IM-A-945 July 2013

INSTRUCTION MANUAL
CDV/CDA-900A
SIGNAL CONDITIONER

Thank you for purchasing KYOWA's product CDV/CDA-900A Signal Conditioner.
Read this Instruction Manual carefully in order to make full use of the high performance capabilities of the product.
Do not use the product in methods other than described in this Manual.

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STANDARD ACCESSORIES

The following accessories are packed with the Signal Conditioner CDV/CDA-900A (hereinafter referred to as the CDV/CDA-900A). When unpacking, check the contents to ensure that all accessories are enclosed.

Instruction Manual·· 1
Simplified instruction manual seal ·· 1
AC power cable (P-25)··· 1
3p-2p conversion plug (CM-39)··· 1
BNC cable (U-59 and U-08)··1 each
Warranty and Test Data Sheet··1 each

SAFETY PRECAUTIONS

The CDV/CDA-900A is designed in accordance with "8. SPECIFICATIONS." Do not use the CDV/CDA-900A in an environment exceeding the specifications. Or, failure of the CDV-CDA-900A may result.

PRIOR TO USE

For safe use of the CDV/CDA-900A, do not forget to read the “Safety Precautions” prior to use.
Kyowa Electronic Instruments Co., Ltd. assumes no liability for any damage resulting from the user’s failure to comply with the safety precautions.
For safety operation of the CDV/CDA-900A, the following symbol mark is used.

GND	Indicates “PROTECTIVE GROUND TERMINAL.” Be sure to connect the GND terminal to the ground. However, excludes when grounding with a 3-prong AC power cable.

SAFETY SYMBOLS

For safety operation of the CDV/CDA-900A, the following symbol marks are used in the Instruction Manual.

⚠ **WARNING**	Improper operation of the system may result in death or severe injury of the operator.
⚠ **CAUTION**	Improper operation of the system may result in injury of the operator and physical damage of the system.
🛇 **Prohibited**	Prohibited acts

⚠ WARNING

- **Power Supply**

  To prevent a fire hazard, before connecting the power cable, be sure to check the local line voltage is matched with the operating voltage specified for the CDV/CDA-900A.
- **Power Cable and Power Outlet**

  To prevent an electric shock or fire hazard, use the accessory power cable, 3p - 2p conversion adapter, and a power plug with protective ground terminal to the greatest possible extent.

  When using 3-prong power cable, use a 3-prong power plug with protective ground terminal.

  Operators must be cautioned that use of an extension power cable with no ground conductor disables the protective ground function.

  Read the Instruction Manual first, connect the power cable to the CDV/CDA-900A with the CDV/CDA-900A turned OFF and connect the power cable to the power outlet.
- **Protective Ground**

  To prevent an electric shock hazard, be sure to ensure protective ground before connecting the power cable.

  If 3p – 2p conversion adapter is used, be sure to ground the CDV/CDA-900A to the "GND" terminal.

  If a 2p flat vinyl power code is used, always ground with optional grounding conductor.
- **For Electrical Operator Safety**

  To prevent an electric shock hazard, operators must be cautioned not to cut the protective grounding conductor or disconnect the GND terminal.
- **External Connection**

  To prevent an electric shock hazard, ensure the safe protective ground of all concerned instrument and then, connect the CDV/CDA-900A to the measuring object and external devices, PC, etc.
- **Avoid using in environment with inflammable gas, etc.**

  To prevent the risk of fire hazard or explosion, do not use the CDV/CDA-900A in environment with inflammable gas, vapor or dust.
- **If any trouble occurs**

  To prevent a fire hazard, if smoke is emitted from the CDV/CDA-900A, immediately disconnect the AC adapter from the receptacle and stop using the CDV/CDA-900A.
- **Maximum input voltage range**

  Do not input voltage lower than -15 V or higher than +15 V. Or, it may lower the performance and cause troubles.

⚠ CAUTION

- **After the power OFF, wait more than 5 seconds to power ON again.**
  If the power switch is repeated turned ON and OFF within 5 seconds, fuse may blow out due to rush current generated by switching the power ON and the CDV/CDA-900A reliable function may not be guaranteed.
- **Do not use the CDV/CDA-900A under excessively high/low temperature.**
  Use the CDV/CDA-900A in the specified operating temperature range -10 to 50ºC.
  Use at temperatures exceeding the specified range may lower the performance and cause trouble.
  If use under direct sunlight or in a cold place is inevitable, prepare a sunscreen or take proper measures to keep it warm.
- **Do not use the CDV/CDA-900A under high humidity.**
  Use in a humid place exceeding the specified range or where it is exposed to splashing water may lower the performance and cause trouble.
- **Immediately stop the CDV/CDA-900A if operating environment changes abruptly.**
  Leave the CDV/CDA-900A as it is until it becomes adaptable to the environment.
  Abrupt change in ambient temperature due to transportation, etc. may cause dew condensation result to deteriorate its performance and cause trouble.
- **Do not use the CDV/CDA-900A under dusty environment.**
  This can lead to performance problems and decreased operating efficiency. Be careful that dust may not enter the CDV/CDA-900A not only during operation but also under stored conditions.
- **Take care when operating the CDV/CDA-900A at a location with excessive vibration**
  If excessive vibration is applied to CDV/CDA-900A , performance of the CDV/CDA-900A may become deteriorated.
  Adopt vibration-proof measures such as shock absorber, etc..
- **Do not use the CDV/CDA-900A under poor power condition.**
  When using the AC power cable, operate the CDV/CDA-900A within the range of 100 to 240 VAC (50/60 Hz). The power supply used for the CDV/CDA-900A should not experience an instantaneous power failure and be free from noise.
- **When using the DC power supply, handle the CDV/CDA-900A with utmost care.**
  Touch the battery terminal by the input/output cable or use the same power supply with the measuring instrument may cause unexpected trouble. Read "3-2 CONNECTION OF POWER" prior to use.
- **Do not pull cords and cables.**
  Lay cords and cables with a certain allowance so that o unreasonable force is applied to the connections.
  Pulling or applying unreasonable force may cause trouble or interrupt the measurement.
- **Preheat the CDV/CDA-900A before use.**
  Preheat the CDV/CDA-900A for about 30 to 60 minutes after the power ON.
- **Do not use the CDV/CDA-900A in strong electromagnetic field.**
  Performance may be lowered and erroneous operation and troubles may result if it is used near a telemetry system, microwave oven, electronic furnace or any other equipment generating a strong magnetic field.
- **Do not disassemble or remodel the CDV/CDA-900A.**
  Disassembling or remodeling by user may cause electric shock hazards or damage the CDV/CDA-900A.
  This warranty does not cover any damaged or defective parts that results from disassembling or remodeling.
- **Avoid installing sensors and CDV/CDA-900A near a welding machine.**
  Failure to do so will pose the risk of erroneous output, malfunction and failure.

LIMITED LIFE PARTS AND PREVENTIVE MAINTENANCE

The CDV/CDA-900A consists of various electronic components and those components, if not all, have a useful life.
Using them exceeding the years specified according to each part type (useful life) may affect the characteristics of the CDV/CDA-900A, resulting in a malfunction or a failure. You need to replace parts with a regular preventive maintenance schedule.

Limited life parts used with the CDV/CDA-900A are as follows.

- Relay
  A relay's insulation will inevitably degrade or a relay itself will be damaged.
- Aluminum electrolytic capacitor
  The signal-noise ratio will lower due to capacity low or smoke will be emitted due to liquid leak, resulting in a malfunction of the CDV/CDA-900A.
- EEPROM
  The CDV/CDA-900A will results in malfunctions or degraded performance.

To operate the CDV/CDA-900A normally, finding a sign of the CDV/CDA-900A failure early by daily/periodic inspections and taking the corrective action are required.
For inspection, contact KYOWA or our representatives.

* All components do age and will fail.

CDV/CDA-900A REPLACEMENT BEFORE THE END OF SERVICE LIFE

Preventive maintenance and replacement parts are a cost-effective way of keeping the performance and extending the service life of the CDV/CDA-900A.
Regardless of the replacement parts, the CDV/CDA-900A itself gradually deteriorates with age. Before the expected service life is reached, consider replacing the CDV/CDA-900A with a new one or the latest series as preventive maintenance.

NOTATIONS USED IN THE INSTRUCTION MANUAL

Notational Words

To express strain, “10^{-6} strain”, μm/m” or “με” is used properly.
This Manual uses “με” relating to the on-panel indications, and “μm/m” when referring to strain in general.
The words suffixed by"*" are explained in "10 GLOSSARY."
The value converted in SI (the International System units) is given in parentheses after each conventional expression of a unit.

Informational Notes

Certain notations are used as necessary to attract your attention to information that requires special care when handing the CDV/CDA-900A and to information provided for reference purpose.

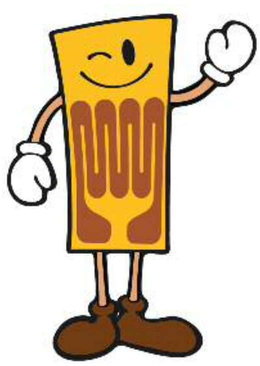
Examples of Notations

NOTE

Essential precautions required when handling the CDV/CDA-900A.

MEMO

Reference items required when handling the CDV/CDA-900A.



1. PRODUCT OUTLINE

1-1. PRODUCT OUTLINE

The CDV/CDA-900A is a strain amplifier that incorporates an DC bridge excitation. When compared to a AC type strain amplifier, the CDV/CDA-900A generally marks broadband, higher input impedance, and better nonlinearity. In addition to these, the CDV/CDA-900A provides unique features as follows.

Features

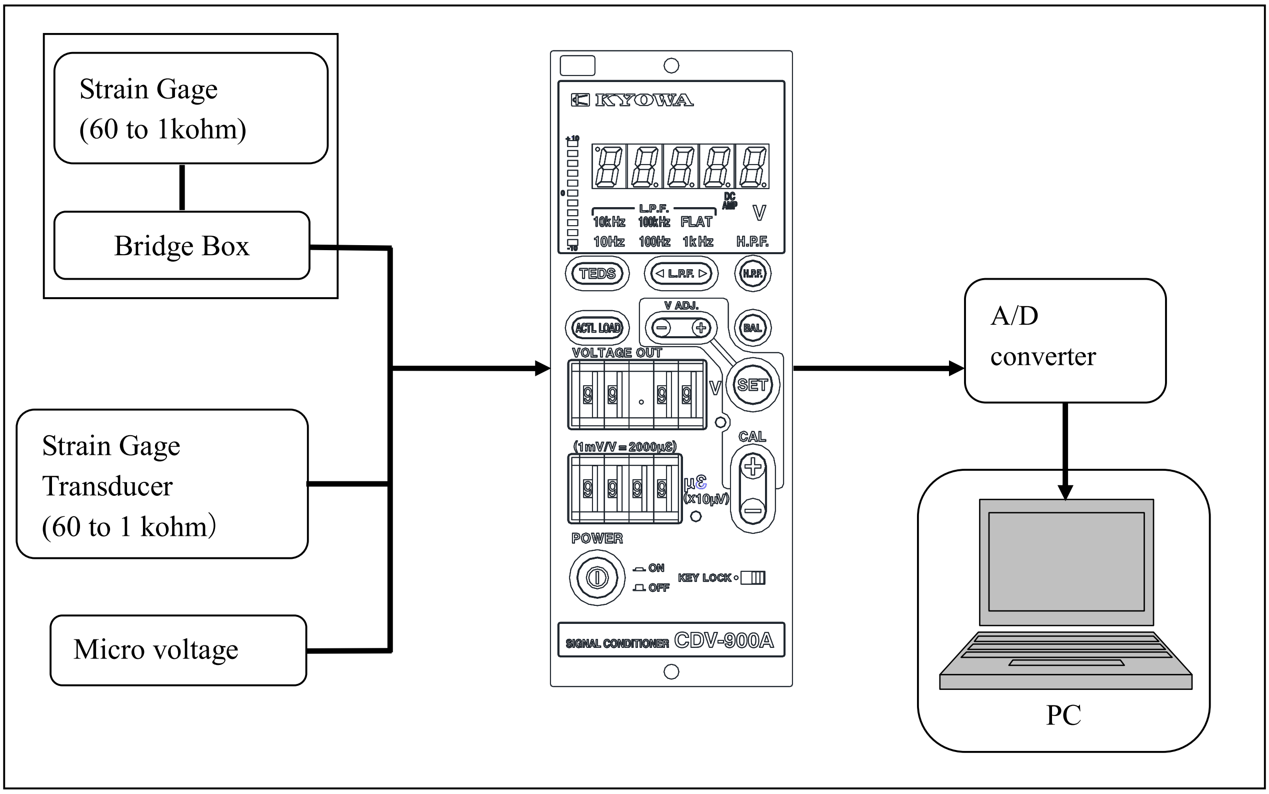
- Easy setting
  Just set input strain and output voltage at the time.
- Light weight
  Approximately 30% lighter than the conventional signal conditioner.
- Monitor and bar graph meter are standard provision
  Not only static strain but also dynamic strain signal can be monitored.
- Low noise
  Reduce noise by 30% than the conventional product.
- DC amplifier function provided
  Capable of 10,000 amplifications as a DC amplifier
- TEDS*1 function
  When using strain gage transducer with built-in TEDS circuit, the internal gain can be easily set without referring the Test Data Sheet by pressing the TEDS switch.
- TEDS-compatible sensors and remote-sensing sensors*14 available
  Capable of using both TEDS-compatible sensors and remote-sensing sensors by using the TEDS-sensor/remote--sensing sensor detection function.
- ACTL LOAD function
  The internal gain can be set with the actual load or external calibrator by pressing the ACTL LOAD switch.
- Bridge resistance check function
  This function checks breaking of wires in the strain gage bridge, and the monitor indicates which wires are broken.

MEMO

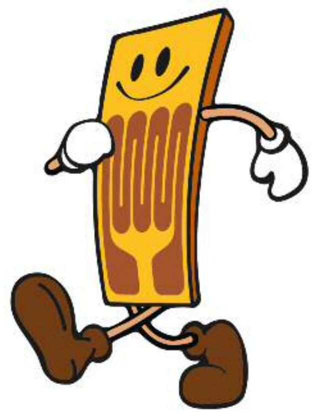
The conventional product is the CDV/CDA-700A.
The words suffixed by "*" in the Instruction Manual are explained in "10. GLOSSARY."
For TEDS function and operation method of the ACTL LOAD function, see "5-7-2 Setting Internal Gain with TEDS" and "5-7-3 Setting Internal Gain with Actual Load."

1-2. SYSTEM CONFIGURATION

This section describes a general system configuration when using the CDV/CDA-900A for measurement.

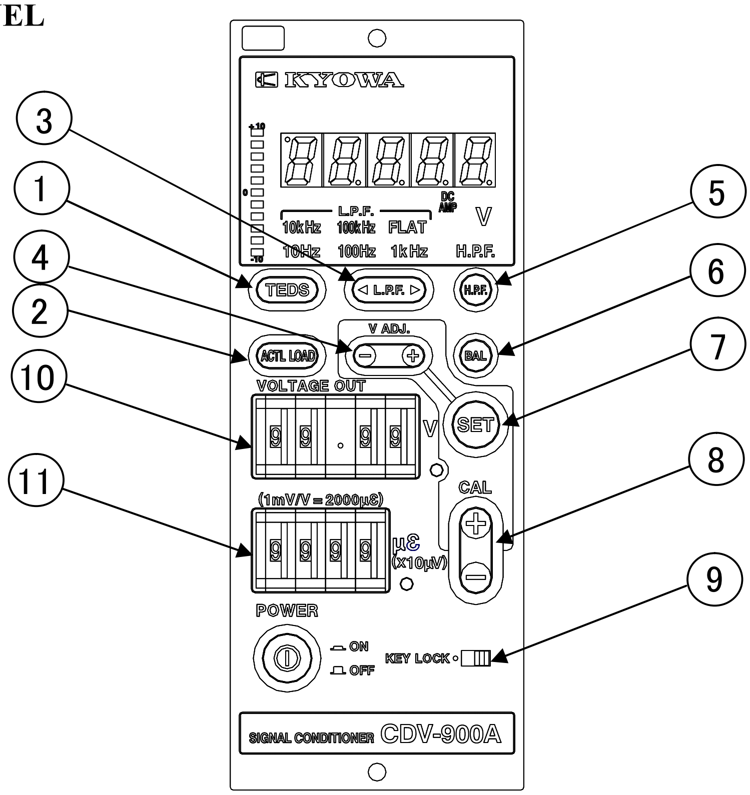


The CDV/CDA-900A adopt the system configuration shown above, whereby it's input terminal connects with a strain gage transducer or a strain gage.
For connection of the latter, a bridge box is used generally. The CDV/CDA-900A amplifies minute signals sensed by a strain gage, and provides an output of several volts after amplification in general cases. This allows connection of the CDV/CDA-900A directly to a recorder or a voltmeter.
To measure a strain converted in electric signals, a calibration signal is used. The CDV/CDA-900A uses a calibration signal that has been certified through a standardizing equipment Kyowa maintains.
For how to use strain gages or how to obtain the application, see "9. APPENDIXES."



2. PARTS AND FUNCTIONS

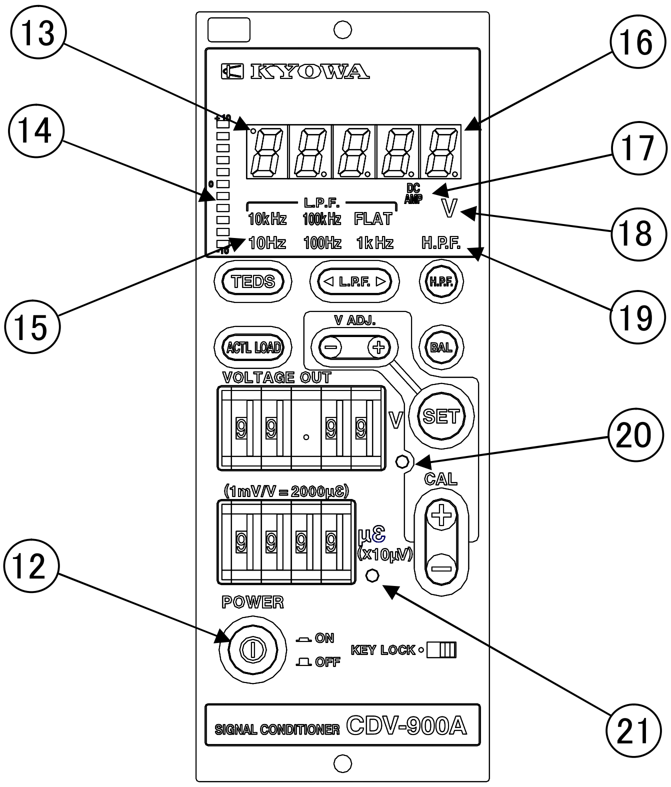
2-1. FRONT PANEL



①TEDS switch	Press and hold the TEDS switch. The TEDS switch lights up in blue, the setting mode becomes "TEDS MODE."
②ACTL LOAD switch	Press and hold the ACTL LOAD switch. The ACTL LOAD switch lights up in orange, the setting mode becomes setting mode with the input strain (voltage).
③LP.F. switch	Changes a cutoff frequency of the low-pass filter. ◁: Changes to a smaller one ▷: Changes to a larger one (10 Hz ↔ 100 Hz ↔ 1k Hz ↔ 10k Hz ↔ 100 kHz ↔ FLAT)
④V ADJ. switch	Conduct zero-point fine adjustment and sensitivity fine adjustment of output voltage. +: Zero point moves to a positive direction. −: Zero point moves to a negative direction. With pressing the SET switch or + of the CAL ON switch, press + of the V ADJ. switch for high sensitivity, press − for low sensitivity.
⑤H.P.F. switch	Changes valid or invalid of the high-pass filter. When the high-pass filter is valid, the H.P.F. lamp [item (19)] lights up.
⑥BAL switch	Press the BAL switch twice for balancing. Press and hold the BAL switch for resistance check of the bridge.
⑦SET switch	Set the VOLTAGE OUT and CAL switches. Press the SET switch twice to set the internal gain of the CDV/CDA-900A.
⑧CAL ON switch	+: Adds + calibration signal that is set to the CAL switch to the output. −: Adds - calibration signal that is set to the CAL switch to the output.
⑨KEY LOCK switch	Set the KEY LOCK switch to left for prohibiting operations other than POWER switch.
⑩VOLTAGE OUT switch	For setting the output voltage.
⑪CAL switch	For setting the input strain (or voltage) and required calibration signal value.

NOTE

Press and hold is an operation for continuously pressing the switch for 0.5 seconds or more.
Press twice is an operation to press the switch twice within 0.5 seconds.



⑫$\boxed{\text{POWER}}$ switch	POWER ON/OFF (ON: The $\boxed{\text{POWER}}$ switch is in the pressed position. OFF: The $\boxed{\text{POWER}}$ switch is in the released position.)
⑬Indicator lamp	Flickers when the remote sensing is ON (CDV-900A). Lights up after executing the cable-resistance-compensation function (CDV-900A). Lights up after executing the bridge-resistance-compensation function (CDA-900A).
⑭Bar graph meter	Indicates an output voltage by the length of the bar. One LED segment corresponds to 2 V. When the internal gain is fine adjusted to lower than ×200, 0 (orange LED) flickers. For details, see "4-7-5 Sensitivity Fine Adjustment."
⑮L.P.F. lamp	Indicates the cutoff frequency of the low-pass filter.
⑯Monitor	Indicates the output voltage of the OUTPUT A and B in general. If the output voltage of the OUTPUT A or OUTPUT B exceeds ±11V, numbers or characters on the monitor flicker. In addition, indicates the physical quantity in "TEDS MODE" and error content in error mode.
⑰DC AMP lamp	Lights up during the "DC AMP MODE." Lights out during the "STRAIN MODE."
⑱V lamp	Lights up when displaying voltage on the monitor. Lights out only in the "TEDS MODE."
⑲H.P.F. lamp	Lights up when the $\boxed{\text{H.P.F.}}$ switch is set to valid. When invalid, the H.P.F. lamp lights out.
⑳VOLTAGE OUT lamp	Lights up after setting the internal gain correctly. After setting the internal gain, if the set value of the $\boxed{\text{VOLTAGE OUT}}$ switch is changed, the VOLTAGE OUT lamp flickers.
㉑CAL lamp	Lights up after setting the internal gain correctly. After setting the internal gain, if the set value of the $\boxed{\text{CAL}}$ switch is changed, the CAL lamp flickers. Lights out in the "TEDS MODE" and "ACTL LOAD MODE." In addition, the CAL lamp also flickers when adding the different CAL value, that is set in internal gain, to the output.

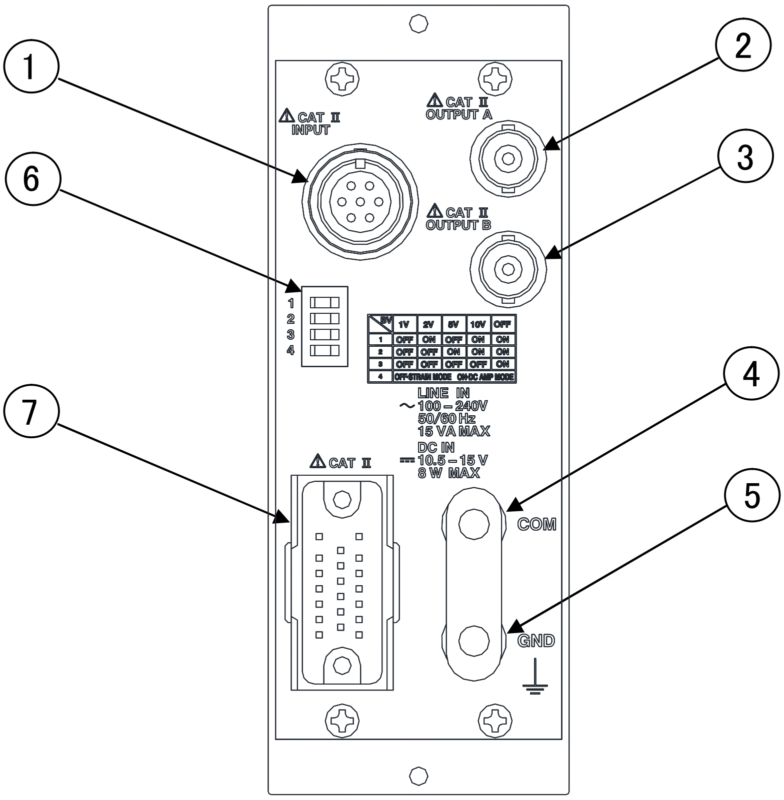
MEMO

Internal gain: Gain from the input to the output of the CDV/CDA-900A.

Capable of setting the internal gain within ×200 to ×10000.

In addition, when the internal gain is high, it means high sensitivity and when it is low, low sensitivity.

2-2. REAR PANEL



① INPUT connector⚠ — NDIS connector
Connects with a strain gage transducer or a bridge box.

② OUTPUT A connector⚠ — BNC connector
Outputs voltage based on the preset internal gain when the strain is input.
Outputs the same voltage with the OUTPUT B connector.
The rated output is 10 V.

③ OUTPUT B connector⚠ — BNC connector
Outputs voltage based on the preset internal gain when the strain is input.
Outputs the same voltage with the OUTPUT A connector.
The rated output is 10 V.

④ COM terminal — Common terminal
Connected internally to common potentials in the circuitry,

⑤ GND terminal — GND terminal
For details, see "3-2-2 DC Power."

⑥ SETTING SWITCH — Sets the bridge excitation voltage and measuring mode.
For details, see "5-13. SETTING SWITCH."

⑦ Centralized connector ⚠ — For connecting the power cable in general.
When the CDV/CDA-900A units are housed in a carrying case, it enables to connect them with certain control signals.
For details. see "5-11. APPLICATION OF CENTRALIZED CONNECTOR."

3. PREPARATION

This chapter describes necessary preparation before turning ON the power and how to use a single unit of the CDV/CDA-900A.
For how to use multiple units (channels) housed in the carrying case, also see "6-5. EXCLUSIVE CARRYING CASE"

3-1. HOW TO SET UP INPUT/OUTPUT INSTRUMENTS

When measuring strain with the CDV/CDA-900A, connect input signal, output instrument and power to the CDV/CDA-900A. The output instrument can be omitted in some cases.

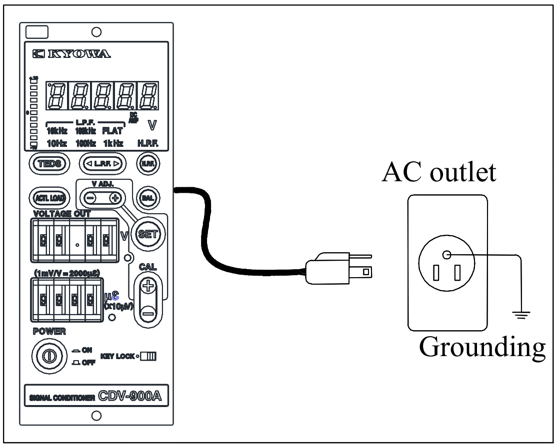
3-1-1 Input Instrument
Prepare a strain gage transducer or strain gage configured in the Wheatstone Bridge[*2].
When using a strain gage, also prepare a bridge box.
For a bridge box, see "6-1. BRIDGE BOX."
For how to connect an input instrument, see "4-1. CONNECTION OF INPUT."

3-1-2 Output Instrument
Output instrument is a voltmeter with input impedance 5 kohm or more or recorder. Requires for reading the amplified strain signal.
The CDV/CDA-900A is provided with a monitor, and so it eliminates the need for a regular voltmeter.
Connect the output instrument to the CDV/CDA-900A using the accessory output cable.
For how to connect an output instrument, see "4-2. CONNECTION OF OUTPUT" and "5-2. OUTPUT."

3-2. CONNECTION OF POWER

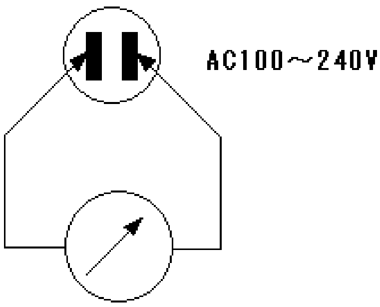
The CDV/CDA-900A requires AC or DC power.
In either case, make sure of a correct power voltage prior to connection.

3-2-1 AC Power
Use the accessory power cable and connect the CDV/CDA-900A to an AC outlet 100 VAC.
The AC outlet should be 100 to 240 VAC (50/60 Hz).

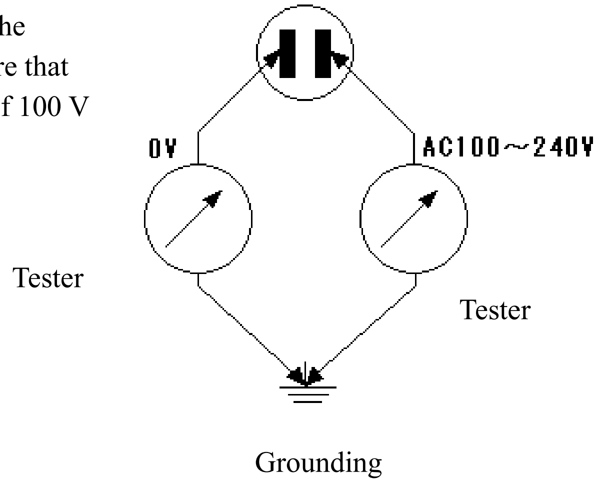


If the power voltage exceeds the above specified voltage range or if a voltage between each terminal and the grounding has a potential exceeding power voltage, do not connect the AC power. Or, it may cause trouble or damage to the CDV/CDA-900A.
The power supply voltage should be checked according to the procedure described below.

(1) Use the tester to measure the voltage between the AC power outlet terminals and ensure that the voltage is within the range of 100 to 240 VAC.



(2) Use the testers to measure the voltage levels between the ground and each of the AC power outlet terminals to ensure that one voltage level is 0 V and the other is within the range of 100 V to 240 VAC.



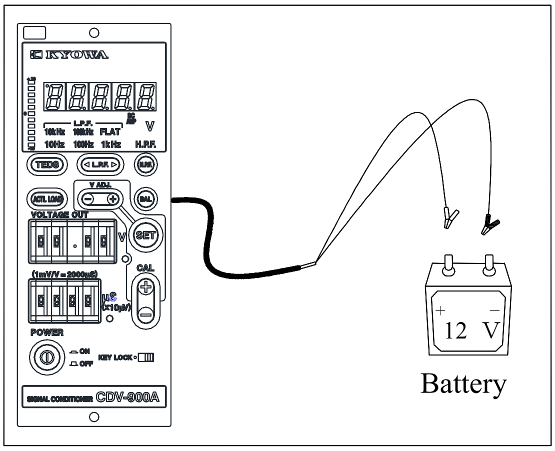
(3) If the CDV/CDA-900A is used at job site where induction motors, electric welder and other devices that generate noise are used, power supply condition may be insufficient due to noise. It is recommended to use Kyowa's insulation transformer or noise cut transformer.

NOTE

Be sure to ground the middle pin of the 3-pin plug.

3-2-2 DC Power

A DC power in a voltage range of 10.5V to 15 V, or a battery is connectable. A DC power cable is not attached to the CDV/CDA-900A. Therefore purchase connector plug (S-1620-C, HIROSE ELECTRIC CO., LTD), and use it as shown at right. For how to connect with DC power, see "5-11. APPLICATION OF CENTRALIZED CONNECTOR."



3-2-3 Grounding

Be sure to carry out correct grounding, in order to prevent accidents and assure the safety of the operator. When using AC power, connect the CDV/CDA-900A to a power source using the accessory AC power cable (3-pin).

L ＝ Line
N ＝ Neutral
E ＝ Earth

NOTE

When using an AC power cable (2-pin), use the accessory 2-pin conversion plug (CM-39). Be sure to ground the green terminal of the conversion adapter.

4. BASIC OPERATIONS

This chapter describes the basic operations of the CDV/CDA-900A.
The instructions given in this chapter is related to the usage of a single unit.

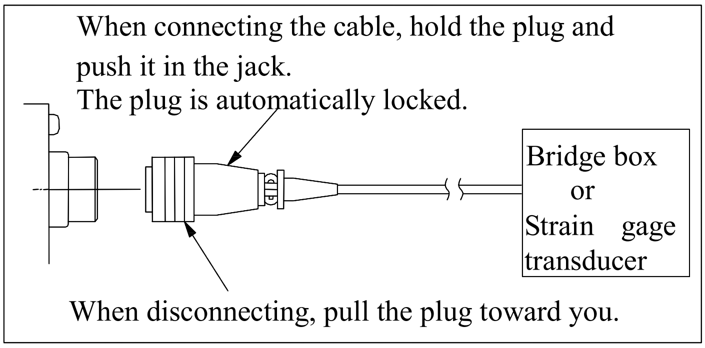
MEMO

For operation of multiple units (channels) using the exclusive carrying case, also see "6-5. EXCLUSIVE CARRYING CASE."

4-1. CONNECTION OF INPUT

Connect a strain gage transducer or a bridge box to the CDV/CDA-900A's INPUT connector.
Configure a Wheatstone Bridge with the strain gage(s) and the bridge box.

If one end of the connection cable of a strain gage transducer is formed by a NDIS connector, insert it into the INPUT connector directly as shown at right.



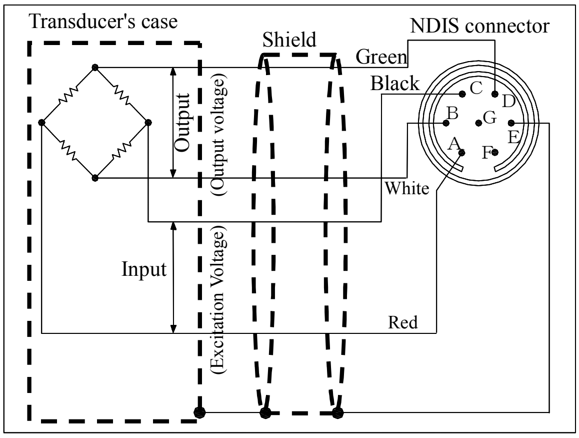
If the connection cable of a strain gage transducer comes without the NDIS connector on its end or if a strain gage is to be connected directly, either of the following 2 methods can be used.

(1) When using the bridge box for connection.
For details, see "6-1. BRIDGE BOX."

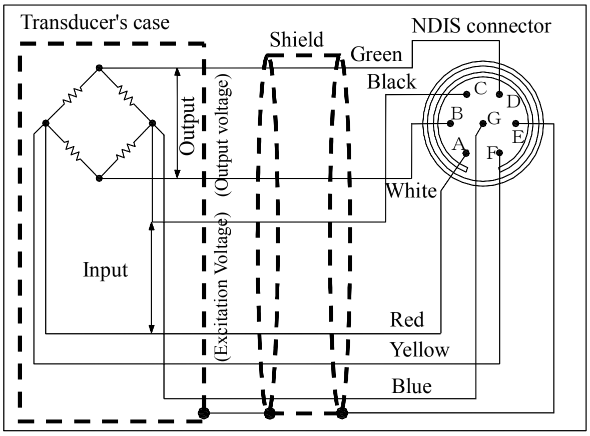
(2) When connecting the strain gage to the plug in advance
Connection diagrams are as follows. The plug is NDIS connector PRC03-12A10-7M10 (TAJIMI ELECTRONICS CO., LTD.).
For connection of a strain gage, a bridge box of the full bridge system*5 can be conveniently used.

MEMO

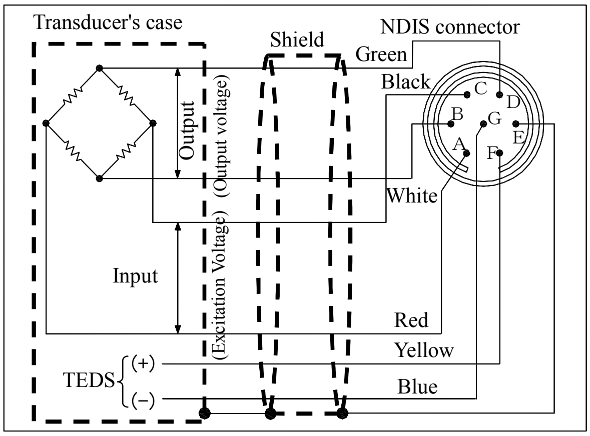
Wire colors described in figures are typical colors of KYOWA strain gage transducer.



Connection of a bridge and plug (4-wire)



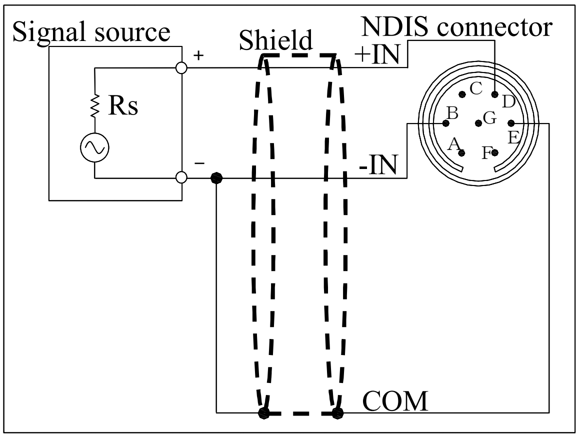
Connection of a bridge and plug (6-wire/remote sensing)



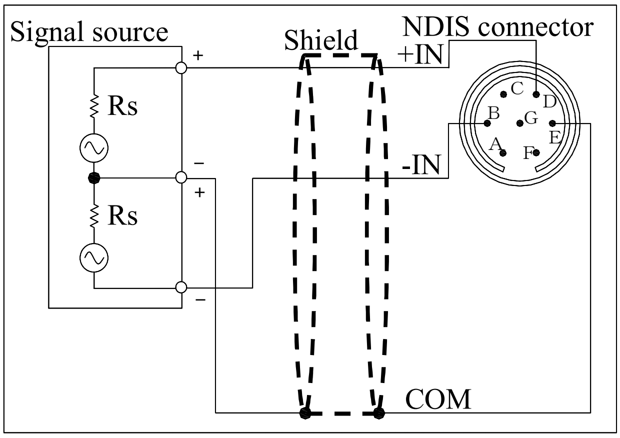
Connection of a bridge and plug (6-wire/TEDS)

When the CDV/CDA-900A is to be used as a DC amplifier, connect a signal source to the NDIS connector of the CDV/CDA-900A.

Connection diagrams are as follows.



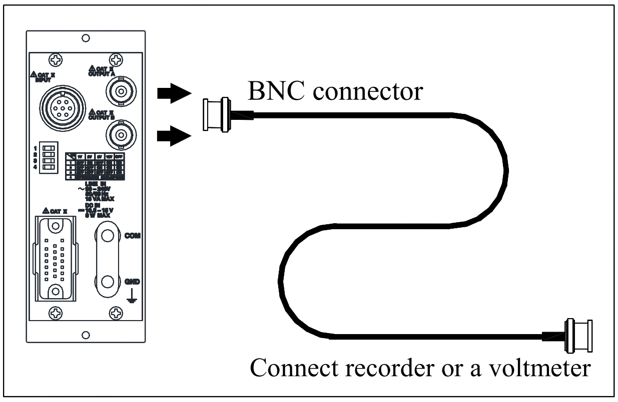
Connection of a signal source and plug (unbalance signal)



Connection of a signal source and plug (balance signal)

4-2. CONNECTION OF OUTPUT

The CDV/CDA-900A provides OUTPUT A and OUTPUT B. These systems output the same voltage but are independent of each other. Therefore, 2 external instruments can be connected at a time. The both output terminals accept a BNC connector. Use the accessory output cable to connect an external instrument. The output impedance*6 is rated at about 2 ohm on either terminal.

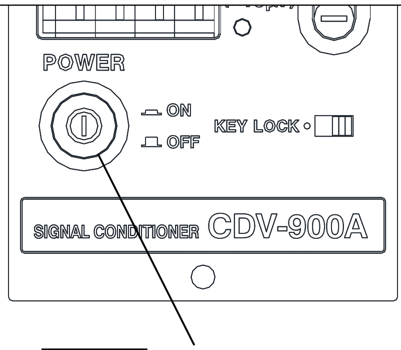


4-3. TURNING ON AND OFF THE POWER

Turning ON and OFF the power is the most important operation. Read the following instructions carefully.

4-3-1 Turning ON the Power

Prior to turning ON, make sure the input connector and power are correctly connected.



POWER switch

MEMO

For how to connect these, see the following.
See "3-1. HOW TO SET UP INPUT/OUTPUT INSTRUMENTS."
See "4-1. CONNECTION OF INPUT."
See "4-2. CONNECTION OF OUTPUT."

Press the POWER switch until it clicks.
Make sure you hear the click sound and the POWER switch is in the pressed (ON) position.
At this time, all LEDs will light up for approximately 1 second. After that, measuring conditions are set and the CDV/CDA-900A becomes measuring state.

NOTE

If " Er-1 " appears after illumination of all LEDs, it is the indication of abnormality that has occurs to the internal CPU control program. Contact Kyowa or our representatives.

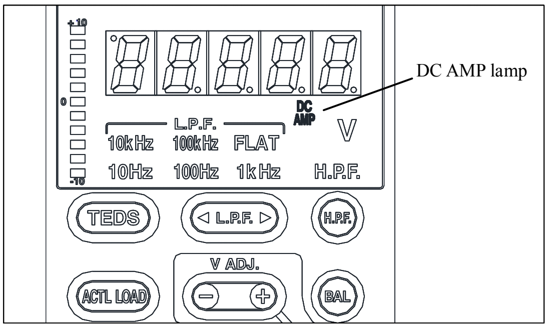
4-3-2 Turning OFF the Power

Press the POWER switch until it clicks.
Make sure the POWER switch is in the released (OFF) position.
All indications disappear.

NOTE

The CDV/CDA-900A maintains all measuring parameters in its internal nonvolatile memory all the time.
However, saving of parameters may fail if the power is turned OFF immediately after the renewal. To prevent it, after executing the zero adjustment, sensitivity fine adjustment, changing low-pass filter setting or high-pass filter setting, wait 3 seconds or more and turn OFF the power.In addition, if you turned OFF the power without setting the internal gain after changing mode to the TEDS or ACTL LOAD mode, turning ON the power again changes the TEDS mode or ACTL MODE to the normal mode. (Conduct the internal gain setting to maintain the current mode.)

4-4. SELECTING MODE



The CDV/CDA-900A provides "STRAIN MODE" and "DC AMP MODE."
To measure a strain gage or strain gage transducer, select the "STRAIN MODE."
To use the CDV/CDA-900A as a DC amplifier, select the "DC AMP MODE."

DC AMP lamp is OFF: "STRAIN MODE"
DC AMP lamp is ON: "DC AMP MODE"

To change the measuring mode, turn ON/OFF the SETTING SWITCH 4.

"STRAIN MODE": Turn OFF the SETTING SWITCH 4.
"DC AMP MODE": Turn ON the SETTING SWITCH 4.

To change the measuring mode, after switching the SETTING SWITCH 4, be sure to turn ON and OFF the power.
For the SETTING SWITCH, see "5-13. SETTING SWITCH."

4-5. TO SELECT THE SENSITIVITY REGISTRATION MODE

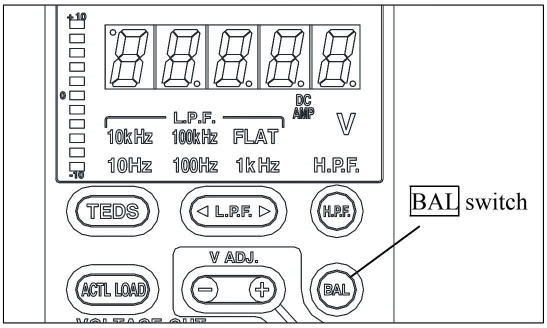
The CDV/CDA-900A has 3 sensitivity registration modes; "NORMAL MODE", "TEDS MODE", and "ACTL LOAD MODE." Note that the setting methods of the internal gain and unit to be displayed on the monitor differ from mode to mode.

The TEDS switch and ACTL LOAD switch light up and light out by pressing and holding them.

"TEDS MODE" TEDS switch: ON, ACTL LOAD switch: OFF
"ACTL LOAD MODE" TEDS switch: OFF, ACTL LOAD switch: ON
"NORMAL MODE" TEDS switch: OFF, ACTL LOAD switch: OFF

For how to set the internal gain, see "5-7. INTERNAL GAIN."

4-6. BASIC BALANCING



The CDV/CDA-900A performs balancing completely electronically. Make sure that input signals are connected, and then press the BAL switch 2 times.
Five (5) seconds later, balancing will then be carried out.

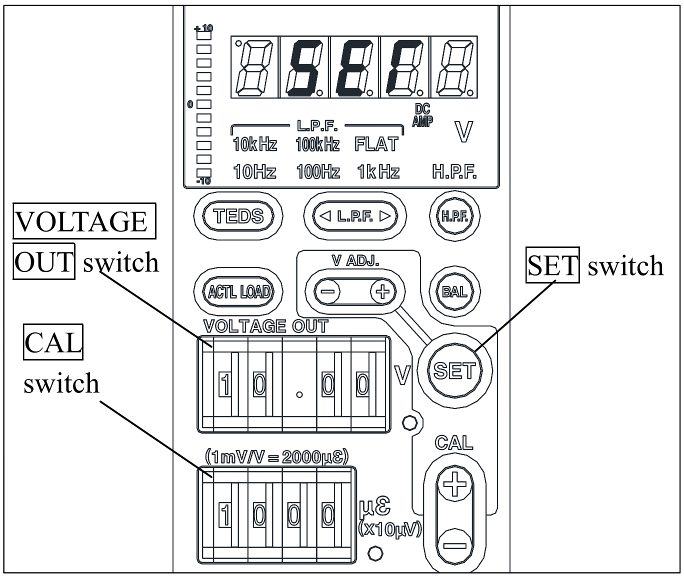
MEMO

After balancing is executed, the panel meter will not necessarily read exactly 0 but several mV remains.
Carry out fine balancing by using the V ADJ. switch if necessary.
Press and hold is an operation for continuously pressing the switch for 0.5 seconds or more.Press twice is an operation to press the switch twice within 0.5 seconds.

4-7. SETTING MEASURING PARAMETERS

This section describes how to set measuring parameters of the CDV/CDA-900A.

4-7-1 Setting an Basic Internal Gain



It is necessary to set an internal gain (sensitivity[*10]) properly to assure the correct strain measurements. This section describes how to select the internal gain with the CAL switch.
For details, see "5-7. INTERNAL GAIN."

First, estimate the strain to be measured.
When using a strain gage transducer for the input, set the internal gain from the rated output.

For example, when using the strain gage transducer with ±1000 μm/m rated output.
For setting the internal gain with 10 V of the rated input, set the VOLTAGE OUT switch to 10.00 and CAL switch to 1000 and press the SET switch twice. After the internal gain is correctly set, " SEt" (SET) appears on the monitor.

With a strain gage, estimate the strain with due regard to the material and construction of a measuring object. Set the value as the standard and set the internal gain in the same way.

NOTE

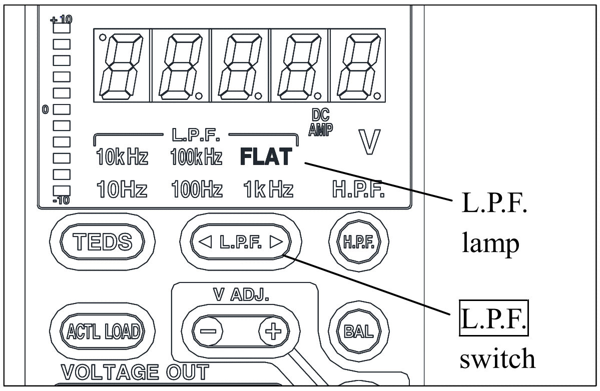
If " Er-○○○" appears, instead of "SEt ", after setting the internal gain, see "9-3. TROUBLE SHOOTING."
Set the VOLTAGE OUT switch within 1.00 to 10.00.

MEMO

The rated capacity and rated output of the strain gage transducer are found in its Test Data Sheet.
When using the TEDS installed strain gage transducer, read the TEDS information to set the internal gain. The internal gain can be easily set.
When using the actual load or external calibrator, use the ACTL LOAD to set the internal gain. The internal gain can be accurately set. For details, see "5-7. INTERNAL GAIN."

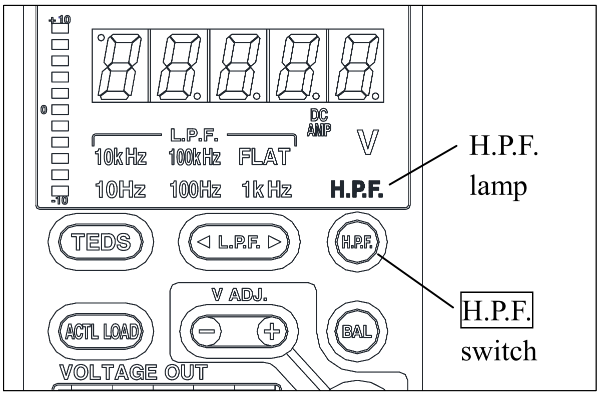
4-7-2 Setting Low-pass Filter

The low-pass filter is used for setting limits to frequency range of outgoing signals normally. For not limiting the frequency range, set the filter to "FLAT", thereby inactivating the filtering function.
To change the low-pass filter of the cutoff frequency, press "<" or ">" of the L.P.F. switch. The target L.P.F. lamp lights up also.
For details, see "5-8. LOW-PASS FILTER" and "9-1. LOW-PASS FILTER CHARACTERISTIC."



4-7-3 Setting High-pass Filter

The high-pass filter is used for eliminating the DC component of outgoing signals normally.
Press and hold the H.P.F. switch for valid.
Press again for invalid.
When the H.P.F. is valid, the H.P.F. lamp lights up and the cutoff frequency of that time is 0.2 Hz.
When the H.P.F. is invalid, the H.P.F. lamp lights out.

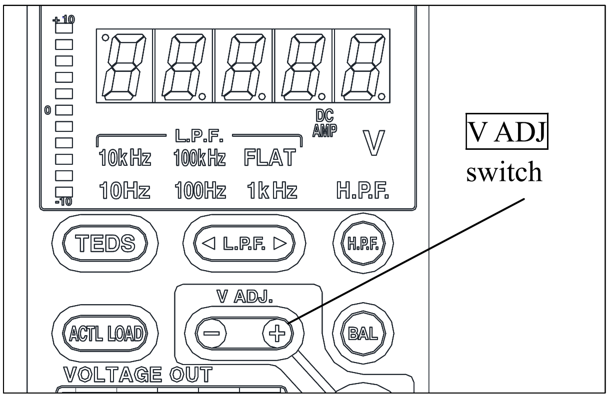


NOTE

After valid the H.P.F., be sure to conduct the balancing before the measurement. (When the input is saturated, accurate measurement cannot be conducted.) In addition, when outputting the calibration signal by pressing the CAL ON switch with the H.P.F. lamp lights up, the calibration signal is not added to the output. Turn OFF the H.P.F. lamp and output the calibration signal.

4-7-4 Zero Point Fine Adjustment

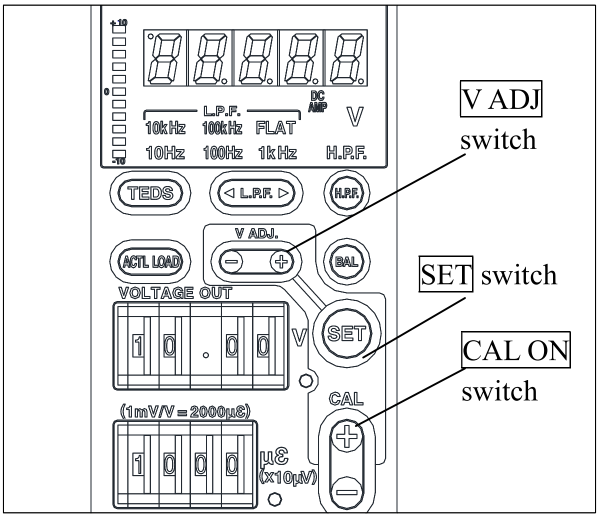
Capable of fine adjusting the output of OUTPUT A and OUTPUT B. It is convenient for moving the baseline of the external equipment, etc.
Press + or − of the V. ADJ. switch to vary the output. In addition, hold down the + or − of the V. ADJ. switch to faster the changing speed. The adjustment range of the zero point is approximately ±100 mV from the balance adjusted value.



4-7-5 Sensitivity Fine Adjustment

Capable of fine adjusting the pre-set internal gain.
Either of the following 2 methods can be used for the sensitivity fine adjustment.
Basically, use the (1). It is convenient to use the (2) for " ACTL LOAD MODE".

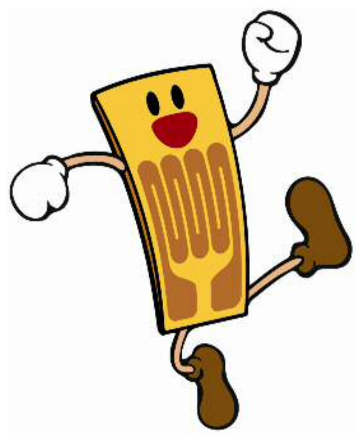
(1) Sensitivity fine adjustment by using the CAL ON switch
With pressing the + of the CAL ON switch, press the + or − of the V ADJ. switch to change the internal gain.
+: Internal gain moves to a higher direction.
−: Internal gain moves to a lower direction.
In addition, hold down the + or − of the V. ADJ. switch to faster the changing speed. The sensitivity fine adjustment range is ×1 to ×1/2.5.



(2) Sensitivity fine adjustment by the SET switch
With pressing the + of the SET ON switch, press the + or − of the V ADJ. switch to change the internal gain.
+: Internal gain moves to a higher direction.
−: Internal gain moves to a lower direction.
In addition, hold down the + or − of the V. ADJ. switch to faster the changing speed. The sensitivity fine adjustment range is ×1 to ×1/2.5.

NOTE

The internal setting range of the CDV/CDA-900A is ×200 to ×10000. For details, see "5-7. INTERNAL GAIN."
Capable of adjusting the internal gain within the range of ×80 to ×10000 by conducting the sensitivity fine adjustment.
When the internal gain is smaller than ×200, "0 (orange LED)" flickers.
However, when the internal gain is smaller than ×200, specifications related to the performance is not guaranteed.



5. FUNCTIONS

This chapter describes all the CDV/CDA-900A functions in detail as well as advanced usage.

5-1. INPUT

The CDV/CDA-900A is a strain measuring instrument itself, and it can also work as a DC amplifier.

- Using as a strain measuring instrument ("STRAIN MODE")
  Connectable sensors are the following.

(1) Strain gage bridge box
When measuring strain by using the strain gage, use the bridge box.
In addition, purchase the bridge box.
For a bridge box, see "6-1. BRIDGE BOX."

(2) Strain gage transducer
For how to connect a strain gage transducer, see "4-1. CONNECTION OF INPUT."

- Using as a DC amplifier ("DC AMP MODE")
  For how to connect a CDV/CDA-900A as a DC amplifier, see "4-1. CONNECTION OF INPUT."

NOTE

Avoid using instruments or sensors other than the above, or else the CDV/CDA-900A will not function properly. Also avoid connecting one input to multiple CDV/CDA-900A units, or else the CDV/CDA-900A will get out of order.

With the bridge excitation voltage 2 V and with the minimum internal gain, the maximum input is approximately ±50000 μm/m.
You can input approximately ±125000 μm/m by executing the sensitivity fine adjustment. However, the performance is not guaranteed.
The maximum input ranges are as follows.

STRAIN MODE

Bridge Excitation voltage 10 V:	±25000 μm/m
Bridge Excitation voltage 5V:	±50000 μm/m
Bridge Excitation voltage 2V:	±125000 μm/m
Bridge Excitation voltage 1V:	±250000 μm/m
DC AMP MODE:	±125000μV

With the CDA-900A. the above bridge excitation voltages indicate bridge excitation voltage equivalent values. For details, see "5-13. SETTING SWITCH."

The maximum output of the CDV/CDA-900A is ±10 V. Where a large amount of strain is input and exceeds the allowable range of the maximum output, the indication on the monitor flickers. If it occurred, lower the internal gain till the indication stops flickering.

When using a bridge box, be sure to use shielded cables to connect strain gages to the CDV/CDA-900A in order to reduce induction noise. If a parallel vinyl cable is used, the performance of the amplifier cannot be guaranteed.

In case the CDV/CDA-900A is used as a DC amplifier, its input impedance is rated at 10M ohm. So it will not adversely affect a signal source. Connect, however, a signal source whose internal impedance is below 1k ohm.

5-2. OUTPUT

The CDV/CDA-900A is provided with 2 independent output systems. The 2 output terminals can be connected to 2 different external instruments. Even if one output system should get out of order, it does not affect the other.
Both OUTPUT A and B enable an output of over ±10 V against a load of over 5k ohm. On OUTPUT A and OUTPUT B, you can adjust their output levels, using the internal gain setting and sensitivity fine adjustment. You can also adjust their zero points, using the zero adjustment.
In addition, the zero output and zero points of the OUTPUT A and OUTPUT B cannot be adjusted separately.

5-3. PREHEATING

When once the CDV/CDA-900A has been turned ON, t it will be ready for operation for 5 seconds. Note that the internal electrical parts and semiconductors cannot acquire the thermal stability immediately after switching the power ON. If the bridge power circuit in particular is thermally unstable, it can cause a change in sensitivity and a zero drift. Carry out preheating time[*7] for approximately 30 to 60 minutes for stable measurement.

5-4. BRIDGE RESISTANCE CHECK

The CDV/CDA-900A is provides a bridge resistance check function. You can check the bridge resistance by the function. The bridge resistance includes cable resistance. Note that this function is not available in the "DC AMP MODE."
Ranges of the bridge resistance check are as follows.

CDV-900A		CDA-900A	
Bridge excitation voltage	Range of the bridge resistance check	Excitation current	Range of the bridge resistance check
1 V	50 to 1050 ohm	8.3 mA	100 to 140 ohm
2 V	66 to 1050 ohm	16.7 mA	100 to 140 ohm
5 V	166 to 1050 ohm	5.7 mA	320 to 380 ohm
10 V	333 to 1050 ohm	14.3 mA	320 to 380 ohm
		28.6 mA	320 to 380 ohm

To execute the bridge resistance check, press and hold the BAL switch.
The result of the bridge resistance check appears on the monitor " r -○○○." Note that "○○○" indicates ○○○ ohm.
If " Er-SEnSor " appears, since the bridge resistance is exceeding the range of the bridge resistance check, you cannot execute measurements correctly.
Before investigating the causes of the trouble, turn OFF the power and disconnect the sensor cable connected to the INPUT connector. Check if the cable is breaking, with a tester, by checking the bridge resistance of sensors,

NOTE

To execute correct measurements, the bridge resistance should be within the range of the bridge resistance check. When connecting or changing the sensor input, before setting the internal gain, be sure to execute the bridge resistance check.
Note that the bridge resistance includes cable resistance. Therefore, when using an extremely long cable, "Er-SEnSor" may appear in spite of the correct connection. Be sure to check the above range of the bridge resistance check.
Before investigating the causes of the trouble or repairing, be sure to turn OFF the power.
For errors, see "9-3. TROUBLE SHOOTING."

5-5. BALANCING

A resistive unbalanced component[*8] exists in a strain gage bridge. It is hence necessary to remove this component, in order to ensure high accuracy of measurement.

5-5-1 Balancing Range

Resistive unbalanced component can be reduced to ±2%, that is, ±10000μm/m.
The CDV/CDA-900A permits you to achieve this balancing using the BAL switch.

5-5-2 Balancing

Push the BAL switch on the front panel twice. This is all you have to do to execute balancing. The monitor lets you know if or not balancing has been carries out correctly. The meter indication of approximately 0 (zero) reflects correct balancing. An indication value within a range of ±5 mV can be taken as normal. To adjust the meter indication to exactly 0 (zero), execute the zero point adjustment. For details, see "4-7-4 Zero Point Fine Adjustment."
If the monitor indicates a large value, it is the indication of some fault or other such as breaking. In this case, first, execute the balancing for several times. If the problem does not solved, check the cause by checking "7-2. INITIAL BALANCING IS IMPOSSIBLE."
You can execute the balancing using an external control signal, too. For details, see "5-12. REMOTE CONTROL."

NOTE

The CPU controls to minimize remaining voltage during balancing the CDV/CDA-900A. If one time of balancing is not enough, repeat balancing a few times. In that case, one time of balancing may require up to 5 seconds, but this does not reflect any error.

5-6. MOVING ZERO POINT

The zero points on OUTPUT A and OUTPUT B can be removed.
This function is conveniently used to move the base line of an output instrument and others.
For details, see "4-7-4 Zero Point Fine Adjustment."
The zero adjustment range is about ±100 mV from the balanced value.

NOTE

The zero points of OUTPUT A and B move at the same time and within the same range.
The zero points of OUTPUT A and B cannot move independently.

5-7. INTERNAL GAIN

Setting methods for the internal gain are the following 3 methods that use CAL, TEDS, or ACTL LOA. In general, CAL is used.
When the measuring target is the TEDS installed strain gage transducer, set the internal gain with the TEDS for easy setting.
In addition, if you want to set the internal gain with the actual load or external calibrator, set the internal gain with the ACTL LOAD.
Selection of the smallest internal gain (× 200) lets you cover up to ±50000 μm/m measuring range.
However, with this internal gain, a maximum output is rated at as small as 20 mV or there against a strain input of 100 μm/m. This means poor precision of measuring.
By contrast, a large internal gain (× 10000) causes saturation against a large strain input.
Accordingly, an appropriate internal gain should be selected so as to meet the amount of a strain to be measured.
The larger the internal gain is selected, the larger an amplification degree becomes, resulting in large noise.

MEMO

The range of the internal gain of the CDV/CDA-900A is ×200 to ×10000.
If you want to set the internal gain with a calibration signal either ×200 or ×10000, set the CAL switch and VOLTAGE OUT switch as follows. (Bridge Excitation voltage: 2 V)

- Internal gain ×200 CAL switch: 5000, VOLTGE OUT switch: 01.00
- Internal gain×10000: CAL switch: 1000, VOLTAGE OUT switch: 10.00

The internal gain can be calculated from the following equation.
Internal gain = Value of the VOLTAGE OUT switch / Value of the CAL switch (μm/m) / (2 / bridge excitation voltage)
With the CDA-900A. the above bridge excitation voltages indicate bridge excitation voltage equivalent values.

5-7-1 Setting Internal Gain with the Calibration Signal

Use the calibration signal (CAL) of the CDV/CDA-900A for internal gain setting.
For functions of the calibration signal, see "5-9. CALIBRATION SIGNAL."
When adjusting the sensitivity with the CAL switch “0000,” neither the calibration value nor signal output is available.

- When the measuring target is a strain gage

Follows are the setting procedures of the optimum internal gain.

① Set the measuring mode to the "STRAIN MODE." (When the DC AMP lamp on the front panel is ON, turn OFF the SETTING SWITCH 4 on the rear panel and turn OFF and ON the power.)
② Turn the sensitivity registration mode to the "NORMAL MODE." (If the TEDS switch lights up or ACTL LOAD switch lights up, press and hold the switch to light out.)
③ Connect a strain gage for executing the bridge resistance check.
④ Estimate the quantity of a strain to be measured.
⑤ Set the CAL switch to the estimated quantity of a strain.
⑥ Set the VOLTAGE OUT switch to the target voltage.
⑦ Press the SET switch 2 times.
⑧ Press the BAL switch 2 times. (The CDV/CDA-900A becomes measuring status by executing the balancing.)

After the internal gain is set correctly, "SEt" appears on the monitor.
If "Er -○○○" appears on the monitor, see "9-3. TROUBLE SHOOTING."

- When the measuring target is a strain gage transducer

The rated output (μm/m) of the KYOWA strain gage transducer is described in the Test Data Sheet. Capable of conducting the optimum internal gain setting by using the rated output. If the strain output is not described in the rated output, the strain output can be obtained from the gage factor Ks[*11].

Rated output (μV/V)× Gage factor Ks = Rated output (μm/m)

Suppose when using the strain gage transducer with the rated output 1567 μV/V and gage factor 2.00. Follows are the setting procedures of the optimum internal gain.

① Set the measuring mode to the "STRAIN MODE." (When the DC AMP lamp on the front panel is ON, turn OFF the SETTING SWITCH 4 on the rear panel and turn OFF and ON the power.)
② Turn the sensitivity registration mode to the "NORMAL MODE." (If the TEDS switch lights up or ACTL LOAD switch lights up, press and hold the switch to light out.)
③ Connect a strain gage transducer for executing the bridge resistance check.
④ Calculate the rated output (μm/m). The rated output is 1567 × 2 = 3134 μm/m.
⑤ Set the CAL switch to "3134".
⑥ Set the VOLTAGE OUT switch to "10.00 (10 V)".
⑦ Press the SET switch 2 times.
⑧ Press the BAL switch 2 times. (The CDV/CDA-900A becomes measuring state after balancing.)

While correctly setting the internal gain," SEt" appears on the monitor.
If " Er - ○○○" appears on the monitor, it is indicating the setting error. See "9-3. TROUBLE SHOOTING."

In addition, when using the strain gage transducer with the half or less of the rated capacity, increase the sensitivity 2 times or more to decrease the noise.

[Example]
When using a strain gage transducer with the rated capacity 20%, the rated output will be 3134 × 20% = 626.8 (μm/m). To execute accurate measurements, with the VOLTAGE OUT switch: 5.00 and CAL switch: 0627, set the internal gain.

- Using as a DC amplifier

You can use the CDV/CDA-900A as a DC amplifier when a bridge excitation voltage, including a bridge, is not required to use.
When using the CDV/CDA-900A as a DC amplifier, the calibration signal (in voltage) is added. The quantity of the calibration signal (in voltage) is 10 times the pre-set CAL switch value on the front panel. The unit is μV.

[Example]
CAL switch on the front panel: 1000
The input is converted to the voltage of 10000 μV (10 mV). Then the calibration signal equivalent to the voltage is added.
Proper operation procedures are as follows.

① Set the "DC AMP MODE." (When the DC AMP lamp on the front panel is OFF, turn ON the SETTING SWITCH 4 on the rear panel and turn OFF and ON the power.)
② Turn the sensitivity registration mode to the "NORMAL MODE." (If the TEDS switch lights up or ACTL LOAD switch lights up, press and hold the switch to light out.)
③ Estimate the quantity of a voltage to be measured.
④ Set the calibration signal to the estimated quantity of a voltage.
⑤ Set the CAL switch to the estimated quantity of a strain,
⑥ Set the VOLTAGE OUT switch to the target voltage.
⑦ Press the SET switch 2 times.
⑧ Press the BAL switch 2 times. (The CDV/CDA-900A becomes measuring status by executing the balancing.)

After the internal gain is set correctly, " SEt " appears on the monitor.
If " Er - ○○○" appears on the monitor, see "9-3. TROUBLE SHOOTING."

NOTE

DC AMP lamp is OFF: "STRAIN MODE"
DC AMP lamp is ON: "DC AMP MODE"
"STRAIN MODE": Turn OFF the SETTING SWITCH 4.
"DC AMP MODE": Turn ON the SETTING SWITCH 4.
To change the settings, after switching the SETTING SWITCH, be sure to turn ON and OFF the power.
For the SETTING SWITCH, see "5-1. INPUT."

Set the VOLTAGE OUT switch within 1.00 to 10.00.
If you set the internal gain with the CAL switch "0000", "oFF" appears on the monitor and the output voltage will be fixed at 0 V regardless of the input. (The same status with the RANGE OFF of the CDV/CDA-900A.)

5-7-2 Setting Internal Gain with TEDS

When the measuring target is the TEDS-compatible sensor, the CDV/CDA-900A can load the TEDS information and set the internal gain easily.
TEDS information that is used in the CDV/CDA-900A are the rated output (μm/m) and rated capacity.
Proper operation procedures are as follows.

① Set the measuring mode to the "STRAIN MODE." (When the DC AMP lamp on the front panel is ON, turn OFF the SETTING SWITCH 4 on the rear panel and turn OFF and ON the power. Then set the measuring mode to the "STRAIN MODE.")
② Turn the sensitivity registration mode to the "TEDS MODE." (Press and hold the TEDS switch to light up the switch,)
③ Connect a TEDS-compatible sensor for executing the bridge resistance check.
④ Set the VOLTAGE OUT switch to the target voltage.
⑤ Press the SET switch 2 times.
⑥ Press the BAL switch 2 times. (The CDV/CDA-900A becomes measuring status by executing the balancing.)

After the internal gain is set correctly, "TEdS-rEAd" appears on the monitor.
If "Er-TEdS" appears on the monitor, see "9-3. TROUBLE SHOOTING."

NOTE

Note that this function is not available in the "DC AMP MODE."

MEMO

A physical quantity (converted from the voltage) appears on the monitor in "TEDS MODE."
For displaying the voltage on the monitor, press and hold the TEDS switch to change the sensitivity registration mode the "NORMAL MODE."
(Although the TEDS switch light out, the settings are saved.)
With the "TEDS MODE", by pressing the SET switch, "○○○○u ○○○○.d " appears on the monitor.
Above are the rated output and rated capacity that are set to the CDV/CDA-900A.
[Example]
When setting the internal gain by using a TEDS information stored in the TEDS-compatible sensor (rated output: 3134 µm/m, rated capacity: 4678 N)
"3134u 4678.d" appears and scrolls by pressing and holding the SET switch.

5-7-3 Setting Internal Gain with Actual Load

The CDV/CDA-900A can set the internal gain with the actual load. When using an extension cable, set the internal gain with the actual load for more accurate measurement.

Proper operation procedures are as follows.

① Set the measuring mode to the "STRAIN MODE" or "DC AMP MODE."

② Set the measuring mode to the "ACTL LOAD MODE." (Press and hold the [ACTL LOAD] switch to light up the switch,)

③ Connect a strain gage, strain gage transducer, or external calibrator to the input for executing the bridge resistance check.

④ Press the [BAL] switch 2 times. (Execute the balancing with no-load applied.)

⑤ Input a strain of an actual load or external calibrator.

⑥ Set the [VOLTAGE OUT] switch to the target voltage.

⑦ Press the [SET] switch 2 times.

⑧ Press the [BAL] switch 2 times. (The CDV/CDA-900A becomes measuring status by executing the balancing.)

After the internal gain is set correctly, "SET" appears on the monitor.
If "Er - ○○○" appears on the monitor, see "9-3. TROUBLE SHOOTING."

MEMO

With the "ACTL LOAD MODE", press and hold the [SET] switch. "○○○○u" appears and scrolls. The value indicates a strain quantity input to the CDV/CDA-900A.
If the input strain (voltage) is 10000 μm/m (100000 μV) or more when setting the internal gain, you cannot set the calibration signal equivalent to the input. The maximum calibration signal is 9999 μm/m (99990 μV).

5-8. LOW-PASS FILTER

The CDV/CDA-900A provides a 4-th order Butterworth type low-pass filter.
Five cutoff frequencies are provided, including - 10, 100, 1k, 10k and 100k Hz - and FLAT.
At the point of a cut-off frequency selected, the amplitude is attenuated by -3dB (about 70%).
The cut-off characteristic is rated at -24 dB/Oct. It means that the amplitude attenuates to 1/16 when frequency is doubled in the cut-off region in excess of a cut-off frequency.

The low-pass filter plays the following roles.

① Removes unnecessary high frequency components from input signals.

② Determines the overall characteristic of a measuring system including a strain gage or a strain gage transducer.

③ Unities the characteristics of data paths for simultaneous multi-point measuring.

For how to set the low-pass filter, see "4-7-2 Setting Low-pass Filter."
If input signals are changing in sinusoidal form, use a cutoff frequency which is two to five times larger than the frequency of input signals.
As regard to the frequency response characteristics of the low -pass filter, see "9-1. LOW-PASS FILTER CHARACTERISTIC."

NOTE

With a low-pass filter having the Butterworth characteristic, the phase delay becomes unproportional to the frequency nearby a cutoff frequency in use. Accordingly, fast rising or falling signals that pass the filter will cause an overshoot. To prevent it, set the low-pass filter to a cutoff frequency about 10 times larger than the frequency of strain signals.

5-9. CALIBRATION SIGNAL

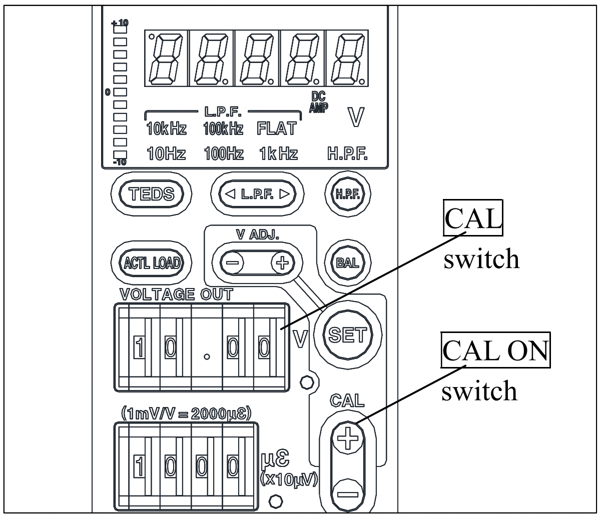
A calibration signal (CAL) is used for measurement the amount of a strain.
The value of this calibration signal is set to the CAL switch by using a positive 4-digit integer as an amount of the strain.
In the case of STRAIN MODE, a calibration signal can be set at from 1με through 9999 με, incremental by 1 με. In the case of DC AMP MODE, from 10 μV through 99990 μV, incremental by 10 μV. You can add the calibration signal to the output in any sensitivity registration mode.

The following explains how to add the calibration signal to the output.
Set the calibration signal to be added to the CAL switch.
Press the CAL ON switch.

+: Add + calibration signal that is set to the CAL switch to the output.

-: Add - calibration signal that is set to the CAL switch to the output.

The calibration signal is being added to the output while pressing the CAL ON switch.



MEMO

It is also possible to activate the function using an external control signal.
For details, see "5-12. REMOTE CONTROL."

5-10. KEY-LOCK

The CDV/CDA-900A is provided with the key-lock function. If used, this function prevents measuring conditions from changing in the event of careless touching on keys (other than the POWER switch).
(However, the setting values of the CAL and VOLTAGE OUT switches can be changed.)

Set the KEY LOCK switch to left for prohibiting operations.

MEMO

It is also possible to activate the function by using an external control signal.
For details, see "5-12. REMOTE CONTROL."

5-11. APPLICATION OF CENTRALIZED CONNECTOR

The CDV/CDA-900A provides a centralized connector on its rear panel. Generally, the connector is used to connect with an AC power supply via the accessory power cable. The connector also provides a pin that connects with a DC power supply. The connector also enables connection of input/output signals. Names and functions of these signals are shown in the following table.
For details of external control signals (with REM on the signal name) in the table, see "5-12. REMOTE CONTROL."

Pin No.	Signal	Type	Function and what to connect with
1	+12 V	Power supply	Connect with the positive side 1) of DC power.
2	REM BAL[2]	Remote input	Connects with an external balancing signal, valid at "L."
3	N.C[3]		
4	N.C[3]		
5	COM	Common potential	
6	N.C[3]		
7	100 VAC	Power supply	Connects with AC power
8	N.C[3]		
9	N.C[3]		
10	REM KEYLOCK[2]	Remote input	Connects with an external key-lock signal, valid at "L."
11	GNF	Ground Terminal	Internally connected in the chassis
12	N.C[3]		
13	N.C[3]		
14	0 V	Power supply	Connect with the negative side[1] of DC power.
15	OUTPUT A[2]	Output	Internally connects with OUTPUT A connector
16	COM	Common potential	The same with the pin No. 5.
17	REM +CAL[2]	Remote input	Connects with an external +CAL input signal, valid at "L".
18	REM –CAL[2]	Remote input	Connects with an external -CAL input signal, valid at "L".
19	N.C[3]		
20	100 VAC	Power supply	Connects with AC power

Connector plug: S-1620-C (HIROSE ELECTRIC CO., LTD)

(NOTE) (1) Use a heat-resistant vinyl cable thicker than 0.3 mm.
(2) The electrical potential of Pin No. 5 COM is common to these pins.
(3) N.C. stands for Non Connection (an unused pin).

5-12. REMOTE CONTROL

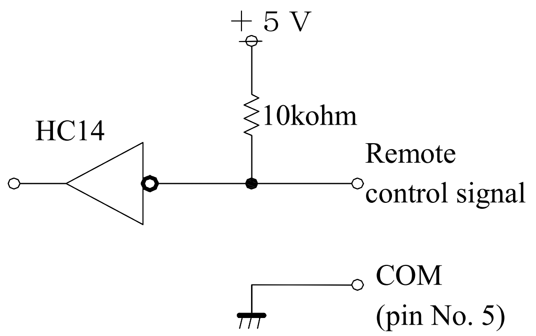
The following functions can be controlled remotely.

①	Execution of balancing:	REM BAL signal
②	Outputting CAL:	REM +CAL signal, REM -CAL signals
③	Execution and cancellation of key-lock:	REM KEYLOCK signal

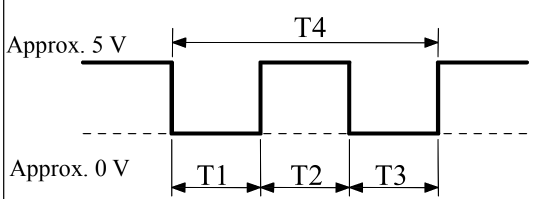
Remote control has the same significance as manual operation of the front panel switches that control the CDV/CDA-900A functions. The priority is given to the first operated one.

5-12-1 Remote Control Signals

Control signal input circuit is shown at the right.

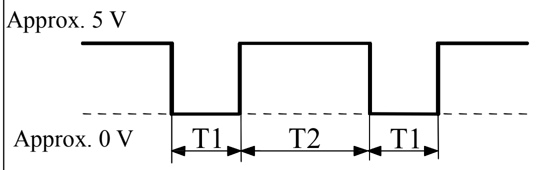


Control signals are valid when they are on the “L” (0 V) level. While this level is maintained, functions are executed. The balancing function by the remote control is executed only one time in response to a signal shown at the right.



Ensure 50 ms minimum for T1, T2, and T3 (valid time lengths).
Repetition time T4 should be in a range of 100 to 500 ms.

When executing the CAL addition on and off by the remote control, use the signal in the right.



Ensure 50 ms minimum for T1, T2, and T3 (valid time lengths).
Repetition time T2 should be 1 s or more

NOTE

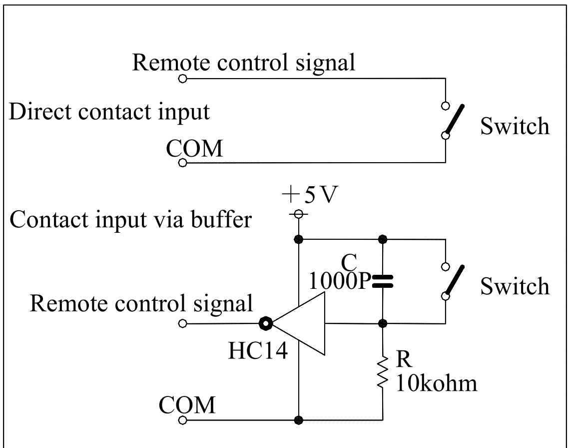
When an external control signal is “H,” it is made to be on the level of approximately 5 V by the internal circuit.
Avoid generating chattering when rising or falling the control signal.

5-12-2 External Connection

When remote controlling the CDV/CDA-900A, use the terminals of the centralized connector. Perform wiring after removing the housing from the centralized connector. For details of the centralized connector, see "5-11. APPLICATION OF CENTRALIZED CONNECTOR."

> **NOTE**
>
> An AC power supply is also connected to the centralized connector. Therefore, be sure to remove the power plug from the AC outlet.

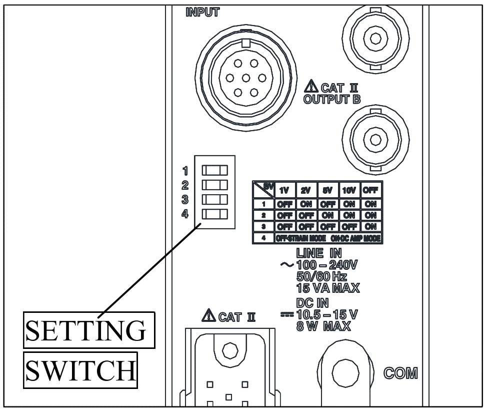
Shown at the right are the recommended circuits for remote control.
If a circuit other than shown is used, contact KYOWA or our representatives.
.



Take care to avoid chattering of a switch.

5-13. SETTING SWITCH

The SETTING SWITCH use for changing the bridge excitation voltage and measuring mode.
Before changing the SETTING SWITCH, turn OFF the CDV/CDA-900A.
Combinations of the SETTING SWITCH and bridge excitation voltage are as follows.
The gray area of the table at right shows the conditions as shipped from the factory.
For the bridge excitation voltage, see "5-14. BRIDGE EXCITATION VOLTAGE." For the measuring mode, see "4-4. SELECTING MODE."



CDV-900A

Bridge excitation voltage		1 V	2 V	5 V	10 V	OFF
SETTING SWITCH	1	OFF	ON	OFF	ON	ON
	2	OFF	OFF	ON	ON	ON
	3	OFF	OFF	OFF	OFF	ON
	4	OFF: STRAIN MODE		ON: DC AMP MODE		

CDA-900A

Bridge resistance		120 ohm		350 ohm			OFF
Excitation current (equivalent to the voltage)		8.3 mA (1 V)	16.7 mA (2 V)	5.7 mA (2 V)	14.3 mA (5 V)	28.6 mA (10 V)	
SETTING SWITCH	1	OFF	ON	OFF	ON	OFF	ON
	2	OFF	OFF	OFF	OFF	ON	ON
	3	OFF	OFF	ON	ON	ON	ON
	4	OFF: STRAIN MODE			ON: DC AMP MODE		

NOTE

Be sure to set the SETTING SWITCH as described above.
With the "STRAIN MODE", you cannot turn OFF the bridge excitation voltage.
If "Er-bu" or "Er-bc" appears on the monitor after turning ON the power, check the SETTING SWITCH and re-set them again.

5-14. BRIDGE EXCITATION VOLTAGE

The CDV/CDA-900A permits selection of a bridge excitation voltage*12, from 1 V, 2 V, 5 V, 10 V, and OFF. As shipped from the factory, 2 V is set to the CDV-900A.
The CDV/CDA-900A permits selection of an excitation current*13, from 8.3 mA, 16.7 mA, 5.7 mA, 14.3 mA, 28.6 mA, and OFF. As shipped from the factory, 5.7 mA is set to the CDA-900A.
You can set the bridge excitation voltage by using the SETTING SWITCH 1 to 3 on the rear panel.
For details, see "5-13. SETTING SWITCH."

It gives you convenience if you select a bridge excitation voltage of 1 V in the case as follows.

- **When strains are measured on a material with poor heat resistance, for instance, plastic or wood.**
  A strain gage is heated if a large current flows on it. Precision measurement is, accordingly impossible unless the material of a measurement object provides good heat radiation. Therefore, the bridge excitation voltage is decreased to suppress self-heating.

- **When large strains are to be measured.**
  Target range will be twice the specified range.

- **When using a strain gage with gage length shorter than 1 mm.**

NOTE

After turning ON the power, bridge excitation voltage (current) appears on the monitor as follows after a few seconds later,
CDV-900A: "bu ○○○" appears on the monitor.
CDA-900A: "bc ○○○" appears on the monitor.
"○○○" indicates the bridge excitation voltage (current).

After changing the bridge excitation voltage, be sure to set the internal gain and execute the balancing.

With the CDA-900A, the available bridge resistance is 60 to 1000 ohm.
When the excitation current is 28.6 mA, the available bridge resistance is 60 to 700 ohm (including cable resistances).

5-15. REMOTE SENSING

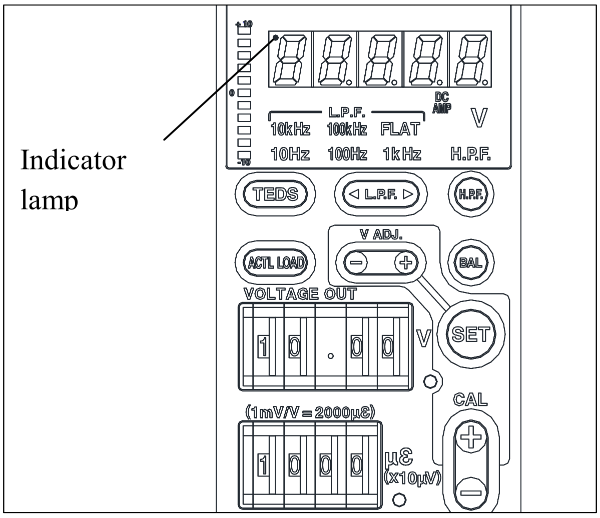
The CDV-900A can measure data by remote sensing.
With the remote sensing, bridge excitation voltage will be stabilized by compensating errors due to conductor resistances of cables and ambient temperature changes.

The remote sensing has 2 settings; AUTO and ALWAYS ON.

AUTO:	The remote sensing connection is determined for turning ON/OFF the remote sensing automatically. Normally the remote sensing is "AUTO."
ALWAYS ON:	The remote sensing is always ON.

With the remote sensing "AUTO", use the remote sensing cable up to 200 m.
If the remote sensing cable is longer than 200 m, set the remote sensing "ALWAYS ON."
With the remote sensing "ALWAYS ON", the remote sensing cable up to 2 km can be used.
To change the remote sensing to the "ALWAYS ON", see user-specified registration function.
For details, see "5-16. USER-SPECIFIED REGISTRATION FUNCTION."

With the CDV-900A, when the remote sensing is ON, the indicator lamp flickers.



MEMO

For the pin assignment of the remote sensing connection, see "4-1. CONNECTION OF INPUT."

NOTE

With the remote sensing "AUTO", if the remote sensing cable is longer than 200 m, " Er - rS" appears on the monitor. At that time, change the remote sensing to "ALWAYS ON" on the user-specified registration function.
The length of the remote sensing cable, described above, are based on the 6-conductor cables (0.5 mm^2).
(Reciprocating resistance value: Approximately 0.8 ohm/10 m)
Note that this function is not available in the "DC AMP MODE."
If the remote sensing is set to ALWAYS ON, do not connect a TEDS-compatible sensor to the input. Or, it may cause trouble.

5-16. USER-SPECIFIED REGISTRATION FUNCTION

The CDV/CDA-900A has an additional function; user-specified registration function.
Measuring accuracy will be increased by using the user-specified registration function.
Note that the user-specified registration items are different on the CDV-900A and on the CDA-900A.

5-16-1 Items that can be Registered on the CDV-900A

The user-specified registration items on the CDV-900A are the cable-resistance-compensation function and setting the remote sensing "ALWAYS ON",

(1) Cable-resistance-compensation function

When a bridge or strain gage transducer is located far away from the CDV/CDA-900A, the applied bridge excitation voltage will be lowered.
At this time, based on the bridge resistance and cable resistance, measuring accuracy will be increased by compensating the calibration signal.

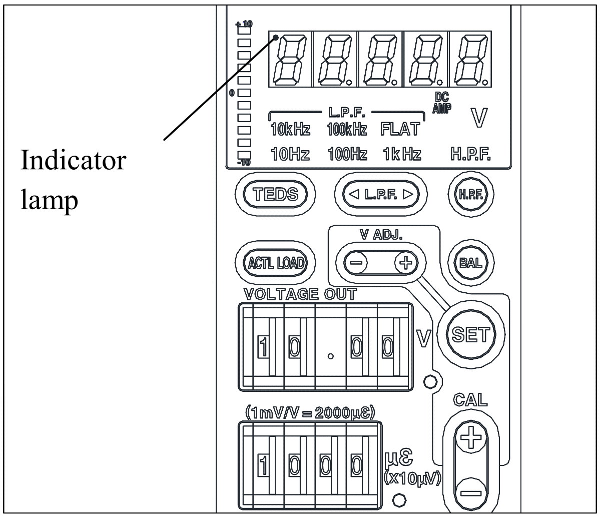
Proper operation procedures are as follows.

① Set the KEY LOCK switch to left for prohibiting operations.

② Press and hold the "+" and "-" of the V ADJ switch.

③ " rSoFF " appears on the monitor.
Press the SET switch to turning OFF the remote sensing.

④ " In-br " appears on the monitor for 2 seconds. Then the bridge resistance setting window appears. " 0350.0 " appears on the monitor. The left-most digit flickers.



To move the flickering digit, press the L.P.F. switch.

◂: Moves the flickering digit to the left.

▸: Moves the flickering digit to the right.

To increase/decrease the number of the flickering digit, press the CAL ON switch.

+: Increases the number of the flickering digit.

-: Decreases the number of the flickering digit.

The bridge resistance should be within 60.0 to 1000.0 ohm.
To complete the setting, press the SET switch.

⑤ " In-Lr " appears on the monitor for 2 seconds. Then the cable resistance will be measured automatically.
Measuring available cable resistance is up to 200.0 ohm in one way.
After completing the measurement, " Lr- ○○○○. ○" appears and scrolls on the monitor. The indicator lamp will light up. "○○○. ○" indicates the cable resistance.

NOTE

If the cable resistance is not measured correctly, " Er-Lr " appears on the monitor.
Press the SET switch to return to the "NORMAL MODE." Note that all settings of the cable-resistance-compensation function is canceled.
Causes of the errors are the cable resistance is exceeding the measuring range or the bridge resistance is different from the pre-set value.
After turning OFF the power, all the setting of the cable-resistance-compensation function is reset.
After turning OFF and ON the power, be sure to re-set the function again.
Note that this function is not available in the "DC AMP MODE."

(2) Setting the remote sensing "ALWAYS ON"

You can set the remote sensing "ALWAYS ON".

Normally the remote sensing is "AUTO." To use the remote sensing cable longer than 200 m, set the remote sensing "ALWAYS ON."

For the remote sensing, see "5-15. REMOTE SENSING."

Proper operation procedures are as follows.

① Set the KEY LOCK switch to left for prohibiting operations.

② Press and hold the "+" and "-" of the V ADJ switch.

③ "rSoFF" appears on the monitor.

To turning ON/OFF the remote sensing, press the L.P.F. switch.

Press the "◂" or "▸" of the L.P.F. switch to display "rS on" on the monitor.

Press the SET switch for completing the setting of the remote sensing "ALWAYS ON". The indicator lamp flickers.

NOTE

Note that this function is not available in the "DC AMP MODE."
When selecting the remote sensing "ALWAYS ON", be sure to connect a remote-sensing sensor.
Do not connect a TEDS-compatible sensor to the input. Or, it may cause trouble.
After turning OFF the power, all the setting of the remote sensing "ALWAYS ON" is reset.
After turning OFF and ON the power, be sure to re-set the function again.

5-16-2 Items that can be Registered on the CDA-900A

The user-specified registration item on the CDA-900A is the bridge-resistance-compensation function.

- Bridge-resistance-compensation function

  When using a strain gage or strain gage transducer other than 120 ohm or 350 ohm, an input strain varies with a bridge resistance. At this time, measuring accuracy will be increased by compensating the calibration signal.

Proper operation procedures are as follows.

① Set the KEY LOCK switch to left for prohibiting operations.

② Press and hold the "+" and "-" of the V ADJ switch.

③ "In-br" appears on the monitor for 2 seconds. Then the bridge resistance setting window appears.

Based on the excitation current, "0120.0" or "0350.0" appears on the monitor. The left-most digit flickers.

To move the flickering digit, press the L.P.F. switch.

◂: Moves the flickering digit to the left.

▸: Moves the flickering digit to the right.

To increase/decrease the number of the flickering digit, press the CAL ON switch.

+: Increases the number of the flickering digit.

-: Decreases the number of the flickering digit.

The bridge resistance should be within 60.0 to 1000.0 ohm.

To complete the setting, press the SET switch. "SET" appears on the monitor and the indicator lamp lights up.

NOTE

Do not execute the bridge resistance check while using the bridge-resistance-compensation function.
Although a sensor is connected correctly, an error may appear.
Note that this function is not available in the "DC AMP MODE."
After turning OFF the power, all the setting of the bridge-resistance-compensation function is reset.
After turning OFF and ON the power, be sure to re-set the function again.

6. OPTIONS

This chapter describes all options that can be used together with the CDV/CDA-900A.
These options are available for separate purchasing.

6-1. BRIDGE BOX

The bridge box can be conveniently used for measuring strains with strain gages. The bridge box incorporates highly stable resistors to allow a variety of strain gage bridges.

6-1-1 Functions of Bridge Box

The bridge box comes with three internal fixed resistors, which enable the strain gage bridge configurations as follows.
For connections other full bridge system, the internal fixed resistors are used as dummy gages.

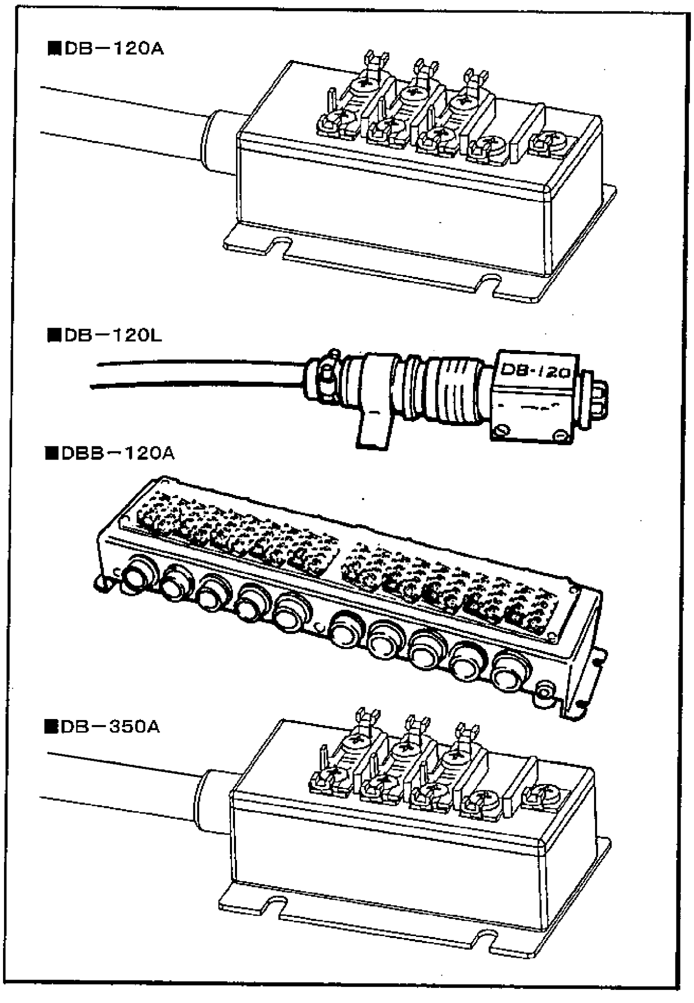
① Quarter bridge 2-wire or 3-wire system*3
② Half bridge system *4
③ Full bridge system

6-1-2 Models of Bridge Box

The following models are provided.

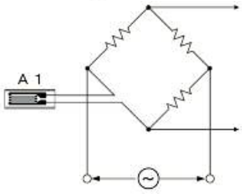
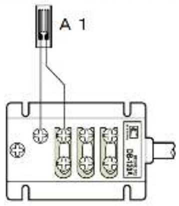
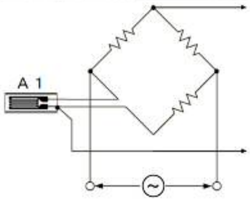
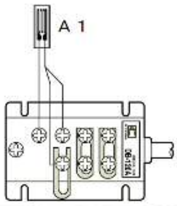
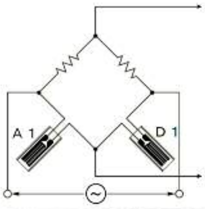
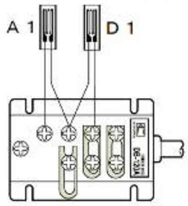
① DB-120A, DB-120L, DBB-120A
For 120 ohm strain gages.

② DB-350A
For 350 ohm strain gages.



6-1-3 Wiring to Bridge Box

How to configure a variety of strain gage bridge is described below.

<table>
<tr><th>Gage System</th><th>Bridge Circuit</th><th>Wiring to the bridge box</th></tr>
<tr><td>Quarter bridge system
(2-wire system)</td><td>
</td><td>
</td></tr>
<tr><td>Quarter bridge system
(3-wire system)</td><td>
</td><td>
</td></tr>
<tr><td>Half bridge system</td><td>
</td><td>
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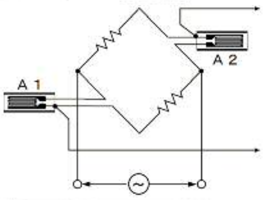
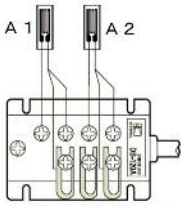
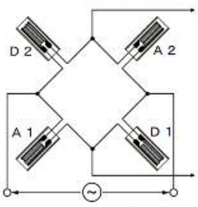
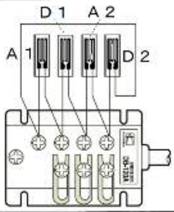
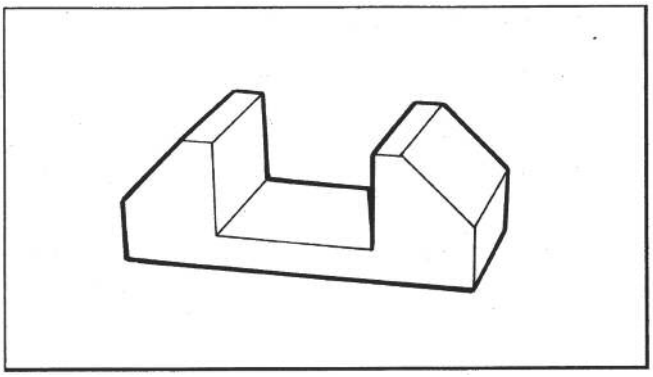
<tr><td>Half bridge system
(3-wire active-active system)</td><td>
</td><td>
</td></tr>
<tr><td>Full bridge system</td><td>
</td><td>
</td></tr>
</table>

NOTE

When wiring strain gage(s) to the bridge box, soldering is recommended to reduce contact resistance.
Use shortest possible wires for connecting the strain gage to a bridge box. Lead wires shorter than 1 m are ideal.
Use a shielded cable for dynamic strain measurement. It is advantageous to reduce noise.
For other details, see Instruction Manual of the bridge box,

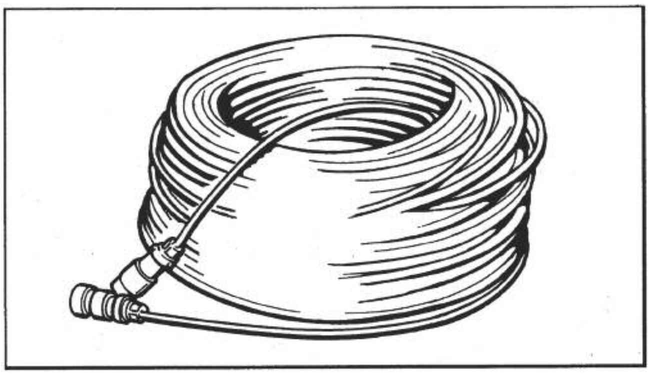
6-2. AMPLIFIER STAND FA-1B

When operating a single unit of the CDV/CDA-900A, this rubber made stand is used for fixing.



6-3. EXTENSION CABLE N

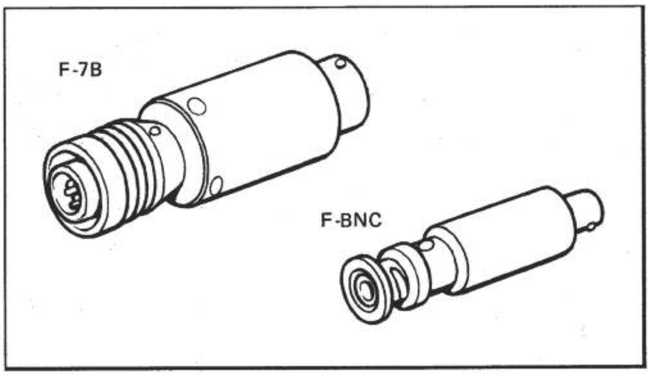
For connecting the bridge box or strain gage transducers at a remote place. The cable ends are provided with connectors. The following 6 models are available offering different lengths.



- N-81 Cable length: 5 m
- N-82 Cable length: 10 m
- N-83 Cable length: 20 m
- N-84 Cable length: 30 m
- N-85 Cable length: 50 m
- N-100 Cable length: 100 m

6-4. NOISE FILTER F

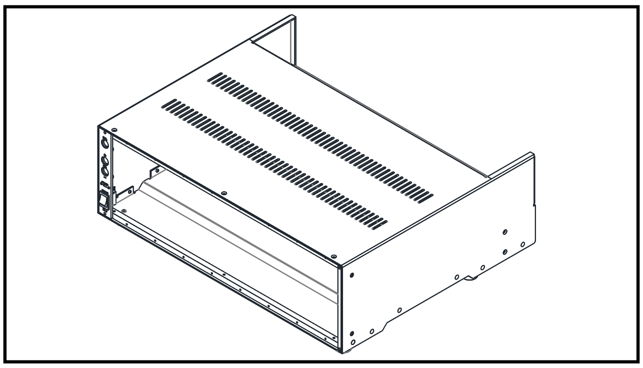
Efficiently reduces external high-frequency noise. They are directly attached to the INPUT connector and OUTPUT A and OUTPUT B connectors, respectively.



6-5. EXCLUSIVE CARRYING CASE

The following 4 models are provided, respectively accommodating different numbers of units to facilitate multichannel measurements.

- YC-3A accommodates 3 channels
- YC-4A accommodates 4 channels
- YC-6A accommodates 6 channels
- YC-8A accommodates 8 channels



Each case provides a converging control switch that is operable on its front panel. What's more, each eliminates the need for interchannel connection, offering a great convenience.

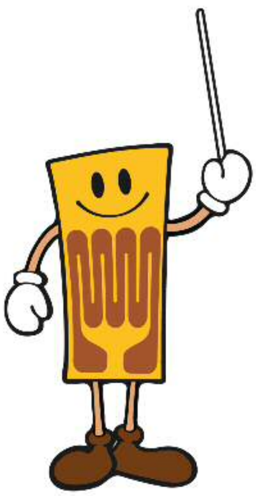
Functions of the exclusive carrying cases are described as follows.

- A batch balance key
- A batch calibration key
- A POWER switch that switches all housed units ON or OFF at a time
- Internal connection that enable oscillator synchronization.
- Centralized connector that connects with bridge status outputs
- A batch key-lock key

Rack mount fixtures for JIS and DIN are also provided.

NOTE

- It is also possible to house signal conditioners and dynamic strain amplifiers together in the carrying case.
- Balancing, calibration or key-lock can be achieved on all units simultaneously by operating the $\boxed{\text{BAL}}$ key, $\boxed{\text{CAL}}$ key or $\boxed{\text{KEY-LOCK}}$ key, respectively.
- When using the CDV/CDA-900A housed in the exclusive carrying case, the CDV/CDA-900A and exclusive carrying case generate heat. But there is no problem in performance.
- While turning ON (1 hour or more after turning ON the power) and immediately after the turning ON, the main body of the CDV/CDA-900A housed in the exclusive carrying case is hot. Do not touch the CDV/CDA-900A with the bare skin to avoid low-temperature burns.
  Be sure to put gloves for touching the CDV/CDA-900A.
- When using the CDV/CDA-900A housed in the exclusive carrying case with continuous current for 24 hours, be sure to perform a periodic inspection every 2 years.



7. TROUBLE SHOOTING

If the CDV/CDA-900A does not operate as expected or if its operation is unstable, do not take it as a machine trouble right away but make sure whether or not the operating environment is acting as the cause. Typical troubles and remedies are introduced below. Contact KYOWA or our representatives if the trouble still remains after carrying out the proper remedy.
KYOWA may refuse to repair if the product has been damaged by failure to follow the instructions given in this Instruction Manual or if the product has been disassembled or remodeled by the user.

7-1. CDV/CDA-900A CANNOT BE TURNED ON

If indicators, including the monitor, do not light up after turning ON the power, the causes can be the breaking of the power cable or failure of the power. First, check the electrical continuity of the power cable. When the continuity is passed, the power is failure. Stop using the CDV/CDA-900A immediately and contact KYOWA or our representatives.
If the CDV/CDA-900A is damaged due to disassembling or remodeling by the user, KYOWA may refuse the repair.

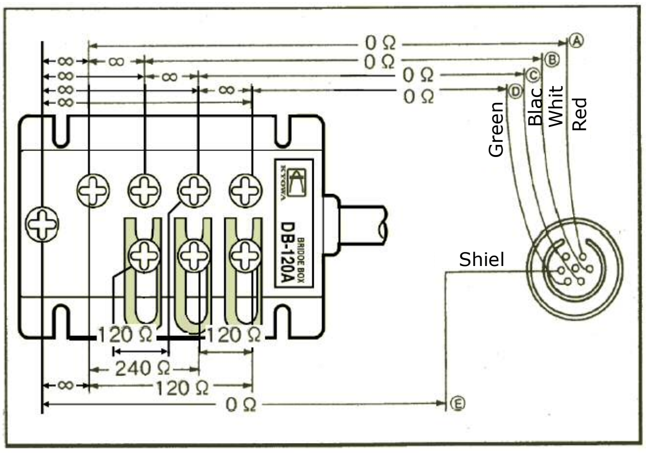
7-2. INITIAL BALANCING IS IMPOSSIBLE.

◆ A reading on the monitor keeps in excess of 10V.
This can result from a fault in a strain gage bridge which is connected to the INPUT connector.
Causes of this fault can be the following. Check the strain gage bridge to discover and remove the cause.

- Breaking, short-circuiting or lowered insulation of arms of the strain gage bridge
- Breaking of lead wires coming from the strain gage bridge
- Bridge resistance is exceeding the applicable range.

◆ When using a bridge box
Check the resistance between the terminals of the bridge box and the terminals of the INPUT connector. If the result shown at right is obtained for a 12o ohm bridge, it is the indication of a normal bridge box.
For a 350-ohm bridge, the resistance values shown at right should read:

- 120 ohm → 350 ohm
- 240 ohm → 700 ohm



◆ Initial balancing is still impossible even though the bridge box has been proven normal.
In this case, the cause can be the abnormal strain gage connected to the bridge box or the contact failure of the connection pin.
Replace the strain gage or the bridge box.

◆ Several tens of mV remains even though balancing has been repeated many times.
Press the V ADJ. switch to execute the zero point adjustment so as to obtain an output voltage of zero.

Contact KYOWA or our representatives if the trouble still remains after carrying out the proper remedy.

7-3. NO OUTPUT IS AVAILABLE.

" oFF " is displayed on the monitor.
The internal gain is set with the $\boxed{\text{CAL}}$ switch "0000".
Re-set the internal gain with the $\boxed{\text{CAL}}$ switch other than "0000".

◆ The monitor indication does not vary and no output is available.
The input cable may not correctly connected to the connector or broken.
Execute the bridge resistance check.

◆ The monitor indication varies but no output is available.
The output cable may not correctly connected to the connector or broken.
Repair or replace the output cable.

Contact KYOWA or our representatives if the trouble still remains after carrying out the proper remedy.

7-4. INSTABILITY OF THE ZERO POINT

◆ When preheating is insufficiently
Preheat the CDV/CDA-900A approximately 30 to 60 minutes. For details, see "5-3. PREHEATING."

◆ When the insulation of the strain gage or leadwires is low
Repair or replace it.

◆ Insufficient temperature compensation effected on a strain gage.
Use a strain gage having sufficient temperature compensation.

◆ When the fixed resistors incorporated in the bridge box are no good.
Repair or replace them.

Contact KYOWA or our representatives if the trouble still remains after carrying out the proper remedy.

7-5. LARGE NOISE

The cause can be the following.

● **Inductive interference**

A nearby instrument having a large leakage flux can be the cause of induction noise. A large capacity motor and an iron-resistance constant-voltage instrument are a few examples. In addition, when the measuring point is far from the CDV/CDA-900A, the induction noise may generate. Remedies are as follows.

- ◆ Place a causative instrument apart from the CDV/CDA-900A.
- ◆ To connect the strain gage to the amplifier, use a 2-conductor flat cable at least. If possible, use a 2-conductor shielded cable, which is the ideal. In this case, connect the shielding wire to the ground terminal E of the bridge box.
- ◆ Ground a measuring object and the CDV/CDA-900A independently at a same grounding point.

- **Interference due to a measuring object's electric potential**

  This interference occurs when a measuring object has a certain electric potential, AC or DC. In this case, grounding the CDV/CDA-900A does not necessarily bring about a good result, but connection of a measuring object to the CDV/CDA-900A can be the solution in some cases.

  In addition, in case of inductive interference or if measuring object has a certain electric potential, it is to solve the problem by a simple method. Especially, the number of devices that are used in the same measuring environment is increasing resulting in interfering with each other as noise resources. The above remedies are just a few examples to solve the noise interference. Fully consider the operating environment and take an appropriate remedy to obtain the most efficient results.

8. SPECIFICATIONS

8-1. SPECIFICATIONS

Model	CDV-900A	CDA-900A
Measuring target	Strain gage, strain gage transducer	
The number of channels	1 CH/unit	
Applicable bridge resistance	60 to 1000 ohm	120 ohm, 350 ohm
Gage Factor	2.00 fixed	
Bridge excitation voltage (Setting by DIP switch 1 to 4 on rear panel.)	Constant voltage	Constant current
	1, 2, 5, 10 V and OFF	8.3 mA, 16.7 mA (120 ohm), 5.7 mA, 14.3 mA, 28.6 mA (350 ohm) and OFF
Balancing range*9	Within ±2% (±10000 µm/m)	
Balancing method Resistance Accuracy Storage	 Auto-balance Within ±1 µm/m [when 1000 µm/m is input, outputs 10 V.] Saved in nonvolatile memory	
Nonlinearity	Within ±0.01% FS	
Input impedance	10M ohm + 10M ohm or more	
Output impedance	Approximately 2 ohm	
Calibration signal (CAL) Setting Range-strain Voltage Accuracy- strain Voltage	 CAL switch (4-digit digital switch) ±(1 to 9999) µm/m ±(10 to 99990) µV Within ±(0.2% +0.5 µm/m) Within ±(0.1% +5.0 µV $_{RTI}$)	
Sensitivity adjuster CAL switch VOLTAGE OUT switch Accuracy	CAL switch and VOLTAGE OUT switch (4-digit digital switch) both required 1 µm/m steps within 100 to 9999 µm/m 0.01 V steps within 1.00 to 10.00 V Condition [when 1000 µm/m is input, outputs 10 V (×10000)] [when 5000 µm/m is input, outputs 1.00 V (× 200)] Example CAL switch: 1000, VOLTAGE OUT switch: 10.00 (× 10000) CAL switch: 1000, VOLTAGE OUT switch: 1.00 (× 200) Within ±(0.5%+5mV)	
Sensitivity fine adjustment	1 to 1/2.5	
Frequency response range	DC to 500 kHz (Deviation: +1dB to -3dB)	
Low-pass filter Transfer characteristic Cutoff frequency Amplitude ratio at the cutoff point Attenuation	 4-th order Butterworth 6 steps: 10, 100, 1k, 10k, 100 kHz, and FLAT -3±1dB -24±1dB/oct.	
High-pass filter Cutoff frequency	 0.2 Hz or OFF	
Output	OUTPUT A and OUTPUT B: ±10 V (load resistance: 5 kohm or more)	

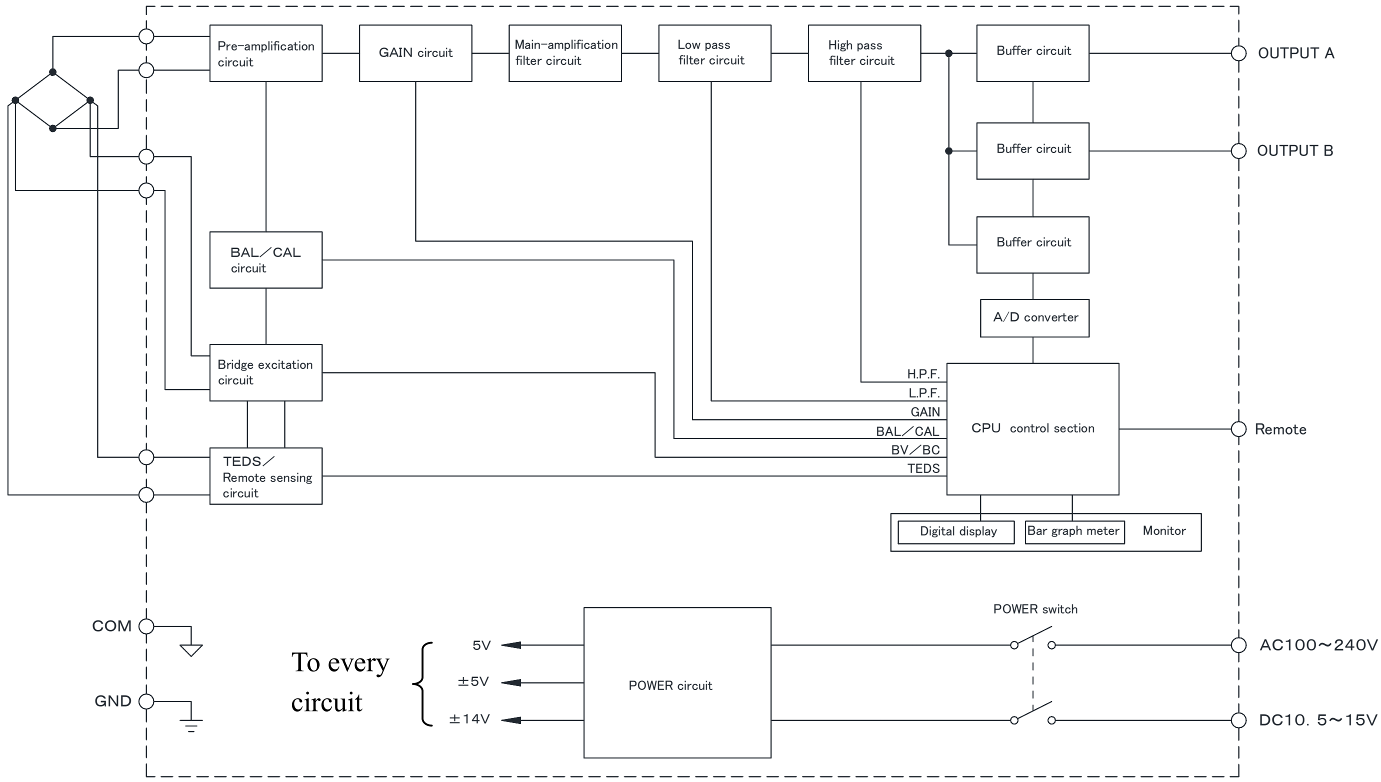
<table>
<tr><th>Model</th><th>CDV-900A</th><th>CDA-900A</th></tr>
<tr><td rowspan="3">Noise

Condition</td><td>Low-pass filter
FLAT
100k Hz
10k Hz
1k Hz
100 Hz
10 Hz</td><td>Noise (converted value)
$40\mu V_{p-p}$ or less
$16\mu V_{p-p}$ or less
$6\mu V_{p-p}$ or less
$4\mu V_{p-p}$ or less
$3\mu V_{p-p}$ or less
$2\mu V_{p-p}$ or less</td></tr>
<tr><td>Bridge Excitation voltage: 2 V</td><td>Bridge Excitation current: 16.7 mA</td></tr>
<tr><td colspan="2">[Bridge resistance: 120 ohm, when 1000 μm/m is input, outputs 10 V.]</td></tr>
<tr><td>Maximum allowable input voltage</td><td colspan="2">±15 V</td></tr>
<tr><td>Allowable common mode input voltage</td><td colspan="2">±10 V</td></tr>
<tr><td>Common mode voltage rejection ratio</td><td colspan="2">100 dB or more</td></tr>
<tr><td>Stability
Temperature - zero point
Sensitivity
Time - zero point
Sensitivity
Power supply - zero point
Sensitivity</td><td colspan="2">
±1 μm/m/℃
±0.01%/℃
±5μm/m/24h
±0.05%/24h
±0.05%FS/±10% fluctuation
±0.05%-±10% fluctuation
[when 1000 μm/m is input, outputs 10 V.]</td></tr>
<tr><td>Withstand voltage</td><td colspan="2">AC power - chassis: 1000 VAC for 1 minute</td></tr>
<tr><td>Output voltage display</td><td colspan="2">$4^1/_2$ digits, digital display (7-segment LED)
11-segment LED bar graph meter</td></tr>
<tr><td>Over-input display</td><td colspan="2">Output voltage: Flickers ($4^1/_2$ digits, digital display only)</td></tr>
<tr><td>Check function</td><td colspan="2">Bridge resistance check</td></tr>
<tr><td>Key-lock function</td><td colspan="2">For prohibiting operations other than POWER switch.
(However, the setting values of the CAL switch and VOLTAGE OUT switch can be changed.)</td></tr>
<tr><td>Remote function</td><td colspan="2">KEY LOCK switch</td></tr>
<tr><td>TEDS</td><td colspan="2">Set the rated output to that of the VOLTAGE OUT switch by loading the sensor information stored in a TEDS-compatible sensor.</td></tr>
<tr><td>Actual load calibration</td><td colspan="2">Set the output voltage of the VOLTAGE OUT switch by loading the actual load.</td></tr>
<tr><td>User-specified registration function</td><td>Cable-resistance-compensation function
(Cable resistance in one way: 0 to 200 ohm)
Setting the remote sensing "ALWAYS ON"</td><td>Bridge-resistance-compensation function
(Bridge resistance: 60.0 to 1000 ohm)</td></tr>
<tr><td>Remote sensing</td><td>The remote sensing connection is determined for turning ON/OFF the remote sensing automatically.
(AUTO)
Capable of setting the remote sensing "ALWAYS ON" on the user-specified registration function.
(ALWAYS ON)</td><td></td></tr>
<tr><td>Cable extension</td><td>Up to 2 km with the 6-conductor shielded cable (0.5 mm^2) with the remote sensing ON.</td><td>Up to 2 km with the 4-conductor shielded cable (0.5 mm^2).</td></tr>
<tr><td>Vibration resistance</td><td colspan="2">5 to 200 Hz, $29.4 m/s^2$ (3G)
12 cycles each in X, Y, and Z directions, 10 minutes/cycle</td></tr>
<tr><td>Impact resistance</td><td colspan="2">15G, 11 msec or less, X, Y, Z, 3 directions for 3 cycles</td></tr>
</table>

Model	CDV-900A	CDA-900A
Operating temperature and humidity range	-10 to 50℃, 20 to 85%RH (noncondensing)	
Storage temperature range	-30 to 70℃	
Power supply	100 to 240 VAC Approximately 8VA (at 100VAC) 10.5 to 15 VDC Approximately 4 W (at 12 VDC)	
Dimensions	49 (W) × 128.5 (H) × 262.5 (D) mm (excluding protrusions)	
Weight	Approx. 1.0 kg	

8-2. BLOCK DIAGRAM AND OPERATION PRINCIPLE

8-2-1 Block Diagram

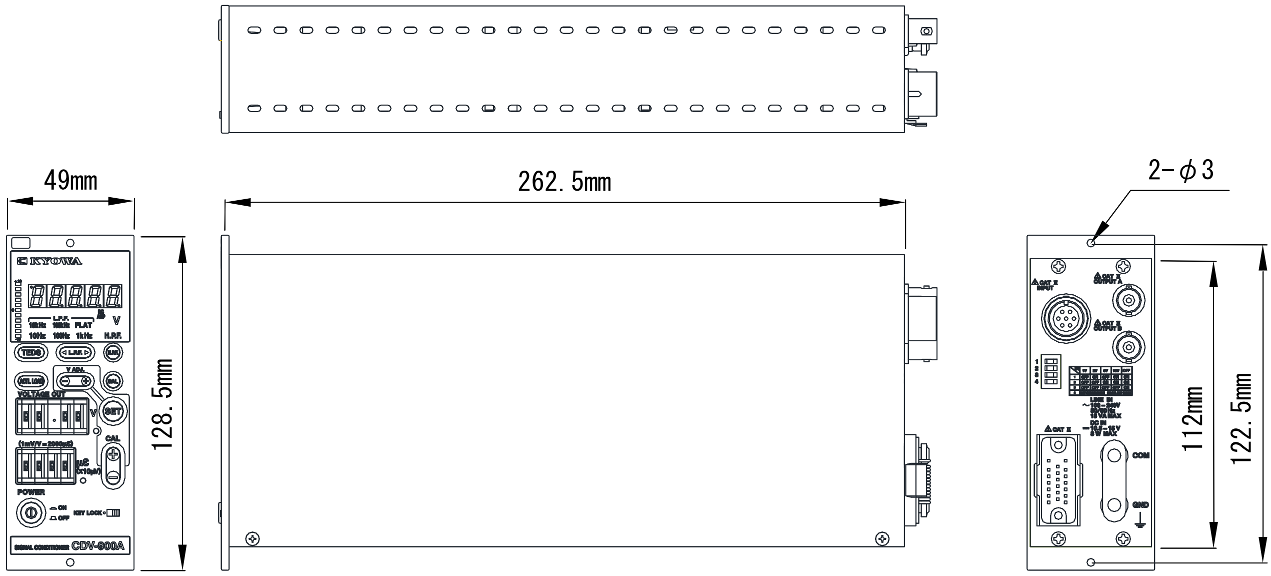


8-2-2 Operation Principle

This explanation is based on the block diagram above.

A change in physical quantities is detected as a change in the resistance of a strain gage, and converted into electric signals. An output from a strain gage bridge at this time is a micro DC voltage in several 100μvolts or thereabouts at its maximum. This bridge output is amplified by the preamplifier, an instrumentation amplifier, up to several milivolts, and further amplified to several volts by the main amplifier, and put out through the buffer circuit.

8-3. DIMENSIONAL DRAWING

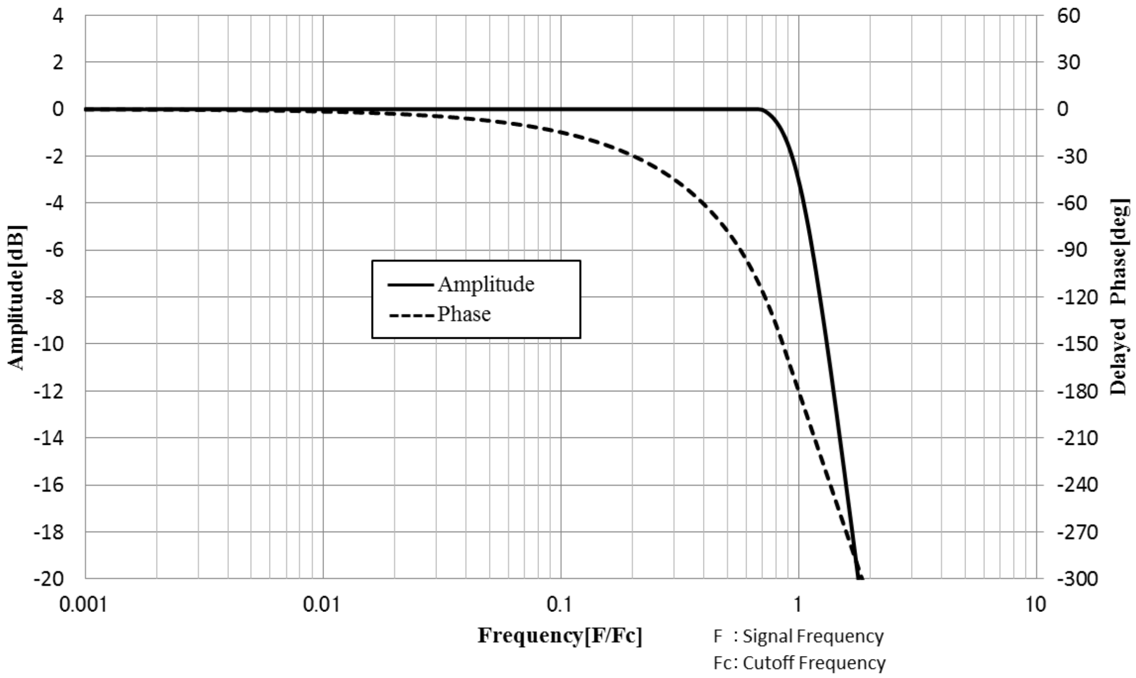


9. APPENDIXES

9-1. LOW-PASS FILTER CHARACTERISTIC

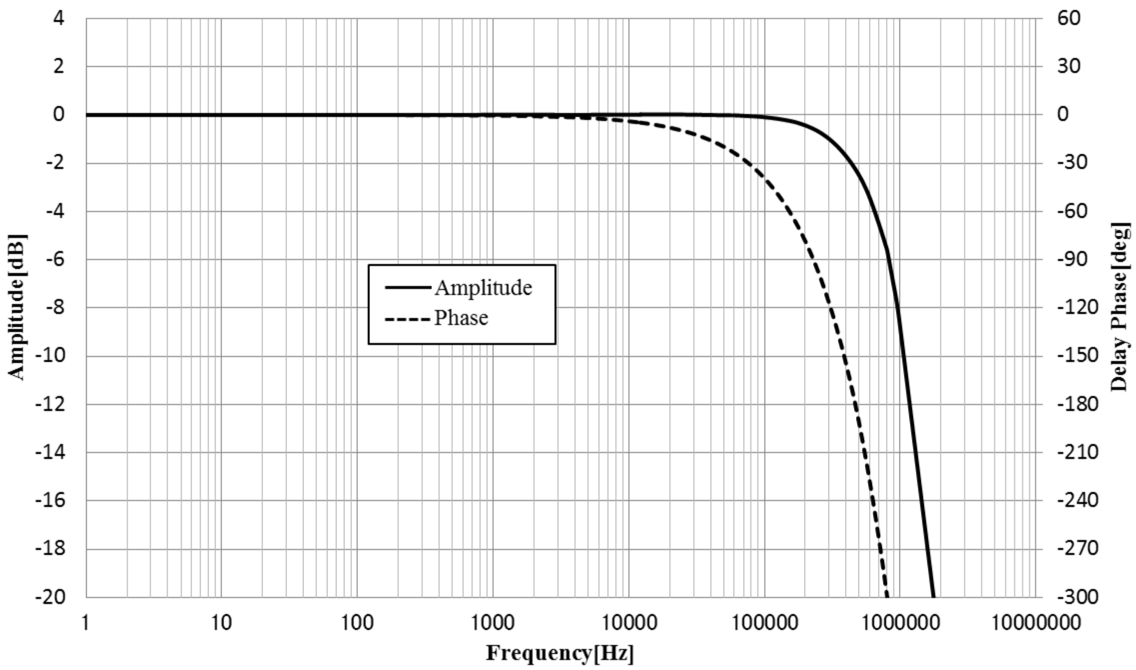
Section 9-1-1 shows the characteristic of the low-pass filter incorporated in the CDV/CDA-900A. In section 9-1-1, the frequency characteristic is normalized against a cutoff frequency. About the relation between the amplitude and the phase, first obtain the ration of F/Fc and then read it from the diagram below.
In addition, frequency response characteristic when cutoff frequency of the CDV/CVA-900A is set to FLAT is shown in the section 9-1-2.

9-1-1 Low-pass Filter Characteristic



9-1-2 Response Frequency Characteristic

Low-Pass Filter when the cutoff frequency is set to FLAT.

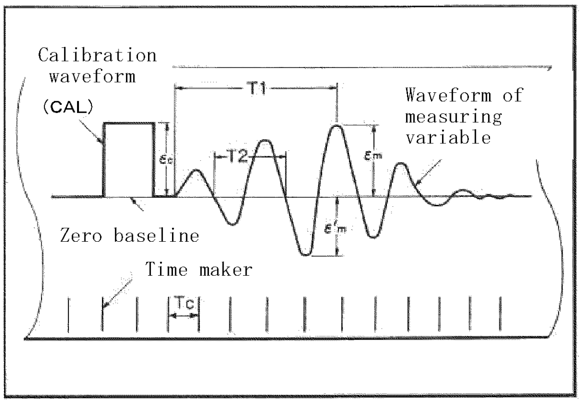


9-2. HOW TO CALCULATE STRAINS

This section describes how to measure strains and stress with the CDV/CDA-900A.

9-2-1 Method of Calculation Applicable to Strain Gage

Suppose that a strain waveform as shown at right was obtained.
The diagram shows a positive (+) calibration signal value recorded at the top of the strain waveform.
Suppose that the direction of this calibration signal waveform shoes the "elongation." The time factor of the strain waveform can be obtained referring to Tc (i.e. an interval between one time-maker and another).
Various values can be obtained as follows from the right figure.



① Calculating the maximum strain ε_m and the maximum stress σ_m

Measure the respective heights of the calibration signal and the maximum strain from the base line of zero by using a scale.
Suppose that the measurement of ε_c is h_c [mm], and that of ε_m is h_m [mm]. The maximum strain ε_m can be calculated using the equation below:

$$\varepsilon_m = \varepsilon_c \times \frac{h_m}{h_c}$$

ε_m is in the same direction as $+\varepsilon_c$. Therefore it is "elongation."
When once the strain ε has been obtained, stress σ at that point (provided that it is of the monoaxially stress system) can be found using the equation below.

$$\sigma = E \times \varepsilon_m$$

However, E is Young's modulus of the measuring point and the gage axis is considered as attached according to stress axis direction.
Therefore, the maximum stress σ_m is obtained by the following equation.

$$\sigma_m = E \times \varepsilon_m$$

② Calculating strain ε'_m and strain σ'_m

Strain ε'_m is in the direction opposite to $+\varepsilon_C$. Therefore it is "construction." Suppose that the height of ε'_m is h'_m [mm], the amount of ε'_m can be obtained using the equation below.

$$\varepsilon'_m = \varepsilon_c \times \frac{h'_m}{h_c}$$

Stress σ'_m (provided that it is of the monoaxially stress system) is calculated using the equation below.

$$\sigma'_m = E \times \varepsilon'_m$$

③ Time from the start point of the strain waveform to the maximum strain

To calculate T1 (i.e. time from the start point to the maximum strain), use the time maker. Measure 10 or so intervals between time makers, and obtain their average, then t_c [mm] against time T_c. Suppose that a measurement of T_1 is t_1 [mm]. T_1 can be calculated by using the equation below.

$$T_1 = \frac{t_1}{t_c} \times T_c[\text{sec}]$$

④ Frequency of the strain waveform

If vibrations are periodically generate, a frequency can be calculated. Measure the length of 10 or so cycles, then obtain their average t_2 [mm]. Compare the result with the marker interval t_c,.

$$T_2 = \frac{t_2}{t_c} \times T_c[\text{sec}]$$

From T_2, the frequency is obtained by using the equation below.

$$f = \frac{1}{T_2}[Hz]$$

⑤ Analysis of phenomenon

If a phenomenon is so simple that a measurement at a single point is enough, it is possible to disclose the whole phenomenon by simple calculating the relation between the amount of a strain and a time from its recorded waveform.

By contrast, a complex phenomenon requires simultaneous or individual measurements at multiple points. In this case, the relation between the amount of a strain and a time at each point can be also disclosed using the calculating methods introduced above. However, only this cannot afford thorough analysis of a complex phenomenon. In addition to analysis on respective measuring points, it is necessary to compare the results of individual analysis on the time axis.

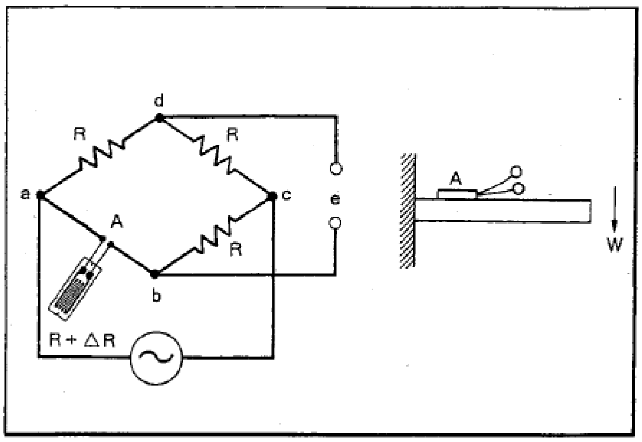
This analyzing technique should vary widely according to different measuring purposes. There cannot be one uniform technique.

In many cases, however, it is possible to estimate the relations between measuring points, So consider these relations together with the measuring results on measuring points, in order to grasp a phenomenon totally.

9-2-2 Correction Required due to the Number of Strain Gages Used

The above calculation methods are applicable to a measurement using one strain gage as an Active gage[*15] as shown in the right. When using multiple strain gages, the measuring result should be corrected according to the number of strain gages in use.

In addition, this correction is not necessary for a strain gage transducer.



ε: Strain after compensation

ε_0: Measuring results

σ: Stress

E: Young's Modulus

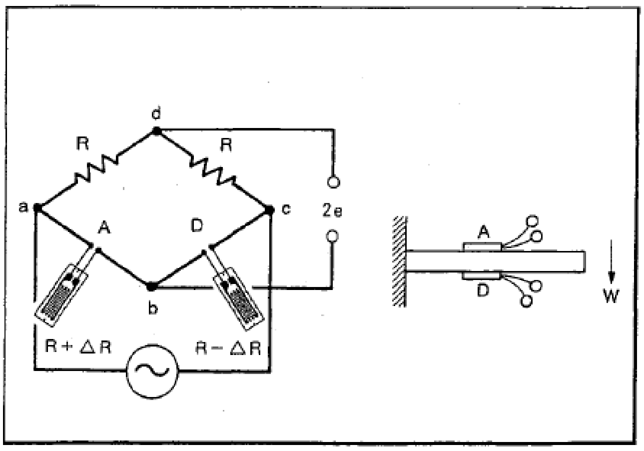
(modulus of longitudinal elasticity)

(1) When using both gages to measure strains

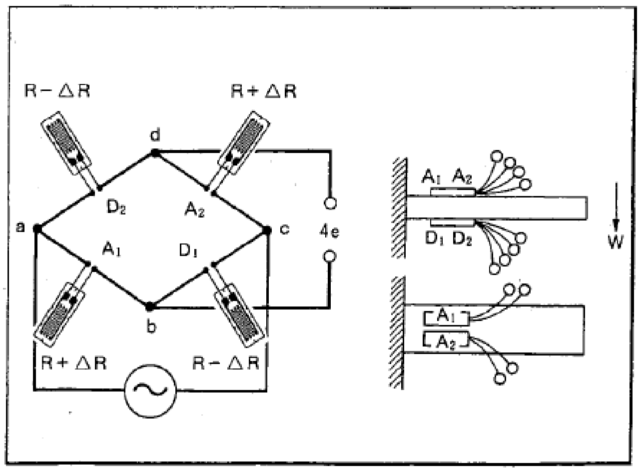
① When using 2 strain gages in the arrangement shown in the right, multiply the measurement value ε0 by 1/2.

$$\varepsilon = \frac{\varepsilon_0}{2}$$

$$\sigma = E \times \varepsilon = \frac{\varepsilon_0}{4} \times E$$



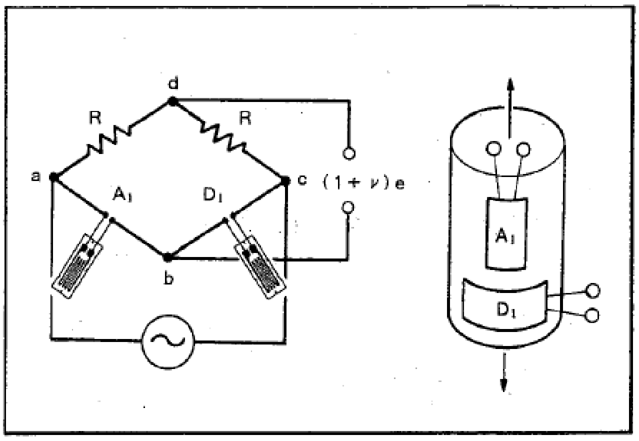
② When using 4 strain gages in the arrangement shown in the right, multiply the measurement value ε0 by 1/4.



$$\varepsilon = \frac{\varepsilon_0}{(1+\nu)}$$

$$\sigma = E \times \varepsilon = \frac{\varepsilon_0}{(1+\nu)} \bullet E$$

(2) When using active gage (A) and dummy gage[*16] (D), which is at a right angle to the former



① When using 2 strain gages in the arrangement shown in the right

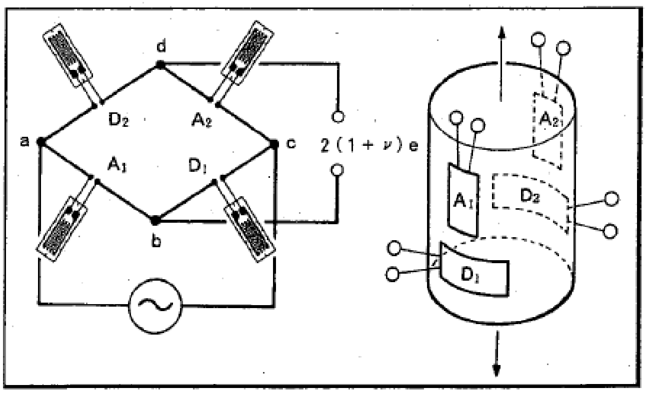
Multiply ε_0, a measured value, by $\frac{1}{(1+\nu)}$

$$\varepsilon = \frac{\varepsilon_0}{(1+\nu)}$$

$$\sigma = E \times \varepsilon = \frac{\varepsilon_0}{(1+\nu)} \bullet E$$

where, ν: Poisson's ratio

② When using 4 strain gages in the arrangement shown in the right



Multiply ε_0, a measured value, by $\frac{1}{2(1+\nu)}$

$$\varepsilon = \frac{\varepsilon_0}{2(1+\nu)}$$

$$\sigma = E \times \varepsilon = \frac{\varepsilon_0}{2(1+\nu)} \bullet E$$

9-2-3 When using strain gage having gage factor other than 2.00

Correct measured values, using the following equation.

$$\varepsilon = \frac{2.00}{K_s} \times \varepsilon_0$$

$$\sigma = E \times \varepsilon = \frac{2.00}{K_s} \times \varepsilon_0 \bullet E$$

where, K_s: The gage factor of a gage in use

9-2-4 Calculating Methods Applicable to Strain Gage Transducer

A strain gage transducer measures a physical variable such as load, pressure, torque, displacement, acceleration or other after conversion into electric signals through strain gages. The CDV/CDA-900A is designed to measure strains. The amount of a measured strain has to be converted into a physical quantity by using the calibration factor or the rated output stated in the Test Data Sheet of a strain gage transducer.

(1) Calculating method using a calibration factor
Multiply the amount of strain obtained using the strain gage transducer by the calibration stated in the Test Data Sheet of the strain gage transducer to obtain the desired physical quantity.

[Example]

Suppose that a measurement of 2900 μm/m was obtained using a load cell with capacity of 2tf (19.6133kN) and calibration factor of 0.0004997tf (0.0049N)/μm/m. A load given to this load cell can be calculated as follows.

$$0.0004997 \times 2900 = 1.44913 \text{ [tf]}$$

(2) Calculating method using a rated output
An output value (or a rated output or output voltage sensitivity) against a rated load is stated in the Test Data Sheet of a strain gage transducer. The following examples show how to obtain the reading of a physical quantity given to a strain gage transducer through adjusting the stated rated output as well as the dynamic strain amplifiers' calibration factor and output.

[Example]

Using the combination of: PG-5KU pressure transducer with capacity of 5kgf/cm^2 and rated output of 3993 μm/m.
Set the $\boxed{\text{CAL}}$ switch of the CDV/CDA-900A to 3993 μm/m or set the $\boxed{\text{VOLTAGE OUT}}$ switch to output 5.000 V. Press the $\boxed{\text{SET}}$ switch twice to set the internal gain. After that, apply pressure to the transducer 5.000 V will come to correspond to 5kgf/cm^2.

[Example]

Using the combination of: AS-20GA acceleration transducer with capacity of 20G (196m/s^2) and rated output of 850 μm/m and the CDV/CDA-900A.
Set the $\boxed{\text{CAL}}$ switch of the CDV/CDA-900A to 850 μm/m, set the $\boxed{\text{VOLTAGE OUT}}$ switch to 10.00 V and press the $\boxed{\text{SET}}$ switch twice to set the internal gain. Then 10.00 V will come to correspond to 20 G.
Suppose a recording meter is used. If calibration signal of 850 με is entered, adjust the vibration width of the recording sheet to have 20 mm or 200 mm. Then, the amount of the vibration width will come to correspond to 20 G.

9-2-5 Correction Required when an Extension Cable was Used

Indoor measurement seldom requires an extension cable. By contrast, for outdoor measurement the CDV/CDA-900A has to be remote from a measuring point on occasions. If such is the case, place a bridge box nearby a measuring point, then connect a bridge box to the CDV/CDA-900A using an extension cable. Note that a measurement thus obtained inevitably contains an error due to an extension cable. The longer an extension cable is used, the larger a measurement error grows. In order to remove this error, multiply a measured value by a suitable correction factor stated in the following table.
In addition, this correction method will not be free from a certain amount of error inducible to the kind of an extension cable and the ambient temperature.

Correction factor when using the extension cable with the CDV-900A

Extension cable / Bridge resistance	5 m	25 m	50 m	75 m	100 m	200 m
120 ohm	1. 003	1. 015	1. 030	1. 045	1. 058	1. 116
350 ohm	1. 001	1. 005	1. 010	1. 015	1. 020	1. 040

MEMO

Shown in the above tables are correction factors applicable to the KYOWA extension cable (0.5 mm^2, 4-conductor shielded cabtire cable) that is described in "6-3. EXTENSION CABLE N".

9-3. TROUBLE SHOOTING

The CDV/CDA-900A provides several error indications.
The error indication, status at that time, and remedies are described in the following table. If any error indication appears on the monitor, check the following table for remedies.

Error message	Displayed Timing	Status	Remedy
Er-bu	When turning ON the CDV-900A.	The bridge excitation voltage is OFF in the STRAIN MODE.	① Re-set the bridge excitation voltage. ② Set the measuring mode to the DC AMP MODE.
Er-bc	When turning ON the CDA-900A.	The excitation current is OFF in the STRAIN MODE.	① Re-set the excitation current. ② Set the measuring mode to the DC AMP MODE.
Er--rS	When measuring data (remote sensing: AUTO)	The remote sensing cable is too long.	Set the remote sensing to the "ALWAYS ON" on the user-specified registration function.
Er-SEnSor	After executing the bridge resistance check	① No sensor connected. ② Not-applicable sensor connected. ③ A cable is breaking.	① Connect a sensor. ② Connect an applicable sensor. ③ Repair the cable or replace the cable with a new one.
Er-CAL-Hi o-Lo	After setting the internal gain (NORMAL MODE)	Minimum internal gain (less than ×200) is set.	Decrease the setting value of the CAL switch or increase the setting value of the VOLTAGE OUT switch and set the internal gain again.
Er-CAL-Lo o-Hi	After setting the internal gain (NORMAL MODE)	Maximum internal gain (higher than ×10000) is set.	Increase the setting value of the CAL switch or decrease the setting value of the VOLTAGE OUT switch and set the internal gain again.
Er-TEdS	After setting the internal gain (TEDS MODE)	①TEDS-installed sensor is not connected. ②TEDS information cannot be read. (Cable is broken or the sensor is faulty.)	①Connect the TEDS-installed sensor. ② Repair the cable or replace the sensor with a new one.
Er--o-Lo	After setting the internal gain (TEDS MODE)	Minimum internal gain (less than ×200) is set.	Enlarge the setting value of the VOLTAGE OUT switch and set the internal gain again.
Er--o-Hi	After setting the internal gain (TEDS MODE)	Maximum internal gain (higher than ×10000) is set.	Smaller the setting value of the VOLTAGE OUT switch and set the internal gain again.
Er-AL-Hi o-Lo	After setting the internal gain (ACTL LOAD MODE)	Minimum internal gain (less than ×200) is set. Input strain is too large.	Enlarge the setting value of the VOLTAGE OUT switch and set the internal gain again. Smaller the input strain.
Er-AL-Lo o-Hi	After setting the internal gain (ACTL LOAD MODE)	The internal gain is larger than ×10000.	Smaller the setting value of the VOLTAGE OUT switch and set the internal gain again.
Er-Lr	After executing the cable-resistance-compensation function	① The bridge resistance is different from the setting. ② The cable resistance is exceeding the measuring range.	① Check the bridge resistance for re-setting. ② Replace the cable for re-setting.

Contact KYOWA or our representatives even if the error indication appears after executing the remedies.

NOTE

If the output voltage of the OUTPUT A or OUTPUT B exceeds ±11V, numbers or characters on the monitor flicker.
If the output voltage becomes within ±11V, numbers or characters on the monitor lights up as usual.

9-4. INTERNAL GAIN AND INPUT STRAIN

【BV=1V】

Internal gain	Switches		Input range [με]		
	CAL [με]	VOLTAGE OUT [V]	Sensitivity Fine Adjustment × 1	to	Sensitivity Fine Adjustment × 1 /2.5
×200	5000	0.50	±100,000	to	±250,000
×2000	5000	5.00	±10,000	to	±25,000
×10000	2000	10.00	±2,000	to	±5,000

【BV=2V】

Internal gain	Switches		Input range [με]		
	CAL [με]	VOLTAGE OUT [V]	Sensitivity Fine Adjustment × 1	to	Sensitivity Fine Adjustment × 1 /2.5
×200	5000	1.00	±50,000	to	±125,000
×2000	5000	10.00	±5,000	to	±12,500
×10000	1000	10.00	±1,000	to	±1,250

【BV=5V】

Internal gain	Switches		Input range [με]		
	CAL [με]	VOLTAGE OUT [V]	Sensitivity Fine Adjustment × 1	to	Sensitivity Fine Adjustment × 1 /2.5
×200	2000	1.00	±20,000	to	±50,000
×2000	2000	10.00	±2,000	to	±5,000
×10000	400	10.00	±400	to	±1,000

【BV=10V】

Internal gain	Switches		Input range [με]		
	CAL [με]	VOLTAGE OUT [V]	Sensitivity Fine Adjustment × 1	to	Sensitivity Fine Adjustment × 1 /2.5
×200	1000	1.00	±10,000	to	±25,000
×2000	1000	10.00	±1,000	to	±2,500
×10000	200	10.00	±200	to	±500

MEMO

With the CDA-900A. the above bridge excitation voltages indicate bridge excitation voltage equivalent values. For details, see "5-1. INPUT."
The larger the VOLTAGE OUT switch, the higher the sensitivity. We recommend you to set the VOLTAGE OUT switch within 1.00 to 10.00.
However, you can widen the input strain range to ±100000 μm/m with the bridge excitation voltage 1 V as described in the above table. Be sure to set the VOLTAGE OUT switch within 00.10 to 10.00 by checking the above table.

10. GLOSSARY

***1 TEDS**

TEDS is an acronym for Transducer Electronic Data Sheet.
It is a table of digitized sensor's information that is held in the transducer. Capable of conducting applicable measurement without manual setting by reading the information with the TEDS-compatible amplifier.

***2 Wheatstone bridge**

A Wheatstone bridge circuit is structured by 4 resistors connecting in series to one another and connecting a power supply and ammeter to 2 opposing connection points, respectively. It is used for detecting minute resistance change except for low resistance.

***3 Quarter bridge system**

It is a measuring system whereby one side of the bridge is formed by a strain gage.

***4 Half bridge system**

It is a measuring system whereby two sides of the bridge are formed by one each strain gage respectively.

***5 Full bridge system**

It is measuring system whereby 4 sides of the bridge are formed by one each strain gage respectively.

***6 Output Impedance**

Impedance seen from the output terminal of an instrument in opening state.

***7 Preheating time**

A time an instrument required to satisfy its all performance specifications after it is turned ON.

***8 Unbalanced component**

Volts that are generated due to the resistive and capacitive deviations of a strain gage bridge.

***9 Balancing range**

A range within which a strain gage bridge's resistive and capacitive deviations can be corrected. The resistive balancing range is expressed by a percentage to gage resistance, and the capacitive balancing range, by a capacitive value.

***10 Sensitivity**

An output against a strain input under the specified condition.

***11 Gage factor Ks**

The ratio of a change in gage resistance to a change in the amount of a strain applied to a strain gage. Generally, it is 2 for metal-wire strain gages.

***12 Bridge excitation voltage**

The voltage or a power source, AC or DC, connected to a Wheatstone bridge. The higher a bridge excitation voltage, the larger a Wheatstone bridge's output voltage grows. A bridge excitation voltage should, therefore, be decided according to the kind of a measuring object and that of a strain gage.

***13 Bridge excitation current**

A current of power supplied to a Wheatstone bridge. Since the current is constant current, if the cable resistance increases, the current and voltage, applied to the transducer, is stable. Changes of cable resistance, due to cable extension, do not affect the voltage applied to the transducer. However, compensate the bridge resistance when the bridge resistance is different from the nominal bridge resistance.

***14 Remote sensing**

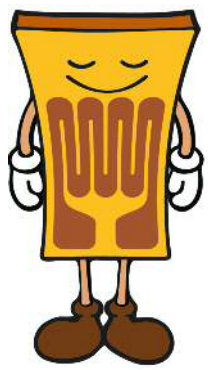
When executing precision measurements, bridge excitation voltage will be stabilized by compensating errors due to conductor resistances of long extension cables and ambient temperature changes.

***15 Active gage**

A gage which is bonded to the strain generating area of a measuring object.

***16 Dummy gage**

This type of gage acts merely as a resistor, i.e. a constituent element of a gage bridge.



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