IM-A-238 '86. 9

INSTRUMENTATION SIGNAL CONDITIONER

WDC-200

SERIES

Instruction Manual

KYOWA

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Thank you for purchasing the Kyowa WDC-200 Series Instrumentation Signal Conditioner. Before operating your WDC-200 series signal conditioner, please read this operation manual carefully so that you can make full use of its versatile functions for many years to come.

Handling Precautions

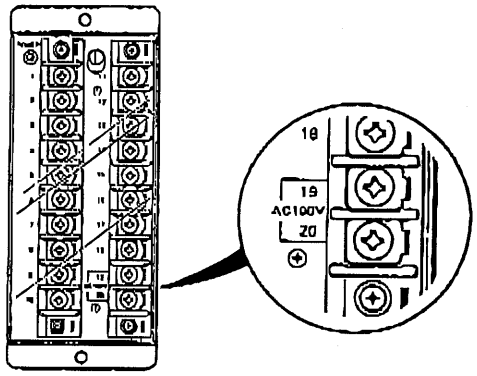
Before use, be sure to read these precautions.

- **Input Power**

  The signal conditioner is provided for AC operation only. The rated input voltage is labelled between pins 19 and 20 on the terminal board. Never operate the signal conditioner on power voltages other than labelled. Check the labelled rating which should be as specified on your order and which is to be either of:

  100—110V AC ±10%, 50/60Hz
  200—220V AC ±10%, 50/60Hz

  (Never use the signal conditioner on other than the labelled voltage range.)



- **External Noise**

  Take proper measures against noise if the input cable between the signal conditioner and the amplifier passes near a power cable, transformer, electric tool, motor transceiver or whatever may cause noise. (Refer to Chapter 2 "Connections.")

- **Output Connection**

  Voltage output: Cannot be connected to other than with 5kΩ min., unbalanced.
  Current output: Cannot be connected to other than with 400Ω max., unbalanced.

- **Setting Output**

  Since the contact capacity is small, use with 24V DC, 0.2A max. (non-inductive load).

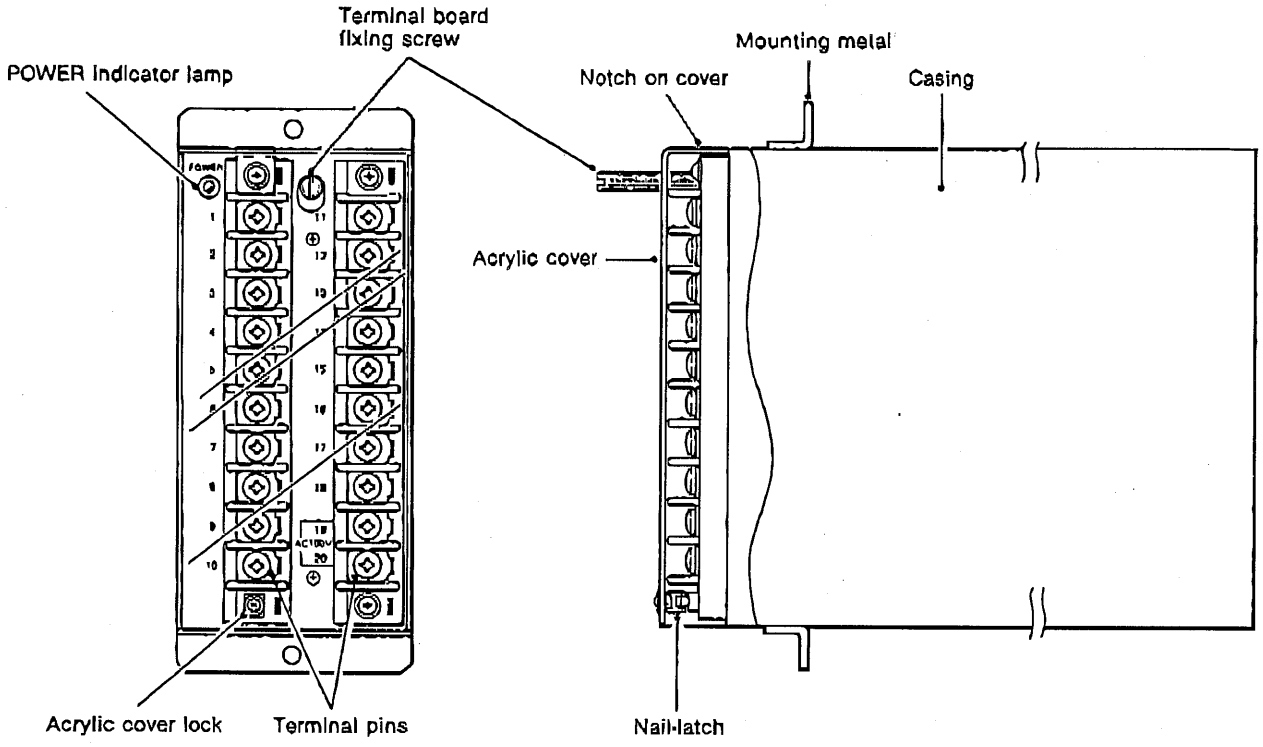
- **Installation Place**

  Use the signal conditioner at an environmental temperature range of 0 to 40°C and at a relative humidity lower than 85%.

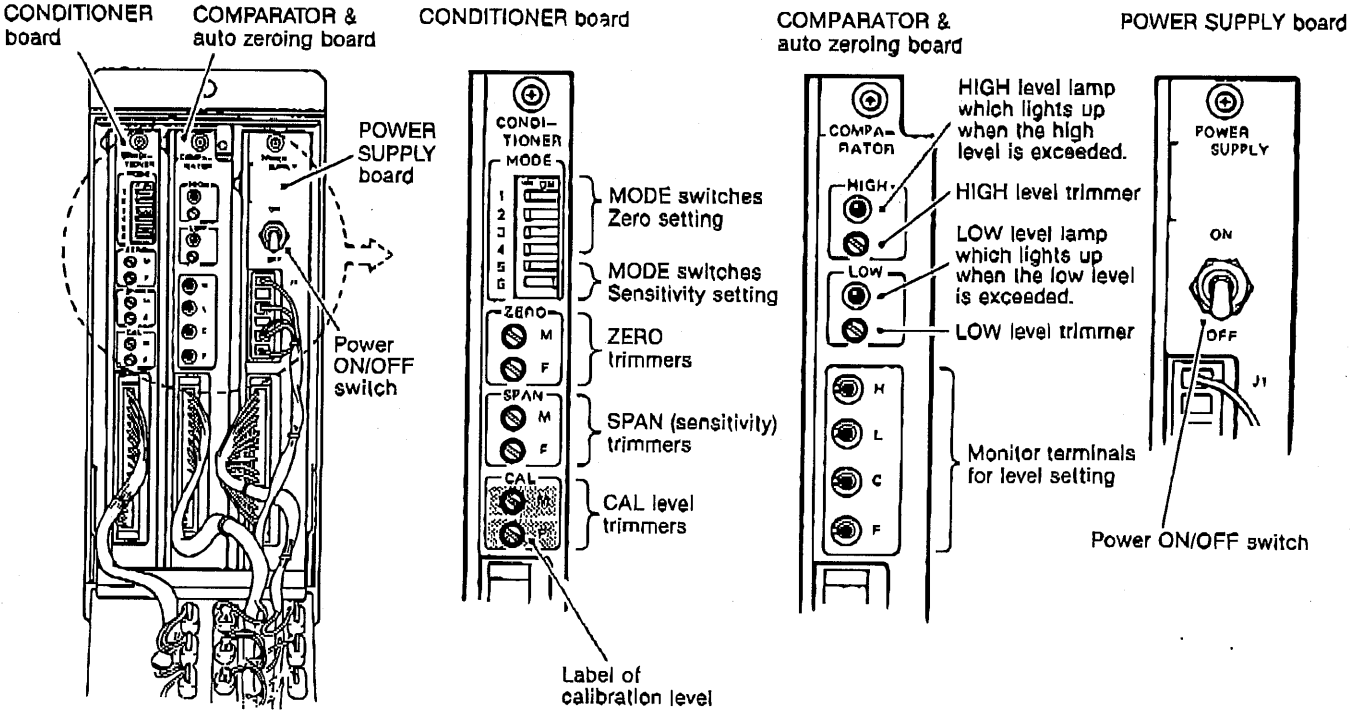
  Also, take sufficient care of the installation place since the signal conditioner does not feature a dustproof, water-repellent and vibration-resistant construction.

1. Parts Identification

■ Terminal Board

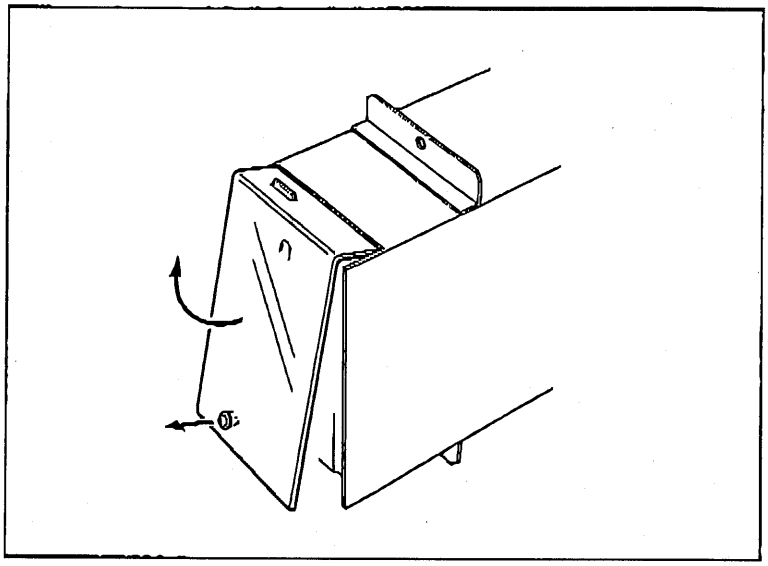


■ Internal Operation Boards

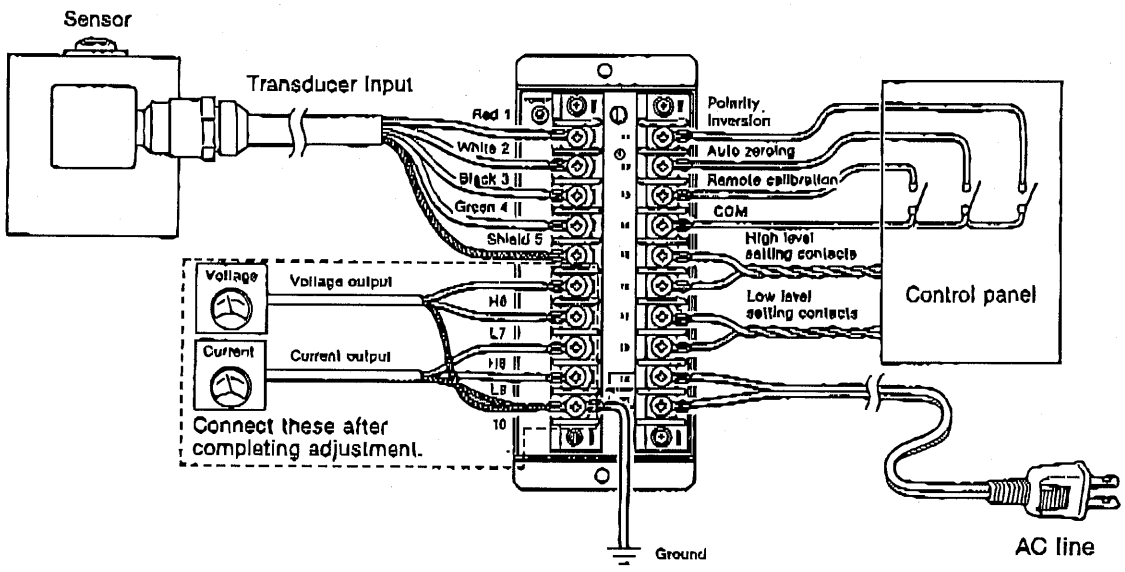


2. Connections

Pull the lock (nail-latch) on the transparent acrylic cover toward you and remove the cover by putting it upward.



- **If the Input Cable is a 4-conductor Shielded Cable**

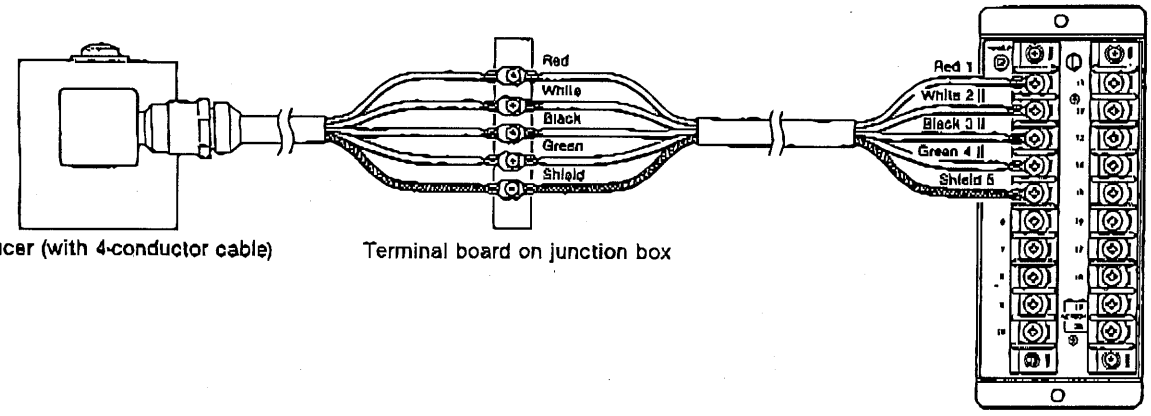


Caution

If the shield wire is isolated from the transducer proper, connect it as above.
Do not connect the shield wire to any pin if it is connected to the transducer proper.

■ Connection to Transducers via Junction Box

- **If You Use One to Four Transducers (bridge resistance 350Ω, connected in pralle)**

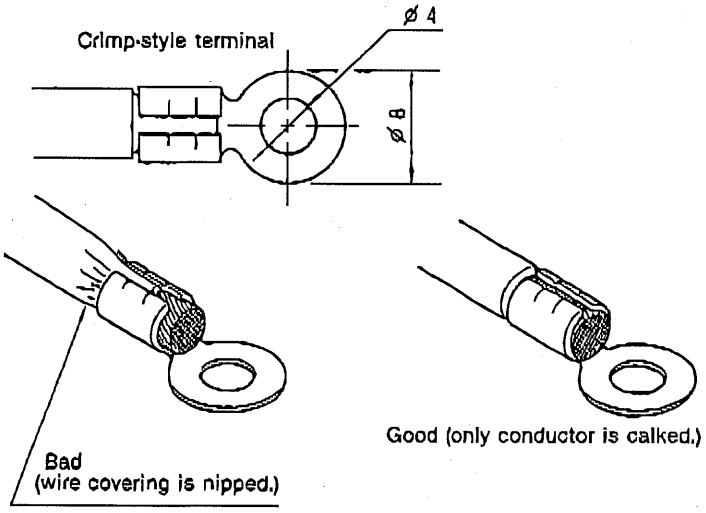


Transducer (with 4-conductor cable)

Terminal board on junction box

Caution

- Connect the power line after all other connections are complete.
- Make the input cable as short as possible.
- Connect each wire to the terminal pin securely by using a crimp-style terminal or the like.
  Improper connection does not ensure correct operation and may often cause a trouble.



■ Parallel Connection of Strain Gage Transducers

The signal conditioner allows for parallel connection of up to four strain gage transducers of 350Ω bridge resistance provided that they are of the same model (featuring the same capacity and sensitivity).
The load factor for parallel connection is the full load/total capacity and you can regard the parallelly-connected strain gage transducers as a single unit.

Example
If a weight of 25 tons is applied to three LC-10TE load cells (strain gage transducers, each featuring 10-ton capacity), the load factor is:

25 tons/(10 tons x 3) = 5/6 (Each load cell receives a load of 5/6 its rated capacity.)

Since the output sensitivity of LC-10TE is 2mV/V*, the output is:

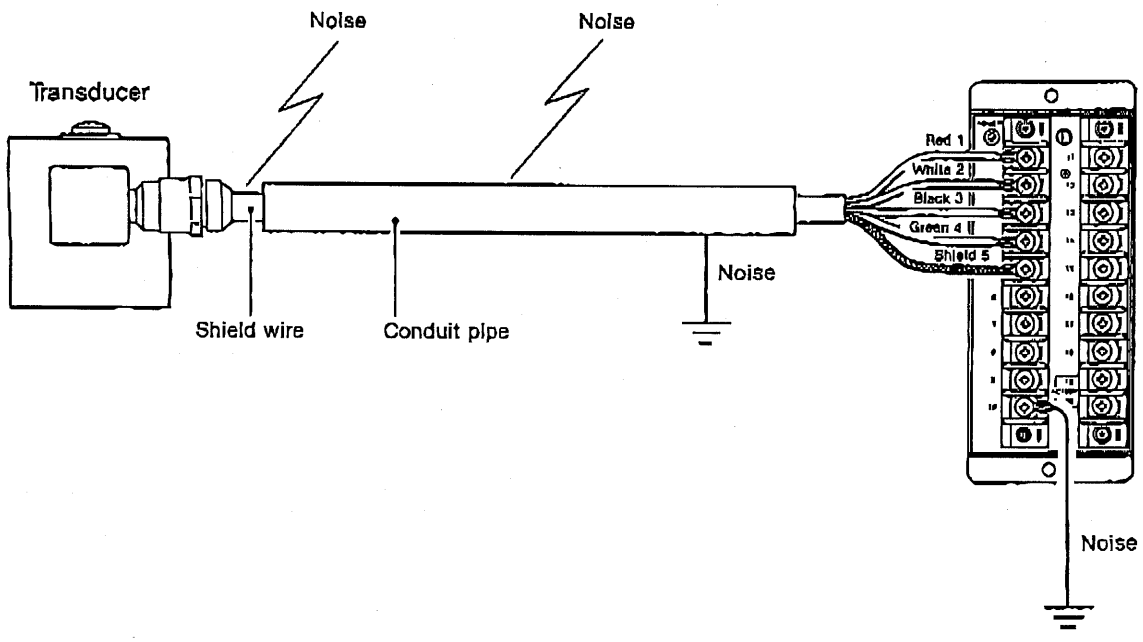
2mV/V x 5/6 = 1.666 (mV/V)

And you can regard the three load cells as a single unit which outputs 1.67mV/V/25 tons.
*Average of output sensitivities of three load cells described on calibration sheets.

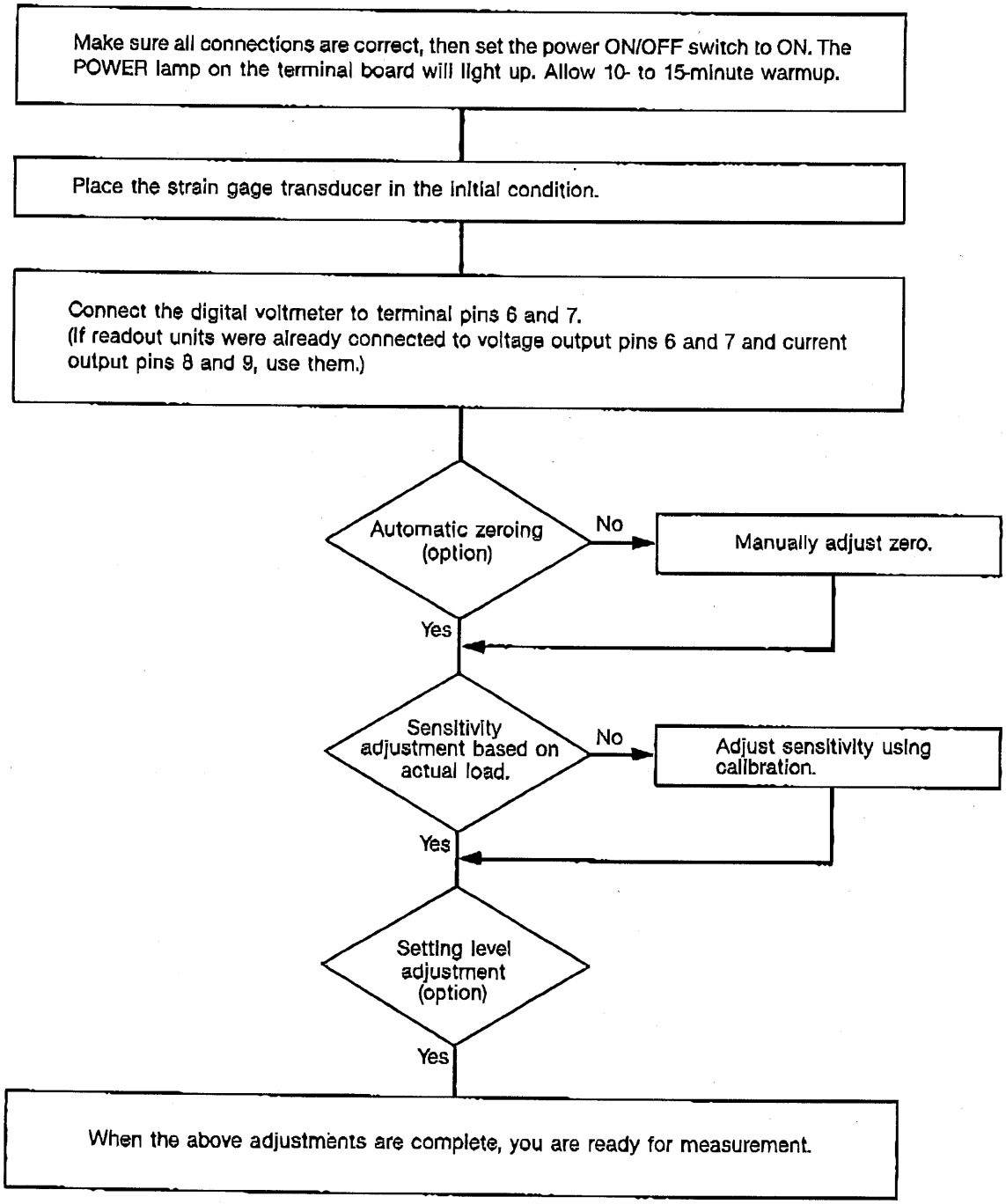
Caution

The signal conditioner amplifies minute electrical signals to approx. 1000 to 2000 times to give ±5V and 4 to 20mA outputs. Accordingly, external small noise too is amplified to 1000 to 2000 times.
If you use the signal conditioner in a place where much noise seems to be induced, take the following countermeasures against noise when connecting the transducer.

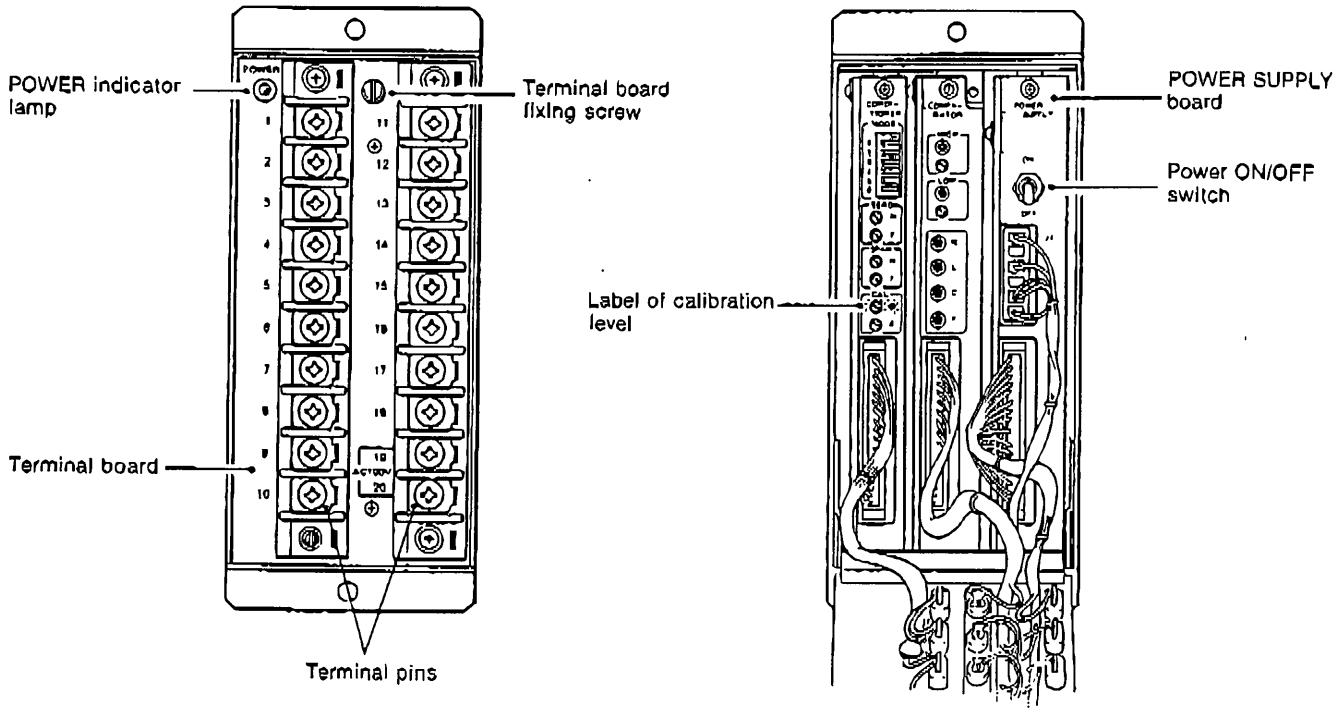
- Make the input cable as shortest as possible and use a shield wire.
- If the input cable crosses, or runs in parallel with, a power cable, use a conduit pipe.



3. Operating Procedure



4. Adjustment



■ Turning ON the Power

- Make sure of correct connections.
- Connect the digital voltmeter to voltage output pins 6 and 7.
- Loosen the terminal board fixing screw by turning it counterlockwise and pull down the terminal board toward you.
- Set the power ON/OFF switch on the POWER SUPPLY board to ON. The POWER lamp on the terminal board will light up.
- Warmup

  The signal conditioner is placed in operating condition immediately after the power is supplied. But allow 10- to 15-minute warmup to let it operate stably.

  For micro strain or a long-term measurement, warmup time should be extended to 30 to 60 minutes.

■ Zero Adjustment

An initial unbalance is generated under the condition of mere connection of the strain gage bridge or strain gage transducer to the signal conditioner. Before you start measurement, you need to adjust the unbalance. Since the WDC-200 series includes manual zeroing models (WDC-100, 201, 202 and 203) and automatic zeroing models (WDC-210, 211, 212 and 213), the zero adjustment method differs with models. Read the paragraph which corresponds to your model in the following description.

• Manual Zeroing Models (WDC-200, 201, 202 and 203)

(1) Short terminal pins 13 and 14. Using the screwdriver, adjust SPAN trimmer "M" on the CONDITIONER board so that the digital voltmeter reads out 5.0V or so.
(2) Cancel the short-circuit of terminal pins 13 and 14.
(3) Make sure the strain gage bridge or strain gage transducer, which is connected to the signal conditioner, is under no load condition.
(4) Conduct coarse adjustment by turning ZERO trimmer "M" on the CONDITIONER board so that the digital voltmeter reads out 0V.
(5) Adjust ZERO trimmer "F" on the CONDITIONER board so that the digital voltmeter reads out 0.000V.

After adjustment to 0.000V is complete, proceed to the next sensitivity adjustment.
If adjustment to 0.000V is not possible, perform readjustment with MODE switches 1 through 4 on the CONDITIONER board set to the following positions.

	If zero shift in plus direction cannot be removed by zero adjustment						If zero shift in minus direction cannot be removed by zero adjustment				
MODE switch 1	ON	ON	ON			OFF	OFF	OFF			
MODE switch 2	OFF	OFF	OFF			ON	ON	ON			
MODE switch 3	ON	OFF	ON			ON	OFF	ON			
MODE switch 4	OFF	ON	ON			OFF	ON	ON			
Input-referred value at standard sensitivity	−0.5 mV/V	−1.0 mV/V	−1.5 mV/V			+0.5 mV/V	+1.0 mV/V	+1.5 mV/V			
Condition	(a)	→ (b)	→ (c)			(a)	→ (b)	→ (c)			

Start from condition (a) and if zero adjustment even under condition (c) does not let the digital voltmeter read out 0.000V, refer to Chapter 6 "Troubles and Countermeasures."

• Automatic Zeroing Models (WDC-210, 211, 212 and 213 with optional spec.)

(1) Make sure the strain gage bridge or strain gage transducer, which is connected to the signal conditioner, is under no load condition.

(2) Short terminal pins 12 and 14, then open. And zero will be adjusted automatically.

■ Indirect Zero Adjustment

• You Can Indirectly Adjust an Unbalance of up to ±5V referred to voltage output.

Example 1:

Suppose the sensitivity of signal conditioner has been so adjusted that an input of ±0.5mV/V causes an output voltage of ±5.0V. If an initial unbalanced corresponds to 0.49mV/V (lower than 5V referred to voltage output), you can adjust the unbalance to ±0.005V (0.1%* fs) max. by make-break between terminal pins 12 and 14.

*0.05% fs possible for your specific requirement.

Example 2:

If an initial unbalance exceeds 0.75mV/V (7.5V referred to voltage output) with the sensitivity of signal conditioner adjusted as above, the adjustment by make-break between terminal pins 12 and 14 reduces the unbalance only to 2.5V.

• Zero Adjustment Independent of Automatic Zeroing Function

- Short monitor terminals "C" and "F" on the COMPARATOR & auto zeroing board. The automatic zeroing function will be ineffective and you will be able to adjust zero by using steps (1) through (5) described for manual zeroing models.
- Each strain gage transducer has the output sensitivity to the rated capacity (100% load which can be measured by the transducer).

Take the Kyowa LC-100KG strain gage load cell for instance. The calibration sheet which is included in standard accessories, discloses the rated output, $\frac{1998\mu V/V}{(3966 \times 10^{-6})}$ for example. This means that a load of 100kgf applied to the LC-100KG with a bridge voltage of 1V causes an output of 1998μV = 1.998mV.

"An input of 0.5mV/V" to the signal conditioner corresponds to a load to this LC-100KG as follows:

$$100\text{kgf} : x = 1.998\text{mV} : 0.5\text{mV}, \quad x = \frac{100 \times 0.5}{1.998} = 25.025.....$$

That is, a load of 25.025kgf applied to the LC-100KG initiates an input of 0.5mV/V to the signal conditioner. Also, when referred to strain, 1000μV/V (1.0mV/V) corresponds to 2000×10^{-6} strain (2000$\mu\varepsilon$).

■ Sensitivity Adjustment

■ Sensitivity Adjustment Based on Actual Load

- If You Can Calculate Input in Advance

MODE switch 5	OFF	OFF	ON
MODE switch 6	OFF	ON	ON
Sensitivity	±5V/ ±1.0mV/V	±5V/ ±0.5mV/V	±5V/ ±0.25mV/V
Condition	(a)	(b)	(c)

(1) Conduct coarse adjustment by placing MODE switches in condition (a), (b) or (c) depending on sensitivity.
(2) Apply an actual load.
(3) Conduct medium adjustment by turning SPAN trimmer "M" on the CONDITIONER board so that the actual load approximately causes required outputs (voltage and current outputs) on the digital voltmeter.
(4) Conduct fine adjustment by turning SPAN trimmer "F" on the CONDITIONER board so that the required outputs (voltage and current outputs) for the actual load are accurately obtained on the digital voltmeter.
(5) Adjust zero and sensitivity several times repeatedly.

Example:

Conditions:

Strain gage load cell LC-100KF
Weighing capacity 50kgf
Output voltage 5V

Consideration:

Suppose the rated output described on the calibration sheet of this LC-100KF is $\frac{1504\mu V/V}{(3008 \times 10^{-6}\ \text{strain})}$.

The input-referred value is calculated as follows:

100:50 = 1504:x

$$x = \frac{1504 \times 50}{100} = 752 = 0.752\text{mV/V}$$

Adjustment Procedure

(1) Since the input sensitivity of 0.752mV/V is higher than 0.5mV/V but lower than 1.0mV/V, place MODE switches in condition (b) on the table above.
(2) Apply the actual load.
(3) Adjust SPAN trimmer "M" on the CONDITIONER board so that the digital voltmeter reads out 5.0V or so.
(4) Adjust SPAN trimmer "F" on the CONDITIONER board so that the digital voltmeter reads out 5.000V.
(5) Adjust zero and sensitivity several times repeatedly.

• If You Cannot Calculate Input in Advance

(1) Conduct coarse adjustment by placing MODE switches in condition (a) on the table above.
(2) Apply an actual load.
(3) Conduct medium adjustment by turning SPAN trimmer "M" on the CONDITIONER board so that the actual load approximately causes the required output on the digital voltmeter.
(4) If the required output is not obtained under this condition, change the MODE switch setting to (b) or (c) and turn SPAN trimmer "M" clockwise so that the digital voltmeter reads out an approximate target value.
(5) Conduct fine adjustment by turning SPAN trimmer "F" so that the actual load accurately causes the required output on the digital voltmeter.
(6) Adjust zero and sensitivity several times repeatedly.

■ Sensitivity Adjustment Using Calibration

The calibration level of signal conditioner is labelled on the CAL trimmer section of CONDITIONER board. Adjust sensitivity using calibration as described in the following example.

Example

Conditions:

Calibration level of signal conditioner 0.5mV/V
Strain gage pressure transducer ..... PG-10KV (rated capacity 10kg/cm^2)
Voltage output for a load of 5kg/cm^2 ..... 5V
Rated output of PG-10KV ..... $\frac{1944\mu V/V}{(3988 \times 10^{-6}\ \text{strain})}$

Adjustment Procedure

(1) Set MODE switches on the CONDITIONER board for coarse adjustment based on the following calculation. Since the input sensitivity = 1994 x 5/10 = 997μV/V = 0.997mV/V which is lower than 1.0mV/V but higher than 0.5mV/V, place MODE switches in condition (b) on the table above.
(2) Apply calibration by shorting terminal pins 13 and 14.
(3) Calculate the resultant voltage output as follows:

Output of PG-10KV for a load of 5kg/cm^2	:	Calibration level	=	Desired output voltage	:	Output voltage to be adjusted
0.997mV/V	:	0.5mV/V	=	5V	:	x

$$x = 5V \times \frac{0.5}{0.997} = 2.508V$$

(4) Adjust SPAN trimmer "M" so that the digital voltmeter reads out 2.5V or so. (Medium adjustment)
(5) Adjust SPAN trimmer "F" so that the digital voltmeter reads out 2.508V. (Fine adjustment)
(6) Cancel short-circuit between terminal pins 13 and 14.
(7) Adjust zero and sensitivity several times repeatedly.

NOTE: During calibration, signal from the transducer is separated and is not superimposed on calibration signal.

Caution

If you need to adjust the calibration level to a desired input-referred value after completing the sensitivity adjustment based on actual load, you can use CAL trimmers "M" and "F" which will be accessible by peeling off the label of calibration level. If the output voltage/some actual load has been adjusted to 5V, you can make the calibration level equal to the output voltage by adjusting CAL trimmers "M" and "F" with terminal pins 13 and 14 shorted.
While this function is convenient for checking the operation of signal conditioner, take care that such adjustment deprives the measuring system of the reference value, thereby making measurement unreliable.

NOTE: Relation between output voltage and output current is 0 to +5V= +4 to 20mA (0 to −5V= +4 to −12mA).

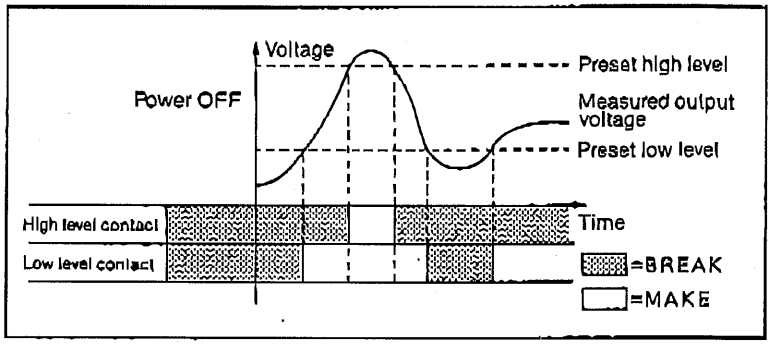
5. Functions

■ Indirect Zero Adjustment

• Refer to "Indirect Zero Adjustment" on page 9.

■ High/Low Level Settings

When a measured output voltage exceeds a preset level, the contact output is placed in the make condition and the HIGH or LOW level lamp lights up.



■ Setting Procedure

• High Level Setting

(1) Connect the digital voltmeter to terminals C and H on the COMPARATOR & auto zeroing board.
(2) While monitoring the digital voltmeter, adjust the HIGH level trimmer to a desired level between 0 and 5V.

• Low Level Setting

(1) Connect the digital voltmeter to terminals C and L on the COMPARATOR & auto zeroing board.
(2) While monitoring the digital voltmeter, adjust the LOW level trimmer to a desired level between 0 and 5V.

Example

If you want to weigh an 8-ton load using the LC-10TE and obtain a contact output when the measured output voltage comes to 90% or 120% of what is expected for the 8-ton load, calculate high and low levels to be set as follows, supposing the output voltage for an 8-ton load is 4V:

High level = 4 x 120% = 4.8V
Low level = 4 x 90% = 3.6V

If the voltage for an 8-ton load is set at 5V,

High level = 5 x 120% = 6V
Low level = 5 x 90% = 4.5V

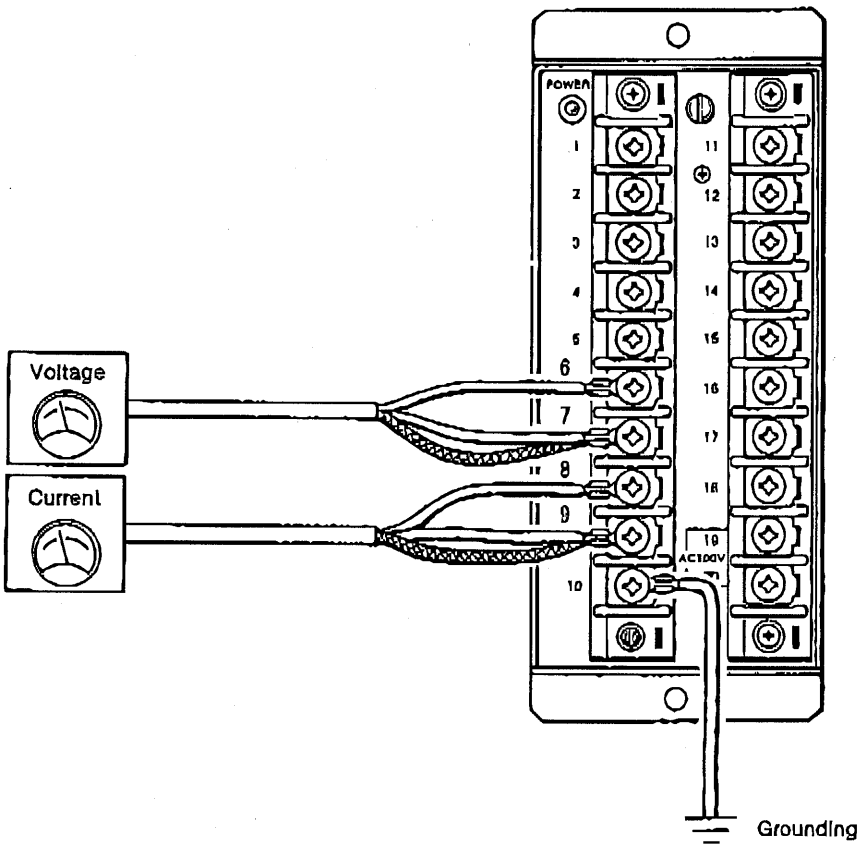
Since the range available for level setting is 0 to 5V, a high level setting is not possible in this case.

■ Polarity Inversion

- Voltage and current output polarities are inverted by shorting terminal pins 11 and 14.
  This function permits you to weigh a discharged amount by adjusting the output to zero after loading a material into a hopper or the like and discharging with terminal pins 11 and 14 shorted.

■ Isolated Amplifier

- Both voltage and current outputs can be isolated from the ground.
- For this purpose, change connection described in Chapter 2 "Connections" as follows.



6. Troubles and Countermeasures

Do not regard a malfunction immediately as a trouble but check according to the following table. If a malfunction is caused by erroneous operation, read this operation manual once more.

	Trouble	Cause	Countermeasure	Ref. page
Power Supply	The signal conditioner is not powered. (The POWER lamp does not light up.)	•The power plug is disconnected. •Contact of wiring or connection is inferior. •Contact of POWER SUPPLY board with the connector is poor.	•Connect it securely. •Check contact of wiring and terminal pins (the crimp-style terminal should not nip wire covering). •Pull out the board and wash the contact of connector with thinner, acetone, chlorosene, alcohol or the like.	3, 4 2
Zero Adjustment	Zero cannot be adjusted to "0.000V."	•MODE switches are set to improper positions. •Contact of wiring or connection is poor. •Initial unbalance of transducer is large. •A load is applied to the transducer.	•Set them correctly. •Check contact of wiring and connection. •Replace the transducer. •Reset it to the initial condition (load=0).	8 3, 4
	The automatic zeroing function is not effective.	•Contact of wiring or connection is poor. •Initial unbalance of transducer is large. •A load is applied to the transducer.	•Check contact of wiring and connection. •Replace the transducer. •Reset it to the initial condition (load=0).	3, 4
	Zero fluctuates.	•External noise. •Insulation of the transducer is inferior. •Vibration is given to the load-sensing element.	•Remove the cause of noise. •Replace the transducer. •Remove vibration.	5

	Trouble	Cause	Countermeasure	Ref. page
Output	No output is given.	•Contact of wiring or connection is poor. •MODE switches are placed in condition (a) and SPAN trimmer "M" is set to the extreme left. •No load is applied. •The transducer is defective.	•Check contact of wiring and connection. •Turn SPAN trimmer "M" clockwise. •Apply a load. •Replace.	3, 4 10
	Output is insufficient	•MODE switches are set to improper positions. •Low power voltage. •An improper transducer is selected. •The transducer is defective. •A load is not sensed correctly.	•Change MODE switch setting. •Connect to the AC line with the rated voltage. •Replace with a proper transducer. A desired output may not be obtained if you measure a large load using a transducer with a large rated capacity. •Replace. •Check the load-sensing degree.	8
	Output fluctuates.	•External noise. •Insulation of the transducer is inferior. •Vibration is given to the load-sensing element. •The load is not stable.	•Remove the cause of noise. •Replace. •Remove vibration. •Wait until it is stabilized.	5
	Output has not good linearity as specified.	•A wrong load resistance is selected. •The load is not sensed normally.	•Select 5kΩ min. for voltage output, and 400Ω max. for current output. •Remodel the load-sensing part.	1
Calibration	Calibration is not effective.	•Contact of wiring or connection is poor. •MODE switches are placed in condition (a) and SPAN trimmer "M" is set to the extreme left.	•Check contact of wiring, terminal pins and switches. •Turn SPAN trimmer "M" clockwise.	3, 4 10
	Calibration level is abnormal.	•CAL trimmers "M" and "F" were erratically turned.	•Readjust the calibration level referring to the standard input.	12
Level Setting	Contact output is not available.	•Contact of wiring or connection is poor. •Output does not reach a preset level.	•Check contact of wiring, terminal pins and switches. •Readjust setting levels.	3, 4 11

■ After-sales Service

• Warranty Card

The warranty card is required for after-sales service. Be sure to fill in model number, serial number and other necessary items and keep it carefully. The warranty period is one year from your purchase.

• When you need repairing

If a malfunction cannot be eliminated by countermeasures described above, stop using the signal conditioner and contact your Kyowa dealer for repair.
At that time, inform your Kyowa dealer of the following:

- Company name, person in charge, telephone number
- Model number, serial number and date of purchase
- Detail of trouble or abnormality
- Desired date the dealer will visit you.

A minimum period when spare parts for repair of the WDC-200 series signal conditioner will be held is seven (7) years from the discontinuation of the production.

7. Specifications

■ Models and Functions Provided

Function / Model	Conditioner + Analog output	2-level setting	Indirect zero adjustment	Indirect calibration	Polarity inversion
WDC-200	Yes				
WDC-202	Yes		Yes	Yes	Yes
WDC-210C	Yes	Yes			

■ Specifications

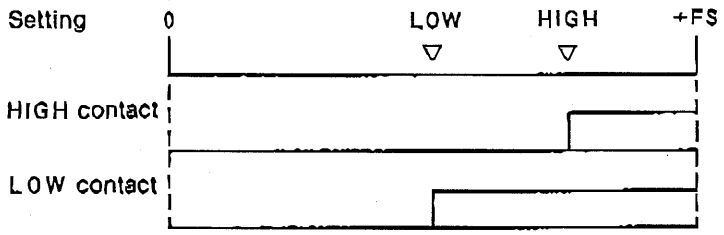
Conditioner Section	
Number of measuring channel:	1
Applicable transducer:	Load cell with bridge resistance 350Ω (up to four units can be parallelly connected).
Measuring range:	±0.25mV/V to ±2mV/V min.
Bridge power supply:	Alternating excitation voltage 10V peak Synchronized with the line frequency Remote sensing possible within 100m of cable
Input mode:	Balanced differential input
Input resistance:	10MΩ min.
Zero adjustable range:	With standard sensitivity* Coarse adjustment, in 3 steps of ±0.5mV/V, ±1.0mV/V and ±1.5mV/V (for tare collection) Medium adjustment, continuously adjustable between 0 and ±0.5mV/V min. Fine adjustment, continuous adjustable between 0 and ±0.08mV/V min.
Sensitivity (span) adjustable range:	a. Coarse adjustment in 3 spteps of: ±5V output/±0.25mV/V input ±5V output/±0.5mV/V input ±5V output/±1.0mV/V input b. Medium adjustment, continuously adjustable between 1/1 and 1/2 min. c. Fine adjustment, continuously adjustable between 1/1 and 23/25 min.
Output:	0 to ±5V (with unbalanced 5kΩ load)
Non-linearity:	Within ±0.05% fs
Calibration:	Coarse adjustment, continuously adjustable between ±0.25mV/V and ±1.0mV/V min. Fine adjustment, continuously adjustable between 1/1 and 23/25 min.
SN ratio:	60dB
Stability:	a. Thermal effect on zero: within ±0.005%fs/°C on sensitivity: within ±0.02%/°C b. Aging effect: on zero: within ±0.005%fs/8 hrs. on sensitivity: within ±0.02%/8 hrs.

Analog Output Section	
Number of oututs:	2 (one each for current and voltage)
Voltage output:	0 to ±5V with unbalanced load of 5kΩ min.
Current output:	+4 to +20mA with unbalanced load of 400Ω max.

Common Specifications	
Operating temperature/ humidity range:	0 to +40°C, 85%RH max. (no dew condensing)
Storage temperature/ humidity range:	−10 to +50°C, 90%RH max. (no dew condensing)
Casing design:	Dust-repellent structure
Power requirements:	100-110V AC ±10% or 200-220V AC ±10% as specified, 50/60Hz, 1-phase, 50VA max.
Power filter:	EMI filter
Dimensions:	96 x 136 x 220mm (excluding mounting metals)
Weight:	Approx. 1.5kg

*Standard sensitivity is ±5V output/±0.5mV/V input with a bridge voltage of 10V DC (±5V).

Options	
1. Level Setting	
Number of set levels:	2
Setting system:	Analog potentiometer (in conjunction with the digital voltmeter)
Setting accuracy:	±0.2%fs
Response time:	Within 10ms
Contact output:	No-voltage contact a, one each for high and low levels. Each contact is on when an input exceeds the set level; and off when an input is within the set level.



Contact capacity:	24V DC, 0.2A max.; non-inductive load
2. Indirect Zero Adjustment	
Adjustable range:	±1/2 or ±1/1 full scale at standard sensitivity
Adjustment accuracy:	Within 0.05%fs for ±1/2 full scale adjustment Within 0.1%fs for ±1/1 full scale adjustment
Adjusting time:	Within 2 sec.
Adjustment signal:	External no-voltage contact a input, contact capacity 24V DC, 0.1A ON: Indirect zero adjustment OFF: Ordinary operation
3. Indirect Calibration	
Indirect calibration signal:	External no-voltage contact a input, contact capacity 24V DC, 0.1A ON: Indirect calibration OFF: Ordinary operation

4. Polarity Inversion

This function can be used to weigh a discharged amount from a hopper or make discharge in a fixed amount. A discharged amount can be read out by adjusting the output to zero after loading a material into a hopper, inputting the polarity inversion signal and discharging the material. On the other hand, a fixed amount can be discharged repeatedly by setting the output to zero at every discharge.

Polarity inversion signal:	External no-voltage contact a signal, contact capacity 24V DC, 0.1A ON: Polarity inversion OFF: Ordinary operation

Output:	Input	Output
At polarity inversion	0 to ±5V	0 to ±5V
At ordinary operation	o to ±5V	0 to ±5V