IM-A-510

INSTRUMENTATION PREAMPLIFIER

WGA-100B

INSTRUCTION MANUAL

2001

KYOWA
ELECTRONIC INSTRUMENTS CO., LTD.

CONTENTS

Thank you for purchasing **KYOWA's WGA-100B INSTRUMENTATION PREAMPLIFIER** (hereinafter referred to as the WGA-100B). Read this Instruction Manual carefully in order to make full use of the high performance of the instrument. Do not operate the WGA-100B in methods other than described in this Manual.

SAFETY PRECAUTIONS

■ **Prior to use**

Before using the WGA-100B, read carefully the Instruction Manual. Always operate the WGA-100B in correct manner for safety.

In addition, be sure that the Instruction Manual is ready for use at any time.

KYOWA ELECTRONIC INSTRUMENTS CO., LTD. assumes no liability for damages resulting from usage made against the safety precautions.

■ **The following symbols are used for safety operation of the instrument.**

This symbol denotes the "Protective Ground Terminal."
Before operating the WGA-100B, do not forget to ground the terminal of the instrument having this mark.

■ **The following alarm marks are used on KYOWA's measuring instruments in order to invite the users' attention to preserve safety.**

Improper handling may result in death or severe injury of the operator. To avoid it, the operator must refer to the accompanying instructions in the user's Manual.

Improper handling may result in injury of the operator or damage to or destruction of parts of the product. To avoid it, the operator must refer to the accompanying instructions in the user's Manual.

⚠ WARNING

(1) Protective Grounding

- To prevent an electric shock, before turning ON the power switch, do not forget to ground the protective ground terminal.

(2) Essential of Protective Grounding

- To prevent an electric shock, special care should be taken not to cut the protective ground wire that is connected to exterior of the WGA-100B or disconnect the protective ground terminal.

(3) Confirm Protective Functions

- To prevent an electric shock, before operating the WGA-100B, always check whether no error exists in protective ground functions.
- When any trouble occurs in protective functions including the protective ground terminal and a fuse holder, do not operate the WGA-100B.

(4) Power Supply

- To prevent fire, before turning ON the power, do not forget to check whether supply voltage currently used is conforming to the specifications of the WGA-100B.

DC Specs	: 10 to 30V DC		
100V AC Specs	: 90 to 110V AC	110V AC Specs	: 99 to 121V AC
200V AC Specs	: 180 to 220V AC	220V AC Specs	: 198 to 242V AC

(5)Power Cable and Power Plug

- The WGA-100B has no power switch.
  Before connecting the power cable to the WGA-100B, always confirm no power is supplied from distribution board, etc.

(6) Fuse

- To prevent fire, use only the fuse with WGA-100B specified rated current, voltage and fuse type.
  Do not use any fuses other than specified or do not shunt the fuse holder.
- For replacing the fuse, always disconnect the AC or DC power supply cable in advance.
  Use the fuse by referring to the following.

DC Specs	Fast active type fuse 500mA, 250V
100V & 110V AC Specs 200V & 220V AC Specs	Fast active type fuse 100mA, 250V

(7) External Connection

- To prevent an electric shock, securely ground the protective ground terminal and then, connect the WGA-100B to external devices such as measurement target device or external control circuit.

(8) Using WGA-100B in Gassy Environment

- To reduce the risk of fire or explosion, avoid using the WGA-100B in environment with flammable and explosive gas or vapor.

HANDLING PRECAUTIONS

Read carefully the following instructions on operation methods and operating environment to prevent accidents and damages caused by incorrect settings or handling, and to make full use of the high performance of the WGA-100B. In addition, keep this Instruction Manual at hand for convenience.

⚠ CAUTION

(1) Power Supply

Always use the power supply having the specified power voltage.
The required power supply has tree types; 10 to 30V DC, 100V AC, & 200V AC
(Preparing 110V AC and 220V AC are available)

(2) External Noise

If a power line, transformer, electric tools, motor, transceiver, etc.,) that may cause interfering noise are located close to the input cable (between the transducer and WGA-100B), take appropriate countermeasures for reducing noise.

(3) Voltage Output & Current Output When Input Cable is Disconnected

If the transducer cable is disconnected, voltage output and current output of the WGA-100B may become as follows. Take appropriate countermeasures against the output signal not to affect other devices.

Voltage output : Approx. -12V or +12V
Current output : Approx. 0mA or 23mA

(4) How to Use Voltage Output & Current Output

Voltage output : Can be used with unbalanced load 2kΩ or more
Current output : Can be used with unbalanced load 500Ω or less

(5) Location

Use the WGA-100B in environment with temperature from -10 to +50 ℃ and humidity from 20 to 85% RH or less.
Since the WGA-100B is not in dustproof, waterproof, or vibrationproof construction, take special care for the operating location.

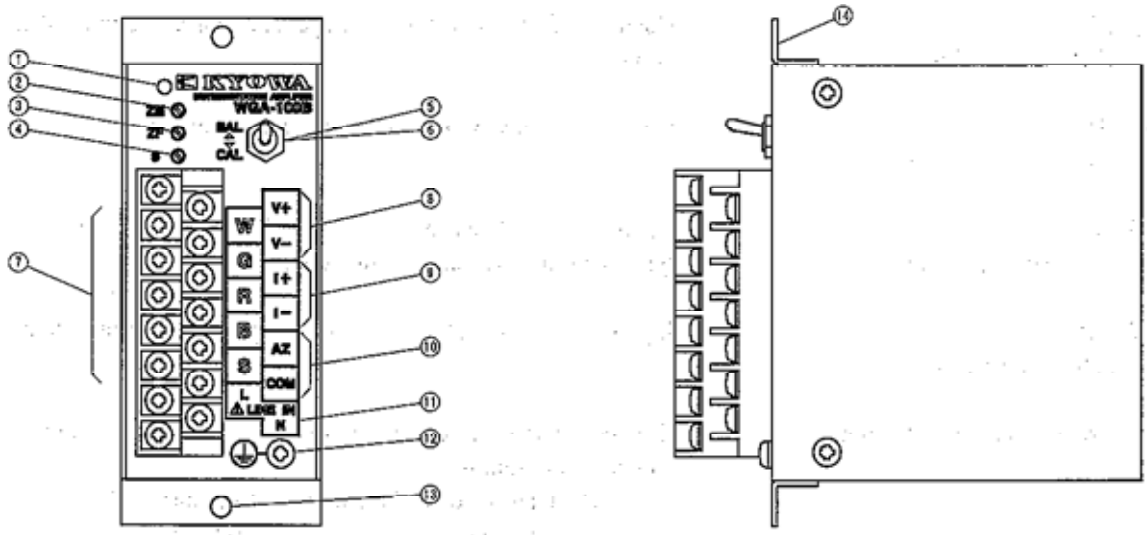
Types

Functions of the WGA-100B differs with the specified varying types.
Confirm the types of the purchased WGA-100B and read the respective Instruction Manuals.

WGA-100B-00	Manual balance,	DC power supply specs
WGA-100B-10	Auto-balance,	DC power supply specs
WGA-100B-01	Manual balance,	100V AC power supply specs
WGA-100B-11	Auto-balance,	100V AC power supply specs
WGA-100B-02	Manual balance,	200V AC power supply specs
WGA-100B-12	Auto-balance,	200V AC power supply Specs

CHAPTER 1. PARTS NAMES

Front Face **Side Face**



① Pilot Lamp

Lights up with the power switch turned ON.

②[ZM]
ZERO Coarse Adjuster

Conducts coarse control to voltage and current output ZERO points. (Not provided for types with auto-balance function.)

③[ZF]
ZERO Fine Adjuster

Conducts fine control to voltage and current output ZERO points.

④[S]
Sensitivity Adjuster

Controls sensitivity of voltage and current output.

⑤[BAL]
Auto-balance Switch

Conducts auto-balance. Note that this switch is invalid for types with manual balance function.

⑥[CAL]
Calibration Switch

Inputs calibration value to voltage output and current output.

⑦ Transducer Input Terminal

Connects a strain gage type transducer. (Screw size : 3mm)
Connects the following

W: Transducer white lead wire (-output)
G : Transducer green lead wire (+output)
R : Transducer red lead wire (+Excitation Voltage)
B : Transducer black lead wire (-Excitation voltage)
S : Transducer shielded wire

⑧ Voltage Output Terminal	Outputs voltage proportional to input voltage issued from the strain gage type transducer. (Screw size : 3mm)
⑨ Current Output Terminal	Outputs current proportional to input current issued from the strain gage type transducer. (Screw size : 3mm)
⑩ Auto-balance Input Terminal	Terminal between AZ and COM is shunt to conduct auto-balance. (Screw size : 3mm)
⑪ Power Supply Input Terminal	Power supply terminal. (Screw size : 3mm) Power supply varies with WGA-100B types actually used. Carefully read the Specifications before connecting the power line.
⑫ Protective Ground Terminal	Protective ground terminal (Screw size : 3mm)
⑬ Mounting Bracket	Used for mounting the WGA-100B to panel, etc. Can be set on both front and rear of the WGA-100B.
⑭ Mounting Bracket Hole (2-ϕ4.5)	Mounting bracket holes on upper and lower portions of the WGA-100B.

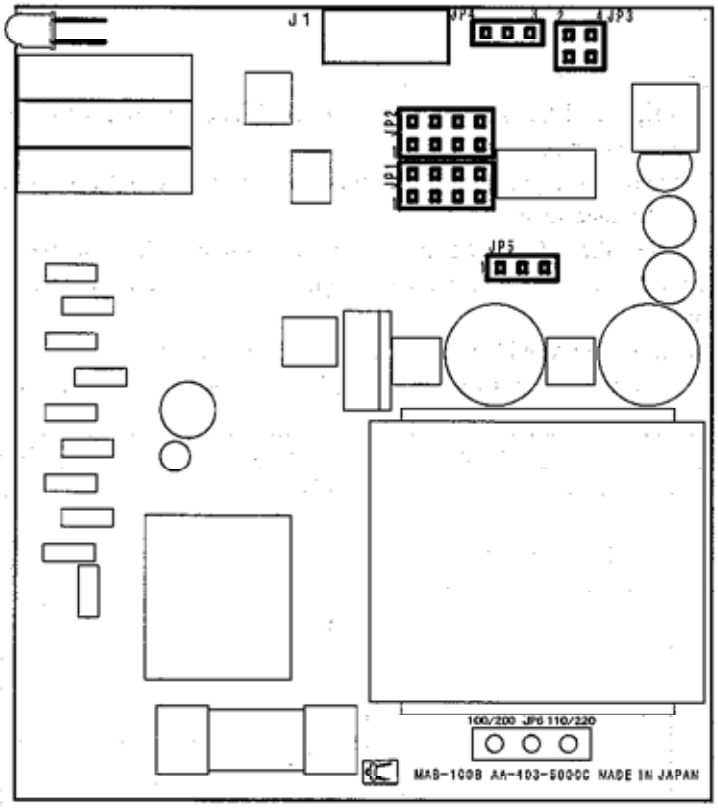
CHAPTER 2. INITIAL SETTING

The WGA-100B is so designed that various settings, for example, excitation voltage, amplifier sensitivity, calibration value, frequency characteristics can be selected on customer's side by changing jumpers on the printed circuit board inside the instrument. Do not forget to confirm the above settings before use.

Settings prior to shipment	Excitation voltage	: 10V	10V output with 1.0mV/V input
	Amplifier sensitivity	: 1000 times	
	Calibration value	: 1.0mV/V	
	Frequency characteristics	: 10Hz	

Note

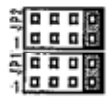
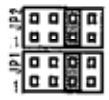
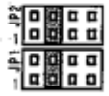
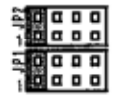
- Do not conduct the above settings in dusty and humid environment.
- Do not operate any setting procedures other than stated on the following page. Or it may cause damage to the WGA-100B.
- Avoid touching other parts or removing screws unless otherwise specified.
- Remove jumper pins with tweezers or pliers. Do not touch the jumper pins or other electronic parts directly with hands. Or, they may be damaged by static electricity.



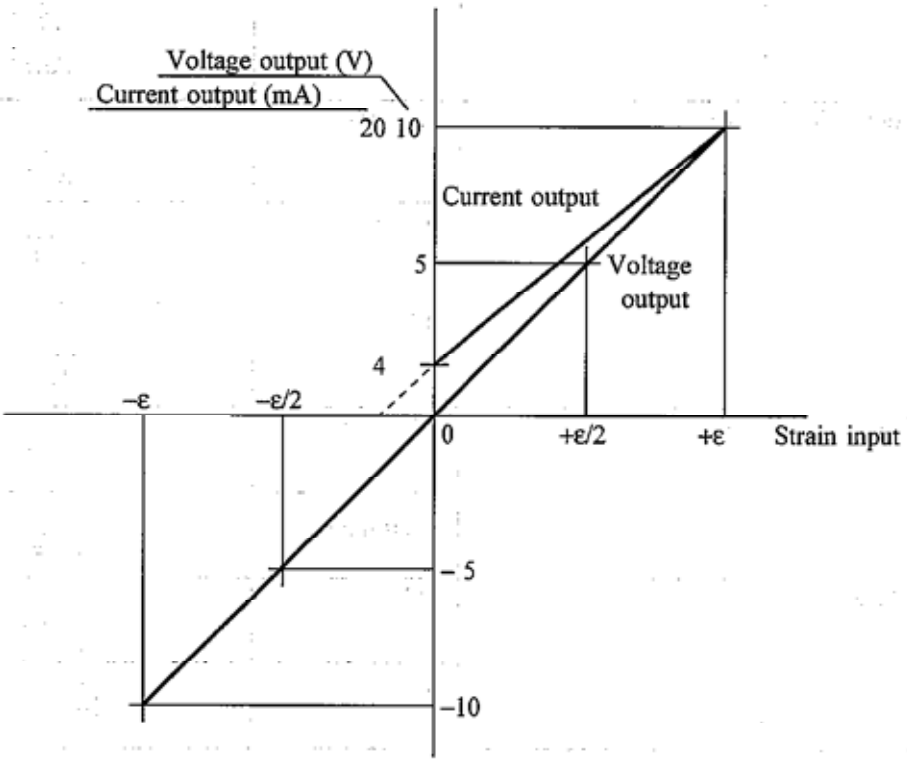
Main Board Inside the WGA-100B

Setting Procedure

①Turn OFF the power.
②Remove screws (4) on right and left sides of the WGA-100B and take out the cover.
③Remove a screw on the board rear.
④Remove an auto-balance board (Approx. 30 × 50mm) from the WGA-100B main board.
(For the type with auto-balance function)
⑤Set jumpers (JPs 1 to 5) of the WGA-100B main board according to the customer's required settings.
⑥Mount the auto-balance board on the main board. Tightly fix it to the connector J1. (For the type with auto-balance function)
⑦Tightly fix the auto-balance board with screws on the main board rear.
⑧Put on the cover and fix it with screws (4) on right and left sides of the WGA-100B.

Set Items	Jumper No.	Contents	Setting Method
Frequency characteristics	JP1 and JP2 Both JP1 and JP2 should have the same settings.	10Hz	
		30Hz	
		100Hz	
		500Hz	
Calibration value	JP3	1.0mV/V	
		0.5mV/V	
		0.25mV/V	
Sensitivity	JP4	1000 times	
		4000 times	
BV Voltage	JP5	10V	
		5V	

Relation Between Strain Input and Voltage & Current Outputs



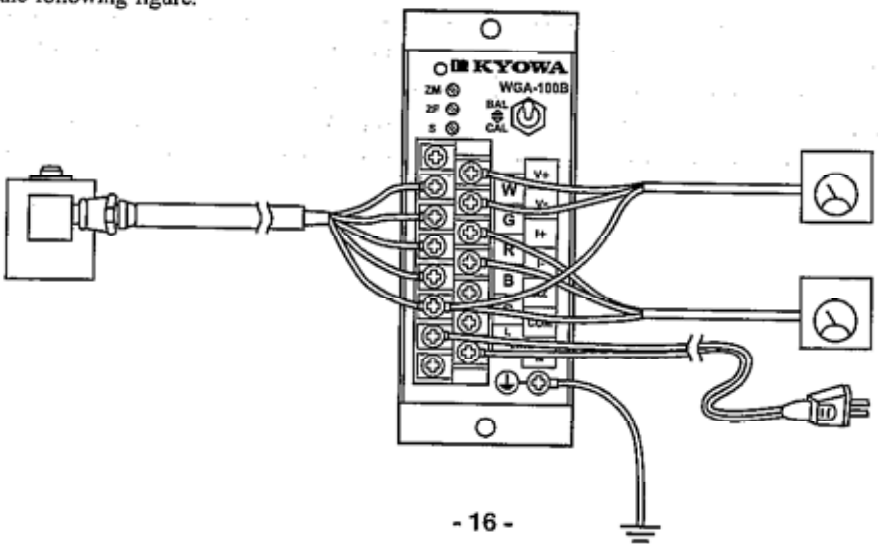
Setting Jumper		Strain Input ε	
Sensitivity	Excitation Voltage	Minimum Span	Maximum Span
1000 times	5V	8mV/V	2mV/V
1000 times	10V	4mV/V	1mV/V
4000 times	5V	2mV/V	0.5mV/V
4000 times	10V	1mV/V	0.25mV/V

CHAPTER 3. CONNECTION

Since the WGA-100B is used as an amplifier for assembling the system, no cables are attached.
To install the WGA-100B, use mounting bracket holes (2-ϕ4.5) provided on upper and lower portions of the WGA-100B.
The mounting brackets can be mounted on upper and lower portions of either front or rear side of the WGA-100B. Take special care for operating environment, for example, vibration, dust, temperature, humidity, etc. when installing the WGA-100B.

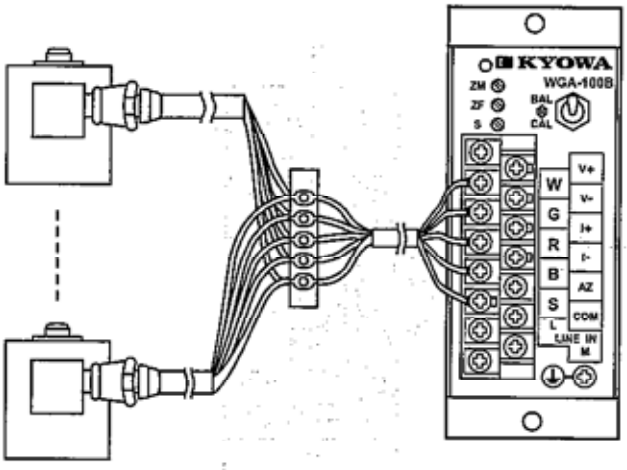
3-1 CONNECTING ONE TRANSDUCER

Connect one transducer to the WGA-100B together with a power cable, voltmeter, or ammeter as shown in the following figure.



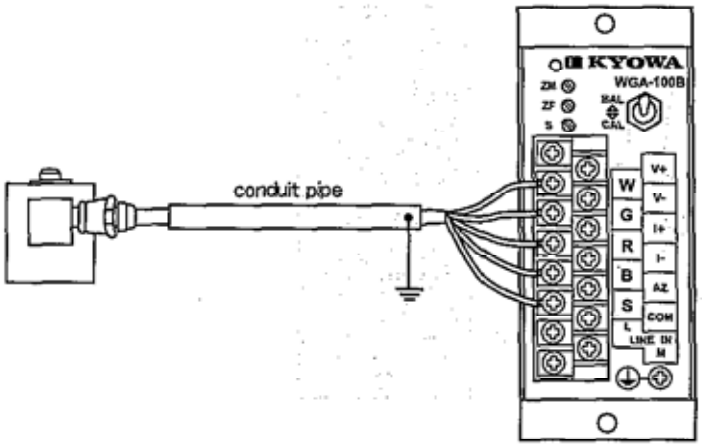
3-2 CONNECTING MULTIPLE TRANSDUCERS USING JUNCTION BOX

Maximum 4 transducers having 350Ω bridge resistance can be connected in parallel using a junction box. (Excitation voltage : 5V)

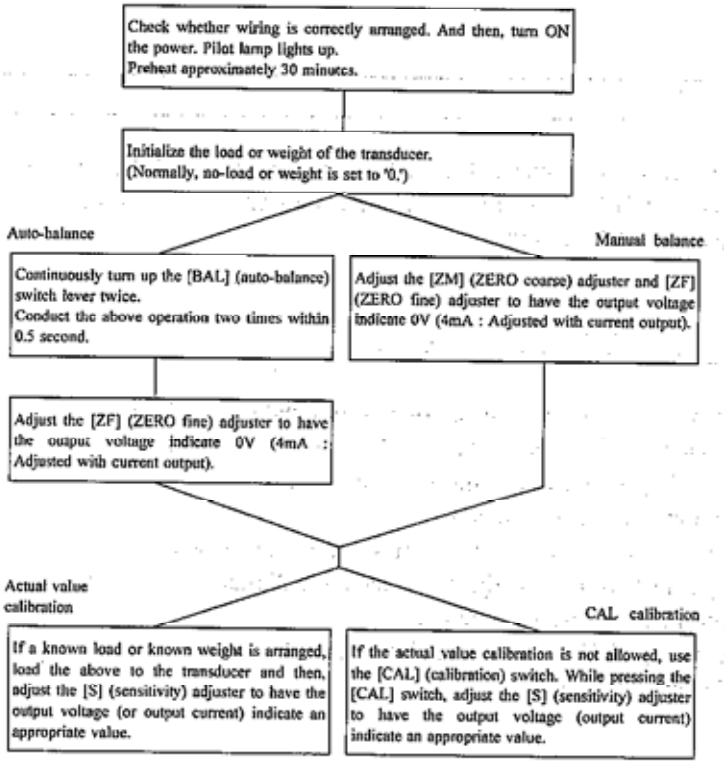


Note

- Set all the required settings and connect the power cable. And then, turn ON the power switch.
- Securely connect a power supply, transducer, voltmeter, etc. to the terminal board.
  Or, it may cause not only malfunction but damage to the WGA-100B.
- The WGA-100B amplifies and increases the input of micro electric signal by a 1000 to 4000 times to obtain the output of 10V or 4 to 20mA.
  Therefore, small external noise are also amplified by a 1000 to 4000 times.
  If it is unavoidably used in environment with various external noises, pay attention to the following items as countermeasures against noise when transducers are connected.
  ①Use a shielded input cable as short as possible.
  ②If the input cable and power line are crossing or arranged in parallel, use conduit pipe arrangement.



CHAPTER 4. OPERATING PROCEDURE



Repeat ZERO adjustment and calibration (sensitivity control) several times if possible to remove adverse effect on measured values caused by running-in, etc. of the detecting mechanism.

4-1 POWER SUPPLY

- Confirm cables are correctly connected to each of the terminals and then, turn ON the power switch.
- Although the WGA-100B becomes ready for operation right after the power ON, preheat approximately 30 minutes to stable the WGA-100B.

4-2 INITIAL BALANCE ADJUSTMENT

- Connect a digital voltmeter to the voltage output terminal (V+ & V–).
- Confirm the transducer is in no-load state (with no weight loaded).
- Turn clockwise the [S] (sensitivity) adjuster to the upmost.
- For the types with auto-balance function
  Turn up the [BAL] switch lever two times within 0.5 second.
  Adjust the [ZF] (ZERO fine) adjuster to have the digital voltmeter indicate 0.000V.
- For the types with manual balance function
  Adjust the [ZM] (ZERO coarse) adjuster and [ZF] (ZERO fine) adjuster to have the digital voltmeter indicate 0.000V.

Note

- The above describes procedures for monitoring and adjusting the voltage output terminal (V+ & V-).
  In addition, it can be adjusted using the current output terminal (I+ & I-).
  Current (4 to 20mA) issued from the current output terminal (I+ & I-) interlocks with the output voltage (0 to +10V) issued from the voltage output terminal (V+ & V-).

4-3 SENSITIVITY (SPAN) ADJUSTMENT

● Actual Load Adjustment

- Apply a known load (weight) to the transducer. Connect a digital voltmeter to the voltage output terminal (V+ and V–) and adjust the [S] (sensitivity) adjuster to have the digital voltmeter indicate the desired value.

(Example 1)

Assume that a weight is measured using one load cell having 1kN (102kgf) rated capacity. When 1kN (102kgf) weight is loaded and the output is adjusted to 1.00V or 10.00V, the loaded weight can be directly read on the digital indicator.

When 1kN (102kgf) weight is loaded and output is adjusted to 1.00V, if 0.80V output is obtained, the loaded weight shall be 0. 8kN (81.6kgf).

(Example 2)

Assume that 5V output is required when 1kN (102kgf) actual weight is loaded using one load cell. But the weight has only 0.8kN (81.6kgf). How to adjust the output voltage?

Since 5V output is required with 1kN (102kgf) actual weight, the output x (V) obtained with 0. 8kN (81.6kgf) weight shall be expressed as follows.

$$\frac{0.8}{1} = \frac{x}{5} \quad \text{Then,} \quad x = \frac{0.8 \times 5}{1} = 4$$

Therefore, when 0.8kN (81.6kgf) weight is loaded, adjust the output to have 4.00V. However, always adopt the weight close to maximum loading weight, or accuracy in measurement may decrease.

● Built-in Calibration Value Adjustment

- Confirm no weight is loaded to the transducer.
- Connect a digital voltmeter to the voltage output terminal (V+ & V-). While pressing the [CAL] switch on the front panel, adjust the [S] (sensitivity) adjuster to have the digital voltmeter indicate the desired value.

(Example)

Assume that a load cell having 1.0mV/V calibration voltage and 1kN (102kgf) rated capacity is used to obtain 5.00V of output when 0.5kN (51kgf) actual weight is loaded. However, the [calibration coefficient *1)] of the load cell at this time is 0.5005kN/1mV/V.

Firstly, obtain strain output by loading 0.5kN (51kgf) actual weight by the following expression.

0.5kN ÷ 0.5005kN/1mV/V =0 .999 (mV/V)

Since it is required to adjust 0.999mV/V of the obtained strain output to 5.00V, the output voltage x (V) with calibration voltage set to 1.0mV/V can be obtained by the following expression.

$$0.999 : 5.00 = 1.0 : x$$

$$x = \frac{5.00}{0.999} = 5.005$$

Therefore, adjust the voltage output terminal (V+ & V-) to 5.005V by pressing the [CAL] (calibration) switch.

*1) Calibration coefficient : A specified value of transducers stated in Transducer Inspection Sheet.

Note

- The above describes procedures for monitoring and adjusting the voltage output terminal (V+ & V-).
  In addition, it can be adjusted using current output terminal (I+ & I-).
  The current (4 to 20mA) issued from the current output terminal (I+ & I-) interlocks with the output voltage (0 to +10V) issued from the voltage output terminal (V+ & V-).

4-4 AUTO-BALANCE OPERATION

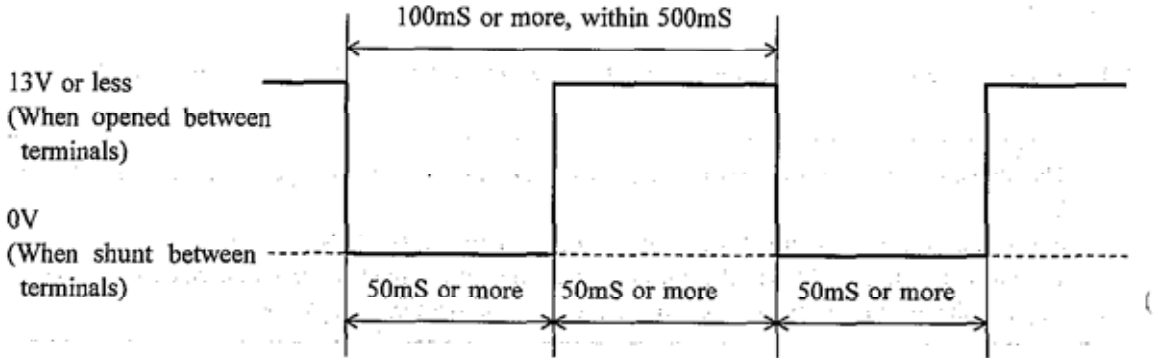
Auto-balance function is activated by the following operations.

- Operate the [BAL] (auto-balance) switch on the front panel.
- Shunt between AZ and COM terminals on the terminal board.

Activate the auto-balance function and the voltage output (V+ & V-) indicates 0V. Also, the current output (I+ & I-) indicates 4mA.

Even if the WGA-100B power is turned OFF, the state of the voltage and current outputs are maintained to have the same state before the power OFF.

In order to prevent malfunction, the preferable timings for operating the switch as well as for shunting the terminal board are described in the following.

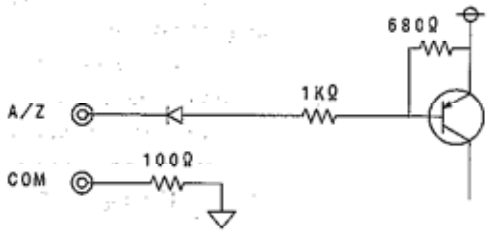


Current : 15mA or less

Note

- It should be noted that no chattering generates on rise and fall of the contact signal.

Inner circuit between AZ and COM terminals of the terminal board



CHAPTER 5. SPECIFICATIONS

5-1 SPECIFICATIONS

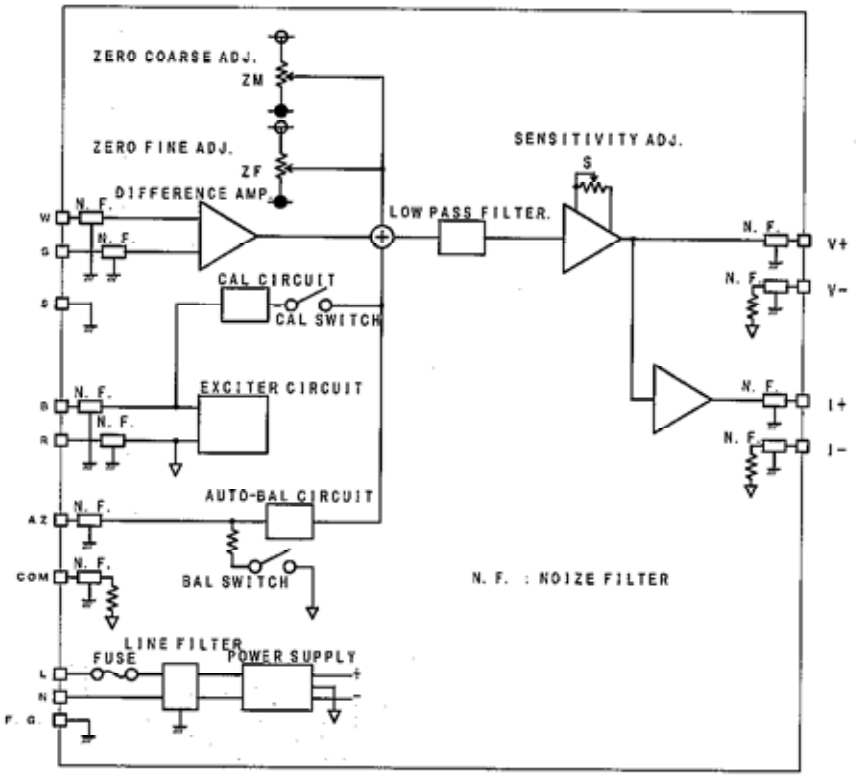
CONDITIONER

Number of Measuring Points	1
Applicable Transducer	Strain gage type transducer (350Ω) When excitation voltage is 5V : Connects maximum 4 transducers in parallel. When excitation voltage is 10V : Connects maximum 2 transducers in parallel.
Bridge Exciter (Excitation Voltage)	10V DC & 5V DC (Changeover)
Input Cable	0.5mm² × 4 conductor shielded cable Length : Within 20m
Input Form	Input balance difference
Input Resistance	1MΩ or more
Initial Adjustment	ZERO : Auto-balnace ±1.5mV/V Coarse and fine adjusters ±1.5mV/V (Manual balance only) Fine adjuster 0.25mV/V Sensitivity : 1000 times & 4000 times (Changeover) 1/1 to 1/4 (Adjusted with [S] sensitivity adjuster.)
Auto-balance Residual Voltage	Within ±35mV (Voltage output terminal)
Rated Output	Voltage : ±10V (Unbalance load : 2kΩ or more) Current : 4 to 20mV (Load resistance : 500Ω or less) (When voltage output is set to 0 to +10V)
Non-Linearity	±0.02% FS
Calibration Value	+0.25, +0. 5, & +1.0mV/V (Changeover)
Noise	SN ratio : 60dB or more (When 10V output sensitivity is obtained with 10V and 1.0mV/V excitation voltage)
ZERO Stability	Within ±0.7μV/℃
Sensitivity Stability	Within ±0.01%/℃
Frequency Characteristics	10, 30, 100, & 500Hz (Changeover) Roll-off characteristics : -12dB/oct
Influence from Conducted Interference & Radiation Field	ZERO variation : Within ±0.05mV/V (With 10V/m)

SPECIFICATIONS IN COMMON

Operating Temperature Range	-10 to +50 ℃
Operating Humidity Range	20 to 85% RH (Non-condensing)
Case Structure	Case is insulated from signal COM in direct current state.
Input/output Terminal	13-Pin resin terminal (M3) (Arranged in front)
Supply Voltage & Consumption Current	10 to 30V DC 200mA or less 100V & 110V AC ±10% 50mA or less 200V & 220V AC ±10% 40mA or less (Conforming to customers' needs)
Dimensions	44(W) × 90(H) × 101(D)mm
Weight	450g or less
Applicable Specifications	EMC standard : EN50081-2-94 Group I Class A EN50082-2-95 Safety standard : IEC61010-1-95 Degree of pollution 2, Installation category II

5-2 BLOCK DIAGRAM



Note : It should be noted that AUTO-BAL CIRCUIT may not be mounted on some types.

5-3 DIMENSIONS