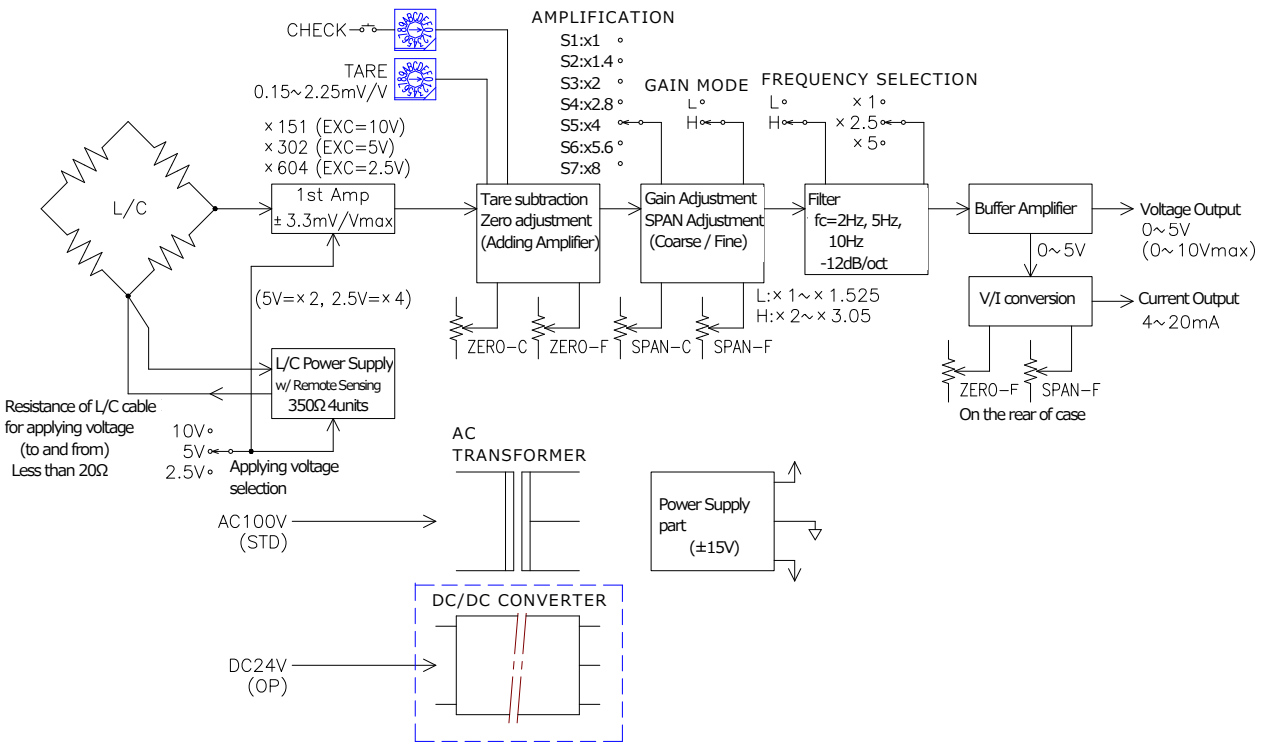
8 – 3) General

1). Power stability	±0.02% FS (Power supplied voltage fluctuation within±10%)	
2). Power supplied voltage	AC100V±10% 50/60Hz	as standard
	DC24V (DC20～27V)	as option
3). Current consumption	approx. 10VA(AC100V), 0.5A typ.(DC24V)	
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. 0.9kg(AC100V), 0.6kg(DC24V)	
7). Mounting method	Wall mount method Fix with M4 screw using 2-Φ4.5 of the base bracket	

§9. Dimensional Drawing



§10. Functional block diagram



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