KYOWA ELECTRONIC INSTRUMENTS CO., LTD.

IM-A-736 September 2009

DYNAMIC STRAIN AMPLIFIER

DPM-900A SERIES

INSTRUCTION MANUAL

Thank you for purchasing KYOWA's product DPM-900A series Dynamic Strain Amplifier.
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.

CONTENTS

STANDARD ACCESSORIES

The DPM-900A series Dynamic Strain Amplifier (hereinafter referred to as the DPM-900A series) comes with the following accessories. After unpacking, check to be sure that they are included.

Instruction Manual	1
Simplified instruction manual seal	1
AC power cable (P-25)	1
2-pin conversion plug (CM-33)	1
BNC cable (U-59 and U-08)	1 each
Fusses, midget type (1 A and 0.5 A)	1 each
Warranty and Test Data Sheet	1 each

SAFETY PRECAUTIONS

The DPM-900A series is designed in accordance with “8. SPECIFICATIONS.” Do not use the DPM-900A series in an environment exceeding the specifications. Or, failure of the DPM-900A series may result.

PRIOR TO USE

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

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

SAFETY SYMBOLS

For safety operation of the DPM-900A series, 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.

⚠ 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 DPM-900A series.
- **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 DPM-900A series with the DPM-900A series 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 DPM-900A series 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.
- **Confirmation of Protective Ground**
  To prevent an electric shock hazard, if any abnormal matters are found in the protective ground function, fuse holder, etc., do not operate the DPM-900A series. In addition, be sure to check safe protective ground function before operating the DPM-900A series.
- **External Connection**
  To prevent an electric shock hazard, ensure the safe protective ground of all concerned instrument and then, connect the DPM-900A series to the measuring object and external devices, PC, etc.
- **Fuse**
  To prevent a fire hazard, be sure to use a fuse providing the same rating (current, voltage, type) as specified for the DPM-900A series.
  Do not use any fuse other than specified. Do not short-circuit the fuse holder.
  Before replacing the fuse, disconnect the power cable from the wall outlet in advance.
- **Inflammable Gaseous Environment**
  To prevent fire and explosion hazards, do not operate the DPM-900A series where it is exposed to inflammable gases, inflammable vapors or inflammable dust.
- **If Any Trouble Occurs**
  To prevent a fire hazard, if smoke is emitted from the DPM-900A series, immediately disconnect the AC adapter from the receptacle and stop using the DPM-900A series.
- **Maximum Input Voltage Range**
  The DPM-900A series is a measuring instrument specified for strain gage transducers and strain gages. Do not input high voltage. Or, deteriorated performance and damage of the product may result.

⚠ 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 DPM-900A series' reliable function may not be guaranteed.
- **Do not use the DPM-900A series under excessively high/low temperature.**
  Use the DPM-900A series 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 DPM-900A series 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 DPM-900A series if operating environment changes abruptly.**
  Leave the DPM-900A series 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 DPM-900A series under dusty environment.**
  If dust is entered into the DPM-900A series, performance of the DPM-900A series may become deteriorated. Be sure to keep away from dust not only when operating but also storage.
- **Take care when operating the DPM-900A series at a location with excessive vibration.**
  If excessive vibration is applied to the DPM-900A series, performance of the DPM-900A series may become deteriorated.
  Adopt vibration-proof measures such as shock absorber, etc.
- **Do not use the DPM-900A series under poor power condition.**
  When using the AC power cable, use the DPM-900A series with 90 to 110 VAC, 50/60 Hz.
  Use the DPM-900A series in an environment without instantaneous voltage drop or interfering noise.
- **When using the DC power supply, handle the DPM-900A series 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 unreasonable force is applied to the connections. Pulling or applying unreasonable force may cause trouble or interrupt the measurement.
- **Preheat the DPM-900A series before use.**
  Preheat the DPM-900A series for about 30 to 60 minutes after the power ON.

NOTATION 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 "10^{-6} strain" 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 handling the DPM-900A series and to information provided for reference purpose.

Examples of Notations

NOTE

Essential precautions required when handling the DPM-900A series.

MEMO

Reference items required when handling the DPM-900A series.

1. PRODUCT OUTLINE

1-1 PRODUCT OUTLINE

The DPM-900A series is a strain amplifier that incorporates an AC excitation voltage. When compared to a DC type strain amplifier, the DPM-900A series generally marks high stability, sensitivity and lower noise. In addition to these, the DPM-900A series provides unique features as follows.

Features

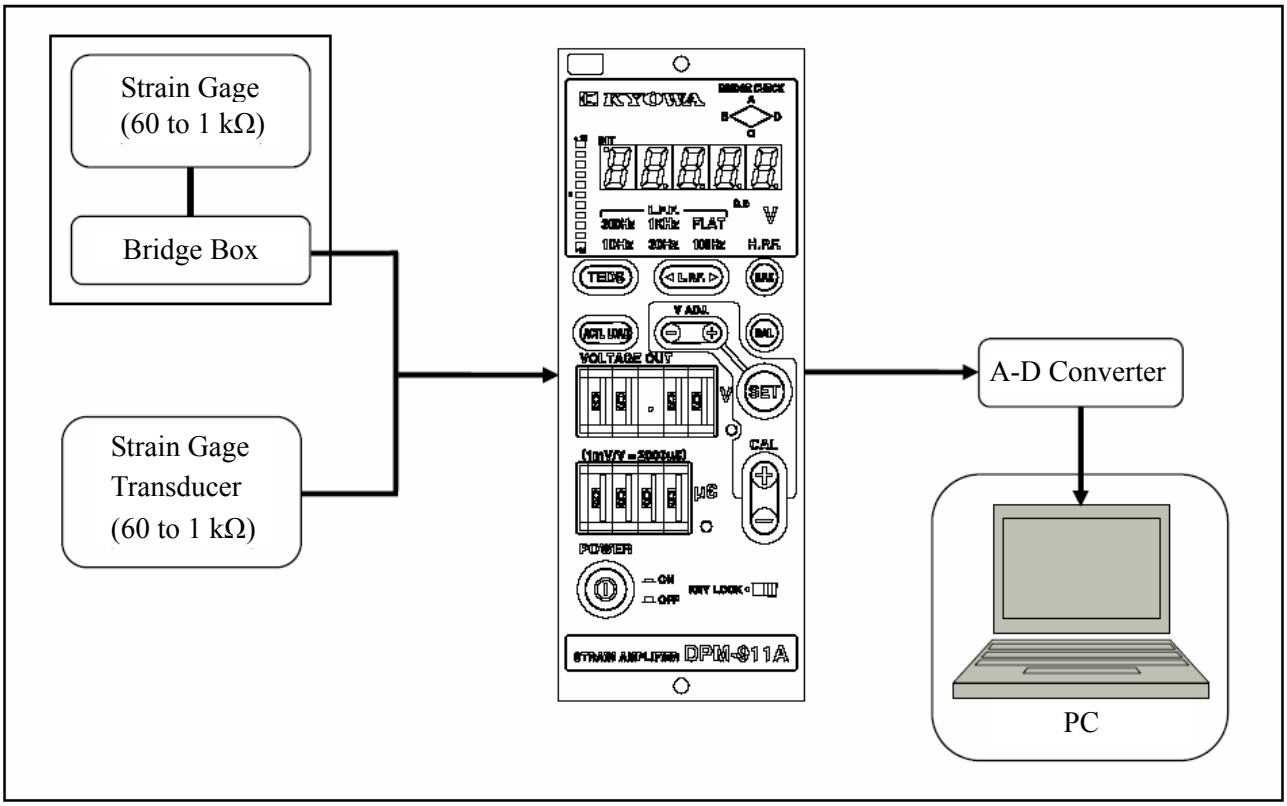
- Easy setting
  Just set input strain and output voltage at the time.
- Light weight
  Approximately 15% lighter than the conventional amplifier.
- Monitor and bar graph meter are standard provision.
  Not only static strain but also dynamic strain signal can be monitored.
- High output
  The rated output is ±10 V (twice of the conventional amplifier).
- High stability
  Noise is reduced to approximately 1/2 of the conventional 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.
- ACTL LOAD function
  The internal gain can be set with the actual load or external calibrator by pressing the ACTL MODE switch.
- Bridge check function
  This function checks breaking of wires in the strain gage bridge, and the monitor indicates which wires are broken.

MEMO

The conventional amplifier is DPM-700B series.
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 function" and "5-7-3 Setting Internal Gain with ACTL LOAD."

1-2 SYSTEM CONFIGURATION

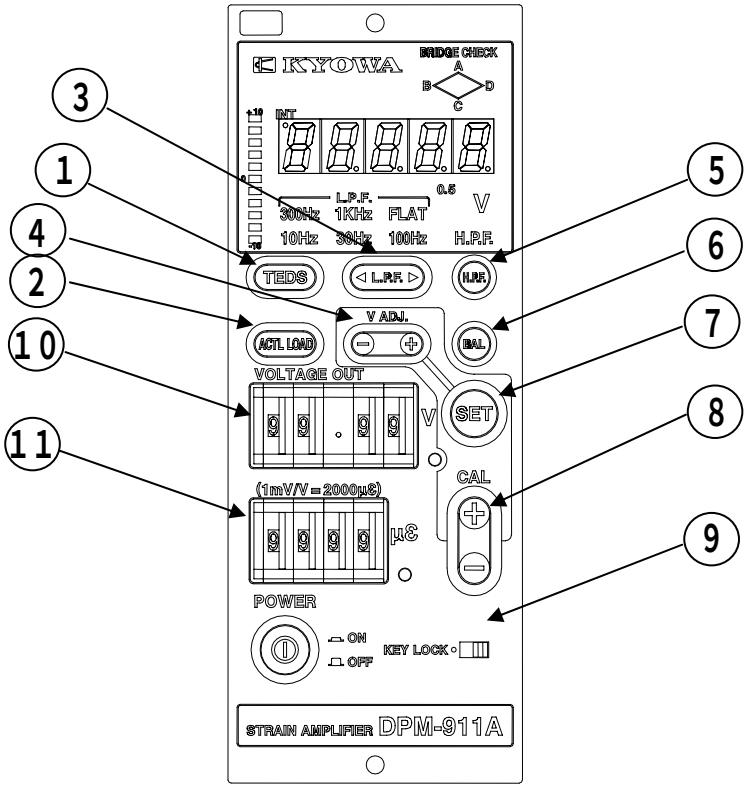
This section describes a general system configuration when using the DPM-900A series for measurement.



The DPM-900A series 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 bride box is used generally.
The DPM-900A series 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 DPM-900A series directly to a recorder or a voltmeter.
To measure a strain converted in electric signals, a calibration signal is used. The DPM-900A series 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 applications, see "9. Appendix."

2. PARTS AND FUNCTIONS

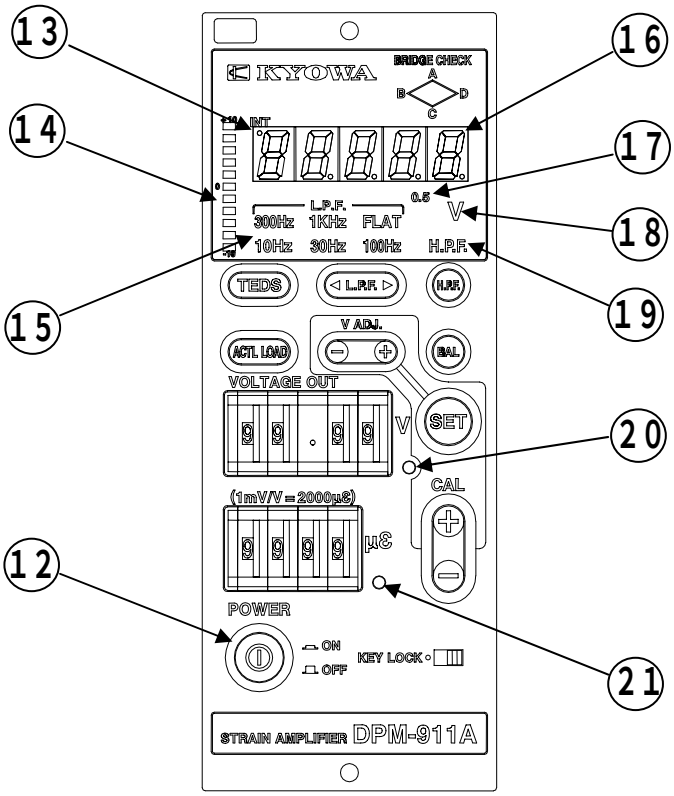
2-1 FRONT PANEL



①	TEDS switch	Press and hold the TEDS switch. The TEDS switch lights up in blue, the setting mode becomes TEDS mode.
②	ACTL 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.
③	L.P.F. switch	Changes a cutoff frequency of the low-pass filter. ◁ changes to a smaller one ▷ changes to a larger one (10 Hz ↔ 30 Hz ↔ 100 Hz ↔ 300 Hz ↔ 1 kHz ↔ FLAT)
④	V 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.
⑤	H.P.F. switch	Changes valid or invalid of the H.P F. When the H.P.F is valid, the H.P.F (Next page ⑲) lights up.
⑥	BAL switch	Press the BAL switch twice for balancing. Press and hold the BAL switch for disconnection check of the bridge.
⑦	SET switch	Set the VOLTAGE OUT and CAL switches. Press the SET switch twice to set the internal gain of the DPM-900A series.
⑧	CAL ON switch	+: Adds + calibration signal that is set to the CAL ON switch to the output. -: Adds - calibration signal that is set to the CAL ON switch to the output.
⑨	KEY LOCK switch	Set the KEY LOCK switch to left for prohibiting operations other than POWER switch.
⑩	VOLTAGE OUT switch	For setting the output voltage.
⑪	CAL switch	For setting the input strain 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.

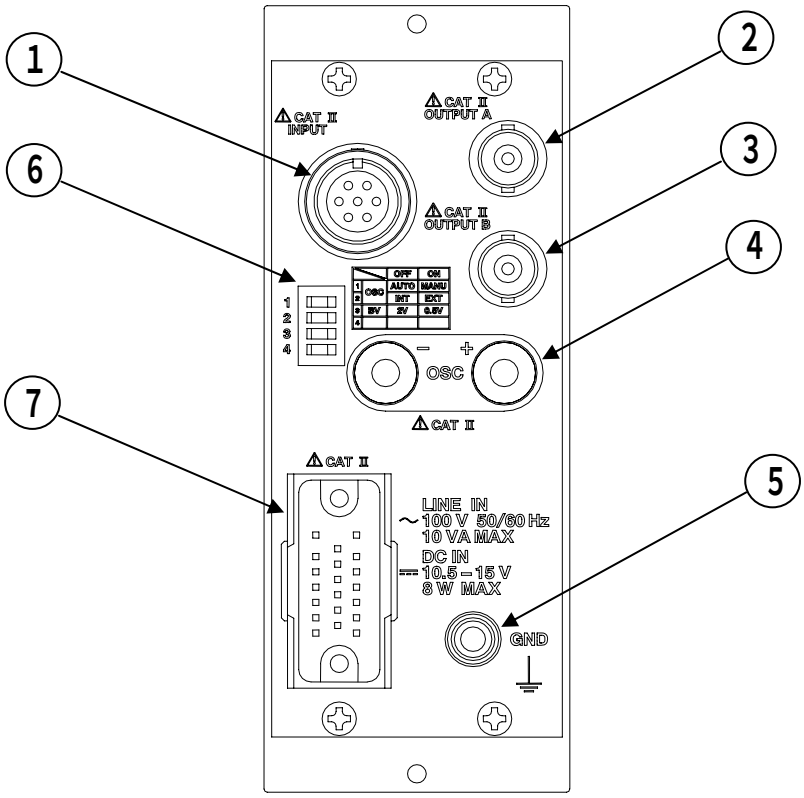


⑫	POWER switch	POWER ON/OFF Press the POWER switch for turned ON and press again for turned OFF.
⑬	INT lamp	Lights up when using the internal oscillator output for the excitation voltage of the DPM-900A series as the carrier.
⑭	Bar graph meter	Indicates an output voltage by the length of the bar. One LED segment corresponds to 2 V. When the internal gain is fine adjusted to lower than ×200, 0 (orange LED) flickers. For details, see "4-6-5 Sensitivity Fine Adjustment."
⑮	L.P.F. lamp	Displays the cutoff frequency of the L.P.F.
⑯	Monitor	Indicates the output voltage of the OUTPUT A and B in general. In addition, indicates the physical quantity in TEDS mode and error content in error mode.
⑰	BV 0.5 V lamp	When outputting 0.5 Vrms excitation voltage, the BV 0.5 V lamp lights up and when outputting 2 Vrms excitation voltage, the BV 0.5 V lamp lights out.
⑱	V lamp	Lights up when displaying voltage on the monitor. Lights out only in the TEDS mode.
⑲	H.P.F. lamp	Lights up when the H.P.F switch is set to valid. When invalid, the H.P.F. lights out.
⑳	VOLTAGE OUT lamp	Lights up after setting the internal gain correctly. After setting the internal gain, if the set value of the VOLTAGE OUT switch is changed, the VOLTAGE OUT lamp flickers.
㉑	CAL lamp	Lights up after setting the internal gain correctly. After setting the internal gain, if the set value of the VOLTAGE OUT switch is changed, the CAL lamp flickers. Lights out when in 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.

NOTE

Internal gain: Gain from the input to the output of the DPM-900A series.
Capable of setting the internal gain within ×200 to ×20000.
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	OSC terminal	Terminal for OSC (internal oscillator) input/output Used for synchronous operation of multiple DPM-900A series units through cascade connection of [+] and [-].
⑤	GND terminal	GND terminal It is connected internally to the common electric potential of the circuitry.
⑥	Setting switch	Used for selecting the oscillator (AUTO/MANU, INT/EXT) and excitation voltage (0.5 Vrms/2 Vrms). Always set the Setting switch 4 to OFF. For details of the setting method, see “5-11 OSC SYNCHRONIZATION” and “5-14 EXCITATION VOLTAGE.”
⑦	Centralized connector	For connecting the power cable in general. When the DPM-900A series are housed in the carrying case, it enables to connect them with certain control signals.

3. PREPARATION

This chapter describes necessary preparation before turning ON the power and how to use a single unit of DPM-900A series.
For how to use multiple units (channels) housed in the exclusive carrying cases, also read “6-5 EXCLUSIVE CARRYING CASE.”

3-1 HOW TO SET UP INPUT/OUTPUT INSTRUMENTS

When measuring strain with the DPM-900A series, connect input signal, output instrument and power to the DPM-900A series. 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 by referring to “6-1 BRIDGE BOX.”

3-1-2 Output Instrument

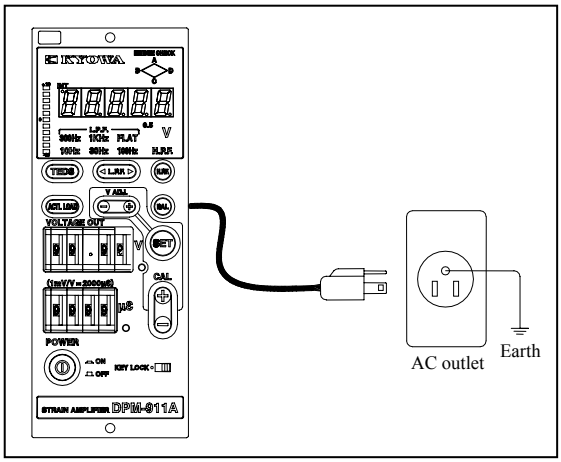
Output instrument is a voltmeter with input impedance 5 kΩ or more or recorder. Requires for reading the amplified strain signal.
The DPM-900A series is provided with a digital panel meter which lets you voltmeter its out. Connect the output instrument to the DPM-900A series using the output cable, and accessory.
For the connection with the output instrument, see “4-2 CONNECTION OF OUTPUT” and “5-2 OUTPUT.”

3-2 CONNECTION OF POWER

The DPM-900A series requires AC or DC power.
In either case, make sure of the power voltage prior to connection.

3-2-1 AC Power

Use the accessory power cable and connect the DPM-900A series to an AC power outlet 100 VAC.
When using the DPM-900A series other than 100 VAC, contact KYOWA or our representatives.

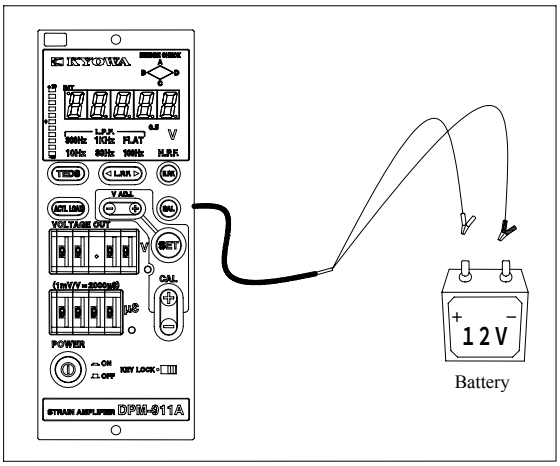


NOTE

Ground the middle prong of the three-prong plug without fail.

3-2-2 DC Power

A DC power in a voltage range of 10.5 V to 15 V, or a battery is connectable.
A DC power cable is not attached to the DPM-900A series. Therefore prepare a connector plug (HIROSE ELECTRIC’s S-1260-C or the equivalent)and use it as shown at right.
For connection to the DC power, see “5-12 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 amplifier to a power source using the accessory AC power cable (3-prong). The grounding will then be carried out automatically.

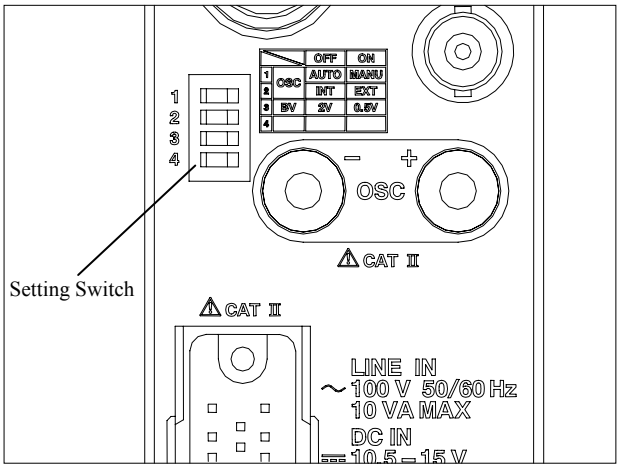
- L = Line
- N = Neutral
- E = Earth

NOTE

When using the accessory 3-prong to 2-prong conversion adapter (CM-33), be sure to ground its earth terminal (green).

3-3 INITIAL SETTING

Set all setting switches 1 to 4 to OFF.



MEMO

Note that setting switch 1 is not necessarily to set to OFF when operating multiple DPM-900A series at a time.
Read “5-11 OSC SYNCHRONOUS.”

NOTE

Always set the setting switch 4 to OFF.

4. BASIC OPERATION

This chapter describes the basic operation of the DPM-900A series.
The instructions given in this chapter is related to the usage of a single unit.

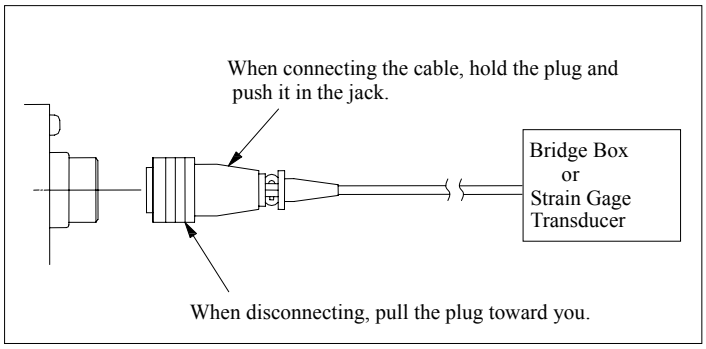
MEMO

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

4-1 CONNECTION OF INPUT

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

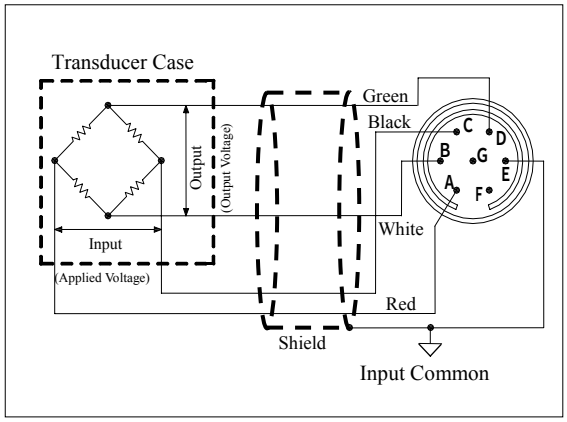
If one end of the connection cable of a strain gage transducer is formed by a NDIS connector, inset it into the INPUT connector directly as shown at right.



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**
See "6-1 BRIDGE BOX."

2) **When connecting the strain gage to the plug in advance**
A connection method is shown in the right. The plug is NDIS connector PRC03-12A10 (TAJIMI MUSEN).
For connection of a strain gage, a bridge box of full bridge method[*5] can be conveniently used.

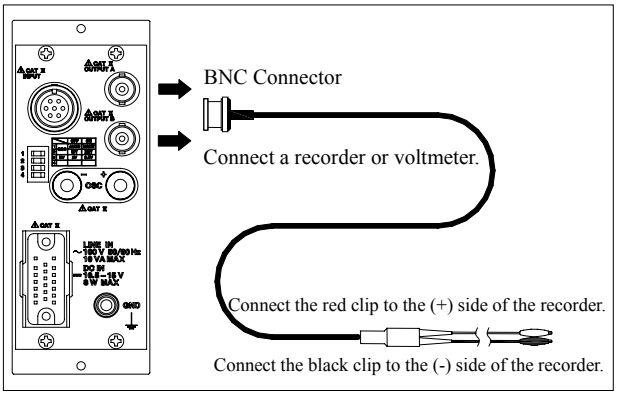


MEMO

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

4-2 CONNECTION OF OUTPUT

The DPM-900A series 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 plug. Use the accessory output cable to connect an external instrument. The output impedance[*6] is rated at about 2 Ω on either terminal.

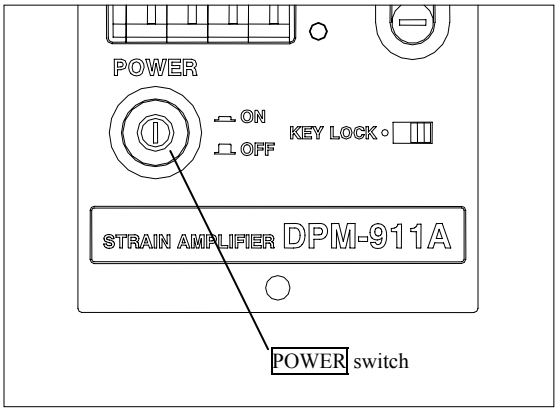


4-3 TURNING ON AND OFF THE POWER

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.



MEMO

For connection, read the following.
"3-1 SETTING UP INPUT/OUTPUT INSTRUMENT"
"4-1 CONNECTION OF INPUT"
"4-2 CONNECTION OF OUTOUT"

Press the POWER switch until it clicks.
At this time, all LEDs illuminate for about 1 second. After that, measuring conditions are set and the DPM-900A series become measuring state.

NOTE

After turning ON the power, be sure to bridge check the DPM-900A series before measurement. For details, see "5-4 BRIDGE CHECK."
If Er-1 appears after illumination of all LEDs, it is the indication of abnormality that has occurs to the control program. If such is the case, contact KYOWA or out representatives.

4-3-2 Turning OFF the Power

Press the POWER switch.
All indications disappear.

NOTE

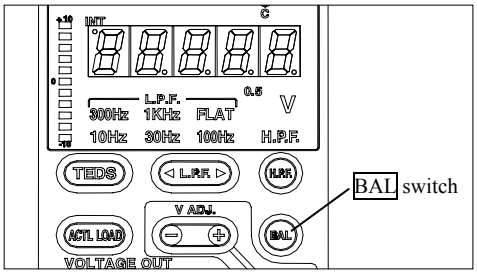
The DPM-900A series maintains all measuring parameters in its internal nonvolatile memory all the time.
However, saving of parameters may fail if the power is turned OFF immediately after the renewal. To prevent it, after conducting the zero adjustment, sensitivity fine adjustment, changing LPF setting or HPF 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 DPM-900A series provides “Normal Mode”, “TEDS Mode” and “ACTL LOAD Mode.” Setting methods of the internal gain and display unit of the indication varies with every mode.
Every time the TEDS and ACTL LOAD switches are pressed and hold, the switches light up and out.
The TEDS switch lights up during the TEDS mode, the ACTL LOAD switch lights up during the ACTL LOAD mode, and neither of switch light out during the normal mode.
For the setting methods of the internal gain, see “5-7 INTERNAL GAIN.”

4-5 BASIC BALANCING

The DPM-900A series performs balancing completely electronically.
Make sure that input signals are connected, and then push the BAL switch twice.
Balancing will then be carried out irrespective of the setting conditions of other parameters.



MEMO

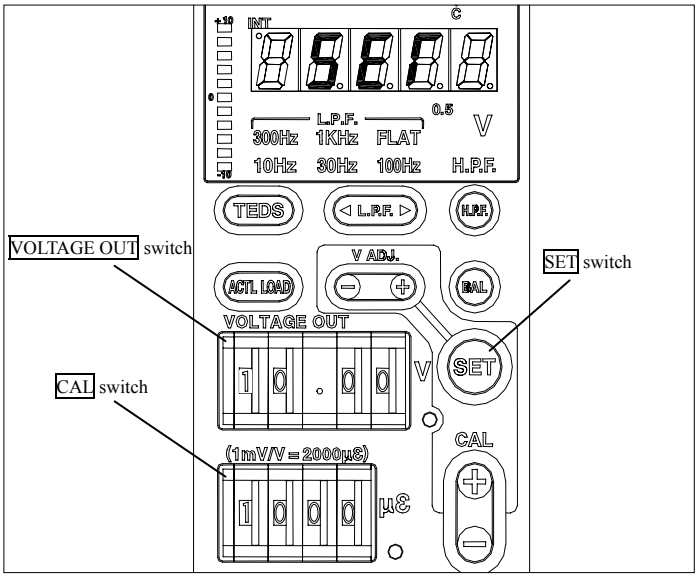
After balancing is executed, the panel meter will not necessarily read exactly 0 but several mV remains.
Carry out fine balancing by using the V ADJ. key if necessary.
Press and hold is an operation for continuously pressing the switch for 0.5 seconds or more. Press twice is an operation to press the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

4-6 SETTING MEASURING PARAMETERS

This section describes how to set the measuring parameters of the DPM-900A series.

4-6-1 Setting an Basic Internal Gain

It is necessary to set an internal gain (sensitivity[*10]) properly to assure the correct strain measuring.
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 the 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 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

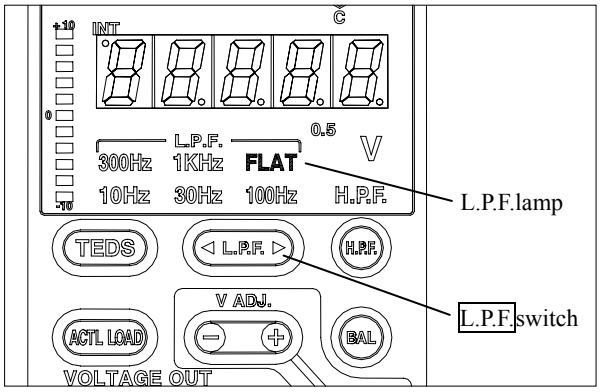
After setting the internal gain, Er-○○○ appears without appearing SEr to the monitor, read "9-4 TROUBLESHOOTING."
After connecting or changing the sensor, be sure to bridge check the DPM-900A series before setting the internal gain.
Set the VOLTAGE OUT switch from 1.00 to 10.00.

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 SETTING INTERNAL GAIN."

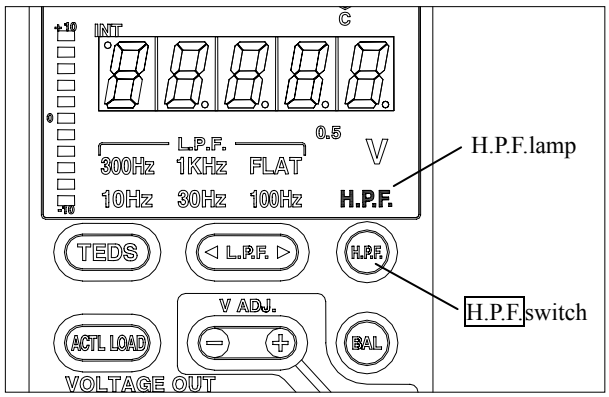
4-6-2 Setting Low-pass Filter

The low-pass filter is used for setting limits to the frequency range of outgoing signals normally.
For not limiting the frequency range, set the filter to "FLAT," thereby inactivating the filtering function.
Press the ◁ or ▷ of the L.P.F. switch to set a target L.P.F. lamp.
For details, read "5-8 LOW-PASS FILTER" and "9-2 LOW-PASS FILTER CHARACTERISTICS."



4-6-3 Setting High-pass Filter

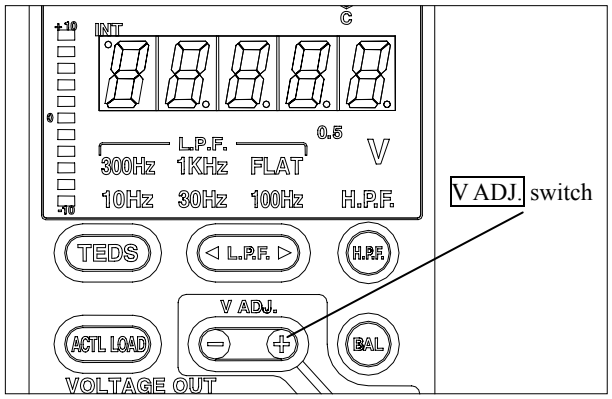
The high-pass filter is used for eliminating the DC component of outgoing signals normally.
As a routine, it is not necessary to set.
Press and hold the H.P.F. switch for valid.
Press again for invalid.
When the H.P.F. is valid, the H.P.F. lamp lights up and the cutoff frequency of that time is 0.2 Hz.
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 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.

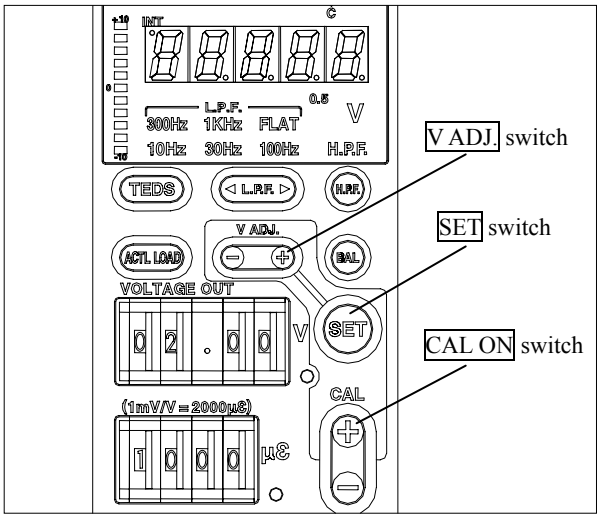
4-6-4 Zero Point Fine Adjustment



Capable of fine adjusting the output of OUTPUT A and OUTPUT B. It is convenient for moving the baseline of the external equipments, 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 ±50 mV from the balance adjusted value.

4-6-5 Sensitivity Fine Adjustment

Capable of fine adjusting the preset internal gain.
Either of the following 2 methods can be used for the sensitivity fine adjustment.
Basically, use the item 1) method. It is convenient to use the item 2) method for ACTL LOAD mode.



1) Sensitivity fine adjustment by 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 DPM-900A series is ×200 to ×20000. For details, see "5-7 INTERNAL GAIN."
Capable of adjusting the internal gain within the range of ×80 to ×20000 by conducting the sensitivity fine adjustment.
When the internal gain lowers ×200, 0 (orange LED) of the bar graph meter flickers.
However, when the internal gain lowers ×200, specifications related to the performance is not guaranteed.

5 FUNCTIONS

This chapter describes all the DPM-900A series functions in detail as well as advanced usage.

5-1 INPUT

The DPM-900A series is designed exclusively for measuring strain. The connectable sensors are as follows.

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

- Strain gage transducer
  For how to connect the strain gage transducer, see "4-1 CONNECTION OF INPUT."

NOTE

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

When setting the minimum internal gain at excitation voltage 2 Vrms, the maximum input is approximately $\pm 50000 \times 10^{-6}$. In addition, it is capable of inputting approximately up to $\pm 130000 \times 10^{-6}$ by conducting the sensitivity fine adjustment. However, the sensitivity at that time is not guaranteed.

The maximum output of the DPM-900A series is ±10 V. Where a large amount of strain is input and exceeds the allowable range of the maximum output, the indication on the panel meter blinks. If it occurred, decrease the internal gain till the indication stops blinking.

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

5-2 OUPTUT

The DPM-900A series 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 5 kΩ.
The zero level of the OUTPUT A and B can be adjusted using the zero adjustment.
In addition, the zero output and zero point of the OUTPUT A and OUTPUT B cannot be adjusted separately.

5-3 PREHEATING

When once the DPM-900A series has been turned ON, it will be ready for operation immediately. Note that the internal electrical parts and semiconductors cannot acquire the thermal stability immediately after switching the power ON. Unless the OSC circuit, especially reaches the thermal stability, a change in the sensitivity or a drift of the zero point can be changed. Carry out preheating[*7] for about 30 to 60 minutes for stable measurement.

5-4 BRIDGE CHECK

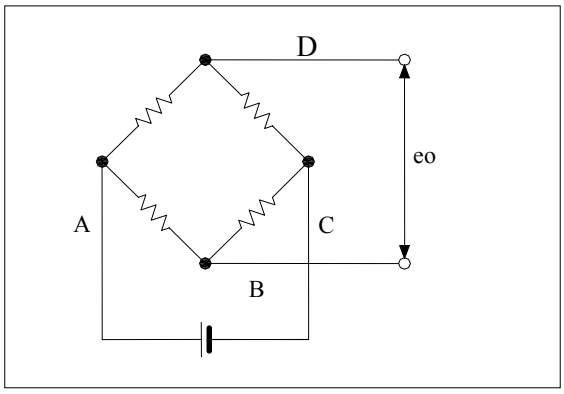
The DPM-900A series provides a bridge-check function. This function is used to check cable breaking on the whole input system, including the input cable and connector.

Press and hold the BAL switch to conduct the bridge check.
The result of the check is indicated on the panel meter.
This indication is maintained while pressing the BAL switch.
If an indication other than Good appears, check and remove the cause from the input system, including the wiring to and from the sensor.
Otherwise, a correct measurement cannot be carried out.
To remove the cause, act as follows.
First, turn OFF the power, and then remove the sensor cable from the input connector. After that, carry out a check on cable breaking.

NOTE

If the breaking exists in the input cable, correct measurement cannot be conducted.
When connecting sensor to the input or changing the sensors, be sure to bridge check and set the internal gain.
Be sure to turn OFF the DPM-900A series before checking and mending the error.

As a matter of convenience, the wirings to the bridge are named as shown in the figure in the right. If error is found Wiring A through the bridge check function, Er-a will appear on the panel meter. Even if error exists on two wirings, the name of only one wiring will be shown. Therefore, check wirings one after another as follows. To begin with, check the wiring whose name is on the monitor to remove the cause. After that, press and hold the BAL switch again, and the error indication will then disappear if there is no more error. If another or other wirings are in error, the name of the next wiring will be shown by Er-b, Er-c, Er-d, one each at a time. Check the sensor and the indication wiring to the sensor, then remove the cause of error one by one so that no error indication will appear finally. For the relation between locations of error and error indications, see "9-1 BRIDGE CHECK FUNCTION AND RESULT INDICATION." The result of bridge check is available as bridge status signals at the converging connector on the rear panel. For details, see "5-12 CENTRALIZED CONNECTOR."



NOTE

Be sure to turn OFF the DPM-900A series before mending the cause.

5-5 BALANCING

Both resistive and capacitive signal components[*8] exist on a strain gage bridge. These unbalance components should be removed through balancing, in order to achieve high quality measurement.

5-5-1 Balancing Range

Resistive unbalance can be reduced to ±2%, i.e. ±10000 μm/m.
Capacitive unbalance can be adjusted up to 2000 pF.
Resistive balancing is carried out by using the BAL switch.
Capacitive unbalance is cancelled all the time by the internal compensation circuit.

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 with in 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 "4-6-4Zero Point Fine Adjustment. "
After pressing the BAL switch, if a large value should appear, it is the indication of some error. Repeat balancing a few times. Should it happen after that, discover the cause by referring to "7-2 INITIAL BALANCING IS IMPOSSIBLE."
Balancing can also be carried out by using the external control signal. For details, see "5-13 REMOTE CONTROL."

NOTE

The CPU controls to minimize remaining voltage during balancing the DPM-900A series. 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 point of OUTPUT A and B can be removed.
This function is conveniently used to move the base line of an external instrument.
For how to move the zero point, see "4-6-4 Zero Point Fine Adjustment."
Zero point adjustment range is about ±50 mV from the balancing 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 LOAD.
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 thereabout against a strain input of 100 μm/m. This means poor precision of measuring.
By contrast, a large internal gain (× 20000) 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.

NOTE

The internal gain setting range of the DPM-900A series is × 200 to × 20000.
If you want to set the internal gain with the CAL either × 200 or × 20000, set the CAL and VOLTAGE OUT switches as follows.

- Internal Gain × 200 : CAL switch "5000", VOLTAGE OUT switch "01.00"
- Internal Gain × 20000: CAL switch "0500", 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" $\times 10^{-6}$)

5-7-1 Setting Internal Gain with the calibration signal

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

- When the measuring target is strain gage

Follows are the setting procedures of the optimum internal gain.

1) Set the DPM-900A series to the normal mode. (When the TEDS or ACTL LOAD switch is lightning up, press and hold the either switch to light out.
2) Connect the strain gage and conduct bridge check.
3) Estimate the amount of the strain to be measured.
4) Set the CAL switch to the estimated amount strain.
5) Set the VOLTAGE OUT switch to the desire voltage value.
6) Press the SET switch twice.
7) Press the BAL switch twice. (The DPM-900A series becomes measuring state after balancing.)
   While correctly setting the internal gain, SEt appears on the monitor.
   When Er- ○○○ appears on the monitor, it indicates the setting error. See the "9-4 TROUBLE SHOOTING.)

NOTE

Set the VOLTAGE OUT switch within the range of "1.00" to "10.00."
When the internal gain is set with the CAL switch set to "0000," oFF appears on the monitor and the voltage out is 0 V fixed regardless of the input. (The same thing happened when the range is set to OFF with the DPM-700B series.)

- When the measuring target is 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 DPM-900A series to the normal mode. (When the TEDS or ACTL LOAD switch is lightening up, press and hold the either switch to light out.)
2) Connect the strain gage transducer and conduct bridge check.
3) Calculate the rated output (μm/m). The rated output at that time is 1567 × 2 = 3134 μm/m
4) Set the CAL switch to "3134."
5) Set the VOLTAGE OUT switch to 10.00 (10.0) voltage.
6) Press the SET switch twice.
7) Press the BAL switch twice. (The DPM-900A series becomes measuring state after balancing.)

While correctly setting the internal gain, SEt appears on the monitor.

When Er- ○○○ appears on the monitor, it is indicating the setting error. See "9-4 TROUBLE SHOOTING."

<u>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.</u>

For example, when using the strain gage transducer with the 20 % of the rated capacity, the rated ouput can be obtained 3134 × 20% =626.8 (μm/m) only. Keep "10.00" of the VOLTAGE OUT switch, set the CAL switch to "0627" and set the internal gain for more accurate measurement.

5-7-2 Setting Internal Gain with TEDS

When the measuring target is the TEDS-installed strain gage transducer, the DPM-900A series can load the TEDS information and set the internal gain easily. TEDS information that is used in the DPM-900A series is the rated output (μm/m) and rated capacity.

Follows are the setting procedures of the optimum internal gain.

1) Set the DPM-900A series to the TEDS mode. (Press and hold the TEDS switch to lights up.)
2) Connect the TEDS-installed strain gaga transducer to the input and conduct bridge check.
3) Set the VOLTAGE OUT switch to the desired voltage.
4) Press the SET switch twice.
5) Press the BAL switch twice. (The DPM-900A series becomes measuring state after balancing.)

While correctly setting the internal gain, rEdS-rEAd appears on the monitor.

When the Er-rEdS appears on the monitor, it is indicating the setting error. See "9-4 TROUBLE SHOOTING."

MEMO

Physical value (converted value from the voltage) is displayed on the monitor in TEDS mode. For displaying the voltage on the monitor, press and hold the TEDS switch to become the normal mode.
(Though the TEDS switch lights out, the setting contents are maintained.)
Pressing the SET switch in TEDS mode appears ○○○○␣ ○○○○.d on the monitor.
Above are the rated output and rated capacity that are set to the DPM-900A series.
For example, when using a TEDS-installed transducer with rated output 3134 μm/m and rated capacity 4678 N. When setting the internal gain with the TEDS, press and hold the SET switch to scroll 3134␣ 4678.d display on the monitor.

5-7-3 Setting Internal Gain with ACTL LOAD

The DPM-900A series can set the internal gain with the ACTL LOAD (actual load). When using an extension cable, set the internal gain with ACTL LOAD for more accurate measurement.

Follows are the setting procedures of the optimum internal gain with the ACTL LOAD.
1) Set the DPM-900A series to the ACTL LOAD mode. (Press and hold the ACTL LOAD switch to lights up.)
2) Connect the strain gage, strain gage transducer, or external calibrator to the input and conduct bridge check.
3) Press the BAL switch twice. (Conduct balance adjustment in no load state.)
4) Input the actual load or strain of the external calibrator.
5) Set the VOLTAGE OUT switch to the desired voltage.
6) Press the SET switch twice.
7) Press the BAL switch twice. (The DPM-900A series becomes measuring state after balancing.)

While correctly setting the internal gain, SEt appears on the monitor.
When the Er-○○○ appears on the monitor, it is indicating the setting error. See "9-4 TROUBLE SHOOTING."

NOTE

Press and hold the SET switch in the ACTL LOAD mode. The ○○○○ scrolls on the monitor. It is the amount of the strain that is input to the DPM-900A series.
When the input strain is 10000 μm/m at the time of internal gain setting, the calibration signal corresponds to the input cannot be set.
Maximum calibration signal is 9999 μm/m.

5-8 LOW-PASS FILTER

The DPM-900A series provides a secondary Butterworth type low-pass filter.
Five cutoff frequencies are provided, including 10, 30, 100, 300 Hz and 1 kHz, in addition to "FLAT."
At the point of a cut-off frequency selected, the amplitude is attenuated by about 70 %.
The cutoff characteristic is rated at -12 dB/Oct. It means that the amplitude attenuates to 1/4 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 the unnecessary high-frequency components from a strain signal.
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 the setting method of the low-pass filter, read "4-6-2 Setting Low-pass Filter."
When strain signals vary in the form of sine wave (sin-functionally), set the low-pass filter to a cut-off frequency from 2 to 5 times larger than the signal frequency or strain signals that are to be measured.
For the characteristic of the low-pass filter, see "9-2 LOW-PASS FILTER."

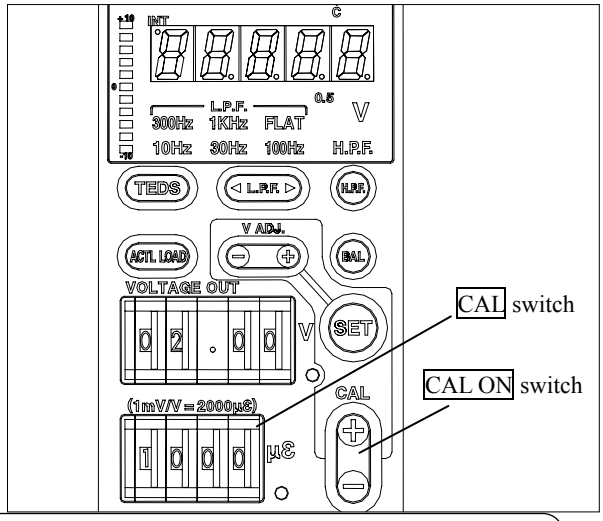
NOTE

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 higher 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.
The calibration value is settable in a range from 1 to 9999 μm/m by an increment or decrement of 1μm/m.
Capable of adding the calibration signal to the output in any mode.

Output adding method of the calibration signal is described in the following.
First, set the target calibration signal to the CAL switch. Press the CAL ON switch. Press + of the CAL ON switch for adding the positive calibration signal, press − for negative calibration signal.
The calibration signal is added to the output while the CAL ON switch is pressed.



MEMO

It is also possible to activate the function using an external control signal.
For details, see "5-13 REMOTE CONTROL."

5-10 KEY-LOCK

The DPM-900A series provides key-lock function. Use the key-lock function in order to prevent the measuring parameters from changing when the keys are touched by mistake.
(Setting methods other than POWER switch become invalid. However, the setting values of the CAL and VOLTAGE OUT switches are changeable.)

To activate the key-lock function, set the key-lock switch to the left position.

MEMO

It is also possible to activate the function by using an external control signal.
For details, see "5-13 REMOTE CONTROL."

5-11 OSC SYNCHRONIZATION

OSC synchronization (carrier[*13] synchronization) is necessary when operating multiple units of the DPM-900A series for simultaneous measurement of strain on multiple measuring points. Carrier synchronization is for prevention of beats[*14] that are caused by difference between carrier frequencies.
When measuring strains with the OSC synchronization, set any one of the DPM-900A series as the master (use the internal OSC) and set others as slaves (use the external OSC).
Capable of setting whether to use the internal OSC or external OSC by the setting switches 1 and 2 on the rear panel.

- When automatically determining (AUTO) the internal or external
  When the setting switch 1 is set to OFF (AUTO), the OSC terminal voltage is checked when turning ON the DPM-900A series and automatically determines the internal (INT) or external (EXT).

- When manually (MANU) setting the internal or external
  When manually setting the internal (INT) or external (EXT), set the setting switch 1 to ON (MANU).
  For using the internal OSC, set the setting switch 2 to OFF (INT).
  For using the external OSC, set the setting switch 2 to ON (EXT).

To achieve OSC synchronization, proceed as follows.
1) Turn OFF all DPM-900A series.
2) Connect all OSC terminals in parallel. Connect a + terminal to another + terminal, and connect a – terminal to another – terminal.
   The YB-500 series exclusive carrying case (option) achieves automatic connection of all OSC terminals internally. So it is a great convenience.
3) Set the setting switch 1 of the DPM-900A series to ON (MANU) and setting switch 2 to OFF (INT) which is to be the master.
4) Set all setting switches 1 of the DPM-900A series other than master (slave) to OFF (AUTO).
5) Turn ON the all DPM-900A series at the same time. The DPM-900A series operating as the master lights up the INT lamp.

NOTE

- In order to achieve OSC synchronization, all dynamic strain amplifiers need to provide a same frequency of the excitation voltage.
- Up to 50 units of the DPM-900A series can achieve synchronization with one unit acting as the master.
- Before connecting the OSC terminals, be sure to turn OFF the DPM-900A series.
- Do not connect multiple units with setting switch 1 set to ON (MANU) and setting switch 2, OFF (INT).
- If the INT lamps illuminate on multiple units after turning ON with the OSC terminals connected, check whether multiple DPM-900A series units with the setting switch 1 set to ON and setting switch 2 to OFF exist. Turn OFF the units once and correct set the setting switches. Then turn ON the units once again.
- When the master is changed, the bridge power of the slave side may vary. In such case, set the internal gain again. (When the excitation voltage is changed, the output accuracy will be approximately the same as before changing by readjusting the internal gain.)
- When the internal OSC circuit broken, Er-Carr appears on the monitor. (When setting as the master.)
- When the input OSC signal of the OSC input/output terminal is not specifying the specifications of the excitation voltage, Er-Carr appears on the monitor to indicate the error. (when setting as slave).
- Where conventional KYOWA's amplifiers (such as DPM-700 series or DPM-600 series, etc.) are to be synchronized with the DPM-900A series, use the conventional amplifiers as master.

5-12 APPLICATION OF CENTRALIZED CONNECTOR

The DPM-900A series 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 "5-13 REMOTE CONTROL."

Pin No.	Signal Name	Input/output	Function and destination
1	+12 V	Power supply	Connects[1] with the + terminal of a DC power supply.
2	REM BAL[2]	Remote input	Valid with an external balancing signal "L."
3	OSC	Input/output	Connects with input synchronous signal.
4	N.C[3]		
5	COM	Common electric potential	Common electric potential of the remote signal, bridge status, OUTPUT A and B Also can be used as OCS – signal.
6	N.C[3]		
7	100 VAC	Power supply	Connects with an AC power supply.
8	N.C[3]		
9	Bridge status	Output	Outputs open collector[*12] "L" against a bridge check which has proven N.G.
10	REM KEYLOCK[2]	Remote input	Valid with an external key-lock signal "L."
11	GND	Grounding terminal	Connects with the case and COM terminals internally.
12	N.C		
13	N.C		
14	0 V	Power supply	Connects with the minus terminal of a DC power supply. [1]
15	OUTPUT A[2]	Output	Connects with OUTPUT A connector internally.
16	OUTPUT B[2]	Output	Connects with OUTPUT B connector internally.
17	REM +CAL[2]	Remote input	Valid with an "L" signal that commands execution of external +CAL input.
18	REM -CAL[2]	Remote input	Valid with an "L" signal that commands execution of external -CAL input.
19	N.C[3]		
20	100 VAC	Power supply	Connects with an AC power supply.

Connector plug: HIROSE ELECTRONIC S-1620-C

[1] Use a heat-resisting vinyl cable of over 0.3 mm^2 in diameter for wiring.

[2] It is a signal with Pin #5 COM as common electric potential. (COM and GND have same electric potential)

[3] N.C: Non connection

5-13 REMOTE CONTROL

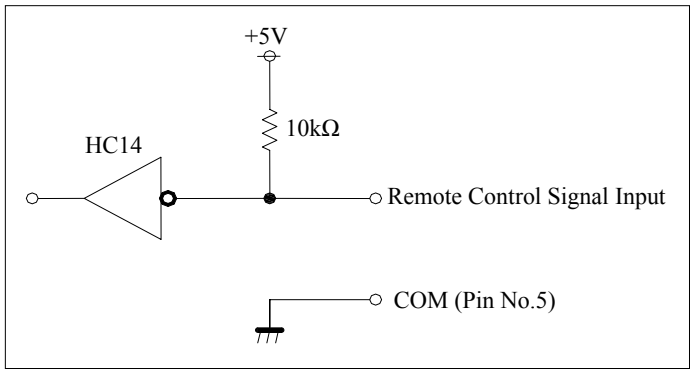
The following functions can be controlled remotely.

- Execution of balancing — REM BAL signal
- Outputting CAL — REM +CAL, REM –CAL signals
- Execution and cancellation of key-lock — REM KEYLOCK signal

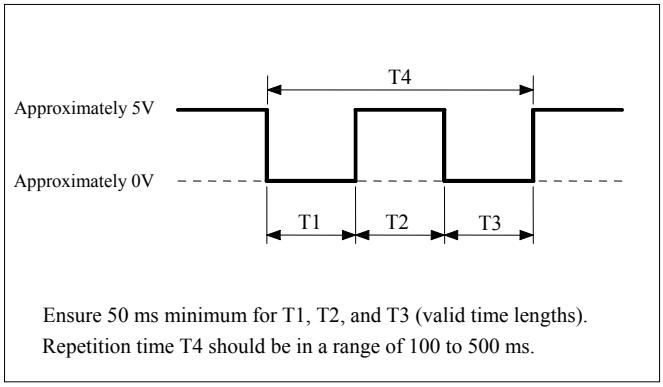
Remote control has the same significance as manual operation of the front panel switches that control the DPM-900A series functions. The priority is given to the first operated one.

5-13-1 Remote Control Signals

Control signal input circuit is shown at the right.

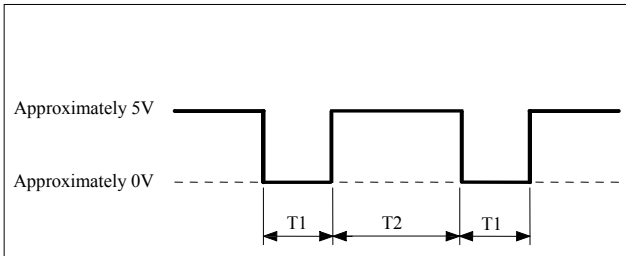


Control signals are valid when they are on the “L” (0 V) level. While this level is maintained, functions are executed.
The balancing function by the remote control is executed only one time in response to a signal shown at the right.



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.

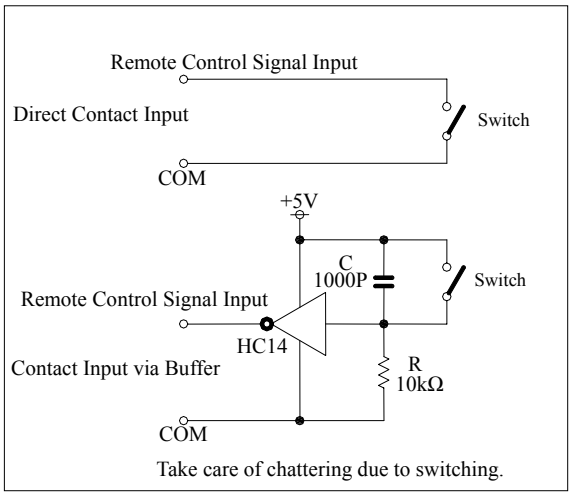
5-13-2 External Connection

When remote controlling the DPM-900A series, use the terminals of the centralized connector. Perform wiring after removing the housing from the centralized connector. For details of the centralized connector, see “5-12 APPLICATION OF THE 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.

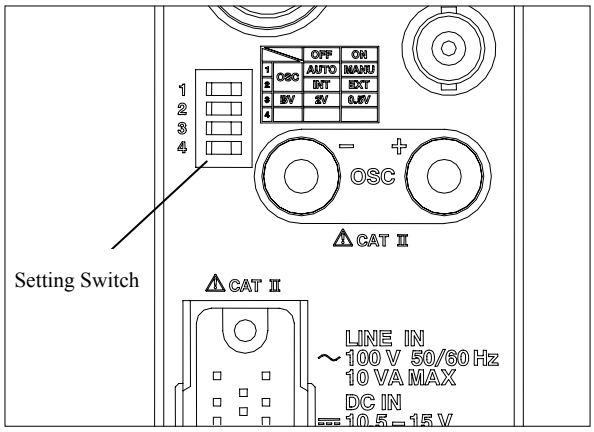
Shown at the right are the recommended circuits for remote control.
If a circuit other than shown is used, contact KYOWA or our representatives.



5-14 EXCITATION VOLTAGE

An excitation voltage[*15] is switched to 2 Vrms or 0.5 Vrms. It is set to 2 Vrms prior to shipment.
To select an excitation voltage, use SW3 provided on the rear panel. Set the setting switch 3 OFF for 2 Vrms and ON for 0.5 Vrms. Be sure to turn OFF the DPM-900A series prior to set the setting switch 3.

When the BV 0.5 V lamp on the front panel lights up, the DPM-900A series is set to 0.5 Vrms, when the light lights out, 2 Vrms.



NOTE

Be sure to balance every time an excitation voltage has been switched from one to the other.

Select an excitation voltage of 0.5 Vrms in the following cases.

- **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 excitation voltage is decreased to suppress self-heating.

- **When large strains are to be measured.**
  An excitation voltage of 0.5 V guarantees four times larger strain measuring range.

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

6. OPTIONS

This chapter describes all options that can be used together with the DPM-900A series.
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 method, the internal fixed resistors are used as dummy gages.

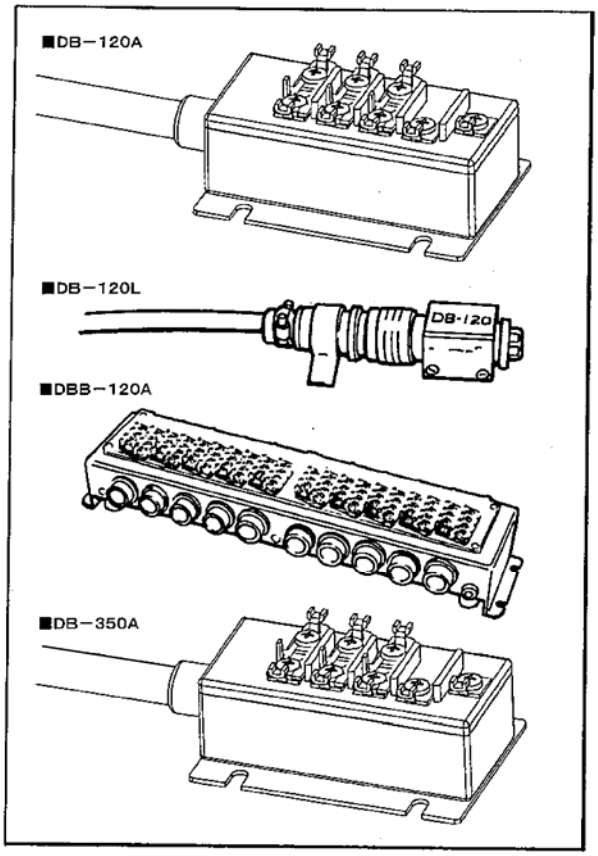
1) Quarter bridge method[*3] using the 2-wire or 3-wire system
2) Half bridge method[*4]
3) Full bridge method

6-1-2 Models of Bridge Box

The following models are provided.

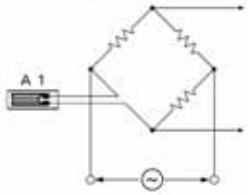
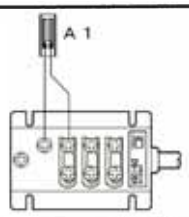
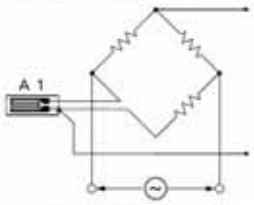
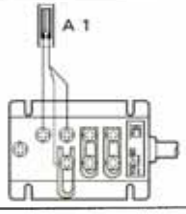
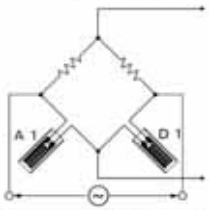
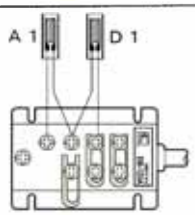
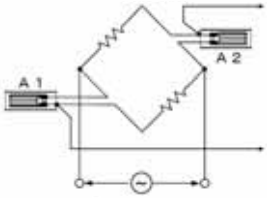
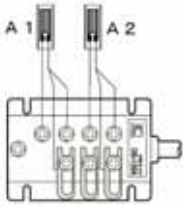
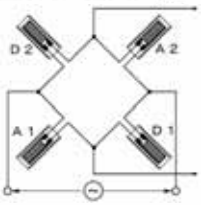
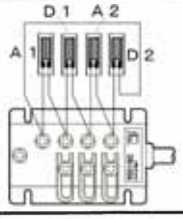
(1) DB-120A, DB-120L
For 120 Ω strain gages.

(2) DB-350A
For 350 Ω strain gages.



6-1-3 Wiring to Bridge Box

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

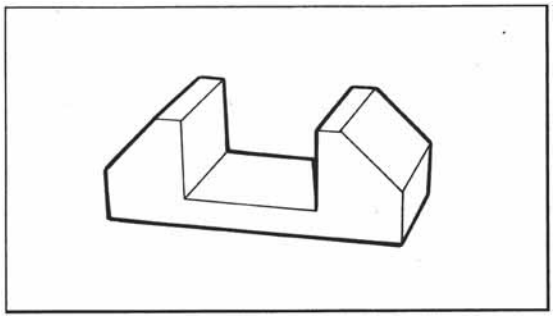
Gage Method	Bridge Circuit	Wiring to the bridge box
Quarter bridge method (2-wire system)		
Quarter bridge method (3-wire system)		
Half bridge method		
Half bridge method (3-wire active-active system)		
Full bridge method		

NOTE

When wiring strain gage (s) to the bridge box, soldering is recommended to reduce contact resistance.
Use shortest possible lead wires for connecting the strain gage and the 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, refer to the bridge box's Instruction Manual.

6-2 AMPLIFIER STAND FA-1B

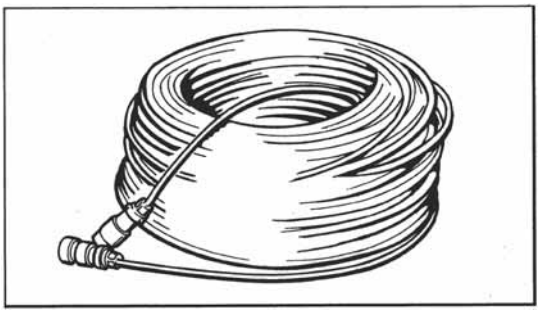
When operating a single unit of the DPM-900A series, this rubber made stand is used for fixing.



6-3 EXTENSION CABLE N

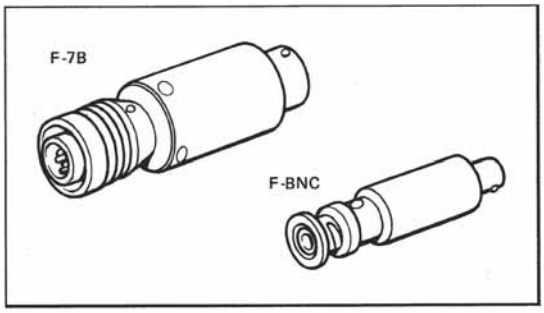
For connecting the bridge box or strain gage transducers at a remote place.
The cable ends are provided with connectors.
The following 6 models are available offering different lengths.

- 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 connected to the INPUT connector and OUTPUT A and B connectors, respectively.

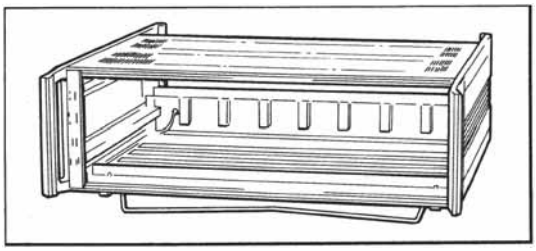


6-5 EXCLUSIVE CARRYING CASE

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

- YB-503A accommodates 3 channels
- YB-504A accommodates 4 channels
- YB-506A accommodates 6 channels
- YB-508A 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.



6-5-1 Functions of Exclusive Carrying Case

Functions of the exclusive carrying case 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 connections that enable OSC synchronization.
- Centralized connector that connects with bridge status outputs
- A batch KEY-LOCK key

Rack mount fixtures for JIS and DIN are also provided.

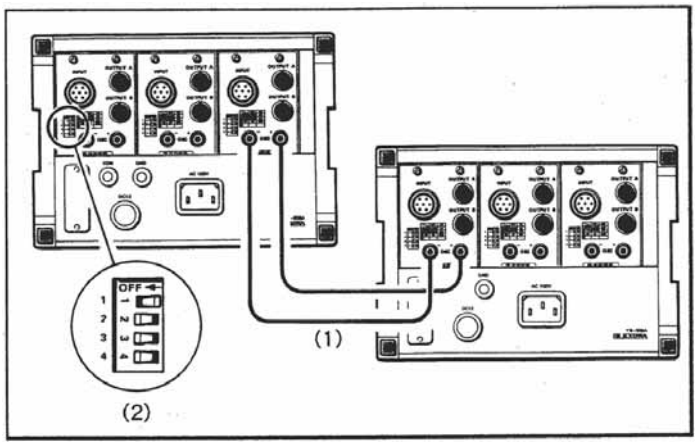
NOTE

- Be sure to house dynamic strain amplifier units of the same model in the exclusive carrying case. If dynamic strain amplifiers having different OSC frequencies are housed in the carrying case, they will not operate normally.
- Set setting switch 1 to ON (MANU) on the rear panel 2 to OFF (INT) on one unit only, and to OFF (INT) on all other units.
- It is also possible to house DC type signal conditioners and dynamic strain amplifiers together in the carrying case.
- Balancing, calibrations or key-lock can be achieved on all channels simultaneously by operating the BAL key, CAL key or KEY-LOCK key, respectively.
- When using the DPM-900A series housed in the exclusive carrying case, the DPM-900A series 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 DPM-900A series housed in the exclusive carrying case is hot.
  Do not touch the DPM-900A series with the bare skin to avoid low-temperature burns.
  Be sure to put gloves for touching the DPM-900A series.
- When using the DPM-900A series housed in the exclusive carrying case with continuous current for 24 hours, be sure to conduct a periodical inspection every 2 years.

6-5-2 Carrier Synchronization between Exclusive Carrying Cases

When using multiple carrying cases, perform carrier synchronization as follows.

(1) Connect one carrying case to another as shown in right.
(2) Set the setting switch 1 of any one of the DPM-900A series to ON (MANU) and setting switch 2 to OFF (INT).
(3) Set the setting switch 1 of all other DPM-900A series to OFF (INT).
(4) Turn ON the all exclusive carrying cases at the same time. If simultaneous turning ON is impossible, turn ON the power of the exclusive carrying case that housing the DPM-900A series with the setting switch 1 to ON (MANU) and setting switch 2 to OFF (INT) at the very first.



7. TROUBLE SHOOTING

If the DPM-900A series 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 DPM-900A SERIES CANNOT BE TURNED ON

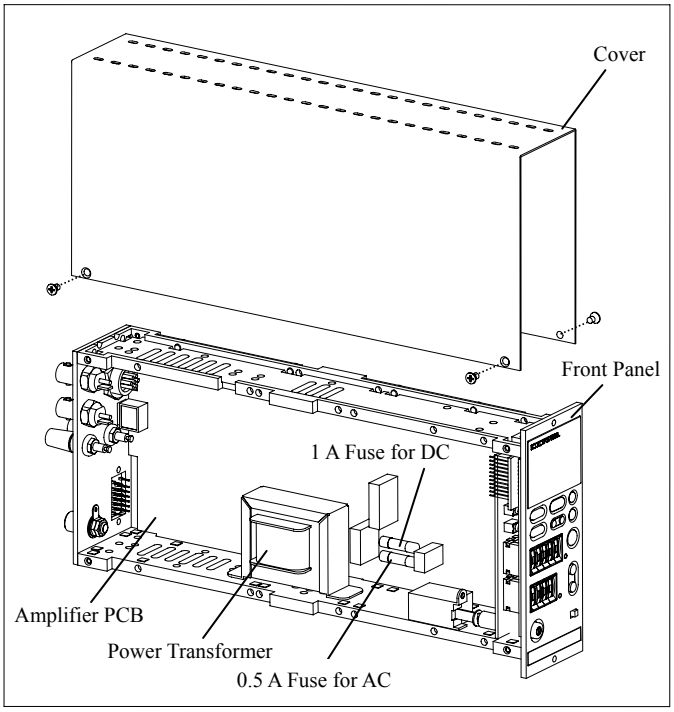
When the indicators such as monitor fail to illuminate after turning ON, the cause may be the broken power cable or the melted fuse. Check the power cable first.
The fuses are inside the case. Prior to replacement, be sure to disconnect the power cable from the AC outlet or the battery.

Check the fuses in the following procedures and replace them if necessary.
The fuses are on the parts side of the control PCB.
Use the fuses having the following rated capacity.

- For AC power: Midget type 0.5 A
- For DC power: Midget type 1 A

(1) Remove 4 screws that fasten the mainframe cover. Use the Phillips-head screw driver for M2.6.
(2) While opening the bottom of the cover, pull it up.
(3) Check if the fuses on the amplifier PCB are melted. If those are melted, replace them.
(4) While opening the bottom of the cover, cover it to the DPM-900A series.
(5) Fix the cover to the DPM-900A series with the replaced 4 screws.

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

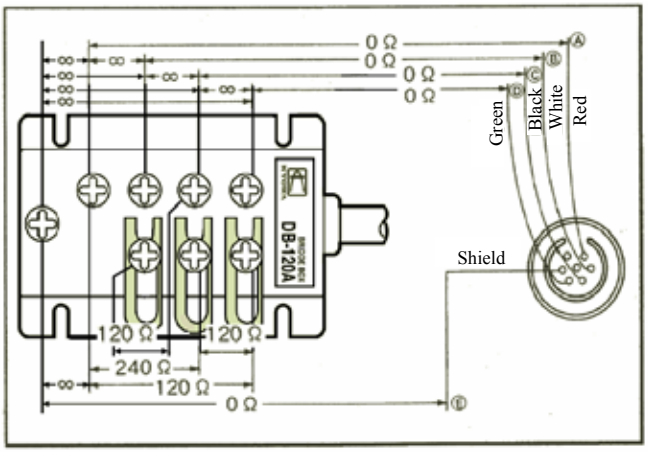


7-2 INITIAL BALANCING IS IMPOSSIBLE

♦ **Er-oPEn appears on the monitor**
The cause can be the abnormal strain gage bridge connected to the INPUT connector. Check the strain gage bridge.

- The sides of the bridges have been broken, short circuited or the insulation resistance has decreased.
- The lead wires from the strain gage bridge have been broken.

♦ 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 120 Ω bridge, it is the indication of a normal bridge box.
For a 350 Ω bridge, the resistance values shown at right should read:
- 120 Ω → 350 Ω
- 240 Ω → 700 Ω



♦ 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 CAL switch set to [0000].
Set the CAL switch at a position 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 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 UNSTABILITY OF THE ZERO POINT

♦ When preheating is insufficiently
Preheat the DPM-900A series approximately 30 to 60 minutes. For details, see “5-3 PREHEATING.”

♦ When the insulation of the strain gage or lead wires is low
Repair or replace it.

♦ When the temperature compensation is insufficient
Use the strain gage having the 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 DPM-900A series, the induction noise may generate.
  Remedies are as follows.
  - Place a causative instrument apart from the DPM-900A series.
  - 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.

- 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 DPM-900A series does not necessarily bring about a good result, but connection of a measuring object to the DPM-900A series 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

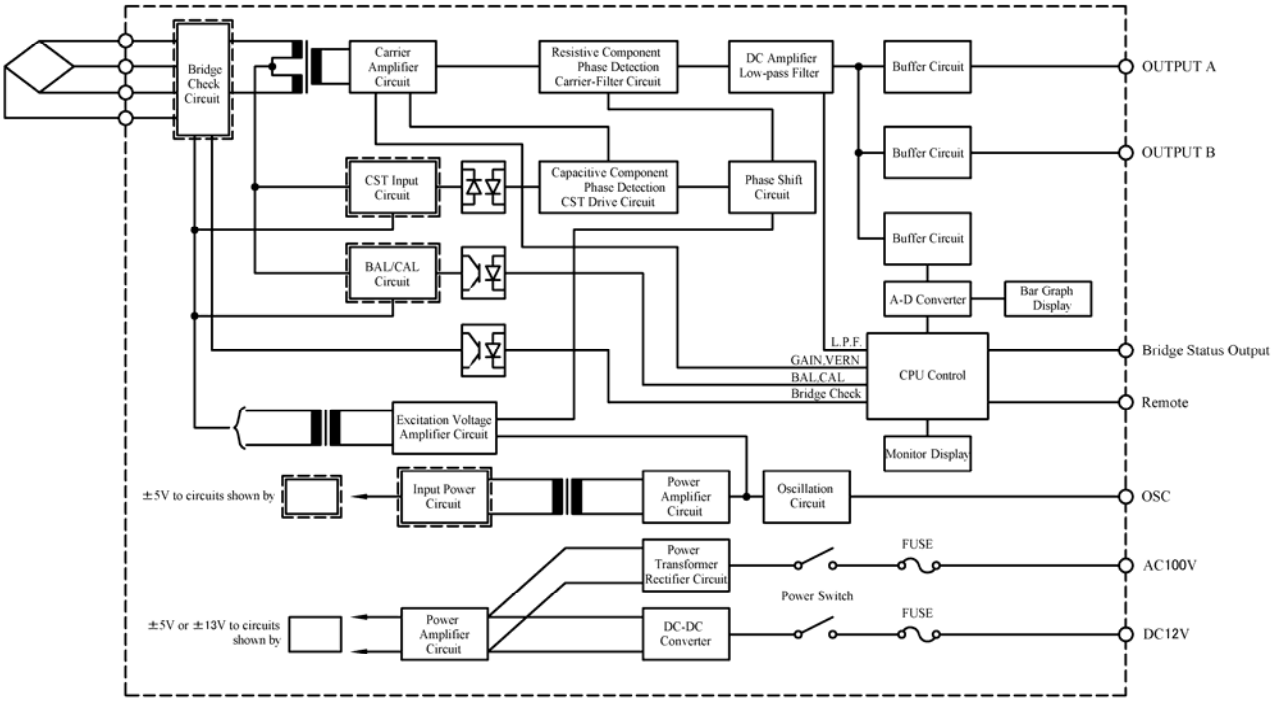
8-1 SPECIFICATIONS

	DPM-911A	DPM-912A
Measuring Target	Strain Gage, Strain Gage Transducer	
Measuring CH	1 CH/unit	
Applicable Bridge Resistance	60 Ω to 1000 Ω	
Gage Factor	2.00 fixed	
Bridge Power Voltage	2 V rms, 0.5 V rms selectable	
Frequency	5 kHz sine wave	12 kHz sine wave
Balancing Range[*9] Resistance Capacitance	Within ±2% (±10000 μm/m) Within 2000 pF	
Balancing Method Resistance Accuracy Storage Capacitance	True electron auto-balance method Within ±0.5 μm/m (When 500 μm/m is input, outputs 10 V, excitation voltage: 2 Vrms) Written into nonvolatile memory CST method (Auto-tracking)	
Nonlinearity	Within ±0.1% FS	
Output Impedance	Approximately 2 Ω	
Calibration Signal (CAL)	1 μm/m steps within ±(1 to 9999) μm/m [Setting: CAL switch (4-digit digital switch)] [Accuracy: Within ±(0.5% + 0.5 μm/m)]	
Sensitivity Adjuster CAL Switch Range VOLTAGE OUT switch range Accuracy	The amplifier sensitivity is set in combined with the CAL and VOLTAGE OUT switches (4-digit digital switch) 1 μm/m steps up to 100 to 9999 μm/m 0.01 V steps up to 1.00 to 10.00 V [Condition: When 500 μm/m is input, outputs 10.00 V (× 20000) to 5000 μm/m is input, outputs 1.00 V (× 200)] [Setting Example: When 500 is set to CAL, VOLTAGE OUT is 10.00 (× 20000) to 5000 is set to CAL, VOLTAGE OUT is 1.00 (× 200) Within ±0.5%	
Sensitivity Fine Adjustment	Range: 1 to 1/2.5	
Frequency Response Range	DC to 2.5 kHz Deviation: ±10%	DC to 5 kHz Deviation: ±10%
Low-Pass Filter (LPF) Transfer Characteristic Cutoff Frequency Amplitude Ratio at the cutoff point	Secondary Butterworth Type 6 steps: 10, 30, 100, 300 Hz, 1 kHz, and FLAT -3 ±1 dB	
Attenuation	-12 ±1dB/oct (Excluding when setting 1 kHz)	-12 ± 1dB/oct
High-Pass Filter Cutoff Frequency	0.2 Hz or OFF	

	DPM-911A	DPM-912A
S/N Ratio	54 dBp-p or more RTI: Within 2 μm/mp-p [when 500 μm/m is input, outputs 10.00 V.] 60 dBp-p or more [when 1000 μm/m is input, outputs 10.00 V.]	52 dBp-p or more RTI: Within 2.5μm/mp-p [when 500 μm/m is input, outputs 10.00 V.] 57 dBp-p or more [when 1000 μm/m is input, outputs 10.00 V.]
	[Common Condition] Excitation Voltage: 2 Vrms, Bridge Resistance: 120 Ω, LPF = FLAT	
Output	OUTPTU A: ±10 V (Load resistance 5 kΩ or more) OUTOUT B: ±10 V (Load resistance 5 kΩ or more)	
Stability Zero - Temperature Zero - Time Zero – Power Fluctuation Sensitivity - Temperature Sensitivity - Time Sensitivity – Power Fluctuation	 ±0.1 μm/m/ºC ±0.5 μm/m/24h ±0.05% FS/±10% fluctuation ±0.05%/ºC ±0.2%/24h ±0.05%/±10% fluctuation	
Withstand Voltage	Between measuring bridge – case : 800 VAC for 1 minutes Between AC power – case : 1000 VAC for 1 minutes	
Output Voltage Display	5-digit digital display (7-segment LED) 11-segment LED bar graph meter	
Excessive Input Display	Output Voltage Display flickers. (5-digit digital display only)	
Check Function	Bridge Check	
Keylock Function	Setting methods other than POWER switch become invalid (However, the setting values of the CAL and VOLTAGE OUT switches can be changed.)	
Remote Function	Capable of controlling the following functions Balance adjustment (BAL) Addition of the calibration signal (CAL) Keylock	
Synchronization Method	Automatically determines internal (INT) or external (EXT) and manual setting	
TEDS	Read the TEDS information of the sensor and set the rated output to the output voltage of the VOLTAGE OUT switch (Condition: Within the setting range of the sensitivity adjuster)	
Actual Load Calibration	Set the actual load to the output voltage of the VOLTAGE OUT switch (Condition: Within the setting range of the sensitivity adjuster)	
Vibration Resistance	5 to 200 Hz, 29.4 m/s^2 (3G) X, Y, and Z directions: 12 cycles with 10 minutes/cycle	
Impact Resistance	15 G, 11 msec or less X, Y, and Z directions: each 3 times	
Operating Temperature & Humidity Range	-10 to 50ºC, 20 to 85 %RH (non condensing)	
Storage Temperature Range	-30 to 70ºC	
Power Supply	90 to 110 VAC (approximately 10 VA: 100 VAC) 10.5 to 15 VDC (approximately 0.6 A: 12 VDC)	
Dimension	49 (W) × 128.5 (H) × 262.5 (D) mm (Protruded portion not included) Pannel Cut Dimensions : 50 × 113 mm	
Weight	Approximately 1.2 kg	

8-2 BLOCK DIAGRAM AND OPERATION PRINCIPLE

8-2-1 Block Diagram



8-2-2 Operation Principle

We explain it as follows depending on the above block diagram. Changes in physical quantities are detected as changes in resistance of strain gages and converted in electric signals. As the result, the strain gage bridges output minute AC volts. They are no more than hundreds of microvolt, normally. These bridge output are amplified up to several volts through the carrier wave amplifier circuit that provides a high AC gain.

Strain signals at up to this stage are superimposed over AC carrier signals so that they cannot be taken out separately. So they are rectified then converted into DC by the circuit that detects the phase of resistive signal components. They are further integrated through the low-pass filter, then output via the DC amplifier. The carrier filter and the low-pass filter have similar functions but they play quite different roles. The former is indispensable in that it works to remove carrier signals, while the latter works to cut off some of signals and is not necessarily needed all time.

The features of the system can be summarized as follows.

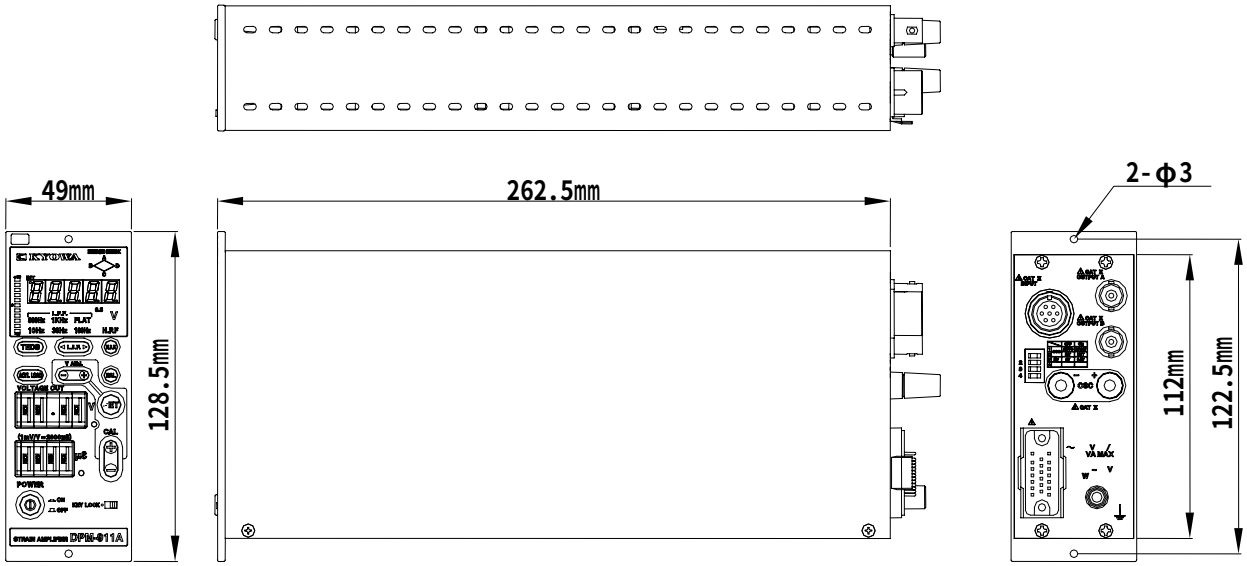
- Advantageous Features
  - Signals are amplified in the AC form so that a highly sensitive strain amplifier is made possible.
  - The temperature characteristic is superbly stable at the zero point. Excellent both in temperature characteristic and long-term stability.
    This is the most important feature of a carrier type dynamic strain amplifier.
  - Carrier waves are transmitted via the input transformer so that they are hardly affected by surge noise. From the construction mentioned above, a carrier type dynamic strain amplifier can well be an isolated amplifier.
  - Free from the effect of thermoelectric power.
  - Less power consumption when compared to a DC amplifier.

- Disadvantages
  - Unnecessary capacitive components generated by wiring to strain gages, etc. need to be removed. But, this is done automatically inside the DPM-900A series.
  - The practical frequency of carrier wave is 30 kHz or thereabouts. High response is therefore unavoidable.
  - Easily affected by resistance induced by wirings.

From the above, the DPM-900A series is optimum for such strain measurements as follows.

(1) General strain measurements using strain gages.
(2) Measurements that requires high stability.
(3) Measurements of small strain outputs. The yardstick will be about approximately 500 μm/m.

8-3 DIMENSIONAL DRAWING



9. APPENDIXES

9-1 BRIDGE CHECK FUNCTION AND RESULT INDICATION

The following table shows the relation between error indications on the monitor and detected wire-breaking locations.
When 1 wire is broken, the monitor indicates “wire-breaking location” exactly. But if 2 or more wires are broken, wire-breaking locations of only one wire are shown as described in the following table. In case 3 wires are broken, Er-b appears all the time.
In addition, if a side of the bridge is broken, an error indication does not necessarily agree with its location.

Wire-breaking locations	Error
A	Er-a
B	Er-b
C	Er-c
D	Er-d
A B C D	Er-b
A B C	Er-b
A B D	Er-b
A C D	Er-b
B C D	Er-b
A B	Er-a
A C	Er-a
A D	Er-d
B C	Er-b
B D	Er-b
C D	Er-d
None	Good

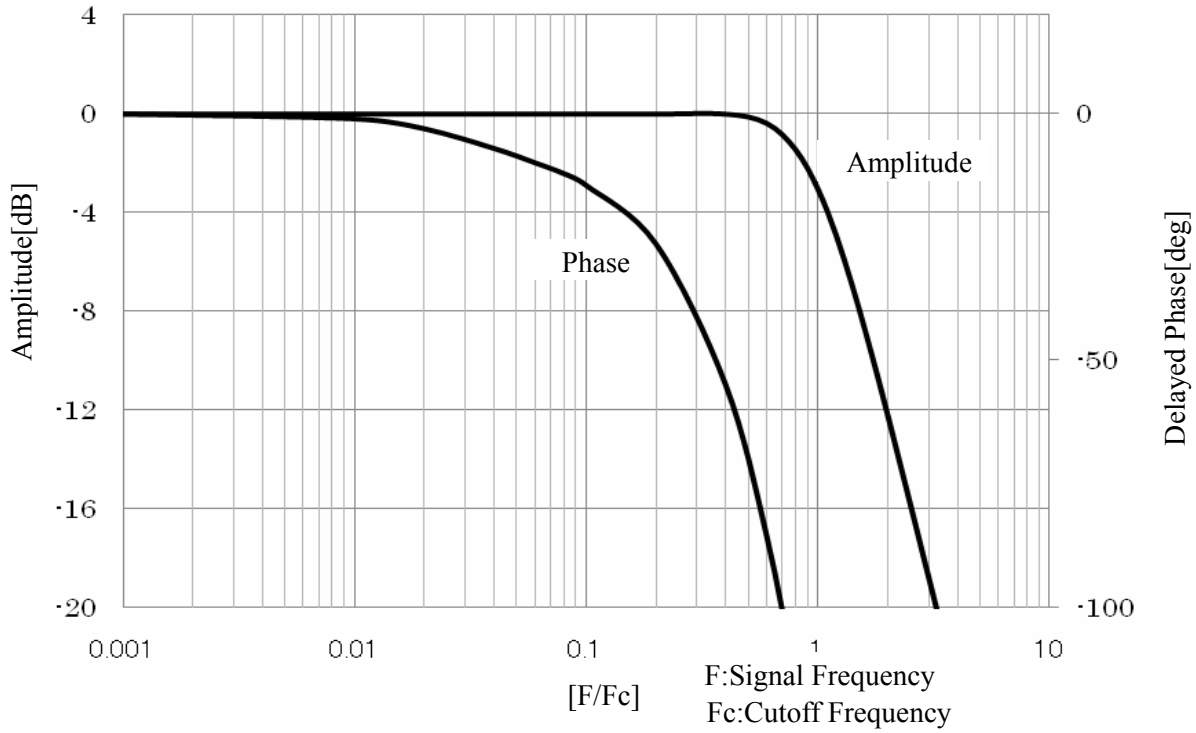
NOTE

If Er-2 appears, it indicated that the bridge check circuit is faulty. In this case, contact KYOWA or our representatives.

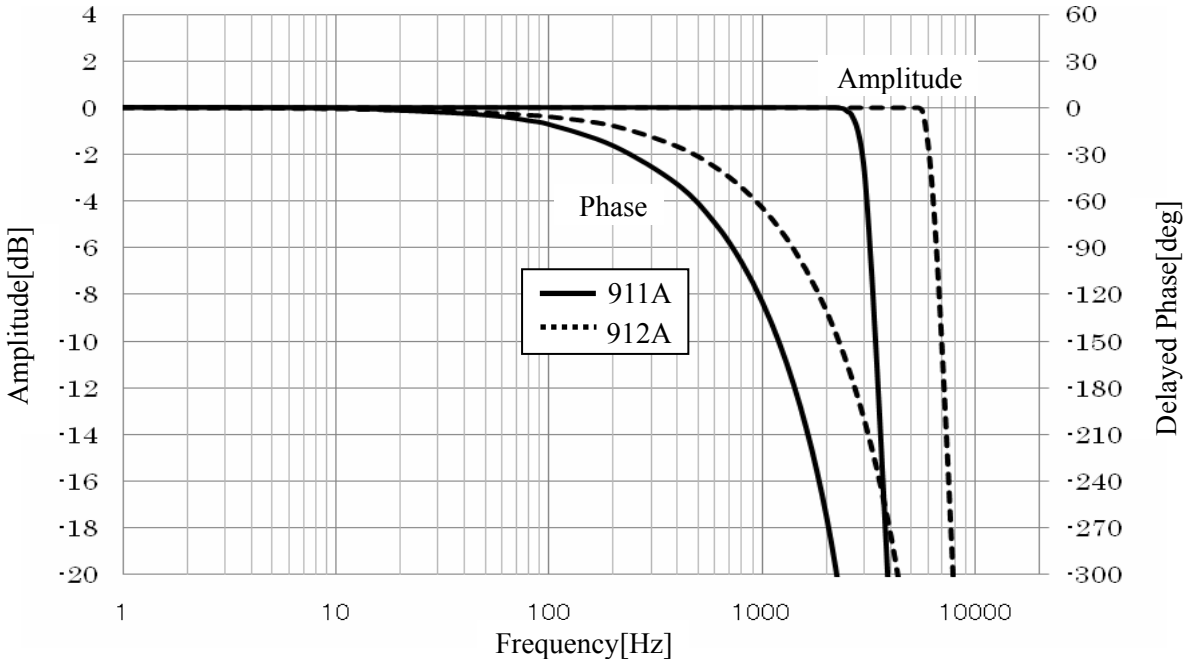
9-2 LOW-PASS FILTER CHARACTERISTIC

Item 1) shows the characteristic of the low-pass filter incorporated in the DPM-900A series. In item 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 is set to FLAT is shown in item 2).

1) Low-pass Filter Characteristic



2) Response Frequency Characteristic (Low-pass Filter when the cutoff frequency is set to FLAT).

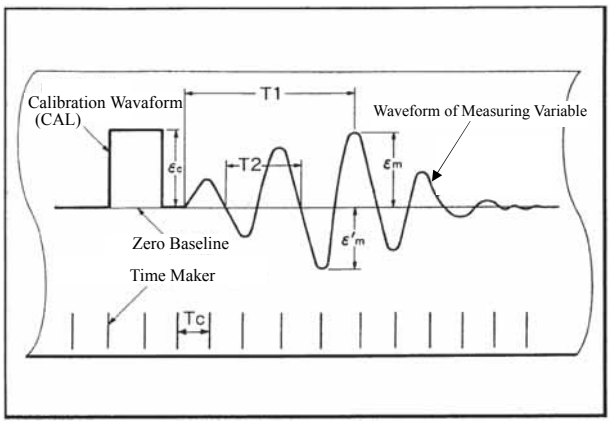


9-3 HOW TO CALCULATE STRAINS

This section describes how to measure strains and stress with the DPM-900A series.

9-3-1 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 waveform.
Suppose that the direction of this calibration signal waveform shows the direction of "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 a 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.

$$\sigma = E \times \varepsilon$$

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 stress 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 T_1 (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 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 generated, 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, tc.

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

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

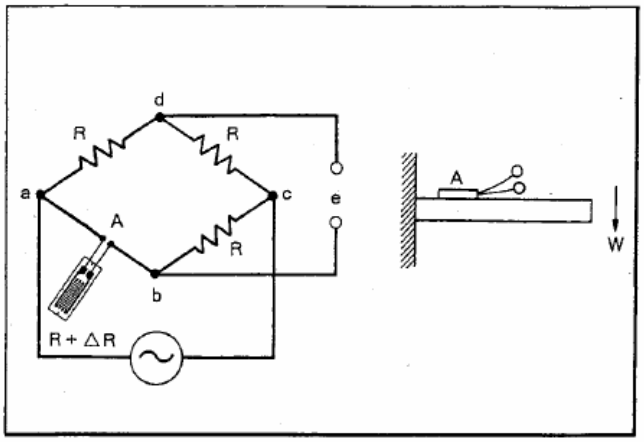
$$f = \frac{1}{T_2} [\text{Hz}]$$

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.

9-3-2 Correction Required due to the Number of Strain Gage Used

The above calculation methods are applicable to a measurement using one strain gage as an Active gage[*16] 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.

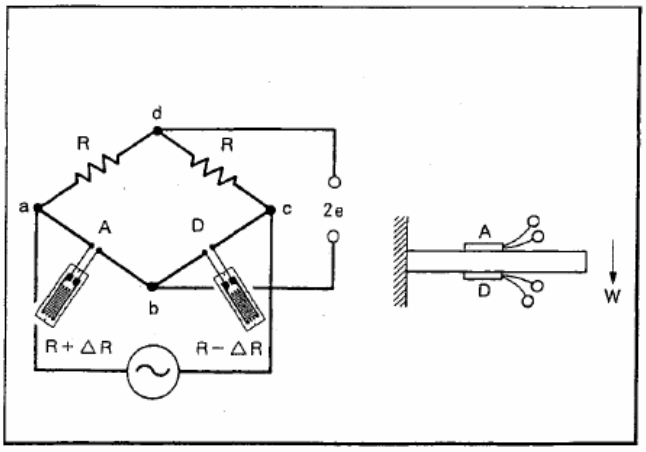
- ε: Strain after correction
- ε_0: Measuring result
- σ: Stress
- E: Young's Modulus (Coefficient of vertical elasticity)



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 ε_0 by 1/2.

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

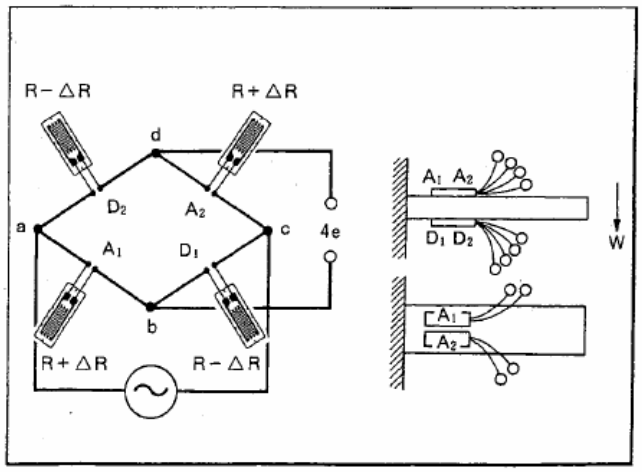
$$\sigma = E \times \varepsilon = \frac{\varepsilon_0}{2} \times E$$



(2) When using 4 strain gages in the arrangement shown in the right, multiply the measurement value ε_0 by 1/4.

$$\varepsilon = \frac{\varepsilon_0}{4}$$

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



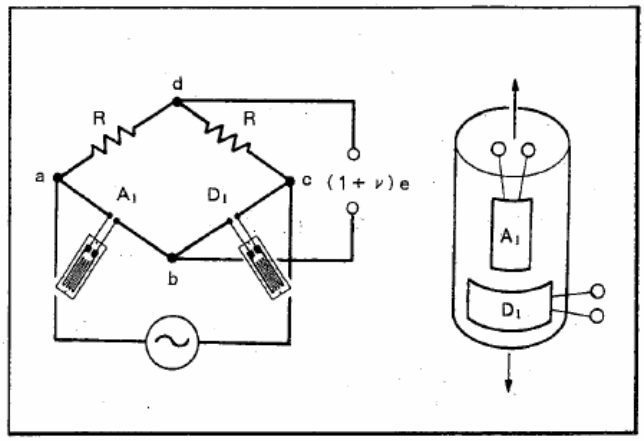
2) When using active gage and dummy gage[*17]

(1) When using 2 strain gages in the arrangement shown in the right, multiply ε_0 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

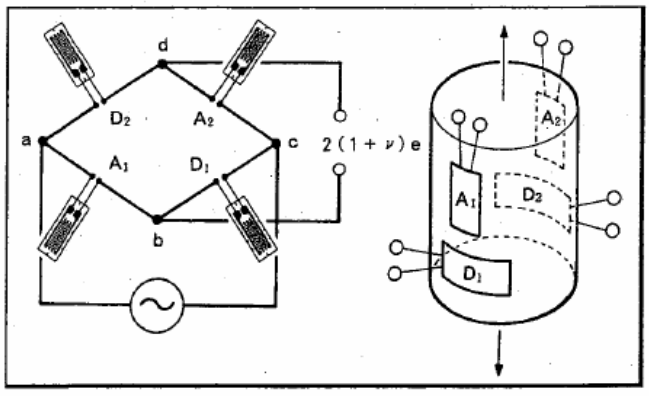


(2) When using 4 strain gages in the arrangement shown in the right, multiply ε_0 by $\frac{1}{2(1+\nu)}$.

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

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

where, ν: Poisson's ratio



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

Correct the measurement value 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: Poisson ratio

9-3-4 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 DPM-900A series 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 the strain gage transducer.

1) Calculating method using a calibration factor
   Multiply the amount of strain obtained using the strain gage transducer by the calibration factor 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 2 tf (19.6133 kN) and calibration factor of 0.0004997 tf (0.0049 N)/μm/m.
A load given to this load cell can be calculated as follows.
0.0004997 × 2900 = 1.44913 [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: pressure transducer with capacity of 5 kgf (490 kPa)/cm^2 and rated output of 3993 μm/m.
Set the CAL switch of the DPM-900A series to 3993 μm/m (rated output of the transducer) or set the VOLTAGE OUT switch to output 10.00 V. Press the SET switch twice to set the internal gain. After that, apply pressure to the transducer. 10.000 V will come to correspond to 5 kgf/cm^2.

<Example> Using the combination of: acceleration transducer with capacity of 20 G (196 m/S^2) and rated output of 850 μm/m and the DPM-900A series
Set the CAL switch of the DPM-900A series to 850 μm/m (rated output), set the VOLTAGE OUT switch to 10.00 V and press the SET switch twice to set the internal gain. Then 10.000 V will come to correspond to 20 G.
Suppose a recording meter is used. If calibration value of 850 μm/m 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.

9-3-5 Correction Required When an Extension Cable was Used

Indoor measurement seldom requires an extension cable. By contrast, for outdoor measurement the DPM-900A series 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 DPM-900A series 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 DPM-911A

Extension Cable / Bridge Resistance	5 m	25 m	50 m	75 m	100 m	200 m
120 Ω	1.003	1.015	1.030	1.046	1.060	1.120
350 Ω	1.002	1.005	1.009	1.013	1.017	1.032

Correction factor when using the extension cable with the DPM-912A

Extension Cable / Bridge Resistance	5 m	25 m	50 m	75 m	100 m	200 m
120 Ω	1.003	1.017	1.034	1.052	1.069	1.151
350 Ω	1.002	1.009	1.015	1.023	1.031	1.070

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."

9-4 TROUBLE SHOOTING

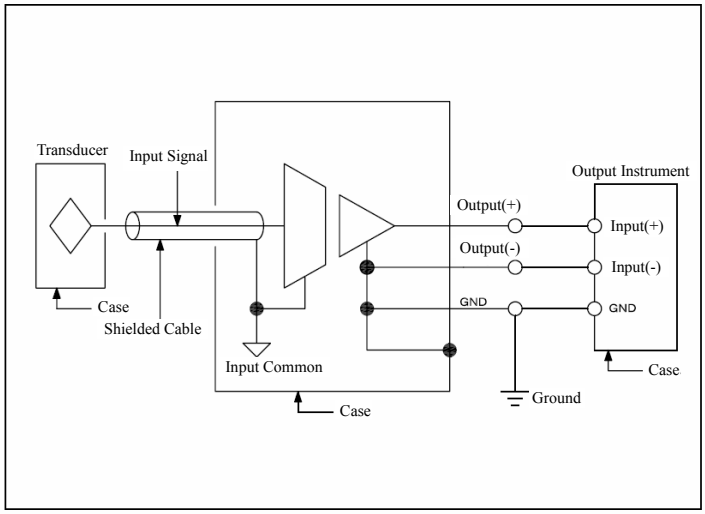
The DPM-900A series provides several error indications.
The error indication, status at that time, and remedies are described in the following table. If any error indication appears on the monitor, check the following table for remedies.

Error	Displayed Timing	Status	Remedy
Er-oPEn	After the bridge check	1) The sensor is not connected 2) The bridge box is not connected or the strain gage (s) is not connected to the bridge box. 3) Cable is broken	1) Connect the sensor 2) Connect the bridge box or strain gage. 3) Repair or replace the cable.
Er-SEnSor	After the bridge check	Not applicable sensor is connected.	Connect the applicable sensor.
Er-Carr	After turning ON the power (slave only) When the input from the external OSC is not coming (slave only)	OSC frequency or voltage is faulty	Replace the normal master or input the equivalent sine wave with the excitation voltage (frequency and voltage) of the DPM-900A series to the OSC I/O terminal.
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 ×200) 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)	1) TEDS-installed sensor is not connected. 2) TEDS information cannot be read. (Cable is broken or the sensor is faulty.)	1) Connect the TEDS-installed sensor. 2) Repair the cable or replace the sensor.
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 ×20000) 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 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 mode)	Maximum internal gain (higher than ×20000) is set.	Smaller the setting value of the VOLTAGE OUT switch and set the internal gain again.

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

9-5 INPUT COMMON AND GROUNDING

The input common and grounding terminals of the DPM-900A series are shown in the following figure.



Use these terminals as instructed below in order to assure safety.

1) Be sure to ground the grounding terminal.
2) When an output instrument is not grounded, connect the grounding terminal of the DPM-900A series.
   (The output instrument is also grounded.)

NOTE

If the shielded cable is grounded, isolating state between the input and output commons becomes not insulating state.
The same thing happened when the shielded cable and grounding terminal are short circuited.
When measuring strain of the target having the electric potential with the shielded cable connected, the DPM-900A series may broken since it has no isolation.

10. GLLOSARY

*1TEDS
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.

*2Wheatstone 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.

*3Quarter bridge method
It is a measuring method whereby one side of the bridge is formed by a strain gage.

*4Half bridge method
It is measuring method whereby two sides of the bridge are formed by one each strain gage respectively.

*5Full bridge method
It is measuring method whereby 4 sides of the bridge are formed by one each strain gage respectively.

*6Output Impedance
Impedance seen from the output terminal of an instrument in opening state.

*7Preheating Time
A time an instrument required to satisfy its all performance specifications after it is turned ON.

*8Unbalance Components
Volts that are generated due to the resistive and capacitive deviations of a strain gage bridge.

*9Balancing 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.

*10Sensitivity
An output against a strain input under the specified condition.

*11Gage Factor Ks
The ratio of a change in gage resistance to a change in the amount of a stain applied to a strain gage. Generally, it is 2 for metal-wire strain gages.

*12Open Collector Output
It is an output system wherein no transistor load resistance exists and a collector is connected directly to the output.

*13Carrier
A carrier or a carrier wave means AC signals that transmit strain signals. Generally, a carrier is more than two times larger than the frequency of strains which are to be measured.

*14Beat
When combining 2 signals having different frequency, frequency components of sum and difference generate. Of this, the beat indicates the component of the general difference.

[*15]Excitation Voltage
The voltage or a power source, AC or DC, connected to a Wheatstone bridge. The higher an excitation voltage, the larger a Wheatstone bridge's output voltage grows. An excitation voltage should, therefore, be decided according to the kind of a measuring object and that of a strain gage.

[*16]Active gage
A gage which is bonded to the strain generating area of a measuring object.

[*17]Dummy Gage
This type of gage acts merely as a resistor, i.e. a constituent element of a gage bridge.