IM-A-1126C Aug 2021

KYOWA

INSTRUCTION MANUAL

MCF-8A,MCF-16A
MCF-8B,MCF-16B

Multi Signal Conditioner

Thank you for purchasing this KYOWA's product MCF-8A,16A,8B,16B Multi signal conditioner.
Read this instruction manual carefully in order to make full use of the high-performance capabilities of the product.
Do not use the product in methods other than described in this manual.

The contents of this instruction manual are subject to change without notice.
For the latest information, refer to the KYOWA website.
Be sure to abide by the safety precautions and other notes provided in this manual.

Kyowa Electronic Instruments Co., Ltd.

Table of Contents

TYPES OF PRODUCTS AND STANDARD ACCESSORIES

After unpacking the box, check the product type and make sure the following parts are enclosed:
Multi Signal Conditioner

Type of Product	Model	Standard Accessories	
		Product Name	Quantity
8-Channel Multi Signal Conditioner	MCF-8A MCF-8B	DC power cable P-76 (approximately 1.8 m)	1
		Ground wire P-72 (approximately 5 m)	1
		Synchronous cable U-59 (approximately 1.5 m)*1	1
16-Channel Multi Signal Conditioner	MCF-16A MCF-16B	Centralized output cable connector	1
		Spare fuse*2	1
		MCF-A/B Instruction Manual	1
		"Terms and Conditions of New Product Warranty" document	1

Conditioner Cards (Amplifier Cards)

Type of Product	Model	Standard Accessories	
		Product Name	Quantity
Strain Amplifier Card	DPM-91A DPM-92A DPM-91A-I DPM-92A-I	Output cable U-59 (1.5 m)*1	1
		"Terms and Conditions of New Product Warranty" document	1
Signal Conditioner Card	CDV-90A	Card mounting screws M2.5 x 6	2
Thermocouple Card	CTA-90A	"READ BEFORE USING THE PRODUCT " document	1
F/V Converter Card	CFV-90A	NDIS connector (NDIS4109)*3	1
Charge amplifier Card	CCA-90A		

*1 Coaxial cable with BNC-BNC connector
*2 Normal blow-type fuse, 5 mm x 20 mm, 125 VDC
(MCF-8A/B: rated capacity of 5 A; MCF-16A/B: rated capacity of 10 A)
*3 NDIS connector (NDIS4109) EPRC07-P9MNDIS, attached to CFV-90A only

Optional Accessories

・ AC Adapter	UEA360-1540 Operating temperature range: 0°C to 40°C
・ AC Adapter (for use in the United States)	SPU61A-106 15V Operating temperature range: 0°C to 70°C
・ 1-Channel Dummy Card	MCF-DUMMY
・ Fixture for JIS Rack for MCF-16A/B	MCF-JIS
・ Fixture for DIN Rack for MCF-16A/B	MCF-DIN
・ MCF Handle Fixture	MCF-HANDLE
・ Independent Left/Right Rack Fixture	MCF-BKT
・ L-Angle Fixture	MCF-L-ANGLE
・ BNC splitter adapter (Type F) for OSC synchronization	BNC-F-JJP
・ Bridge boxes	For a list of bridge boxes, refer to KYOWA's general product catalog.
・ Carge converter	CAC1R0 (Fuji ceramics corporation)

・ RS-485 communication cable for MCF	N-136	approximately 1 m
・ RS-485 communication Y cable for MCF	N-137	approximately 0.3 m

For a list of optional accessories, see "13. OPTIONAL ACCESSORIES" on page 89.

SAFETY PRECAUTIONS (Be sure to read the safety precautions before use.)

This product complies with the specifications listed in "12.Product Specifications" on page 81. Avoid using the product in environments that depart from the applicable specifications. Failure to observe this precaution may result in malfunctions.

Prior to use

To ensure safe use of this product, be sure to read the safety precautions before use.
Kyowa Electronic Instruments Co., Ltd., assumes no liability for any damage resulting from the user's failure to comply with the safety precautions.
The following symbol is used to help ensure safe use of the product:

	Indicates the functional earth terminal. Be sure to connect the product's [GND] terminal to ground.
	Indicates the operator must refer to an explanation in this manual in order to avoid the risk of injury or death of personnel or damage to the instrument.

Warning and Caution indicators

The following symbols are used to draw attention to important issues and to help ensure safe use of the product:

⚠WARNING	Improper use of the system may result in death or severe injury.
⚠CAUTION	Improper use of the system may result in injury and/or damage to the system.

⚠WARNING

- **Power supply**
  To prevent fire hazards, before turning on the product, make sure the power supply voltage specified for the product matches the local line voltage.
- **Functional earth**
  Be sure to connect the [GND] terminal to ground. Failure to do so may result in electric shock, performance degradation, or malfunctions.
- **Confirming protective functions**
  To prevent electric shock, do not operate the product if there is any chance of an abnormality in the [GND] terminal or fuse holder. Be sure to check for abnormalities in the [GND] terminal and fuse holder before using the product.
- **Power cable and power outlet**
  To prevent electric shock and/or fire hazards, always use the power cable supplied with the product.
  Before connecting or disconnecting the power cable, make sure that the [GND] terminal is connected to ground.Note that the ground wire must remain connected during measurement.
  Be careful to polarities when connecting the DC power cable.
  Reverse connection may cause fire hazards or malfunction.
- **External connection**
  To prevent electric shock, make sure the protective ground terminals of all instruments are properly connected before connecting the measuring object and external control circuit.
- **Fuse**
  To prevent fire hazards, be sure to use a fuse with the necessary specifications (current, voltage, type). Use only the specified fuse. Avoid short-circuiting the fuse holder.
  Before replacing the fuse, disconnect the power cable from the product.

⚠WARNING

- **Environments containing inflammable substances**
  To prevent the risk of fire and/or explosion, do not use the product in environments containing inflammable gas, vapor, or dust.
- **In the event of problems**
  To prevent a fire hazard, immediately turn OFF the [POWER] switch of the MCF-A/B if smoke emerges from the product, and disconnect the power cable to terminate system operations.
- **Compatible input**
  Strain amplifier: DPM-91A, DPM-92A, DPM-91A-I, DPM-92A-I, CDV-90A
  Avoid connecting any device other than sensors that use a strain gage. Failure to observe this precaution may result in electric shock, performance degradation, or malfunctions.
  Thermocouple: CTA-90A
  Avoid connecting any device other than thermocouples. Failure to observe this precaution may result in electric shock, performance degradation, or malfunctions.
  Alternating signal output sensors: CFV-90A
  Avoid inputting the voltage outside specification range. Failure to observe this precaution may result in electric shock, performance degradation, or malfunctions.
  IEPE accelerometer(Built-in amplifier type): CCA-90A
  Avoid connecting any device other than IEPE accelerometer. Failure to observe this precaution may result in electric shock, performance degradation, or malfunctions. When connecting a charge output accelerometer, please use a charge converter.

⚠CAUTION

- **After power is turned OFF, wait at least five seconds before turning ON power once again.**
  If power is turned on again within five seconds or if the [POWER] switch is repeatedly turned ON and OFF, the fuse may blow due to the inrush current generated by the product being turned on, and the product may not function properly.
- **Use the product in a temperature range of -10°C to 50°C.**
  Using the product at temperatures outside of the specified range may lower product performance or result in malfunctions. If the product must be used under direct sunlight or in a cold place, protect the product with a screen or take proper measures to keep it warm.
- **Use the product in a relative humidity range of 20% to 85%. Safeguard against condensation.**
  Using the product in environments in which the relative humidity falls outside the specified range may degrade product performance or result in malfunctions. For the same reasons, avoid exposing the product to condensation.
- **Take care of condensation after an abrupt change in the environment.**
  After changes in ambient humidity and/or temperature, wait for the product to acclimate before use. Abrupt changes in ambient temperature, such as during transportation, may cause condensation, which can degrade performance or cause malfunctions.
- **Take care when operating the product in locations where the product may be subject to severe impact or vibration.**
  The product's vibration resistance is as follows:
  Vibration resistance 49.03 m/s^2 (5 G): 5 Hz to 55 Hz (during operation), 15 cycles (1 min/cycle) in each direction of X, Y, and Z
  Use the product only in areas where vibrations can be kept within the scope of the specifications. Continuous vibration or severe impact may result in performance degradation or malfunctions.
- **Avoid using the product in the presence of strong electromagnetic fields.**
  Use the product only in environments in which magnetic fields will not disrupt computer operations. Performance degradation, erratic operation, or malfunctions may occur if the product is used near radio equipment, microwave ovens, electric furnaces, or other equipment generating strong electromagnetic fields.
- **Avoid using the product under poor power supply conditions.**
  Failure to observe this precaution may result in performance degradation, erratic operations, or malfunctions.When using the AC adapter (SPU61A-106), make sure the power supply voltage is within the range 90 VAC to 264 VAC (50/60 Hz).When using the DC power cable, make sure the supply voltage is within the range 10 to 30 VDC.Be sure to use an AC power supply that does not emit noise or produce risk of instantaneous power outages. Alternatively, use a battery.
  The specifications for the AC adapter (SPU61A-106) are as follows:

Input voltage	90 VAC to 264 VAC (47Hz to 63Hz)
Output voltage	13 VDC to 16 VDC (4.61 A to 3.75 A)
Operating temperature range	0°C to 70°C

⚠CAUTION

- **When using the AC adapter, replace with a new adapter periodically.**
  The AC adapter has a limited service life. Replace about once every five years.
- **Do not pull on or apply excessive tension to the cables.**
  Lay the cables with a certain safety margin of length to avoid subjecting the connections to excessive force.
  Applying excessive tension to a cable may result in abnormal output, conductor damage, or connector damage.
- **Avoid installing sensors near a welding machine or performing measurements near a welding machine.**
  Failure to observe this precaution may result in output abnormalities, erratic operations, or malfunctions.
- **Do not disassemble or modify the product.**
  Failure to observe this precaution can result in electric shock or malfunctions. Attempting to disassemble or modify the product will invalidate the warranty.
- **Do not use or store the product in environments in which the product may be exposed to dust, fine particles, or corrosive gases.**
  Failure to observe this precaution may result in performance degradation or malfunctions. Entry of dust into the product may degrade performance. Keep dust out of the product during use and during storage.
- **If the product is used or stored in a place near the sea, take appropriate measures to protect the product from exposure to outside air.**
  Failure to observe this precaution may result in performance degradation or malfunctions.
- **Avoid exposing the product to liquid.**
  The product is not waterproof or drip-proof.
  Make sure no liquids come into contact the product; otherwise, electrical leakage or malfunctions may result.
- **Operate the switches using your fingertip.**
  The push switches on the product are made of an elastic resin. To avoid damaging switches, avoid operating or allowing your fingernails to come into contact with switches. Avoid using pointed objects to operate the switches.
  Pressing a switch with excessive force may cause the switch to stick and prevent it from returning to its original position.
  Use your finger to operate the switches. Apply force in a direction perpendicular to the switch surface.
- **Allow the product to warm up before use.**
  When switched on, the product will assume operating status in about three seconds. However, the internal electric parts and semiconductors need more time to reach thermal stability. To ensure stable operations, always let the product warm up for about 10 to 15 minutes.
  When measuring trace strains of about several 100 μm/m, using a thermocouple for measurements, or performing measurements for an extended period of time, let the product warm up for 30 to 60 minutes.
  If the product is insufficiently warmed up before use, measurement accuracy may fail to meet product specifications due to the temperature-dependent characteristics of the amplifier card.
- **Clean the product as needed.**
  When the product becomes dirty, clean with a soft, dry cloth.
  If dust collects inside the product, remove dust using an air blower. Avoid contact with electronic components
- **Use shielded cables.**
  Always use shielded input cables for conditioner cards.
- **About the [COM] terminal**
  Because the [COM] terminal is connected to the output common terminal (outer side of negative BNC connector), when the switch is operated to connect the [COM] terminal to the [GND] terminal, the output common terminal connects to the chassis ground.

⚠CAUTION

- **About the utility nuts**
  Before using the utility nuts, carefully read "8-7. Utility Nuts" on page 71 of this manual. Use only screws of the specified length. Using screws of the incorrect length may result in product damage and/or injury.
- **Mounting cards**
  Mount the monitor display section and conditioner cards at the correct locations.
  Use a screwdriver suitable for the size of the screws to tighten the screws securing the cards.
  Be careful to avoid exceeding the maximum tightening torque or stripping the screw threads.
  Damaged screws may prevent card removal.

Precautions On CE Marking

NOTE

- Use a shielded cable as the remote control/command control signal cable for the unit.
- Attach a ferrite core near the centralized output connector of the signal cable for remote control/command control.
  Recommended ferrite core: GRFC-6 (Kitagawa Industries Co., Ltd.)

LIMITED-LIFE PARTS AND PREVENTIVE MAINTENANCE

The product incorporates various electronic components, some of which have limited service life.
These parts will degrade over the time, depending on the frequency of use, cumulative operating time, operating conditions (temperature and humidity), and other factors, leading eventually to potential performance degradation, erratic operations, or malfunctions.
To prevent such problems, perform inspections/maintenance and replace parts as needed.

The limited-life parts used in the product and optional accessories are as follows:

- Power supply unit
  A decrease in the signal-to-noise ratio, generation of smoke due to liquid leakage, or erratic operations may occur due to a change in the capacity of the aluminum electrolytic capacitor.
- AC adapter (option)
  Overheating, smoke generation, or unstable output voltage may result.
- One-touch-type terminal block (CTA-90A)
  The lead wire connection may come loose, resulting in contact failure or other problems.
- Nonvolatile memory (EEPROM)
  The system may no longer retain internal gain and other settings.

To ensure optimal performance for many years, perform all required inspections/maintenance and replace parts when needed.
For inspections/maintenance and to replace limited-life parts, contact your KYOWA representative.

* Main limited-life parts: Power supply unit, AC adapter (option), one-touch-type terminal block (CTA-90A)

* Age-related performance degradation may also affect parts other than limited-life parts and result in malfunctions.

REPLACEMENT OF THE UNIT BEFORE THE END OF SERVICE LIFE

Maintaining the product and replacing components will help ensure optimal performance and prolong product service life. However, since only consumables and limited-life parts can be replaced, natural age-related degradation will occur and progress for the entire unit. We recommend replacing units that have served for an extended period or begin to require frequent repairs.

TERMS AND INDICATIONS USED IN THE INSTRUCTION MANUAL

- Cards used with the product are referred to as "amplifier cards" or "conditioner cards."

- A slot into which a conditioner card is inserted is referred to as a "channel." Each conditioner card mounting position is indicated by a specific channel number.
  Channel numbers are indicated as follows: CH1, CH2, … CH16.

- DPM-91A, DPM-92A, DPM-91A-I, and DPM-92A-I are sometimes referred to collectively as the DPM-90A series.

- The MCF-8A and MCF-16A are sometimes referred to collectively as the MCF-A or the MCF-A series. The MCF-8B and MCF-16B are sometimes referred to collectively as the MCF-B or the MCF-B series.

- The MCF-8A and MCF-8B are sometimes referred to collectively as the MCF-8A/B. The MCF-16A and MCF-16B are sometimes referred to collectively as MCF-16A/B.

- The MCF-8A, MCF-16A, MCF-8B, and MCF-16B are sometimes referred to collectively as the MCF-A/B or the MCF series.

- A piezoelectric accelerometer with a built-in amplifier is referred to as an IEPE accelerometer.
  A piezoelectric accelerometer with charge output is referred to as a charge output accelerometer.

- If statements or other parts in the instruction manual are cited in other parts of the manual, they are enclosed in quotation marks (").
  Example: For terms and indicators used in the manual, see "TERMS AND INDICATIONS USED IN THE INSTRUCTION MANUAL" on page 8.

- Unless otherwise specified, discussions and explanations refer to illustrations of the MCF-A.
  The model name indication is the only difference in external appearance between the MCF-A and the MCF-B.

- NOTE and MEMO
  Important information or information useful in using the product will be indicated by "NOTE" or "MEMO," as shown below to call attention to the reader.

  Examples

NOTE

- Describes important information pertaining to product usage.

MEMO

- Describes information useful for product usage.

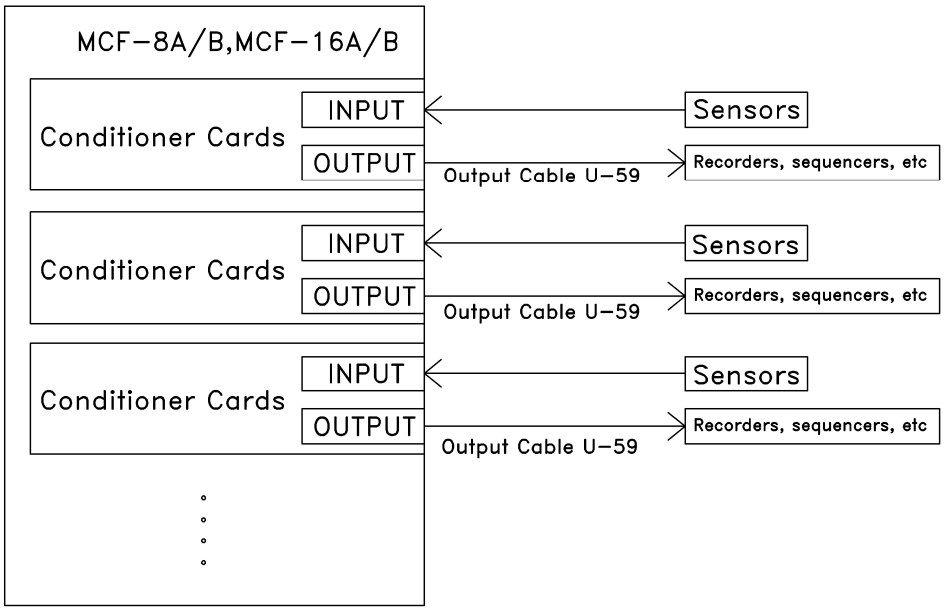
1. PRODUCT OVERVIEW

1-1. Product Overview

- Overview of Product Functions

  The MCF-8A/B and MCF-16A/B are multisignal conditioners used with a combination of various sensor amplifier cards (conditioner cards). A conditioner card amplifies the weak signal from the connected sensor and outputs a voltage. Connecting voltage outputs to a recorder, sequencer, or similar device allows the user to configure a multichannel measurement system.
  The MCF-8A/B and MCF-16A/B are smaller and lighter than our previous MCD-A series, making them easier to transport.
  They offer the same acclaimed functionality as our DPM-900 series and are easy to set up.
  Utility nuts are provided on the left and right sides of the product to allow the user to secure the product in place.
  Optional JIS- or DIN-compliant mounting fixtures are available for mounting the product into a rack.
  The MCF-8B and MCF-16B support command control via RS-485 communication.

- Product Features
  - Smaller and lighter than previous MCD-A series
  - Available as 8-channel or 16-channel unit
  - Flexibility to combine conditioner cards
  - Batch balance adjustment function and batch calibration signal output function
  - Utility nuts on the left and right sides of the unit
  - Isolated input and output terminals in all conditioner cards and isolated input channels
  - Simple settings



Possible to mount a maximum of 8 conditioner cards into MCF−8A/B or 16 conditioner cards into MCF−16A/B.

Example of system configuration

● Types of Conditioner Cards

Name	Model	Compatible Sensor
Strain amplifier card	DPM-91A	Strain gage, strain gage-type sensor
	DPM-92A	
	DPM-91A-I	
	DPM-92A-I	
Signal conditioner card	CDV-90A	
Thermocouple card	CTA-90A	Thermocouple K, T, J, N, E, R
F/V converter card	CFV-90A	Alternating signal output sensors
Charge amplifier card	CCA-90A	IEPE accelerometer (Built-in amplifier type)

● Overview of Conditioner Card Functions

[DPM-91A/92A/91A-I/92A-I]

・Strain amplifier with AC bridge power supply.
A high SN ratio makes these products ideal for high-accuracy measurements with a strain gage.

・DPM-91A-I/92A-I incorporate an inverter noise-reducing function but are otherwise identical to the DPM-91A/92A.
These products provide high-accuracy measurements even in environments subject to significant inverter noise.

・When used with a TEDS installed sensor, the TEDS function reads sensor information to set the internal gain.

Model	Carrier Frequency	Frequency Response Range	SN Ratio*	Inverter Noise Reduction
DPM-91A	5kHz	DC～2.5kHz	49dBp-p or higher	No
DPM-92A	12kHz	DC～5kHz	45dBp-p or higher	No
DPM-91A-I	5kHz	DC～2.5kHz	44dBp-p or higher	Yes
DPM-92A-I	12kHz	DC～5kHz	40dBp-p or higher	Yes

* When 200 μm/m input with 5 V output, 120 Ω short

[CDV-90A]

・Strain amplifier with a DC bridge power supply.
High frequency response makes the product ideal for measurements of high-speed phenomena.

・2 V or 10 V can be set for the bridge power supply.

・Using with a TEDS installed sensor allows the TEDS function to load sensor information to set internal gain.

[CTA-90A]

・Conditioner card for thermocouple.

・Measurements can be performed with six types of thermocouple: K, T, J, N, E, and R.

・The built-in reference junction compensator eliminates the need for an external adapter.

[CFV-90A]

・Conditioner card for frequency-voltage conversion.

・Enables conversion up to 100 kHz.

・Supplies power to sensors. (DC12V 50mA max)

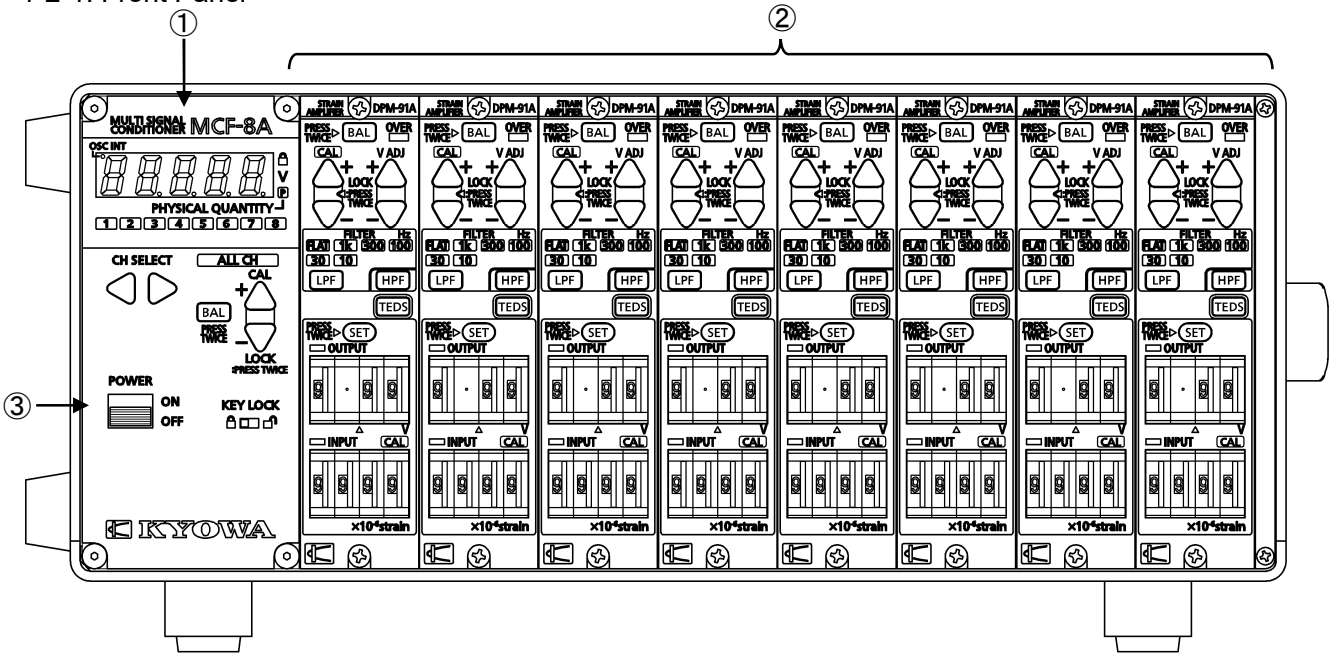
[CCA-90A]

・Conditioner card for IEPE accelerometer.

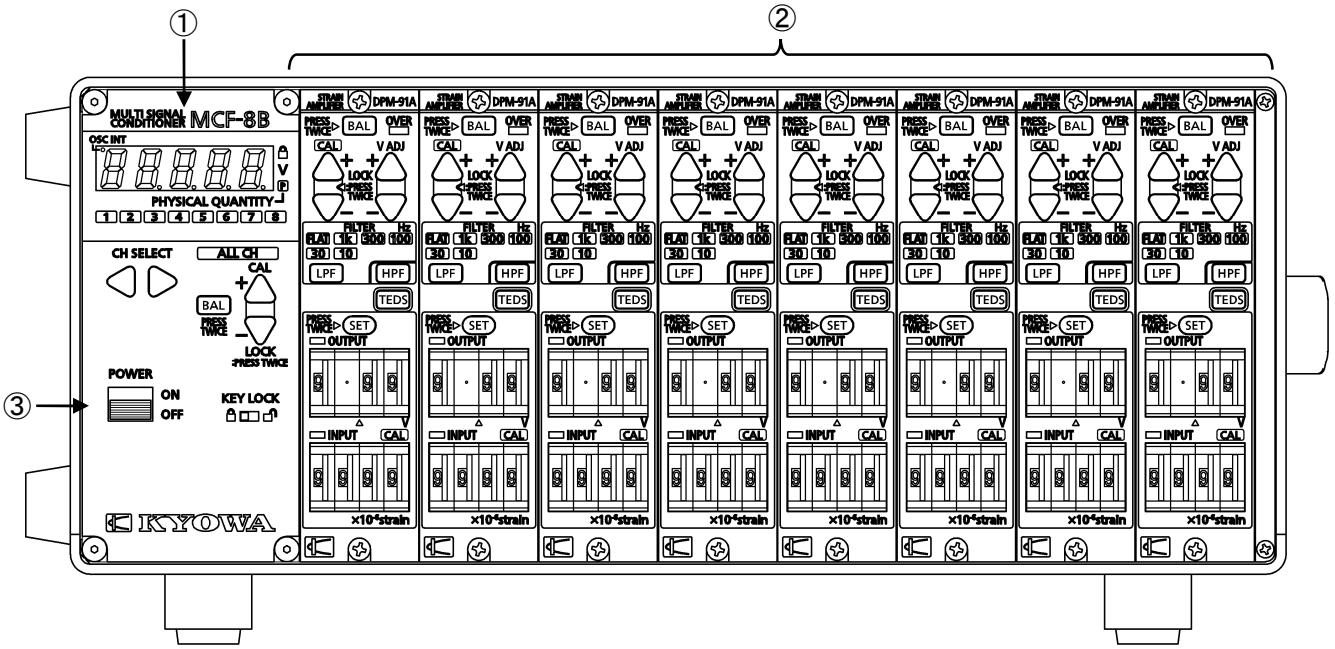
・When connecting a charge output accelerometer, use an optional charge converter.
The recommended charge converter is CAC1R0 (Fuji ceramics corporation).

1-2. Controls and Indicators

1-2-1. Front Panel



* Shown above is the front panel of the MCF-8A. The MCF-16A has a different number of slots for conditioner cards but offers the same controls and indicators as the MCF-8A.

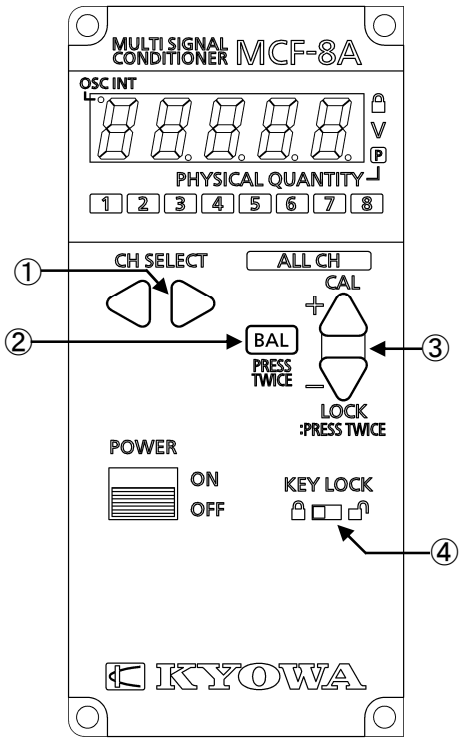


* Shown above is the front panel of the MCF-8B. The MCF-16B has a different number of slots for conditioner cards but offers the same controls and indicators as the MCF-8B.

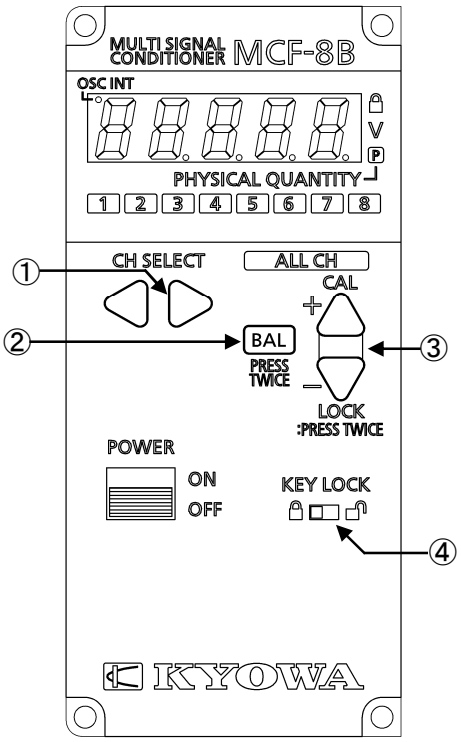
Aside from the command control function using RS-485 Communication, the MCF-8B and MCF-16B are functionally identical to the MCF-8A and MCF-16A.

① Monitor display section	Used to monitor and operate conditioner cards and view output. For more information, see "1-2-2. Front Panel (Monitor Display Section)" on page 12.
② Conditioner cards	Conditioner cards are mounted in the slots. The MCF-8A/B accepts up to 8 conditioner cards. The MCF-16A/B accepts up to 16 conditioner cards. For more information on conditioner cards, see "1-3. Controls and Indicators (Conditioner Cards)" on page 16.
③ [POWER] switch	The unit turns ON when the main power supply switch is moved to the upper position.

1-2-2. Front Panel (Monitor Display Section)



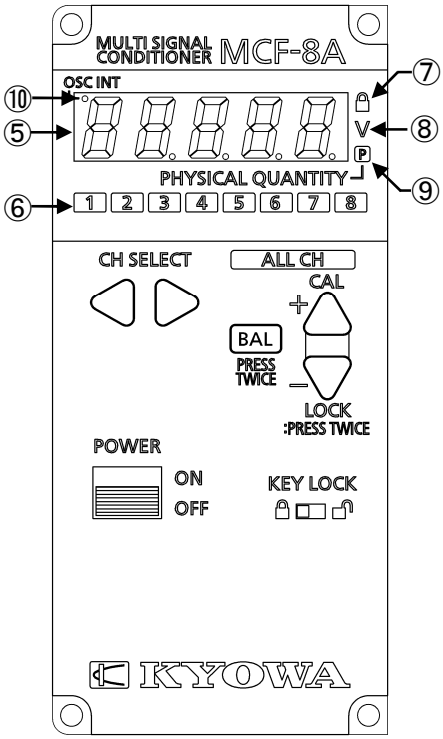
MCF-8A



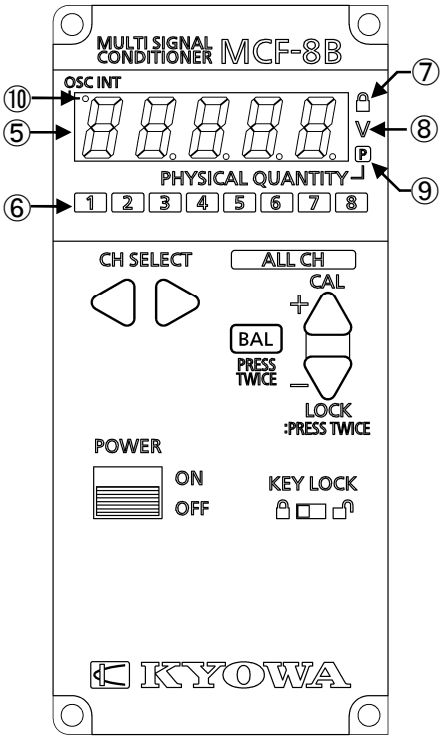
MCF-8B

* Aside from model identification, the MCF-8B monitor display section is functionally identical to that of the MCF-8A.
Aside from model identification and number of channel LEDs, the MCF-16A/B monitor display section is functionally identical to that of the MCF-8A.

① [CH SELECT] switches	This switch is used to select the channel displayed on the monitor meter.
② [BAL] switch (balance switch, balance adjustment switch)	This switch is used for conducting balance adjustment for all channels at the same time. For more information, see "8-4. Batch Calibration Function and Batch Balance Adjustment Function" on page 64.
③ [CAL] switch (calibration signal output switch, calibration switch)	This switch outputs the calibration signal while the [CAL] switch is pressed and held. Push the upper button to output positive (+) calibration signals. Push the lower button to output negative (-) calibration signals. Press the button twice in succession to hold the calibration signal output. Press the button again to release the hold. For more information, see "8-4. Batch Calibration Function and Batch Balance Adjustment Function" on page 64.
④ [KEY LOCK] switch	This switch is used to disable most switch operations and prevent accidental switch operation. Move the switch to the left to activate the key lock function for the MCF-A/B and all channels (excludes a few keys). For more information, see "8-5. Key Lock Function" on page 64.



MCF-8A



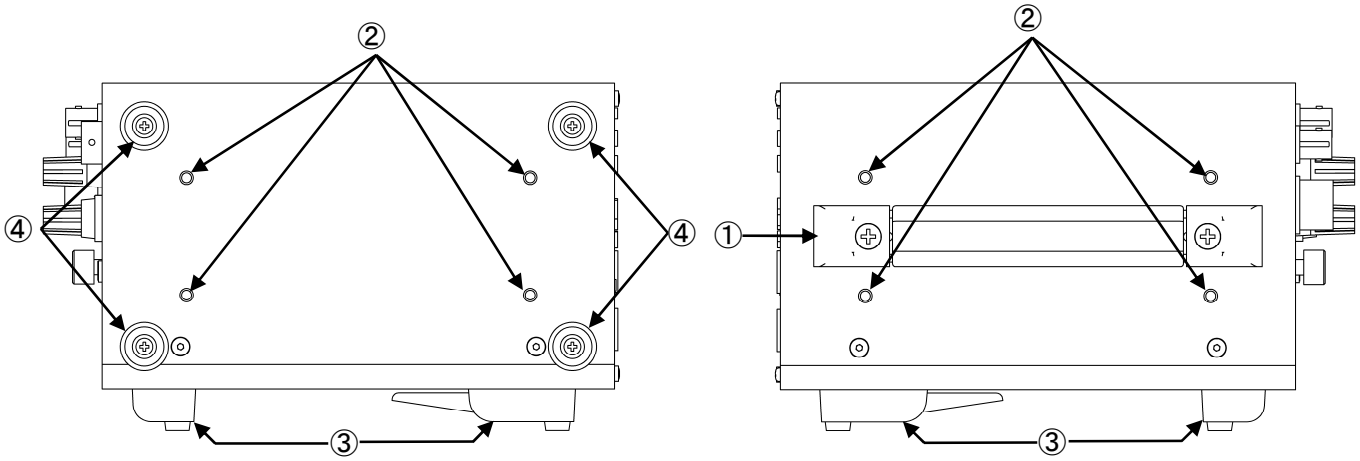
MCF-8B

⑤ Monitor meter	This meter indicates the output voltage of the selected channel. The indication flashes when the output voltage is exceeded by ±5.1 V. In TEDS mode, the monitor meter indicates physical quantities. If an error occurs, the meter will display an error message.
⑥ [CHANNEL] LED	This LED indicates the selected channel.
⑦ [KEY LOCK] LED	The [KEY LOCK] LED remains lit while the key lock function is active.
⑧ [VOLT] LED	The [VOLT] LED illuminates when the monitor meter indicates a voltage value.
⑨ [PHYSICAL QUANTITY] LED	The [PHYSICAL QUANTITY] LED illuminates when the monitor meter indicates a physical quantity.
⑩ [OSC INT] LED	The [OSC INT] LED remains lit when the internal oscillator is selected while using a strain amplifier card. For information on oscillator synchronization, see "2-4-1. Setting the OSC (DPM-90A Series)" on page 36.

MEMO

- "Press twice in succession" means pressing the switch twice within 0.5 seconds.

1-2-3. Side Panels



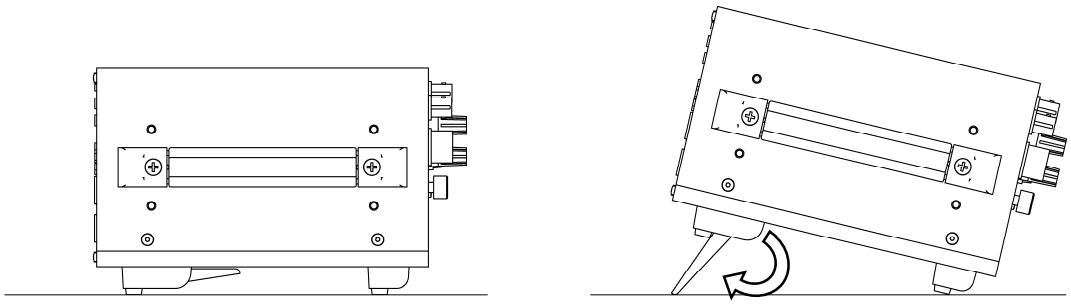
Left side　　Right side

① Handle	Used for transporting the unit.
② Utility nuts	Each of the left and right sides has four utility nuts, as well as M4-size screw holes for securing the product. For more information, see "8-7. Utility Nuts" on page 71.
③ Tilt legs	The tilt legs can be folded out to change the unit positioning angle.
④ Rubber legs	The unit can be temporarily placed with its left side facing down during transportation.

NOTE

- When placing the unit on its rubber legs, make sure it does not tip over. Malfunctions or user injury may result if the product tips over.
  If the unit is stored or operated in such a condition, secure the unit in place or take other measures to prevent the unit from tipping over.
- When using the CTA-90A, make sure the unit is level with the floor. If the unit is set up with its left side facing down, internal temperatures will change, keeping the product from performing according to specification.

Fold out the tilt legs to change the unit positioning angle.

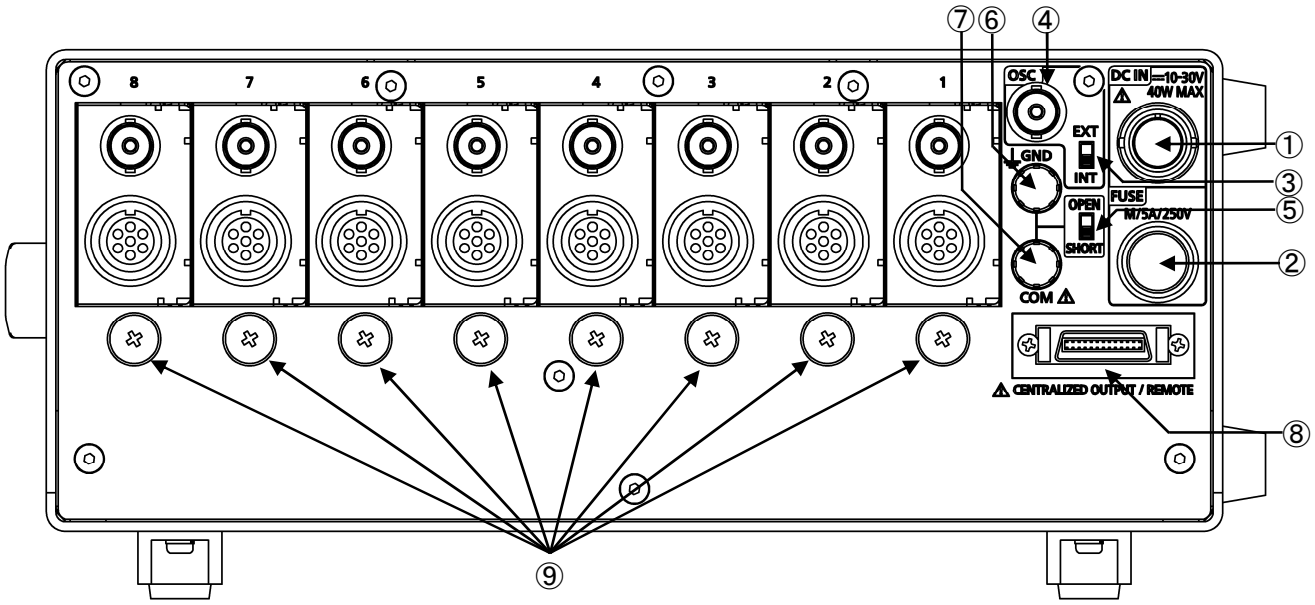


Unit setup with tilt legs in folded positions　　Unit setup with tilt legs folded out

NOTE

- When using the tilt legs, make sure that both left and right legs are folded out.
- When using the product in environments in which it is subjected to vibration or impact, keep the tilt legs folded.
  Damage may result if the product is used with the tilt legs folded out in such environments.
- If the unit is set up on its fold-out tilt legs, avoid placing any items or applying force on the unit.
  Doing so may damage the tilt legs.
- Before using the utility nuts, carefully read the information provided in "8-7. Utility Nuts" on page 71.
  Improper use of the utility nuts may damage the product and result in injuries.

1-2-4. Rear Panel

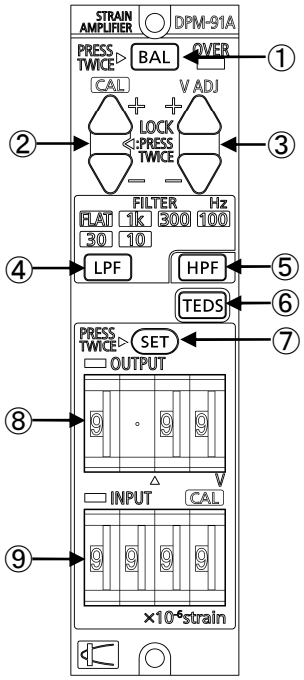


* Shown above is the rear panel of the MCF-8A/B. The MCF-16A/B has a different number of slots for conditioner cards but is equipped with the same controls and indicators as the MCF-8A/B.
(However, a command control function via RS-485 Communication is not supported.)

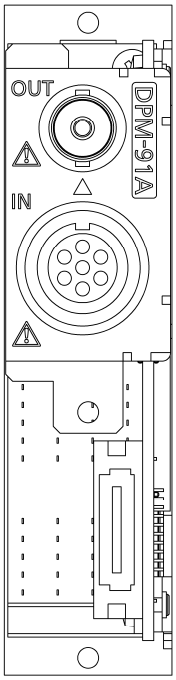
① [POWER SUPPLY] connector	Connects the AC adapter or DC power cable. The allowable power supply voltage range is 10 VDC to 30 VDC.
② [FUSE] holder	Used as the fuse holder for the power supply. The MCF-8A/B uses a normal blow-type fuse (5 mm x 20 mm, 125 VDC) with a rated capacity of 5 A. The MCF-16A/B uses a normal blow-type fuse (5 mm x 20 mm, 125 VDC) with a rated capacity of 10 A.
③ [OSC] select switch	Used to set the OSC used with a strain amplifier card. If only one MCF-A/B unit is used, select "INT" (internal OSC). If multiple MCF-A/B units are used with strain amplifier cards, select "INT" (internal OSC) in one unit and set all others to "EXT" (external OSC). For more information, see "2-4-1. Setting the OSC (DPM-90A Series)" on page 36.
④ [OSC BNC] connector	Used for measurements with multiple MCF-A/B units and strain amplifier cards. For more information, see "2-4-1. Setting the OSC (DPM-90A Series)" on page 36.
⑤ [COM] select switch	Used to set SHORT/OPEN for the [COM] terminal and [GND] terminal. When set to OPEN, the [COM] terminal and [GND] terminal become open. When set to SHORT, the [COM] terminal and [GND] terminal become shorted. In normal use, set the [COM] select switch to SHORT to transition from COM to GND.
⑥ [GND] terminal	This protective ground terminal is connected to the chassis. Be sure to ground the [GND] terminal.
⑦ [COM] terminal	This terminal is connected internally to the output circuit's common potential. The [COM] terminal is connected to the negative sides (outer sides) of the output [BNC] connectors of all channels.
⑧ [CENTRALIZED OUTPUT] connector	For more information on this connector, see "8-6-2. Centralized Output" on page 66.
⑨ Rear-panel mounting screws	Used to attach the rear panels of conditioner cards.

1-3. Controls and Indicators (Conditioner Cards)

1-3-1. Strain Amplifier Card (DPM-90A Series)



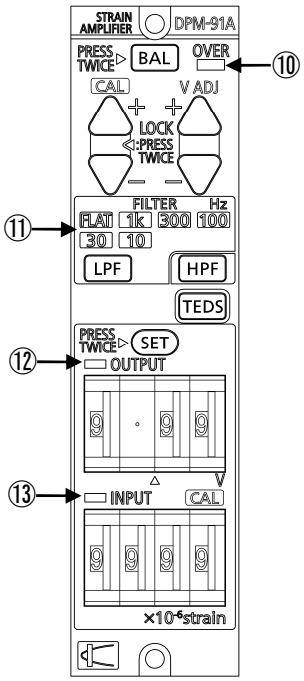
Front panel



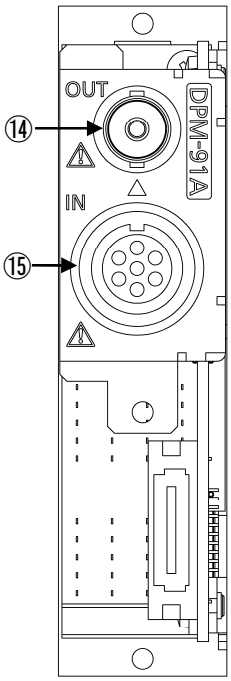
Rear panel

* Shown above is the DPM-91A. Other strain amplifier cards look the same except for the indicated model name.

① [BAL] switch	Used to adjust balance. Press the [BAL] switch twice in succession to adjust the balance.
② [CAL] switch	Used to output calibration signals. Push the [+] side to add a positive (+) calibration signal to the input. Push the [-] side to add a negative (-) calibration signal to the input. Press the [CAL] switch twice in succession to hold the calibration signal output. The [CAL] switch remains lit during the output of the calibration signal.
③ [V ADJ] switch	Used to adjust the zero point of output voltage and to make fine adjustments of internal gain. Push the [+] side to move the zero point in the positive (+) direction. Push the [-] side to move the zero point in the negative (-) direction. The internal gain increases when the [+] side is pressed while the [SET] switch or [CAL] switch is pressed and held. The internal gain decreases when the [-] side is pressed while the [SET] switch or [CAL] switch is pressed and held.
④ [LPF] switch	Used to change the cutoff frequency of the low pass filter (LPF). Each press of the [LPF] switch reduces the cutoff frequency by one increment. Pressing the [LPF] switch when the cutoff frequency is "10 Hz" will reset the cutoff frequency to "FLAT". (FLAT → 1k → 300 → 100 → 30 → 10 → FLAT)
⑤ [HPF] switch	Used for enabling or disabling the high pass filter (HPF). Press and hold the [HPF] switch to enable or disable the high pass filter. The [HPF] switch remains lit while the high pass filter is enabled. The switch light goes out when the filter is disabled.
⑥ [TEDS] switch	Used for activating or deactivating TEDS mode. Press and hold the [TEDS] switch to activate or deactivate TEDS mode. The [TEDS] switch light turns blue when TEDS mode is active. For more information, see "4-3-2. Setting Internal Gain Using the TEDS Function" on page 45.
⑦ [SET] switch	Used to set the internal gain. Press the [SET] switch twice in succession to set the internal gain according to the settings of the [INPUT] switch and [OUTPUT] switch.
⑧ [OUTPUT] switch	Used to set the output voltage value. The setting can be configured in the range from 1.00 V to 5.00 V in 0.01 V increments.
⑨ [INPUT] switch	Used to set the amount of input strain or the calibration strain value.



Front panel



Rear panel

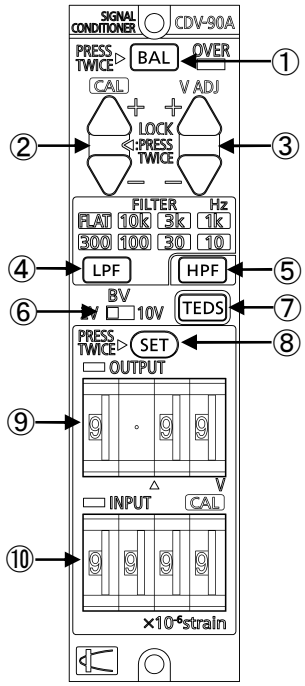
⑩ [OVER] LED	Lights up when the input is excessive in comparison to the set internal gain. For more information, refer to "8-1. [OVER] LED" on page 62.
⑪ [LPF] LED	Indicates the cutoff frequency of the low pass filter (LPF).
⑫ [OUTPUT] LED	Lights up after the internal gain is set properly. The [OUTPUT] LED flashes if the [OUTPUT] switch setting is changed after configuring the internal gain.
⑬ [INPUT] LED	Lights up after the internal gain is set properly. The [INPUT] LED flashes if the [INPUT] switch setting is changed after configuring the internal gain.
⑭ [OUTPUT] connector	Outputs a voltage corresponding to the input in accordance with the internal gain setting. BNC connector (female)
⑮ [INPUT] connector	Used to connect a strain gage transducer or bridge box. The compatible bridge resistance is 60 Ω to 1,000 Ω. NDIS connector (female)

MEMO

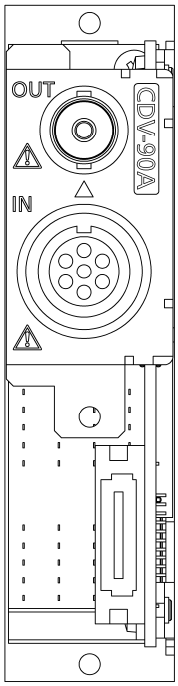
- "Press and hold" means to hold down the switch for at least one second.
- "Press twice in succession" means pressing the switch twice within 0.5 seconds.
- "Internal gain" refers to the amplification from the unit's input terminal to its output terminal.
- The internal gain can be set in the range from x200 to x50,000.

For more information on using strain amplifier cards, see "4. MEASUREMENT METHODS (DPM-90A SERIES, CDV-90A)" on page 42.

1-3-2. Signal Conditioner Card (CDV-90A)

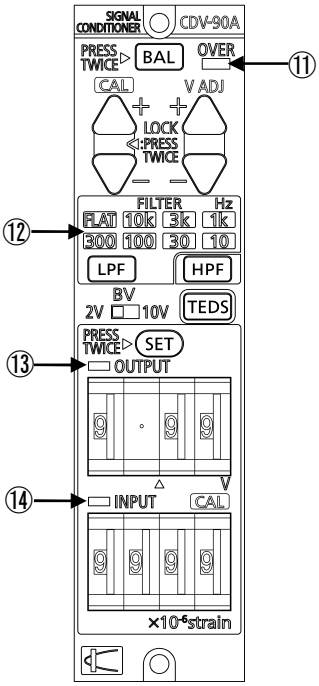


Front panel

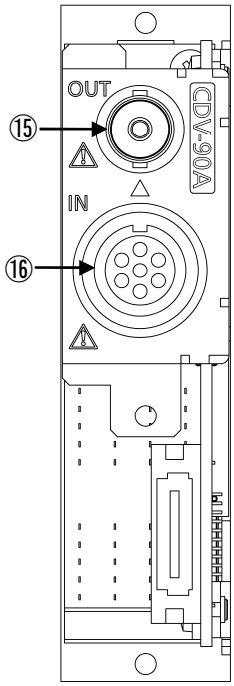


Rear panel

① [BAL] switch	Used to adjust the balance. Press the [BAL] switch twice in succession to adjust the balance.
② [CAL] switch	Used to output the calibration signal. Push the [+] side to add a positive (+) calibration signal to the input. Push the [-] side to add a negative (-) calibration signal to the input. Press the [CAL] switch twice in succession to hold the calibration signal output. The [CAL] switch lights up during the output of the calibration signal.
③ [V ADJ] switch	Used to adjust the zero point of output voltage and for fine adjustments of internal gain. Push the [+] side to move the zero point in the positive (+) direction. Push the [-] side to move the zero point in the negative (-) direction. The internal gain increases when the [+] side is pressed while the [SET] switch or [CAL] switch is pressed and held. The internal gain decreases when the [-] side is pressed while the [SET] switch or [CAL] switch is pressed and held.
④ [LPF] switch	Used to change the cutoff frequency of the low pass filter (LPF). Each time the [LPF] switch is pressed, the cutoff frequency decreases by one increment. Pressing the [LPF] switch when the cutoff frequency is "10 Hz" will reset the cutoff frequency to "FLAT". (FLAT → 10k → 3k → 1k → 300 → 100 → 30 → 10 → FLAT)
⑤ [HPF] switch	Used to enable/disable the high pass filter (HPF). Press and hold the [HPF] switch to enable or disable the high pass filter. The [HPF] switch lights up when the high pass filter is enabled. The switch light goes out when the filter is disabled.
⑥ [BV] switch	Select the excitation voltage (2 V or 10 V) for the bridge power supply.
⑦ [TEDS] switch	Used to activate/deactivate TEDS mode. Press and hold the [TEDS] switch to activate or deactivate TEDS mode. The [TEDS] switch light turns blue when TEDS mode is active. For more information, see "4-3-2. Setting Internal Gain Using the TEDS Function" on page 45.
⑧ [SET] switch	Used to set the internal gain. Press the [SET] switch twice in succession to set the internal gain based on the settings for the [INPUT] switch and [OUTPUT] switch.
⑨ [OUTPUT] switch	Used to set the output voltage value. The setting can be configured in the range from 1.00 V to 5.00 V in 0.01 V increments.
⑩ [INPUT] switch	Used to set the input strain or calibration strain value.



Front panel



Rear panel

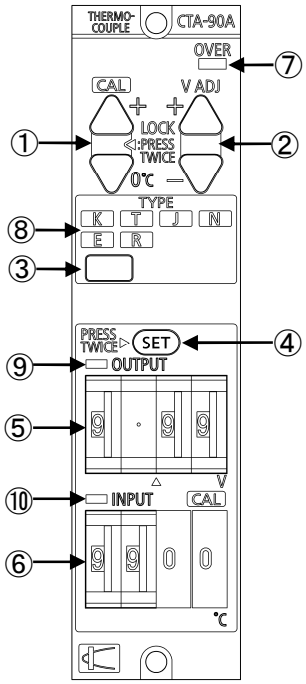
⑪ [OVER] LED	Lights up when the input is excessive in comparison to the set internal gain. For more information, refer to "8-1. [OVER] LED" on page 62.
⑫ [LPF] LED	Indicates the cutoff frequency of the low pass filter (LPF).
⑬ [OUTPUT] LED	Lights up after the internal gain is set properly. The [OUTPUT] LED flashes if the [OUTPUT] switch setting is changed after configuring the internal gain.
⑭ [INPUT] LED	Lights up after the internal gain is set properly. The [INPUT] LED flashes if the [INPUT] switch setting is changed after configuring the internal gain.
⑮ [OUTPUT] connector	Outputs a voltage corresponding to the input based on the internal gain setting. BNC connector (female)
⑯ [INPUT] connector	Used to connect a strain gage transducer or bridge box. The compatible bridge resistance is 60 Ω to 1,000 Ω. NDIS connector (female)

MEMO

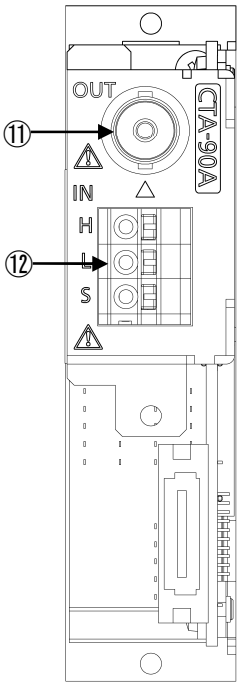
- "Press and hold" means to hold down the switch for at least one second.
- "Press twice in succession" means pressing the switch twice within 0.5 seconds.
- "Internal gain" refers to the amplification from the unit's input terminal to its output terminal.
- The internal gain can be set in the range from x200 to x5,000.

For more information on using signal conditioner cards, see "4. MEASUREMENT METHODS (DPM-90A SERIES, CDV-90A)" on page 42.

1-3-3. Thermocouple Card (CTA-90A)



Front panel



Rear panel

① [CAL] switch	Used to output calibration signals. Push the [+] side to output the calibration signal set with the [INPUT] switch. Push the [0°C] side to output the calibration signal at 0°C. The calibration signal is not a summed value, unlike in the DPM-90A and CDV-90A. Press the [CAL] switch twice in succession to hold the calibration signal output. The [CAL] switch lights up during the output of the calibration signal.
② [V ADJ] switch	Used to adjust the internal gain for output voltage. The internal gain increases when the [+] side is pressed and decreases when the [-] side is pressed.
③ [TYPE] select switch	Used to select the thermocouple type. Press the [TYPE] select switch repeatedly to cycle through type settings in the following sequence: K → T → J → N → E → R → K.
④ [SET] switch	Used to set the internal gain. Press the [SET] switch twice in succession to set the internal gain based on the settings for the [INPUT] switch and [OUTPUT] switch.
⑤ [OUTPUT] switch	Used to set the output voltage value. The setting can be configured in the range from 1.00 V to 5.00 V in 0.01 V increments.
⑥ [INPUT] switch	Used to set the input value or the calibration signal.
⑦ [OVER] LED	Lights up when the input is excessive in comparison to the set internal gain. For more information, refer to "8-1. [OVER] LED" on page 62.
⑧ [TYPE] LED	Indicates the type of thermocouple set.
⑨ [OUTPUT] LED	Lights up after the internal gain is set properly. The [OUTPUT] LED flashes when the [OUTPUT] switch setting is changed after configuring the internal gain.
⑩ [INPUT] LED	Lights up after the internal gain is set properly. The [INPUT] LED flashes if you change the [INPUT] switch setting after configuring the internal gain.
⑪ [OUTPUT] connector	Outputs a voltage corresponding to the input in accordance with the internal gain setting. BNC connector (female), model: BNC186
⑫ [INPUT] connector	Used to connect a thermocouple. Compatible bridge resistance values range from 60 Ω to 1,000 Ω. One-touch type terminal block, model: OSN-060-BS-3P

NOTE

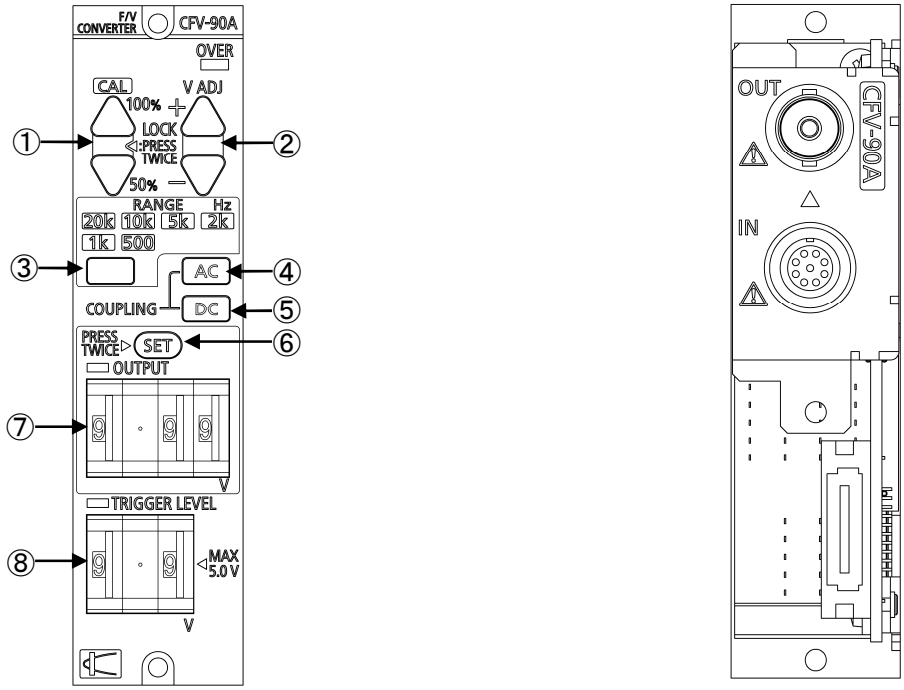
- Remove approximately 9 mm to 10 mm of the sheath from the thermocouple to be used and insert into the terminal block while holding the button on the terminal block.
  Release the button to lock the connection. Be sure to press and hold the button when inserting or removing a thermocouple.
- The following electrical wires are compatible:
  Single wire: ∅0.4 to ∅1.3 mm (UL AWG16 to 26)
  Stranded wire: 0.2 mm^2 to 1.3 mm^2 (UL AWG16 to 24)
  Be sure to use compatible wire (wire meeting specifications).Using a wire not listed above may result in wire breakage or connection failures.
- The service life of the terminal block is approximately one year, assuming that a lead wire is inserted and removed twice per day for 20 days per month.
  If a lead wire is inserted and removed repeatedly, the lead wire connection may come loose.

MEMO

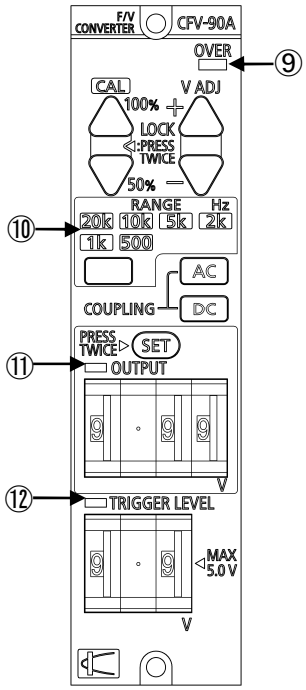
- "Press twice in succession" means pressing the switch twice within 0.5 seconds.
- "Internal gain" refers to the amplification from the unit's input terminal to its output terminal.
- For calibration signal output, the CTA-90A generates a voltage at 0°C or a voltage corresponding to the temperature set with the [INPUT] switch regardless of the input.

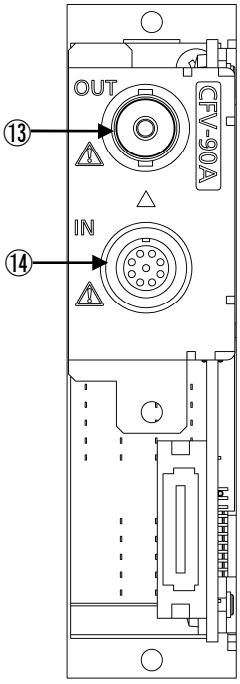
For more information on using thermocouple cards, see "5. MEASURING METHOD (CTA-90A)" on page 49.

1-3-4. F/V Converter Card (CFV-90A)



① [CAL] switch	Used to output calibration signals. Push the [100%] side to output a calibration signal with the value set for the [OUTPUT] switch. Push the [50%] side to output a calibration signal at 50% of the value set for the [OUTPUT] switch. Press the [CAL] switch twice in succession to hold the calibration signal output. The [CAL] switch lights up during the output of the calibration signal.
② [V ADJ] switch	Used to adjust the zero point of output voltage a. Push the [+] side to move the zero point in the positive (+) direction. Push the [-] side to move the zero point in the negative (-) direction.
③ [RANGE] switch	Select the frequency range to measure. Press the switch repeatedly to cycle through the range in the following sequence: 20 kHz → 10 kHz → 5 kHz → 2 kHz → 1 kHz → 500 Hz → 20 kHz.
④ [AC] switch	Press the switch to change to AC coupling input. Frequency is measured with input signal offset removed. The switch lights up when an AC coupling is in use.
⑤ [DC] switch	Press the switch to change to DC coupling input. Frequency is measured without removing input signal offset. The switch lights up when a DC coupling is in use.
⑥ [SET] switch	Press twice to set the output voltage as set for the [OUTPUT] switch.
⑦ [OUTPUT] switch	Used to set the output voltage value. The setting can be configured in the range from 1.00 V to 5.00 V in 0.01 V increments. When a frequency corresponding to [RANGE] is supplied, the voltage set for the [OUTPUT] switch is output.
⑧ [TRIGGER LEVEL] switch	Set the trigger level for signal detection. This setting can be configured in the range from 0.0 V to 5.0 V in 0.1 V increments.





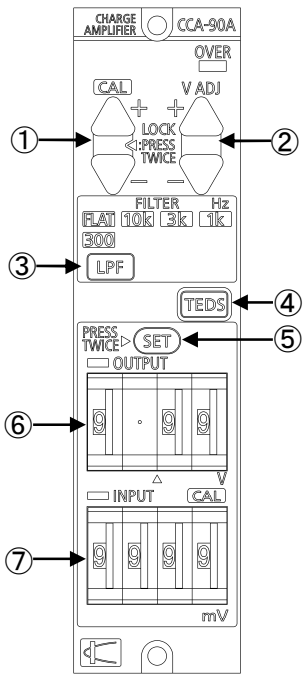
⑨ [OVER] LED	Lights up when the input is excessive in comparison to the set internal gain. For more information, refer to "8-1. [OVER] LED" on page 62.
⑩ [RANGE] LED	Indicates the set range.
⑪ [OUTPUT] LED	Lights up after the output voltage is set properly. The [OUTPUT] LED flashes when the [OUTPUT] switch setting is changed after configuring the output voltage.
⑫ [TRIGGER LEVEL] LED	Lights up when input signals at the set trigger level are detected.
⑬ [OUTPUT] connector	Outputs a voltage corresponding to the input based on the [OUTPUT] switch. BNC connector (female)
⑭ [INPUT] connector	Used to connect alternating signal output sensors. The supported input voltage range is ±0.5 V to ±50 V. NDIS4109 connector (female)

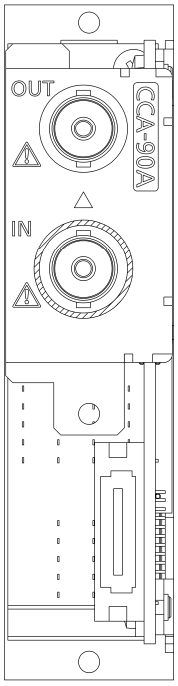
MEMO

- "Press twice in succession" means pressing the switch twice within 0.5 seconds.

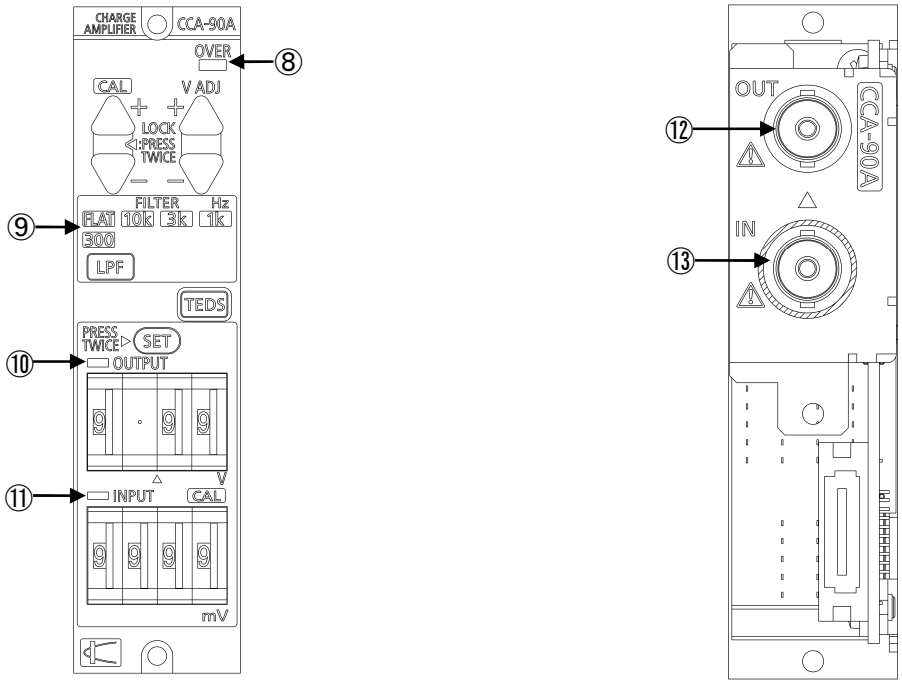
For more information on using F/V converter cards, see "6. MEASURING METHOD (CFV-90A)" on page 52.

1-3-5. Charge Amplifier Card (CCA-90A)





① [CAL] switch	Used to output calibration signals (DC CAL). Push the [+] side to add a positive (+) calibration signal to the input. Push the [-] side to add a negative (-) calibration signal to the input. Press the [CAL] switch twice in succession to hold the calibration signal output. The [CAL] switch remains lit during the output of the calibration signal.
② [V ADJ] switch	Used to adjust the zero point of output voltage and for fine adjustments of internal gain. Push the [+] side to move the zero point in the positive (+) direction. Push the [-] side to move the zero point in the negative (-) direction. The internal gain increases when the [+] side is pressed while the [SET] switch or [CAL] switch is pressed and held. The internal gain decreases when the [-] side is pressed while the [SET] switch or [CAL] switch is pressed and held.
③ [LPF] switch	Used to change the cutoff frequency of the low pass filter (LPF). Each time the [LPF] switch is pressed, the cutoff frequency decreases by one increment. Pressing the [LPF] switch when the cutoff frequency is "300 Hz" will reset the cutoff frequency to "FLAT". (FLAT→10k→3k→1k→300→FLAT)
④ [TEDS] switch	Used to activate/deactivate TEDS mode. Press and hold the [TEDS] switch to activate or deactivate TEDS mode. The [TEDS] switch light turns blue when TEDS mode is active. For more information, see "7-5. TEDS Function" on page 61.
⑤ [SET] switch	Used to set the internal gain. Press the [SET] switch twice in succession to set the internal gain based on the settings for the [INPUT] switch and [OUTPUT] switch.
⑥ [OUTPUT] switch	Used to set the output voltage value. The setting can be configured in the range from 1.00 V to 5.00 V in 0.01 V increments.
⑦ [INPUT] switch	Used to set the input voltage or calibration signal.



⑧ [OVER] LED	Lights up when the input is excessive in comparison to the set internal gain. For more information, refer to "8-1. [OVER] LED" on page 62.
⑨ [LPF] LED	Indicates the cutoff frequency of the low pass filter (LPF).
⑩ [OUTPUT] LED	Lights up after the internal gain is set properly. The [OUTPUT] LED flashes if the [OUTPUT] switch setting is changed after configuring the internal gain.
⑪ [INPUT] LED	Lights up after the internal gain is set properly. The [INPUT] LED flashes if the [INPUT] switch setting is changed after configuring the internal gain.
⑫ [OUTPUT] connector	Outputs a voltage corresponding to the input based on the internal gain setting. BNC connector (female)
⑬ [INPUT] connector	Used to connect an IEPE accelerometer. When connecting a charge output accelerometer, connect it to the sensor via a charge converter. BNC connector (female)

MEMO

- "Press and hold" means to hold down the switch for at least one second.
- "Press twice in succession" means pressing the switch twice within 0.5 seconds.
- "Internal gain" refers to the amplification from the unit's input terminal to its output terminal.

For more information on using Charge amplifier cards, see "7. MEASURING METHOD (CCA-90A)" on page 57.

2. SETTING UP THE MCF-A/B

This section describes the preliminary steps needed to set up the product and start measurement:
Follow the procedures described below to prepare for measurements:

Section 2-1	Mounting/dismounting conditioner cards	.....Mount the conditioner cards in the MCF-A/B.
↓		
Section 2-2	Connecting to the [INPUT] connector	.....Connect the sensors to the conditioner cards.
↓		
Section 2-3	Connecting to the [OUTPUT] connector	.....Connect the output destination devices to the conditioner cards.
↓		
Section 2-4	Initializing the MCF-A/B	.....Initialize the MCF-A/B.
↓		
Section 2-5	Connecting the power supply	.....Connect the power supply.
↓		
Section 3	Powering on	.....Turn on the [POWER] switch.

2-1. Mounting/Dismounting a Conditioner Card

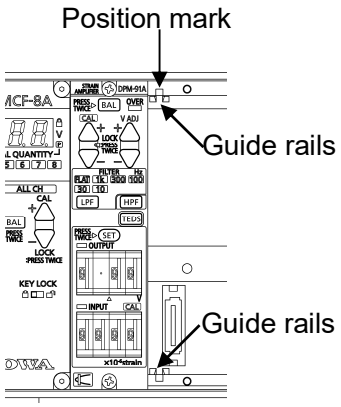
This section describes how to mount/dismount a conditioner card.

MEMO

- If conditioner cards were mounted in the product at the factory and there is no need to mount or dismount conditioner cards, proceed to "2-2. Connecting to the [INPUT] Connector" on page 30.

2-1-1. Mounting a Conditioner Card

Follow the procedure described below to mount a conditioner card:

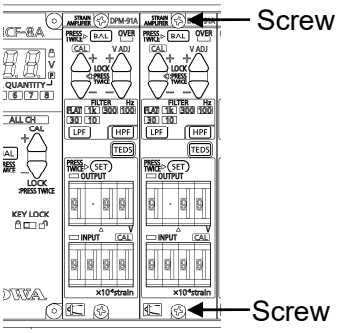


(1) Inserting a conditioner card
Insert a conditioner card into the guide rails inside the MCF-A/B. Push the conditioner card all the way in to securely connect the conditioner card to the MCF-A/B.

NOTE

- Four guide rails are provided (at the top and bottom on the front side and at the top and bottom on the back side) in each channel slot.
  Make sure the conditioner card passes through all guide rails.
- Inserting the conditioner card with the circuit board displaced from the guide rails may result in damage to the MCF-A/B or conditioner card.
  If the circuit board is displaced from the guide rails, pull out and reinsert the conditioner card. Make sure the circuit board passes through the guide rails.

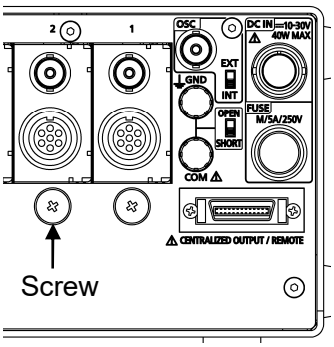
(2) Attaching the front panel to the MCF-A/B
Using the supplied screws, attach the front panel of the conditioner card. Use a screwdriver to tighten the screws.



MEMO

- The size of the screws is M2.5 x 6.
  Use an appropriate screwdriver.
- The recommended tightening torque is 36 [N-cm].
  Note that overtightening may damage the screws.

(3) Attaching the rear panel to the MCF-A/B
After attaching the front panel, install the rear panel of the conditioner card using the rear-panel mounting screws. Secure the rear panel in place by turning each rear-panel screw counterclockwise while pressing to keep the panel in place.



MEMO

- Use a No. 2 screwdriver to retighten the screws.
  The recommended tightening torque is 52 [N-cm].
- Install the rear panel after attaching the front panel. If the rear panel is attached first, the screws for the front panel may not tighten properly.

NOTE

- Please securely attach the front panel and the rear panel with screws.
  If the attaching is insufficient, contact failure may occur due to vibration etc., causing malfunction.

● Mounting a CTA-90A card

When using the CTA-90A thermocouple card for temperature measurements, you must stabilize temperatures inside the MCF-A/B.

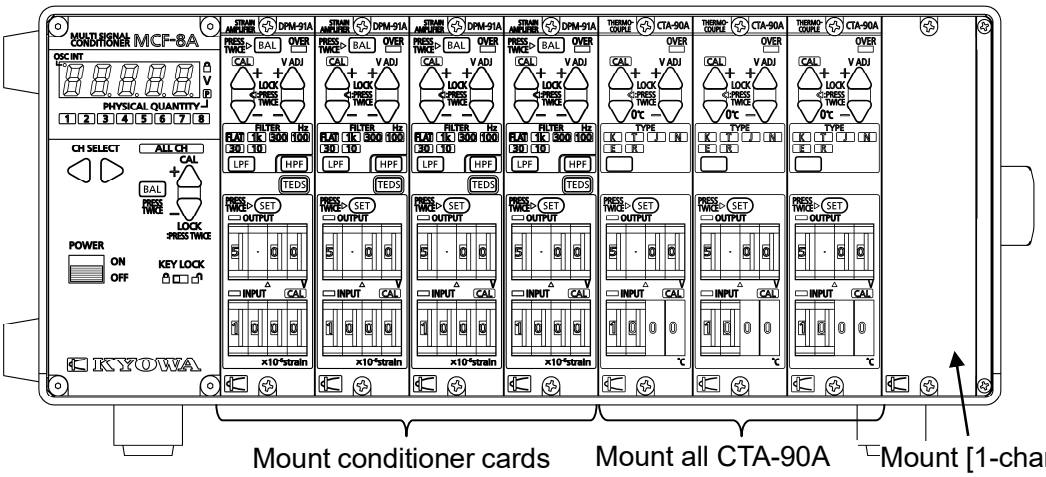
The following restrictions apply to the mounting of the CTA-90A for the purpose of stabilizing the internal temperatures of the MCF-A/B.

When mounting the CTA-90A in the MCF-A/B, observe the following restrictions:

- Mount conditioner cards other than the CTA-90A on the left side. The left side has lower-numbered channel slots.
  Mount the CTA-90A on the rightmost side, which has higher-numbered channel slots, of all mounted conditioner cards.

- When mounting multiple CTA-90A cards, mount the cards next to each other, with no empty channel slots in between.

- Make sure no channel slot lacks a conditioner card.
  If vacant channel slots exist, obtain the number of [1-channel dummy cards (option)] equal to the number of vacant channel slots and fill the slots. Mount the dummy cards on the right side of the CTA-90A.



● Mounting a CFV-90A card

A limited number of CFV-90A F/V converter cards can be mounted.

When using CFV-90A cards, refer to the following information and mount the cards in the MCF-A/B.

Do not exceed the limit.

- When using MCF-8A/B
  No limit applies to the number of cards that can be mounted in the MCF-8A/B. CFV-90A cards can be mounted in all eight channels.
- When using MCF-16A/B
  A limited number of CFV-90A cards can be mounted in the MCF-16A/B.
  The actual limit depends on whether other cards are in use.
  Up to 12 cards can be mounted if only CFV-90A is in use.
  When other cards are also in use, up to eight CFV-90A cards can be mounted.

NOTE

● Due to increased electrical load, exceeding the maximum number of cards may degrade product performance or result in malfunctions. Do not mount more than the maximum number of cards.

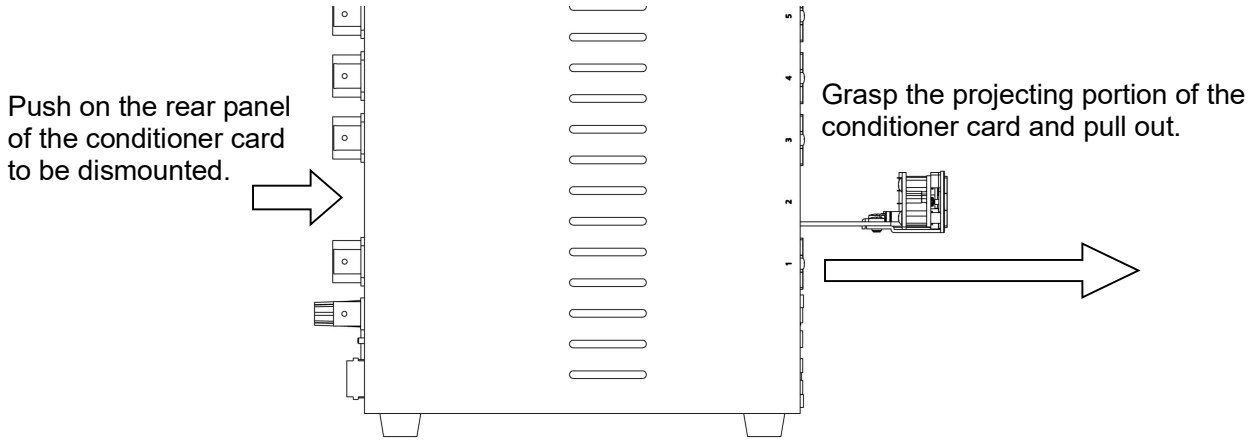
2-1-2. Dismounting a Conditioner Card

Dismount conditioner cards as follows:

(1) Removing the rear panel
Using a screwdriver, remove the rear-panel mounting screws from the rear panel of the MCF-A/B and detach the rear panel.

(2) Removing the front panel
Using a screwdriver, remove the conditioner card's front-panel mounting screws from both locations.

(3) Dismounting a conditioner card
Slowly push out the rear panel of the conditioner card.
When the rear panel is pushed, the conditioner card will extend from the front side. Grasp and pull out the conditioner card.



NOTE

- Conditioner cards are mounted along guide rails inside the MCF-A/B.
  To dismount a conditioner card, pull out along the guide rails.
- Always confirm that power is OFF before mounting/dismounting conditioner cards.
  Attempting to dismount a conditioner card while power is ON may result in malfunctions.

2-2. Connecting to the [INPUT] Connector

This section describes how to connect sensors to the [INPUT] connectors of the conditioner cards.

NOTE

- Before connecting various sensors to conditioner cards, make sure the card is screwed into the MCF-A/B.
  If conditioner cards are not screwed in, they may come loose from the MCF-A/B when sensors are connected.

2-2-1. Connecting a Strain Gage (DPM-90A Series, CDV-90A)

The following describes how to connect a strain gage for measurements.
Follow the procedure given below.

NOTE

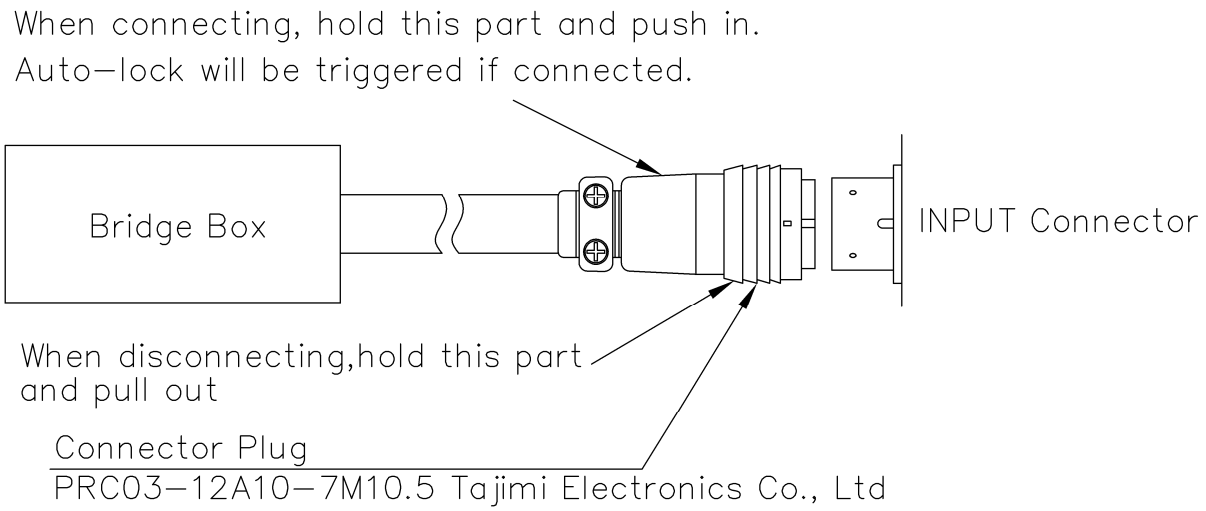
- A strain gage cannot be connected directly to the [INPUT] connector.
  Before attempting to connect a strain gage, obtain and configure a bridge box.

(1) Connecting a strain gage
Connect the strain gage to the bridge box to configure a Wheatstone bridge.
How a strain gage is connected depends on the strain gage type and measurement method.
Refer to the connection examples shown in "16-1. Examples of Strain Gage Bridge Assembly" on page 97.

NOTE

- For the wiring of the bridge box, we recommend soldering the connections to minimize contact resistance.
- Make the wire between the strain gage and bridge box as short as possible to minimize errors caused by lead wire resistance and the effects of external noise.
  The wire length should be less than 1 m, if possible.

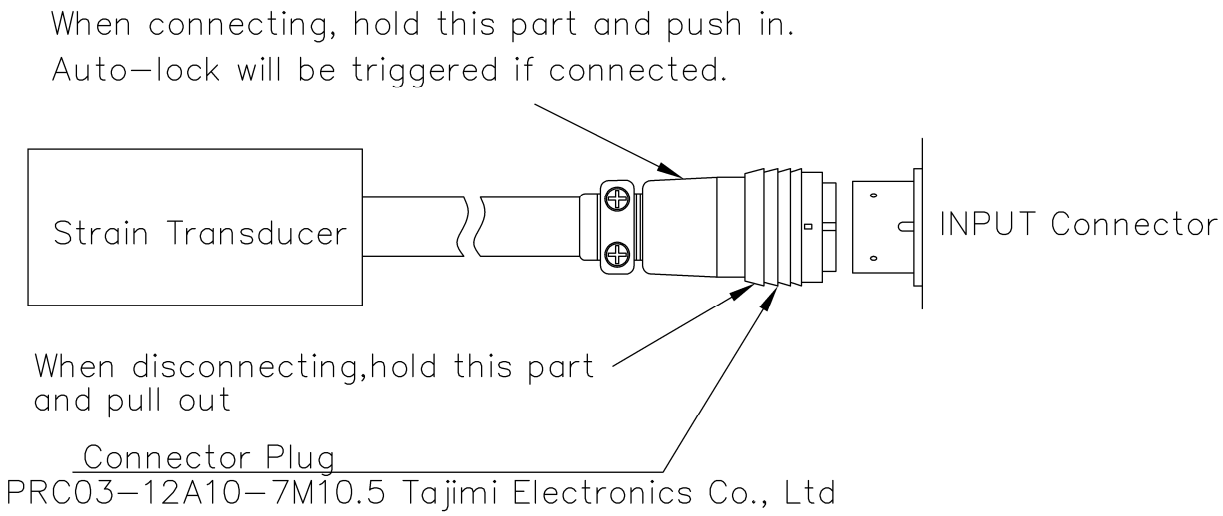
(2) Connecting a bridge box
Connect the plug of the bridge box to the [INPUT] connector on the rear panel.



2-2-2. Connecting a Strain Gage Transducer (DPM-90A Series, CDV-90A)

The connection method depends on whether or not a plug is attached to one end of the strain gage transducer.

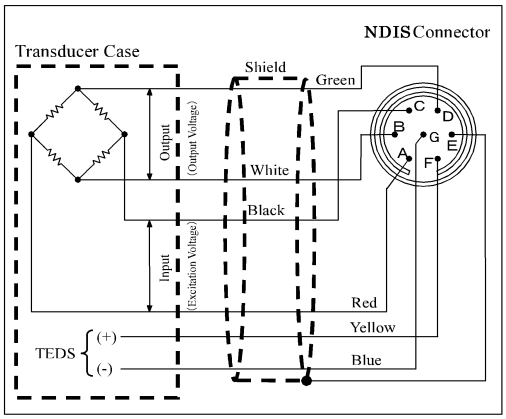
(1) When a plug is provided
Connect the plug of the strain gage transducer to the [INPUT] connector on the rear panel.



(2) If no plug is provided
Use a bridge box or solder a plug and connect to the [INPUT] connector on the rear panel.

① When using a bridge box
Connect the cable of the strain gage transducer to the bridge box in accordance with the connection method for a full bridge system. Refer to "16-1. Examples of Strain Gage Bridge Assembly" on page 97. After connecting the cable, connect the plug of the bridge box to the [INPUT] connector on the rear panel.

② When connecting a plug
Solder a plug to the cable of the strain gage transducer. The connection method is shown to the right.
The recommended NDIS plug is the Tajimi Electronics PRC03-12A10-7M10.5.
After soldering the plug, connect it to the [INPUT] connector on the rear panel.



MEMO

- The diagram shows the wire colors generally used for KYOWA strain gage transducers.

NOTE

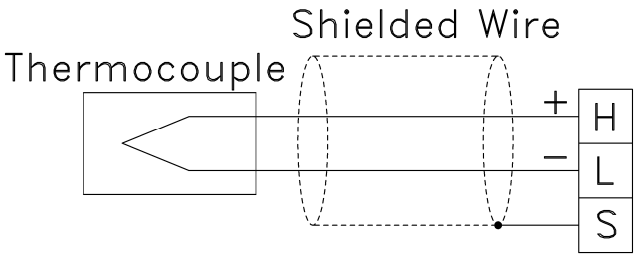
- For sensors designed to connect to carrier wave–type strain amplifiers, like the KYOWA TPN-AB/CB rotary transformer torque transducer or DLT-AS/BS inductance displacement transducer, carrier wave frequency will affect output voltage and characteristics.
  This means calibration must be performed with the sensor connected to the MCF-A/B to ensure proper operation.
  For a fee, KYOWA can perform calibrations for a combination of the sensor and the MCF-A/B. Contact your KYOWA representative to inquire about this service.
- Terminals F and G are exclusively for TEDS input. Do not connect remote sensing sensors to these terminals. To use a remote sensing sensor, use a Kyowa connection cable (N-81 to N-85, option) to connect the conditioner card to the sensor. (Remote sensing is disabled.)

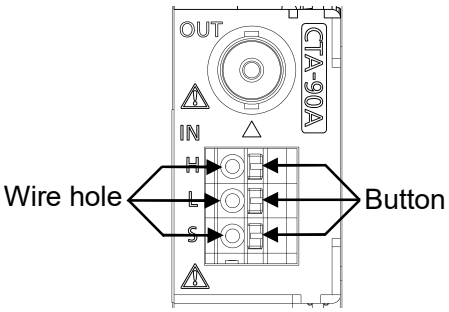
2-2-3. Connecting a Thermocouple (CTA-90A)

This section describes how to connect a thermocouple to the CTA-90A.

Thermocouples are connected to the [INPUT] connector on the rear panel. The [INPUT] connector is a one-touch-type terminal block. Connect the positive (+) side to the H terminal, the negative (-) side to the L terminal, and the shielded wire to the S terminal.
Follow the procedure given below to connect a thermocouple:

① Push in the button on the terminal block.
② With the button pushed in, insert the lead wire all the way into the wire hole.
③ Release the button after inserting the lead wire.
④ Gently tug on the wire to confirm a secure connection.
If the lead wire comes loose, repeat the procedure from ①.





Use shielded cable if you are connecting a thermocouple cable measuring more than 3 m.
Allow the equipment to warm up adequately (approximately 30 to 60 minutes) to ensure stable measurements. It will take some time for the equipment to stabilize thermally after being turned on.

NOTE

- Wait for the output to stabilize after changing thermocouples.
- Keep the MCF-A/B away from direct sunlight and air conditioning vents during measurements.
- Remove approximately 9 mm to 10 mm of the sheath from the thermocouple to be used and insert into the terminal block while holding down the button on the terminal block.
  Release the button to lock the connection. Always press and hold the button while inserting or removing a thermocouple.
- The following electrical wires are compatible:
  Single wire: ∅0.4 to ∅1.3 mm (UL AWG16 to 26)
  Stranded wire: 0.2 mm^2 to 1.3 mm^2 (UL AWG16 to 24)
  Be sure to use a compatible wire (wire meeting specifications). Using a wire other than one of those listed above may result in wire breakage or connection failure.

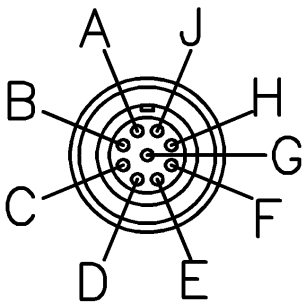
2-2-4. Connecting an F/V Converter Card (CFV-90A)

This section describes how to connect an alternating signal output sensor to the CFV-90A

(1) Input Connector

The CFV-90A input connector is a compact NDIS connector (model EPRC07-R9FNDIS; NDIS 4109 compliant, Tajimi Electronics). See the following figure for pin assignments.

Input connector



Input connector pin assignment

Pin	Signal Name
A	+ sensor power (+12 V)*1
B	Input COM*2
C	- sensor power (input COM)*1
D	Input +*2
E	Shield/chassis (GND)
F	NC
G	NC
H	NC
J	NC

*1 The sensor power supply can be up to 12 V, 50 mA.
*2 The input voltage range is ±0.5 V to ±50 V.

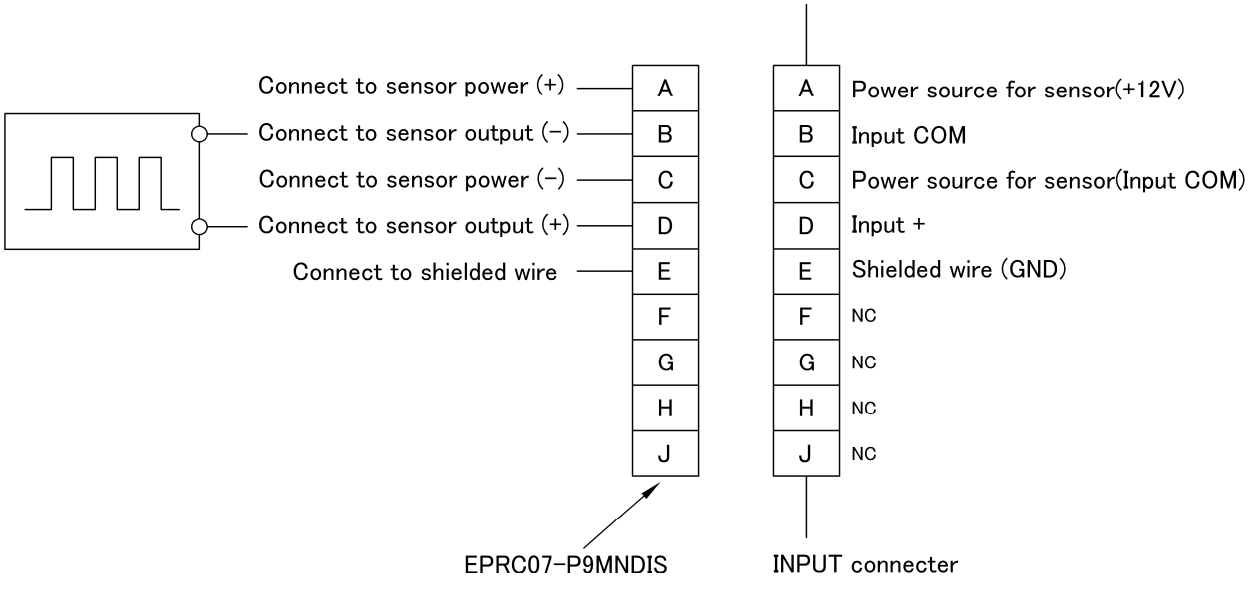
NOTE

- Do not apply a voltage below -50 V or greater than +50 V. Doing so may result in mulfunction.
- Do not short-circuit the positive and negative pins (pins A and C) of the sensor power. Doing so may result in mulfunction.

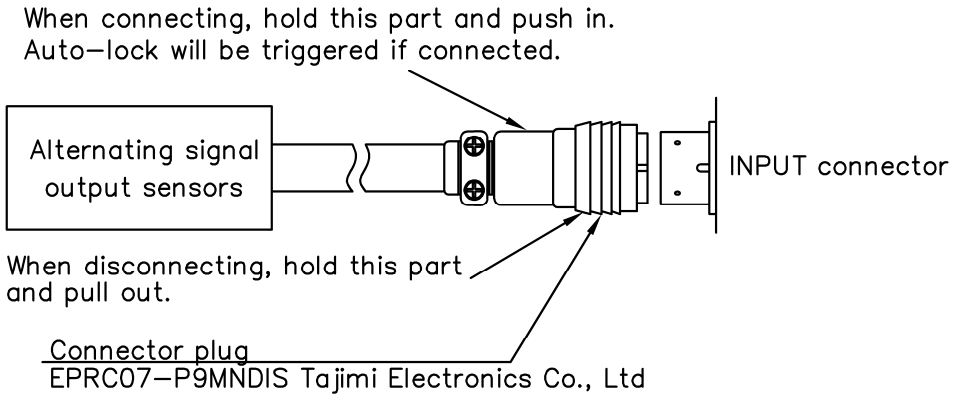
(2) Sensor Connection

Use the included connector plug (EPRC07-P9MNDIS) for this connection. Wire the plug and sensor as shown in the following figure.

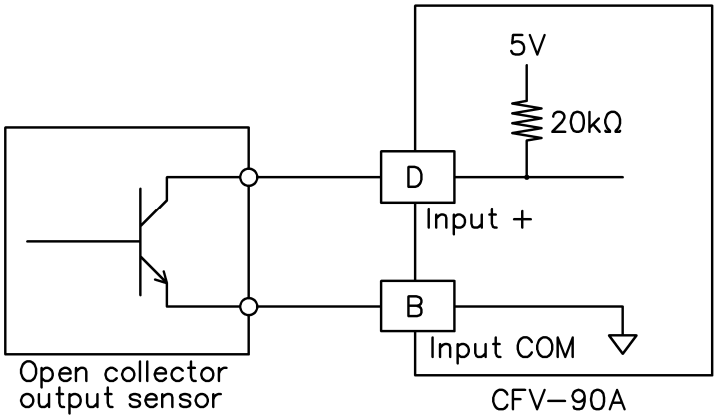
① Connect pins D and B of the plug to the sensor output.
② To use the sensor power supply, connect pins A and C of the plug to the sensor power supply.
③ To use a shielded wire, connect the shielded wire to pin E of the plug.



After wiring, connect the plug to the input connector.



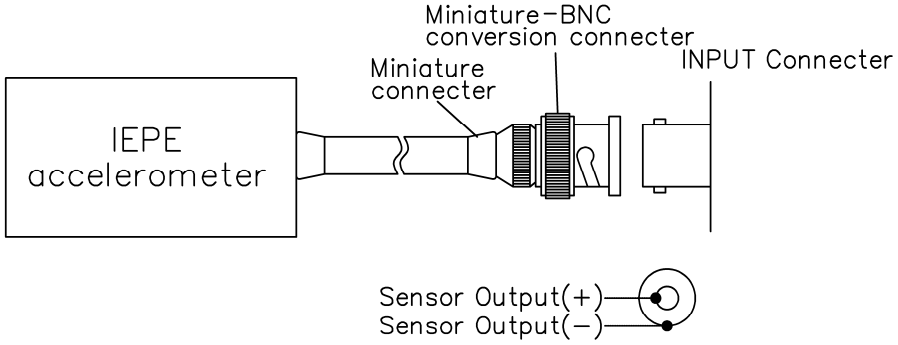
Pin D of the input connector is pulled up internally to 5 V.
To connect an open collector output sensor, connect pins D and B to the sensor as shown in the following figure.



2-2-5. Connecting a Charge Amplifier Card (CCA-90A)

This section describes how to connect an IEPE accelerometer or charge output accelerometer to the CCA-90A. Note that the connection method varies for each.

(1) IEPE Accelerometer Connection
Connect an IEPE accelerometer directly to the CCA-90A input connector.
The CCA-90A input connector is a BNC connector. A BNC adapter is required for accelerometers with miniature connectors.
Use the BNCP-C25J-A miniature-BNC conversion connector (option).
Refer to the following figure for the connection method when using a conversion connector.



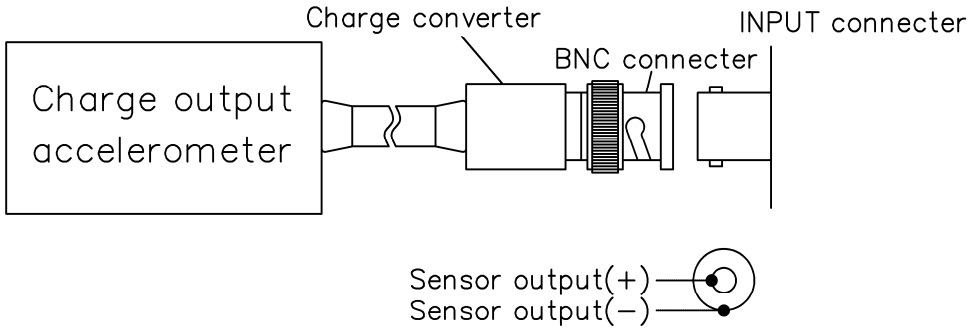
MEMO

- Connect an accelerometer that meets sensor power supply specifications for the CCA-90A (constant current: 4 mA; applied voltage: approx. 24 V). Connecting an accelerometer beyond the range supported may mulfunction the accelerometer.

(2) Charge Output Accelerometer Connection

Connecting a charge output accelerometer requires a charge converter.

Connect the accelerometer to the CCA-90A input connector via a charge converter.



MEMO

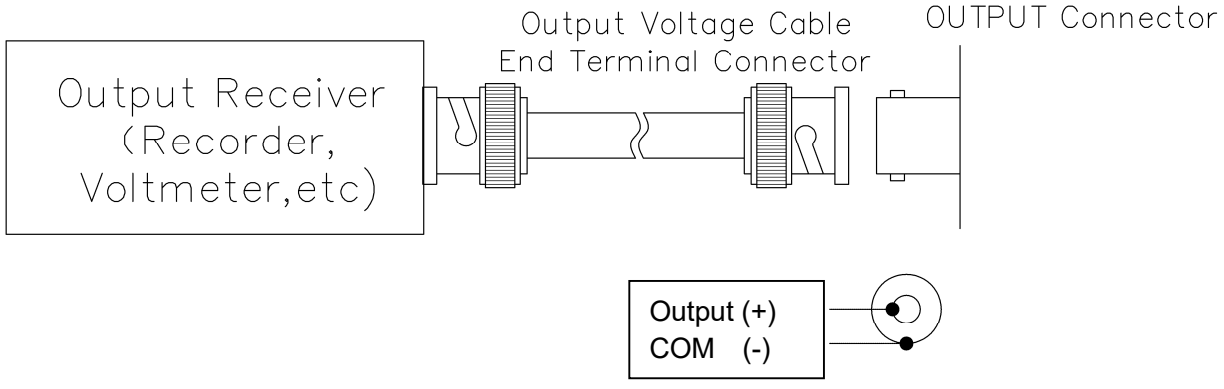
- Connect a charge converter that meets sensor power supply specifications for the CCA-90A (constant current: 4 mA; applied voltage: approx. 24 V).
  Connecting an accelerometer or charge converter beyond the range supported may mulfunction the charge converter.
- The charge converter recommended by Kyowa is the CAC1R0 (Fuji ceramics corporation).
  The polarity of CAC1R0 output is inverted relative to input signals.
  Thus, with the CAC1R0, the CCA-90A output and sensor signal polarity are inverted.
  If you wish to restore the original polarity, reverse the polarity on the recording device.

NOTE

- Output may fluctuate dramatically immediately after CCA-90A startup, when sensors are attached or removed, or when excessive input occurs. This does not indicate damage.
  In this case, it will take approximately 90 seconds for output to stabilize, depending on the sensors used and CCA-90A internal gain setting.
  Starting measurement before output stabilizes will cause output drift and affect measurement accuracy.
  Immediately after startup or after attaching or removing input connectors or sensors, wait for output to stabilize before starting measurement.

2-3. Connecting to the [OUTPUT] Connector

Using the supplied output cable, connect the output device to the [OUTPUT] connector.



2-4. Initializing the MCF-A/B

Before turning on power, initialize the MCF-A/B as follows:

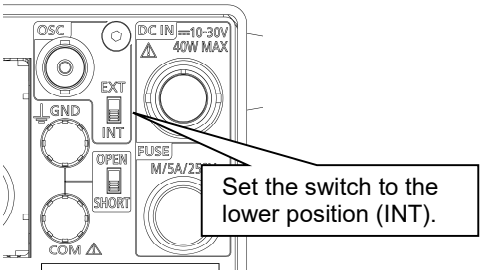
2-4-1. Setting the OSC (DPM-90A Series)

You must set the OSC (oscillator) to use a strain amplifier card.
Follow the procedure described below to set the OSC.

MEMO

- You do not need to set the OSC if you are not using a strain amplifier card.

- When using only one MCF-A/B unit
  Set the [OSC] select switch on the MCF-A/B 's rear panel to "INT" (internal oscillator).
  The switch setting is read when the power is turned ON.
  If you change the switch setting, turn power OFF, wait at least five seconds, then turn power back ON.



- When using two or more MCF-A/B units or when using an MCF-A/B together with another type of KYOWA dynamic strain amplifier
  If you use multiple MCF-A/B units and strain amplifier cards, the carrier waves in the multiple amplifiers may interfere with one another, generating beat waveforms in the output.
  To prevent this, the carrier waves of all amplifiers must be synchronized.

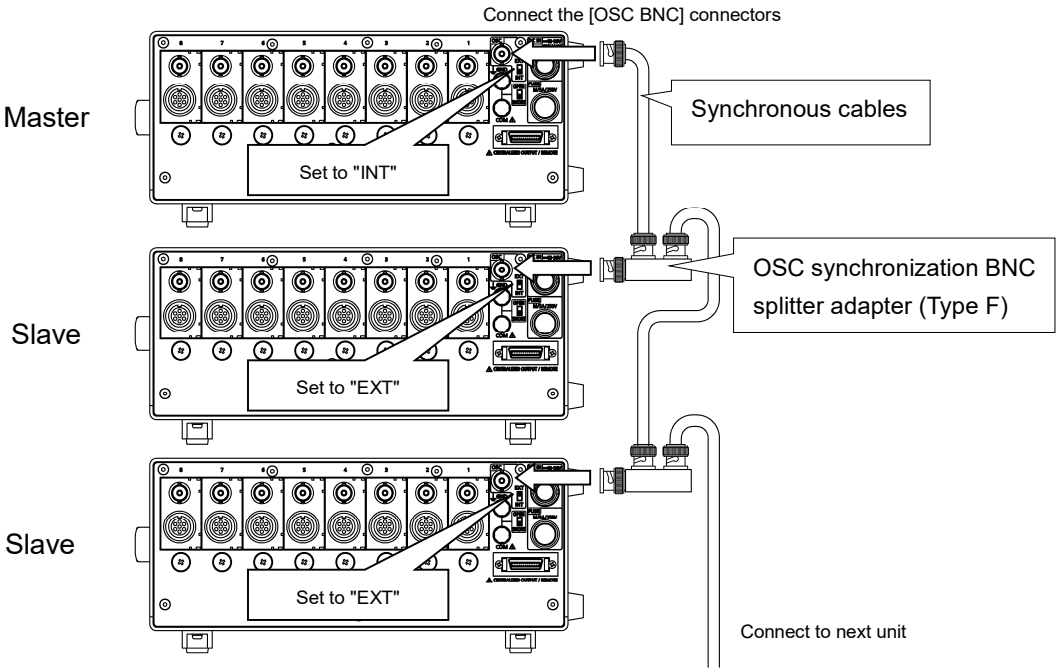
  Follow the connection and setting procedure described below:

  ① Using the supplied synchronous cables, connect the [OSC BNC] connectors on the rear panels of all MCF-A/B units in the series.

NOTE

- The optional OSC synchronization BNC splitter adapter (Type F) is required to synchronize three or more units.

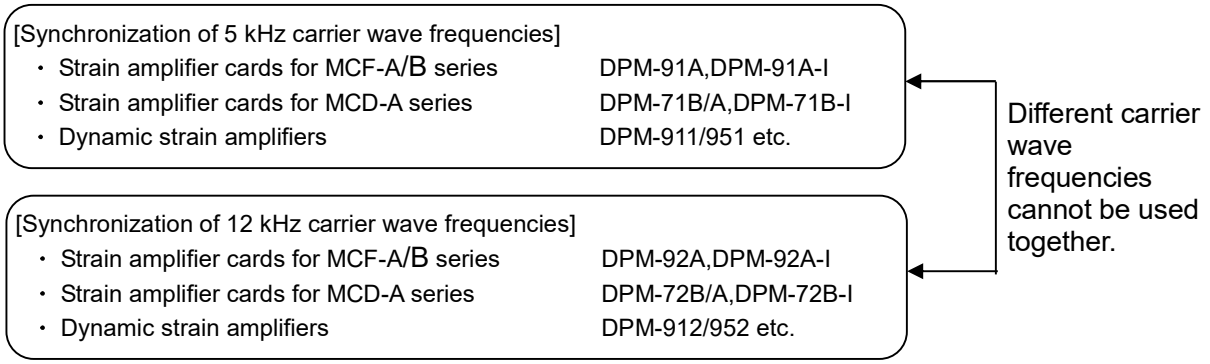
  ② Set the [OSC] select switch of one unit to "INT" (internal OSC). Set the [OSC] select switches of all other units to "EXT" (external OSC).



③ First, turn ON the [POWER] switch of the MCF-A/B unit (master unit) with its [OSC] select switch set to "INT" (internal OSC). Once it starts up, turn ON the [POWER] switches for all other MCF-A/B units (slave units).

NOTE

- Carrier wave synchronization
  If measurements involve multiple dynamic strain amplifiers, even a slight difference in carrier wave frequencies can generate beat waves. To prevent this, the carrier waves must be synchronized. Synchronizing carrier waves allows use of the following product in combination:



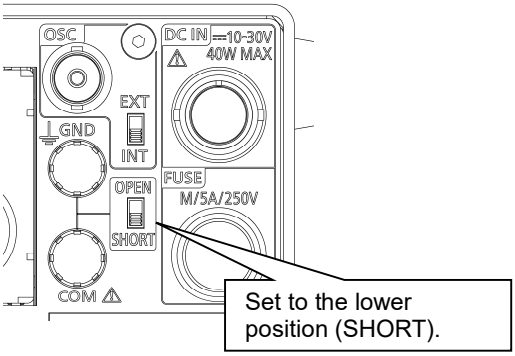
- Do not connect strain amplifiers other than KYOWA to the OSC BNC connector.
- After changing the [OSC] select switch setting or master, reset the internal gain of the conditioner cards.
- If the carrier waves are synchronized before measurement, turn ON all amplifiers subject to carrier wave synchronization.
  If none of the connected amplifiers is turned ON, strain measurements cannot be conducted with the OSC waveform.

MEMO

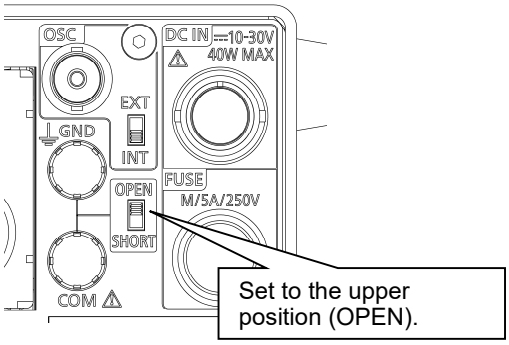
- About beat waves
  Combining two or more signals of different frequencies can result in the addition and cancellation of frequency components that generate recurring crests and troughs.
  Generated by the discrepancy between the signal waveforms, beat waves occur at a frequency called the beat frequency.

2-4-2. Setting the [COM] Select Switch

The [COM] select switch on the rear panel is used to change the connection between the [COM] terminal and [GND] terminal.
When the [COM] select switch is set to "SHORT," the connection between the [COM] terminal and [GND] terminal forms a short circuit.
When the [COM] select switch is set to "OPEN," the connection between the [COM] terminal and [GND] terminal forms an open circuit.



Short circuit between COM and GND



Open circuit between COM and GND

MEMO

- The [COM] terminal is internally connected to the output circuit's common potential.
  Short-circuiting the [COM] terminal and [GND] terminal connects the common output potential to the chassis ground.

2-5. Connecting the Power Supply

2-5-1. When Using the AC Adapter (Option)

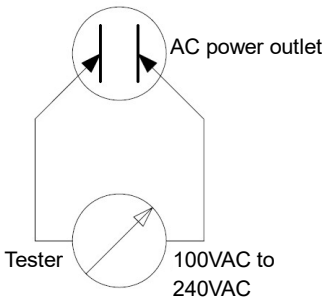
Connect the AC adapter to the [POWER SUPPLY] connector on the rear panel, then supply power.

NOTE

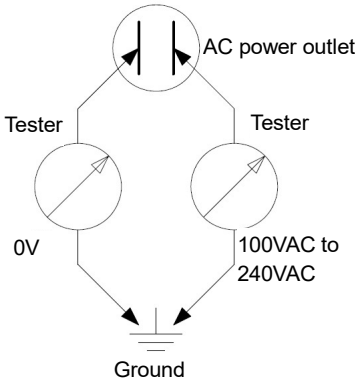
- Confirm the power supply voltage before connecting the AC plug of the AC adapter to a power outlet.
  The acceptable range for the power supply voltage for the AC adapter is 90 VAC to 264 VAC, 47Hz to 63Hz. Make sure the power supply voltage is within this range.
  To prevent malfunctions and accidents, do not connect the AC adapter to the AC power outlet if the power supply voltage falls outside the allowable voltage range or if the voltage to ground at any power supply terminal may exceed the power supply voltage.

The power supply voltage can be checked by doing the following:

① Measure the voltage between the terminals of the AC power outlet with a tester to make sure it is within the range of 100 VAC to 240 VAC.



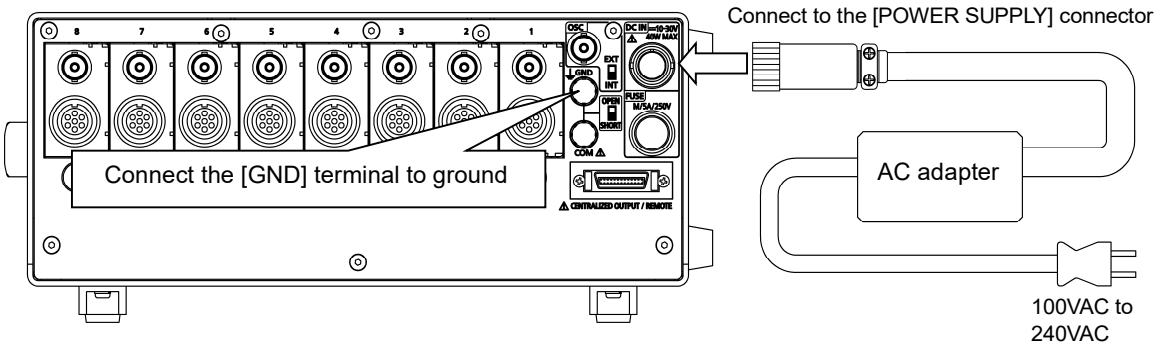
② Measure the voltage between each of the terminals of the AC power outlet and ground to make sure the voltage at one terminal is 0 V and the voltage at the other terminal is within the range of 100 VAC to 240 VAC.



③ If an induction motor, electric welding machine, or other noisy equipment is used in the same environment, use an isolation transformer or a commercial noise cut transformer to minimize noise effects. The presence of significant noise is likely to result in poor power supply conditions.

NOTE

- Be sure to connect the [GND] terminal to ground.
  Failure to ground the product properly may result in electrical shock, degraded performance, or malfunctions.



2-5-2. When Connecting DC Power Supply

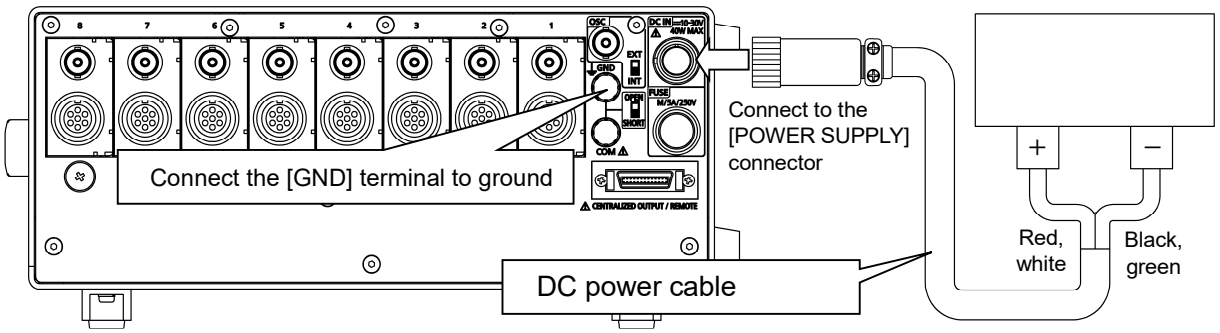
If a DC power supply must be used, use the supplied DC power cable (P-76).
Connect the cable to a DC power supply or external battery with a voltage in the range from 10 VDC to 30 VDC.

NOTE

- Confirm the power supply voltage before connecting the DC power cable.
  The acceptable range for the power supply voltage is 10 VDC to 30 VDC.
  Make sure the DC power supply voltage is within the allowable range. Be sure to ground the product.
  To prevent malfunctions and accidents, do not connect the DC power cable if the power supply voltage falls outside the allowable voltage range or if the voltage to ground at any power supply terminal may exceed the power supply voltage.
  Be careful to polarities when connecting the DC power cable. Reverse connection may cause fire hazards or malfunction.

Connect the connector of the supplied DC power cable to the rear panel of the MCF-A/B. Connect the other end of the cable as specified below:

Cable tip Red, white → 10 VDC to 30 VDC
Cable tip Black, green → 0 VDC

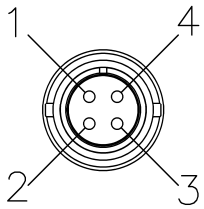


MEMO

- The model and pin assignment of the power connector are indicated below:

Pin assignment

Pin No	Name
1	+ side
2	
3	- side
4	

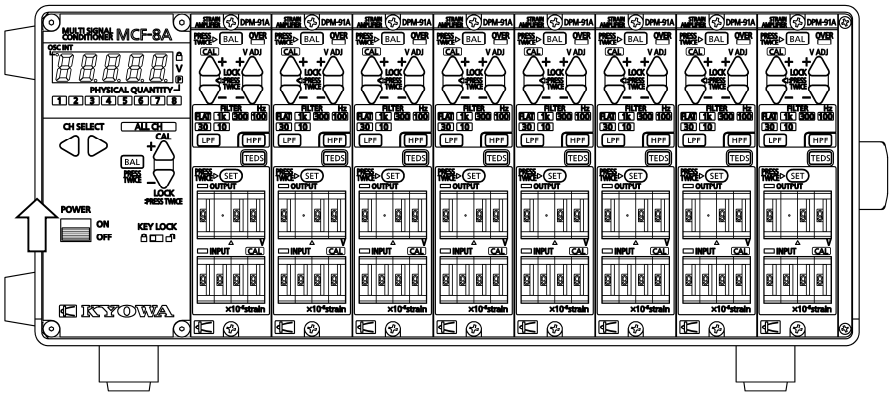


Model: RM12BRD-4PH (male)
Manufacturer: Hirose Electric
Applicable plug: RM12BPE-4S (female, Hirose Electric)

3. POWER ON/OFF METHOD

Set the [POWER] switch on the MCF-A/B 's front panel to the upper position. The MCF-A/B starts up, and the LED illuminates.
To turn power OFF, set the [POWER] switch to the lower position.

Set the [POWER] switch to the upper position



NOTE

- Warming up
  The device will assume operating status within about three second after it is turned on.
  However, internal electric parts and semiconductors take longer to reach a thermally stable condition.
  To ensure stable performance, always allow the product to warm up for 10 to 15 minutes.
  When measuring trace strains of about several 100 μm/m, using a thermocouple for measurements, or performing measurements for extended periods, allow the device to warm up for 30 to 60 minutes.
  Failure to allow the device to warm up adequately may affect measurement accuracy. In this case, accuracy may fail to meet product specifications due to the temperature specifications of the amplifier card.

- Powering down
  After switching power OFF, wait at least five seconds before turning power back ON.
  If power is turned back ON within five seconds after being turned OFF or if the [POWER] switch is repeatedly turned ON and OFF, the fuse may blow and the product may not function properly due to the inrush current generated by the product being turned ON .

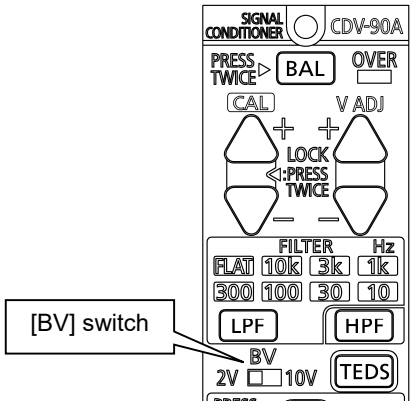
4. MEASUREMENT METHODS (DPM-90A SERIES, CDV-90A)

This section describes how to perform measurements using the DPM-90A series and CDV-90A.

Section 4-1	Selecting BV	..... Set the excitation voltage of the bridge power supply. (CDV-90A only)
	↓	
Section 4-2	Setting the filters	..... Set the low pass filter and high pass filter.
	↓	
Section 4-3	Setting the internal gain	..... Set the internal gain based on the strain gage or sensor.
	↓	
Section 4-4	Balance adjustment	..... Remove the initial imbalance.
	↓	
Section 4-5	Output of calibration signal	..... Set and output the calibration signal based on the strain gage or sensor.
	↓	
	Measurement	..... Begin measurement.

4-1. Selecting BV (CDV-90A Only)

Select a value from 2 V to 10 V as the bridge voltage for the CDV-90A.
Set the [BV] switch to the left side to select 2 V or to the right side to select 10 V.



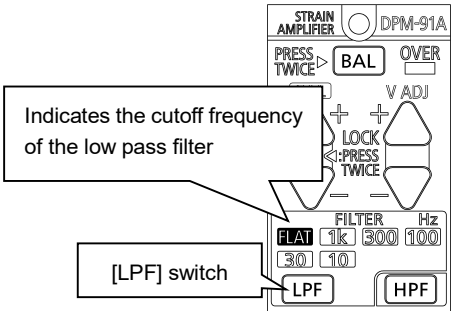
NOTE

- The range of applicable bridge resistance varies depending on the [BV] switch setting.
  The ranges of applicable bridge resistance are as follows:
  - BV = 10 V : 300 Ω to 1,000 Ω
  - BV = 2 V : 60 Ω to 1,000 Ω
- Changing the BV will result in abrupt fluctuations in current flowing to the strain gage or strain gage transducer, resulting in thermal instability.
  Since output fluctuates when measurements are done under unstable temperature conditions, wait about five minutes after changing the BV to allow temperatures to stabilize before proceeding with measurements.

4-2. Setting the Filters

4-2-1. Setting the Low Pass Filter (LPF)

The low pass filter restricts unnecessary high-frequency bands contained in a strain signal. If no such frequency band restrictions are needed, set the low pass filter to [FLAT] to disable the filter.
The filter's cutoff frequency changes each time you press the [LPF] switch. The lit LED indicates the set low pass filter cutoff frequency.

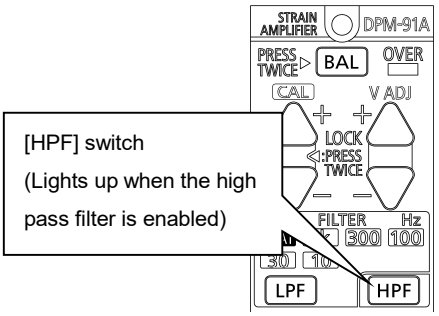


MEMO

- The cutoff frequency setting options differ for the DPM-90A series and the CDV-90A.
  - ・DPM-90Aseries : FLAT,1k,300,100,30,10
  - ・CDV-90A : FLAT,10k,3k,1k,300,100,30,10

4-2-2. Setting the High Pass Filter (HPF)

The high pass filter removes the DC component from the output.
Press and hold the [HPF] switch for at least one second to enable the high pass filter. The switch will illuminate.
The cutoff frequency is 0.2 Hz.
To disable the high pass filter, press and hold the [HPF] switch once again for at least one second.
The [HPF] switch light goes out when the high pass filter is disabled.



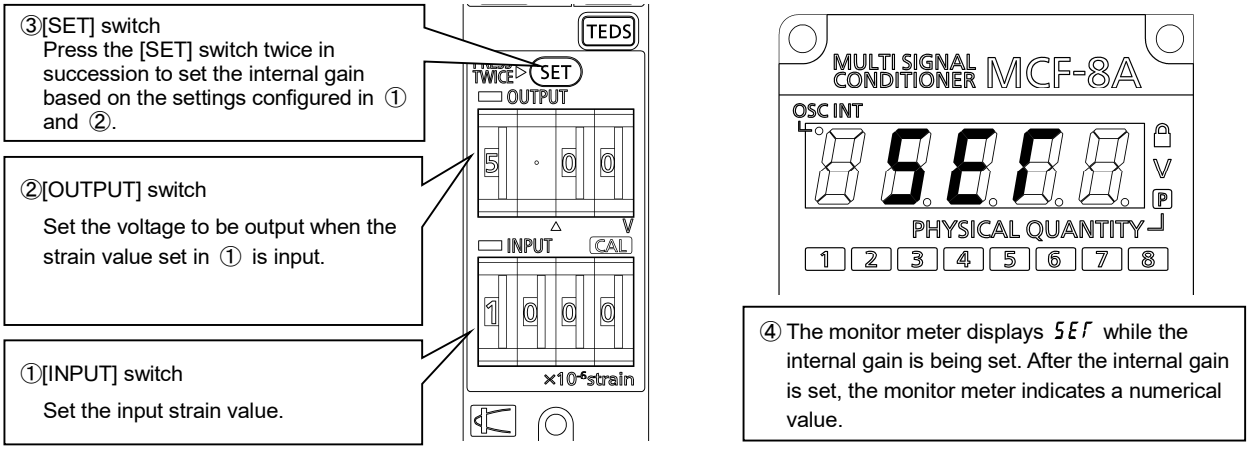
NOTE

- After enabling the high pass filter, be sure to perform balance adjustments before performing measurements.
  Input saturation prevents accurate measurements.
  If the high pass filter is enabled, operating the [CAL] switch will not add the calibration signal to the output.
  Disable the high pass filter before outputting a calibration signal.

4-3. Setting the Internal Gain

4-3-1. Basic Internal Gain Setting

Set the appropriate internal gain to assess strain accurately.
First, estimate the strain to be measured.
If the input is from a strain gage transducer, set the internal gain based on the rated output.
For example, when using a strain gage transducer with a rated output of ±1,000 μm/m with the setting configured to output 5 V with the transducer's rated output, set the [OUTPUT] switch to [5.00] V and the [INPUT] switch to [1,000] μm/m (strain), and press the [SET] switch twice in succession.
Once the internal gain is set properly, the monitor meter will display SET and indicate a numerical value.



If the input is from a strain gage, estimate strain based on the material and structure of the measuring target. Using that value as a reference, set the internal gain as described above.
The setting ranges of the [OUTPUT] switch, [INPUT] switch, and internal gain are limited. Values exceeding the ranges cannot be set. Internal gain can be calculated using the following equation:

$$\text{Internal gain} = \frac{[\text{OUTPUT}]\ \text{switch value}}{[\text{Input}]\ \text{switch value} \times 10^{-6}} \times \frac{2}{\text{Bridge voltage}}$$

* The bridge voltage for the DPM-90A series is 2 V.
For the CDV-90A, the bridge voltage corresponds to the value set with the [BV] switch.

Conditioner Card	[INPUT] Switch Setting Range	[OUTPUT] Switch Setting Range	Internal Gain Setting Range
DPM-90A series	100 to 9,999 μm/m in 1 μm/m increments	1.00 to 5.00 V in 0.01 V increments	x200 to x50000
CDV-90A	200 to 9,999 μm/m in 1 μm/m increments	1.00 to 5.00 V in 0.01 V increments	x200 to x5000

NOTE

- If an error message appears while you are setting the internal gain, the internal gain may not have been set properly.
  To resolve the error, refer to "9. ERROR MESSAGES" on page 74.
- After connecting or changing a sensor, be sure to set the internal gain.

MEMO

- The Data Sheet enclosed with the transducer gives the rated capacity and rated output of the strain gage transducer .
- For TEDS installed sensors, use the TEDS function to ease the process of making internal gain settings. For more information, see "4-3-2. Setting Internal Gain Using the TEDS Function" on page 45.

4-3-2. Setting Internal Gain Using the TEDS Function

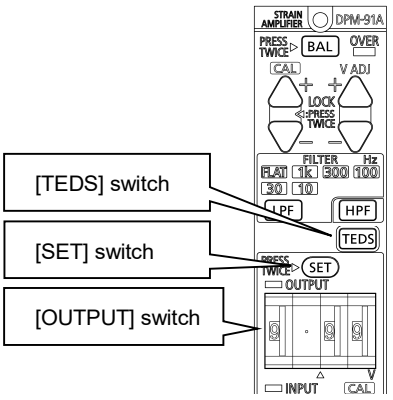
For TEDS installed sensors, load and use the sensor information to set internal gain.
The TEDS information used by the MCF-A/B includes rated output (μm/m) and rated capacity.
Do the following to set the appropriate internal gain using the TEDS function:

① Connect the TEDS installed sensor to the [INPUT] connector.

② Press and hold the [TEDS] switch.
The [TEDS] switch lights up, indicating TEDS mode is activated.

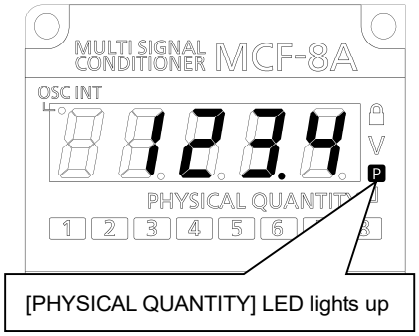
③ Set the [OUTPUT] switch.
If the input matches the rated output value read from the TEDS information, the voltage set with the [OUTPUT] switch is output.

④ Press the [SET] switch twice in succession.
The TEDS information is read, and the internal gain is set.



When the [TEDS] switch lights up, the monitor meter's [VOLT] LED goes out, and the [PHYSICAL QUANTITY] LED lights up.
At the same time, the monitor meter displays the physical quantity (i.e., the value converted from the voltage value). The unit used for the displayed physical quantity is the same as for the sensor's rated capacity.

Example: For a sensor with a rated capacity of 500 N, the display shown to the right will read "123.4 N".



To exit TEDS mode, press and hold the [TEDS] switch. The [TEDS] switch light goes out, and the monitor meter displays a voltage value.

To set internal gain using the [OUTPUT] switch and [INPUT] switch, press the [SET] switch twice in succession after the [TEDS] switch light goes out. The internal gain will be set based on the settings configured with the [OUTPUT] switch and [INPUT] switch.

MEMO

- In TEDS mode, the monitor meter indicates a physical quantity (i.e., the value converted from the voltage value).
  To display the voltage value on the monitor meter, press and hold the [TEDS] switch. Make sure the [TEDS] switch light goes out.
  The internal gain setting remains in effect even after the [TEDS] switch light goes out.
- A flashing [OUTPUT] LED in TEDS mode indicates a change from the time the internal gain was set in the value set with the [OUTPUT] switch. To change the value set with the [OUTPUT] switch, press the [SET] switch twice in succession once again, then set internal gain.
- The [INPUT] LED remains off in TEDS mode, but the calibration signal can be output.
  The value set with the [INPUT] switch is output as a calibration signal.

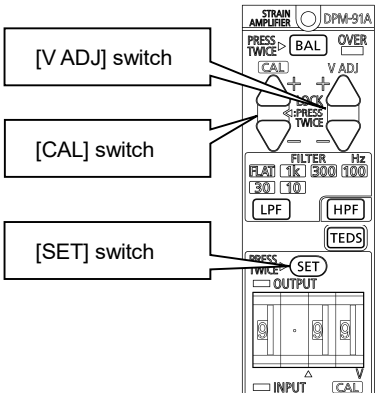
NOTE

- When the [TEDS] switch lights up, the monitor meter indicates a physical quantity, but this is before the internal gain has been set. (The physical quantity displayed is based on the previously read TEDS information.) Be sure to press the [SET] switch twice in succession to set the internal gain.
- If the power is turned OFF with the MCF-A/B in TEDS mode, the MCF-A/B will start in TEDS mode in the subsequent startup.
  In this case, an error message is displayed if the TEDS information for the connected sensor differs from the previously read TEDS information. (This reminds you to load the TEDS information after changing the sensor.)
  If this happens, load the TEDS information once again, then set the internal gain.

4-3-3. Fine Adjustments of Internal Gain

You can make fine adjustments of internal gain in either of the two ways below:

(1) Fine adjustments of internal gain using the [CAL] switch.
While pressing and holding the [CAL] switch or after locking the calibration signal output by pressing the [CAL] switch twice in succession, press the [+] side or [-] side of the [V ADJ] switch to adjust the internal gain. Press the [+] side to increase internal gain. Press the [-] side to decrease internal gain.
Press and hold the [+] or [-] side of the [CAL] switch to scroll through internal gain values faster.



(2) Fine adjustments of internal gain using the [SET] switch.
While pressing and holding the [SET] switch, press the [+] side or [-] side of the [V ADJ] switch to change the internal gain. Press the [+] side to increase internal gain. Press the [-] side to decrease internal gain.
Press and hold the [+] or [-] side of the [CAL] switch to scroll through internal gain values faster.

MEMO

- About the two methods for making fine adjustments of internal gain
  Method (1) is used more often because it allow confirmation of the calibration signal output during the process. Method (2) is more convenient for adjusting internal gain while confirming the actual load when you do not need to check the calibration signal.

4-4. Balance Adjustment

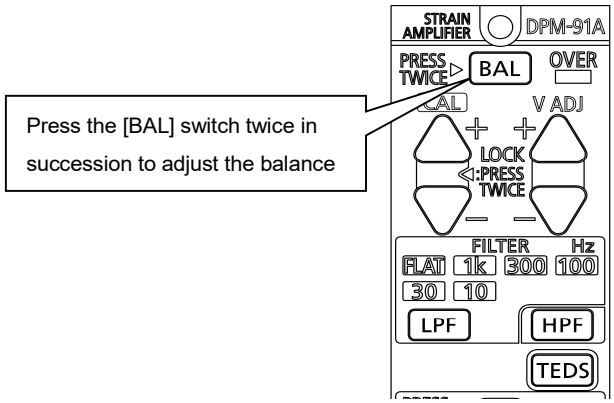
Resistance and capacity imbalances exist in strain gage bridges. To ensure accurate strain measurements, adjust to address the initial imbalances.
Resistance imbalances can be eliminated through balance adjustments. Perform balance adjustments as described below.
The DPM-90A series incorporates an internal correction circuit (CST method) that automatically cancels capacitive imbalances.

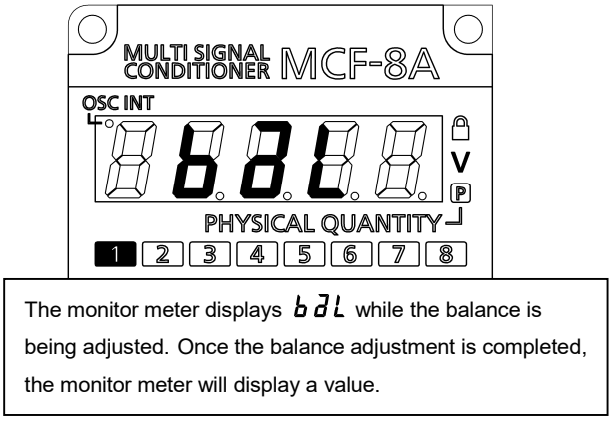
MEMO

- The adjustment range for resistance imbalance is up to ±2% of the amount of change of the resistance value (expressed as strain, $\pm 10{,}000 \times 10^{-6}$ strain).
- Capacitive imbalances of up to 2,000 pF can be canceled automatically.

4-4-1. Balance Adjustment Method

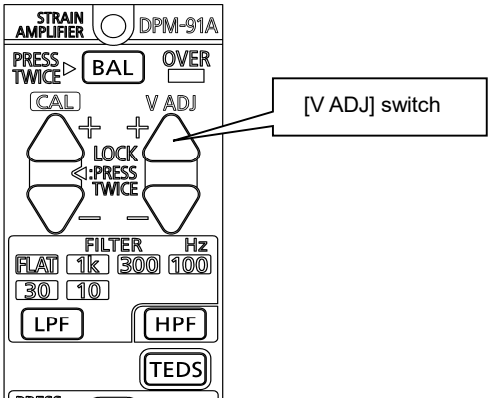
Press the [BAL] switch twice in succession to adjust the balance.
The monitor meter displays bAL while the balance is being adjusted.
Once the balance adjustment is completed, the monitor meter will display a value near zero ("0").
A value within ±25 mV of 0 means the balance adjustment has been completed successfully.
To adjust the value on the monitor meter exactly to zero ("0"), adjust the zero point as described in "4-4-2. Making Fine Adjustments of the Zero Point".
If the balance adjustment fails, the monitor meter will display an error number and error message.
To resolve the error, refer to "9. ERROR MESSAGES" on page 74.





4-4-2. Making Fine Adjustments of the Zero Point

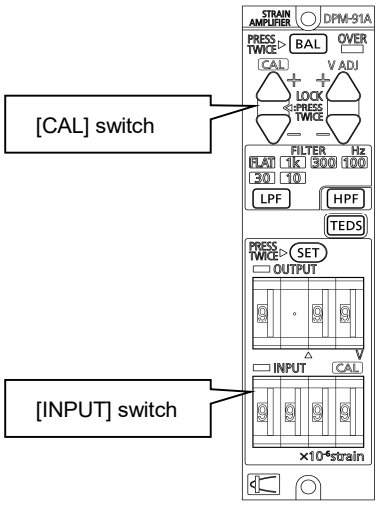
Use the [V ADJ] switch to make fine adjustments of the output voltage zero point.
This function is convenient when moving the base line of the output device.
Press the [+] side or [-] side of the [V ADJ] switch to change the output gradually. Press and hold the [+] side or [-] side of the [V ADJ] switch to scroll through the output value faster. The zero point can be finely adjusted to about ±100 mV of the value resulting from the preliminary balance adjustments.



4-5. Outputting the Calibration Signal

4-5-1. Setting the Calibration Signal

Set the calibration signal (also called "equivalent strain" or "reference strain") for measuring the magnitude of the strain. To set the value, use the [INPUT] switch to enter a positive four-digit whole number. Set the calibration signal between 1 and 9,999 μm/m in 1 μm/m increments.



4-5-2. Calibration Signal Output Method

Use the [CAL] switch to output the calibration signal. Press the [+] side of the [CAL] switch to add a positive calibration signal to the input. Press the [-] side of the [CAL] switch to add a negative calibration signal to the input. The calibration signal is added to the input for as long as you press and hold the [CAL] switch.

4-5-3. CAL Lock Function

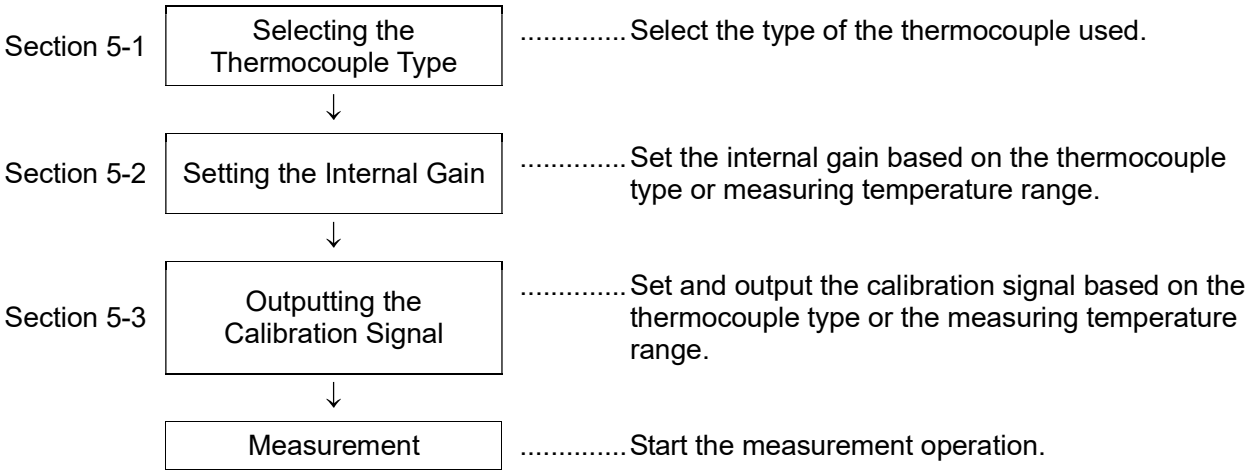
Use the CAL lock function to continue outputting the calibration signal. Press the [CAL] switch twice in succession to enable the CAL lock function and output the calibration signal continuously. The [CAL] switch remains lit while the CAL lock function is active. To disable the CAL lock function, press the [CAL] switch once again.

MEMO

- The [CAL] switch remains lit while the calibration signal is output.
- The [INPUT] LED flashes if the value set with the [INPUT] switch changes from the time the internal gain was set.
  A flashing LED indicates a change has occurred since the internal gain was set.
  Note that this does not indicate an abnormality.
- If the high pass filter is enabled, the calibration signal will not be added to the output even when you press the [CAL] switch.
  To output the calibration signal, disable the high pass filter.

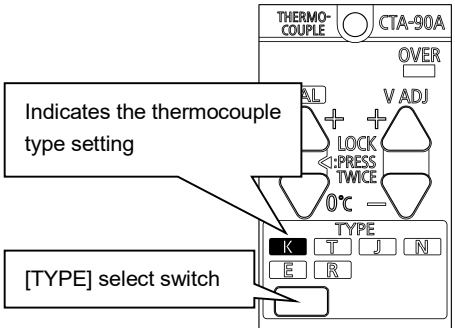
5. MEASURING METHOD (CTA-90A)

This section describes how to perform measurements with the CTA-90A.



5-1. Selecting the Thermocouple Type

Use the [TYPE] select switch to set the thermocouple type.
The CTA-90A is compatible with thermocouple types K, T, J, N, E, and R.
Each time you press the [TYPE] select switch, the settings for thermocouple type will change in the following sequence: K → T → J → N → E → R → K.
The [TYPE] LED indicates the thermocouple type setting.



5-2. Setting the Internal Gain

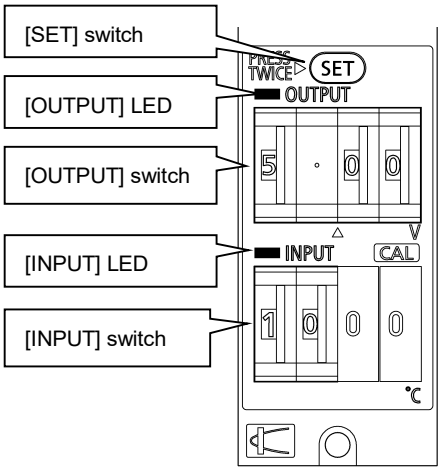
5-2-1. Basic Internal Gain Setting

Set the appropriate internal gain to determine temperatures accurately. Set the internal gain as follows:

(1) Use the [INPUT] switch to enter the setting.
Estimate the temperature to be measured. Use the [INPUT] switch to set a value greater than the anticipated temperature value.

(2) Use the [OUTPUT] switch to enter the setting.
The voltage set with the [OUTPUT] switch is output if the measured temperature matches the value set with the [INPUT] switch.

(3) Press the [SET] switch twice in succession to set the internal gain.
The internal gain is set automatically based on settings configured with the [OUTPUT] switch and [INPUT] switch.
The monitor meter displays SET while the internal gain is being set.
The internal gain has been set when you see a numerical value.
Once the internal gain is set, the [OUTPUT] LED and [INPUT] LED will light up.

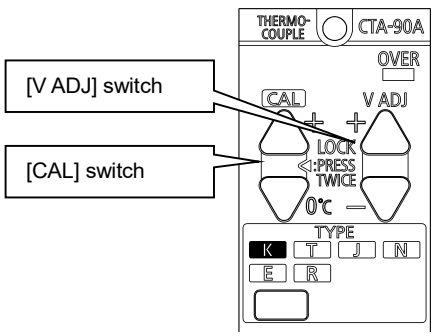


NOTE

- If an error message appears while setting the internal gain, the internal gain has not been set properly. To resolve the error, refer to "9. ERROR MESSAGES" on page 74.
- You can configure the [OUTPUT] switch setting within the range of 1.00 to 5.00 V in 0.01 V increments.
  Settings outside the above range are not possible.
- You can configure the [INPUT] switch setting from 100°C in 100°C increments.
  The maximum value for this setting varies depending on thermocouple type. Settings exceeding the maximum value cannot be set.
  For more information on maximum values, refer to "5-4. Measuring Range" on page 51.
- The MCF-A/B performs an open-circuit check when the internal gain is set. If an open circuit is detected, the output will be saturated toward the negative direction. If the output becomes "-5.2 V" after you set the internal gain, there may be an open circuit in the thermocouple.
  Check the connection and reconfigure the internal gain.

5-2-2. Making Fine Adjustments of Internal Gain

The internal gain changes when you press the [+] side or [-] side of the [V ADJ] switch while the calibration signal is being output by operating the [CAL] switch.
Press the [+] side to increase internal gain. Press the [-] side to decrease internal gain.
Press and hold the [+] side or [-] side of the [CAL] switch to scroll faster through internal gain values.

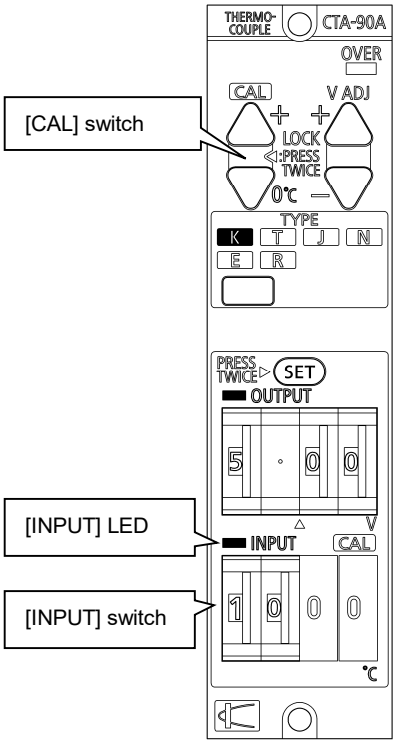


5-3. Outputting the Calibration Signal

5-3-1. Setting the Calibration Signal

Set the calibration signal for accurate temperature measurements.
Use the [INPUT] switch to set the calibration signal.

The [INPUT] LED flashes if the setting has changed from the time the internal gain is set. The flashing LED indicates a change has occurred since the internal gain is set. Note that this does not indicate an abnormality.



5-3-2. Calibration Signal Output Method

Use the [CAL] switch to output the calibration signal. Press the [+] side of the [CAL] switch to output the positive calibration signal corresponding to the temperature set with the [INPUT] switch.
Press the [0°C] side of the [CAL] switch to output the calibration signal at 0°C.

The [CAL] switch will remain lit while you press and hold the [CAL] switch, and the calibration signal output will continue.

5-3-3. CAL Lock Function

The CAL lock function allows continuous output of the calibration signal. Press the [CAL] switch twice in succession to enable the CAL lock function and initiate continuous output. The [CAL] switch remains lit while the CAL lock function is active.
To disable the CAL lock function, press the [CAL] switch once again.

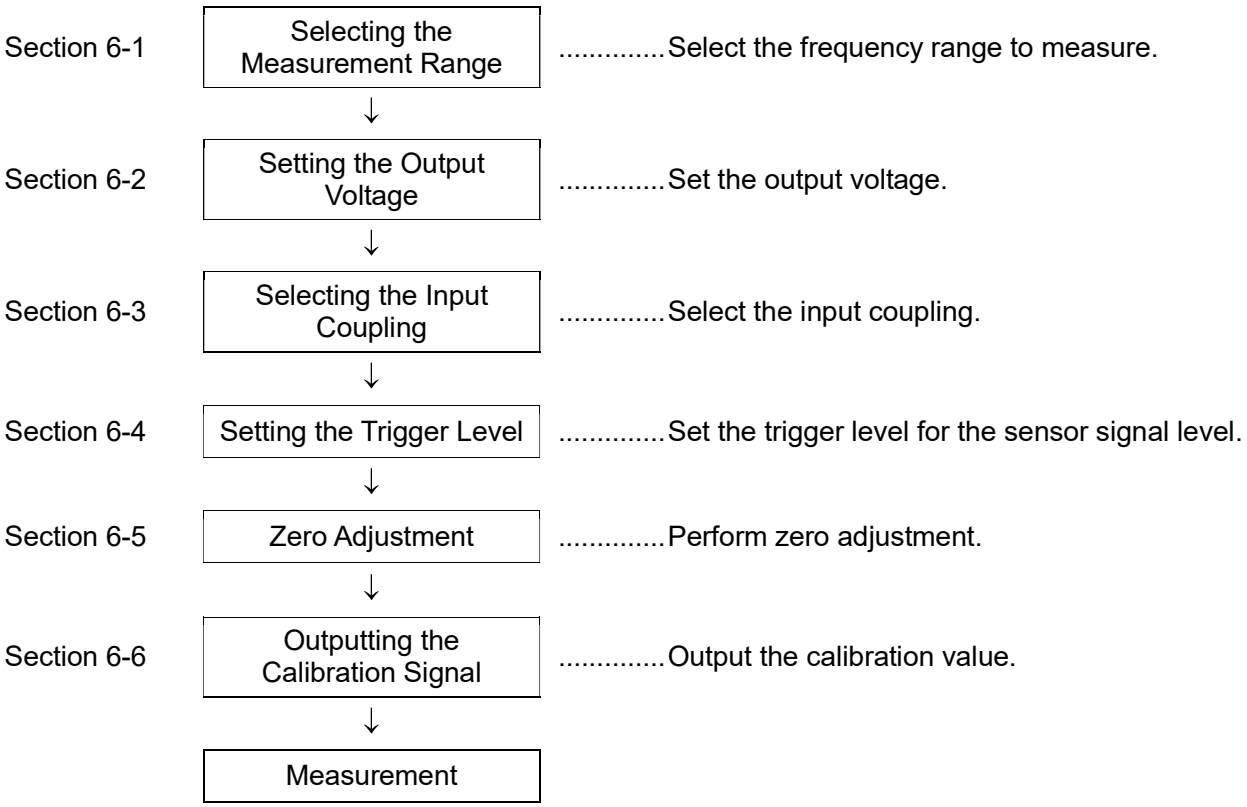
5-4. Measuring Range

The range of measurable temperatures varies depending on the thermocouple used.
The following table gives the relationship between the thermocouple type and measurable temperature range.
Values exceeding the temperature range cannot be set.

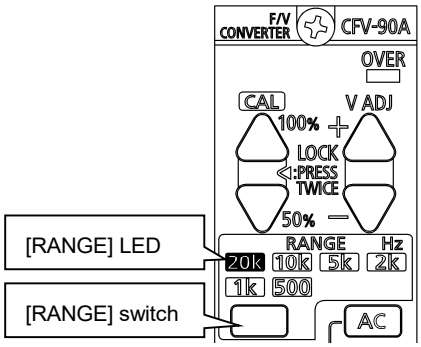
Type of Thermocouple	Measurable Range [°C]
K	-200～1300
T	-200～ 400
J	-200～1200
N	-200～1300
E	-200～1000
R	0～1700

6. MEASURING METHOD (CFV-90A)

This section describes how to perform measurements with the CFV-90A.

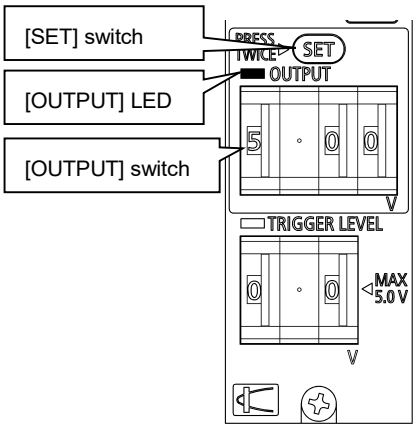


6-1. Selecting the Measurement Range



Use the [RANGE] switch to set the measurement range.
Press the switch repeatedly to cycle through the range in the following sequence: 20 kHz → 10 kHz → 5 kHz → 2 kHz → 1 kHz → 500 Hz → 20 kHz.
The [RANGE] LED indicates the current measurement range.
Select the measurement range for the frequency to be measured.

6-2. Setting the Output Voltage



Use the [OUTPUT] switch to set the output voltage.
The voltage set for the [OUTPUT] switch is output when you supply a frequency corresponding to the measurement range.
Set the output voltage as described below.

① Configure the [OUTPUT] switch.
Set the voltage to output when you supply the same frequency as the measurement range. At this point, the [OUTPUT] switch setting is not applied to output.

② Press the [SET] switch twice to set the output voltage.
When a value is set, SET is displayed on the monitor meter.
The output voltage configuration is finished when a value is displayed.
Once configuration is finished, the [OUTPUT] LED lights up.

NOTE

- The [OUTPUT] switch can be configured in the range from 1.00 V to 5.00 V in 0.01 V increments. Note that it cannot be set outside this range.
- The [OUTPUT] LED flashes if you change the [OUTPUT] switch setting after configuring the output voltage.
  This indicates that the [OUTPUT] switch value has been changed since the output voltage was set. It does not indicate an abnormality.

- Measurement range

The CFV-90A measurement range varies depending on the specified range and [OUTPUT] switch setting. When set to the maximum and minimum [OUTPUT] switch settings (5.00 V and 1.00 V, respectively), the measurement range for each range setting is as follows:

Measurement range for each range setting

Specified Range	[OUTPUT] Switch Setting (V)	Measurement Range	
		Minimum	Maximum
20 kHz	5.00	5 Hz	20 kHz
	1.00	5 Hz	100 kHz
10 kHz	5.00	2.5 Hz	10 kHz
	1.00	2.5 Hz	50 kHz
5 kHz	5.00	1.4 Hz	5 kHz
	1.00	1.4 Hz	25 kHz
2 kHz	5.00	0.6 Hz	2 kHz
	1.00	0.6 Hz	10 kHz
1 kHz	5.00	0.3 Hz	1 kHz
	1.00	0.3 Hz	5 kHz
500 Hz	5.00	0.2 Hz	500 Hz
	1.00	0.2 Hz	2.5 kHz

● When measuring frequencies 20 kHz or higher
To measure frequencies above the measurement range, set the [OUTPUT] switch to a value below 5.00 V.
To measure 100 kHz, set the range to 20 kHz and the [OUTPUT] switch to 1.00 V. In this case, 100 kHz input corresponds to 5.00 V output.

6-3. Selecting the Input Coupling

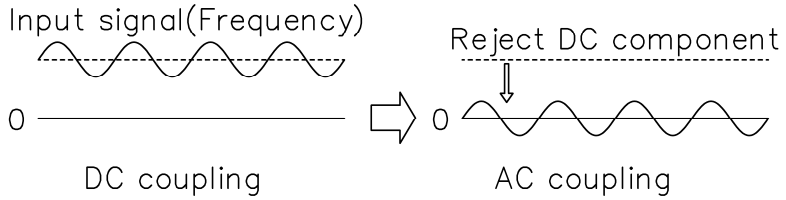
The CFV-90A input coupling can be switched between DC and AC coupling.
Press the [DC] switch to select DC coupling and the [AC] switch to select AC coupling.
The selected switch lights up, and the input coupling changes.

① DC Coupling
Press the [DC] switch to illuminate the switch and change the input coupling to DC coupling. With the DC coupling, signal detection involves comparing input signals directly from the sensor to the trigger level.

② AC Coupling
Press the [AC] switch to illuminate the switch and change the input coupling to AC coupling.
With the AC coupling, signal detection involves rejecting the DC component.
This is used to remove input signal offset.

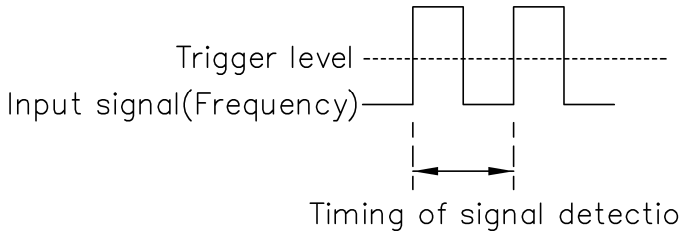
MEMO

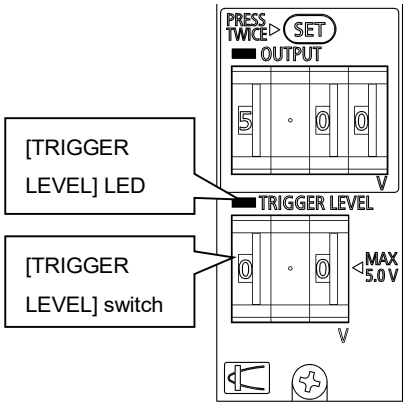
● When set to the AC coupling, zero cross signals are used to reject the DC component.
Switch to AC coupling and set the trigger level to 0.0 V to detect signals even when input signals have an offset.



6-4. Setting the Trigger Level

Set the trigger level for input signal detection.
Use the [TRIGGER LEVEL] switch to set.
Input signals are detected when they exceed the value set for the [TRIGGER LEVEL] switch and the frequency is measured.

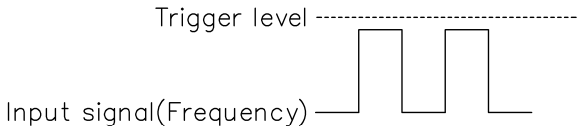




The [TRIGGER LEVEL] switch can be adjusted in the range from 0.0 V to 5.0 V in 0.1 V increments.
Set the value for the voltage level of input signals.
The trigger level is 5.0 V when the [TRIGGER LEVEL] switch is set to 5.1 V or above.

MEMO

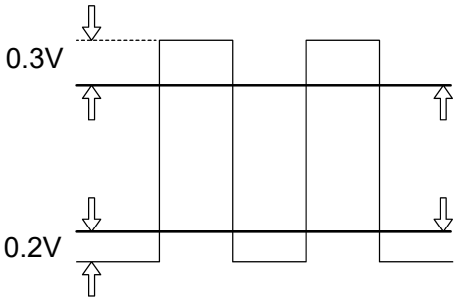
- The [TRIGGER LEVEL] LED lights up during input signal detection and voltage output.
- Signals are not detected and the output voltage is 0 V if there is no input or the trigger level fails to match the input signal voltage level.
  At this time, the [TRIGGER LEVEL] LED will remain unlit.



Signals cannot be detected if the trigger level fails to match the input signal voltage level.

NOTE

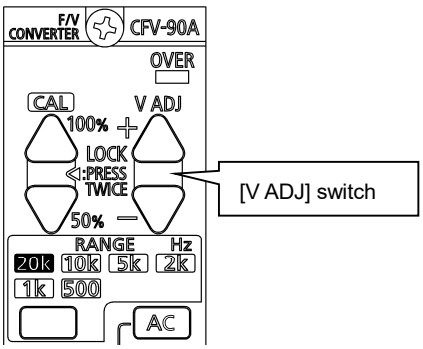
- Trigger level setting
  Signals may fail to exceed the trigger level and go undetected if the trigger level is set near maximum or minimum input signal levels.
  Thus, the trigger level setting must allow some leeway relative to maximum and minimum input signal levels.
  Set the trigger level to leave at least 0.3 V from the maximum input signal level and 0.2 V from the minimum input signal level.
  As a practical consideration, account for noise and other factors affecting input signals.
  To avoid the effects of disturbances on input signals, center the trigger level on the input signal level to the extent possible.



Set the trigger level within this range.

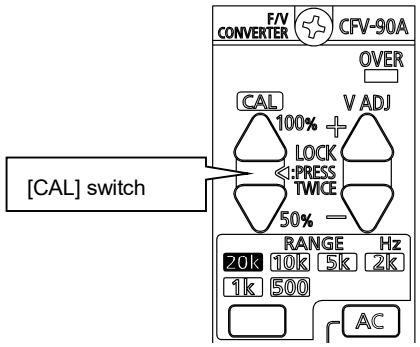
- Open collector output sensor
  If you use an open collector output sensor, the responsiveness may be insufficient relative to frequency, which may result in lesser input signal waveforms. In this case, setting the trigger level above the lesser input signal will prevent signal detection.
  If so, either reduce the trigger level until signals are detected or switch the coupling to AC and set the trigger level to 0.0 V.

6-5. Zero Adjustment



Use the [V ADJ] switch to make adjustments of the output voltage zero point.
This function is convenient when moving the base line of the output device.
Press the [+] side or [-] side of the [V ADJ] switch to change the output gradually. Press and hold the [+] side or [-] side of the [V ADJ] switch to scroll through the output value faster. The zero point can be finely adjusted to about ±100 mV of the value resulting from the preliminary balance adjustments.
To restore the default zero point, press and hold both the [+] and [-] sides of the [V ADJ] switch for at least two seconds.

6-6. Outputting the Calibration Signal



6-6-1. Calibration Signal Output Method

Use the [CAL] switch to output a calibration value.
Press the [100%] side of the [CAL] switch to output a calibration value equivalent to the set range or press the [50%] side of the [CAL] switch to output a calibration value equivalent to 50% of the set range.
For more information, see the following table.
The [CAL] switch remains lit as long as you press the switch.
The calibration value is output constantly.

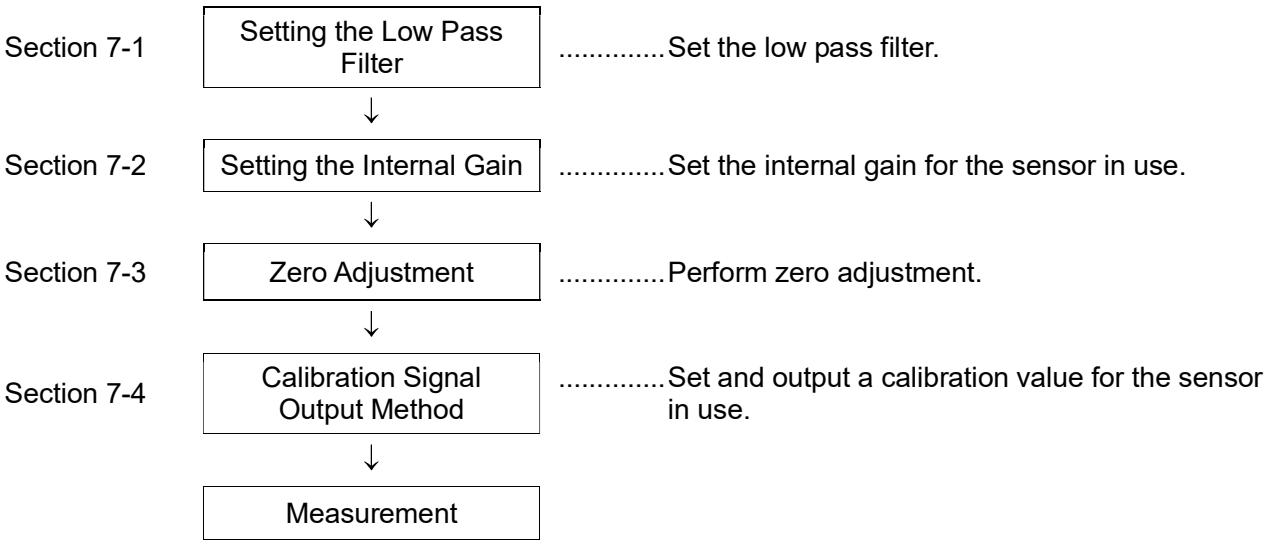
Measurement Range	Calibration Value (CAL)	
	100%	50%
20 kHz	20 kHz	10 kHz
10 kHz	10 kHz	5 kHz
5 kHz	5 kHz	2.5 kHz
2 kHz	2 kHz	1 kHz
1 kHz	1 kHz	500 Hz
500 Hz	500 Hz	250 Hz

6-6-2. CAL Lock Function

The CAL lock function allows continuous output of the calibration signal. Press the [CAL] switch twice in succession to enable the CAL lock function and initiate continuous output. The [CAL] switch remains lit while the CAL lock function is active.
To disable the CAL lock function, press the [CAL] switch once again.

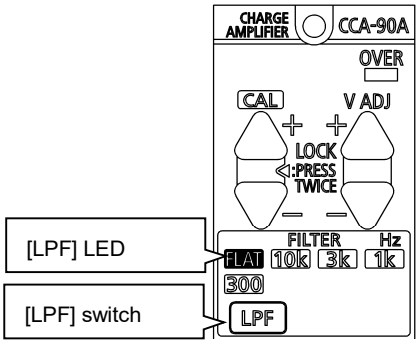
7. MEASURING METHOD (CCA-90A)

This section describes how to perform measurements with the CCA-90A.



7-1. Setting the Low Pass Filter (LPF)

Use the low pass filter to control unneeded high-frequency bands in signals from sensors.
Repeatedly press the [LPF] switch to cycle through filter cut-off frequencies in the following sequence: FLAT → 10 kHz → 3 kHz → 1 kHz → 300 Hz → FLAT.
If there is no need to control frequency bands, set to [FLAT] so that the low pass filter has no effect.
You can check the low pass filter setting on the [LPF] LED.



7-2. Setting the Internal Gain

7-2-1. Basic Internal Gain Setting

A suitable internal gain must be set for the sensitivity of the sensor used and the expected acceleration. Set the internal gain as described below.

First, estimate the sensor output voltage from sensor sensitivity and maximum expected acceleration.

Example: Sensor sensitivity: 1.02 mV/m/s^2 (10 mV/G)
Maximum expected acceleration: 392.3 m/s^2 (40 G)
Sensor output voltage: 392.3 m/s^2 × 1.02 mV/m/s^2 = 400 mV

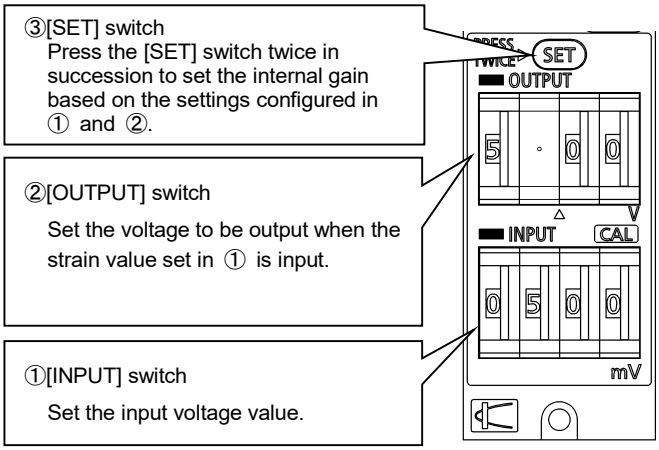
Under the conditions described above, the expected sensor output voltage is 400 mV.

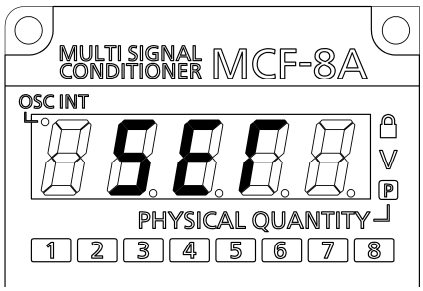
① The expected sensor output voltage determines the value to set for the [INPUT] switch.
In this example, we will set the value to 500 mV, slightly higher than 400 mV.

② Next, set the voltage output when the voltage set for the [INPUT] switch is supplied.
To set the output voltage, use the [OUTPUT] switch. Here, this is set to 5.00 V.

③ Once the [INPUT] and [OUTPUT] switch values are determined, press the [SET] switch twice.
Set the internal gain for the values set for the [INPUT] and [OUTPUT] switches.

④ When the internal gain value is set correctly, a value appears after SEt is displayed on the monitor meter.





④ The monitor meter displays SEt while the internal gain is being set. After the internal gain is set, the monitor meter indicates a numerical value.

The setting ranges of the [OUTPUT] switch, [INPUT] switch, and internal gain are limited.
Values exceeding the ranges cannot be set. Internal gain can be calculated using the following equation:

$$\text{Internal gain} = \frac{\text{[OUTPUT] switch value}}{\text{[INPUT] switch value} \times 10^{-3}}$$

[INPUT] Switch Setting Range	[OUTPUT] Switch Setting Range	Internal Gain Setting Range
20 to 5000 mV 1mV increments	1.00 to 5.00 V 0.01 V increments	x 1 to x 250

NOTE

- If an error message appears while you are setting the internal gain, the internal gain may not have been set properly.
  To resolve the error, refer to "9. ERROR MESSAGES" on page 74.

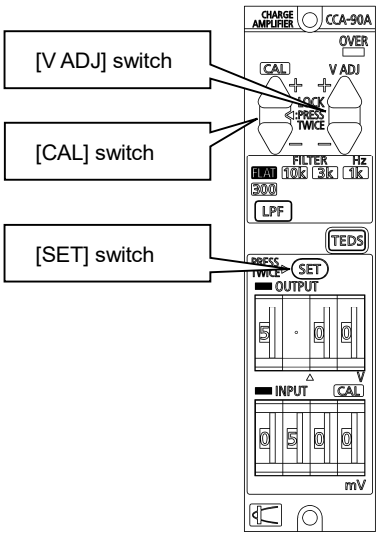
MEMO

- The sensor sensitivity is indicated on the test data sheet included with the sensor.
- When using a TEDS-compatible sensor, refer to "7-5. TEDS Function" on page 61.

7-2-2. Fine Adjustments of Internal Gain

You can make fine adjustments of internal gain in either of the two ways below:

(1) Fine adjustments of internal gain using the [CAL] switch.
While pressing and holding the [CAL] switch or after locking the calibration signal output by pressing the [CAL] switch twice in succession, press the [+] side or [-] side of the [V ADJ] switch to adjust the internal gain. Press the [+] side to increase internal gain. Press the [-] side to decrease internal gain.
Press and hold the [+] or [-] side of the [CAL] switch to scroll through internal gain values faster.

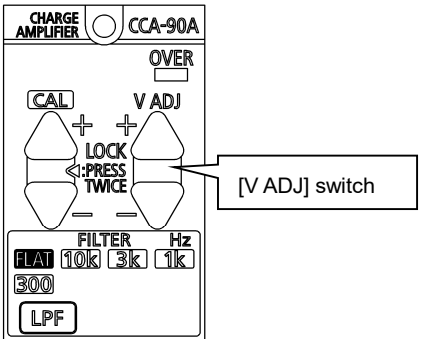


(2) Fine adjustments of internal gain using the [SET] switch.
While pressing and holding the [SET] switch, press the [+] side or [-] side of the [V ADJ] switch to change the internal gain. Press the [+] side to increase internal gain. Press the [-] side to decrease internal gain.
Press and hold the [+] or [-] side of the [CAL] switch to scroll through internal gain values faster.

MEMO

- About the two methods for making fine adjustments of internal gain
  Method (1) is used more often because it allow confirmation of the calibration signal output during the process. Method (2) is more convenient for adjusting internal gain while confirming the actual load when you do not need to check the calibration signal.

7-3. Zero Adjustment

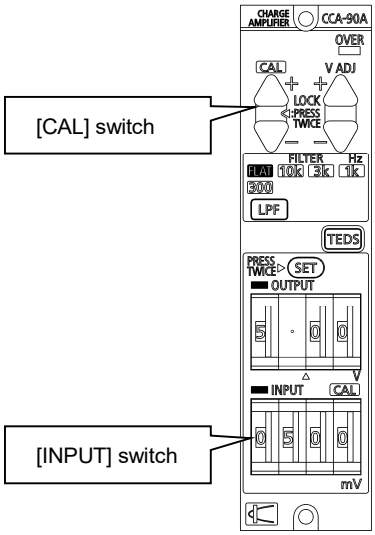


Use the [V ADJ] switch to make adjustments of the output voltage zero point.
This function is convenient when moving the base line of the output device.
Press the [+] side or [-] side of the [V ADJ] switch to change the output gradually. Press and hold the [+] side or [-] side of the [V ADJ] switch to scroll through the output value faster. The zero point can be finely adjusted to about ±100 mV of the value resulting from the preliminary balance adjustments.
To restore the default zero point, press and hold both the [+] and [-] sides of the [V ADJ] switch for at least two seconds.

7-4. Outputting the Calibration Signal

7-4-1. Setting the Calibration Signal

Set the calibration signal for measuring the sensor output.
To set the value, use the [INPUT] switch to enter a positive four-digit whole number.
Set the calibration signal between 1 and 5,000 mV in 1 mV increments.



7-4-2. Calibration Signal Output Method

Use the [CAL] switch to output the calibration signal. Press the [+] side of the [CAL] switch to add a positive calibration signal to the input.
Press the [-] side of the [CAL] switch to add a negative calibration signal to the input.
The calibration signal is added to the input for as long as you press and hold the [CAL] switch.

7-4-3. CAL Lock Function

The CAL lock function allows continuous output of the calibration signal.
Press the [CAL] switch twice in succession to enable the CAL lock function and initiate continuous output.
The [CAL] switch remains lit while the CAL lock function is active.
To disable the CAL lock function, press the [CAL] switch once again.

MEMO

- The [CAL] switch remains lit while the calibration signal is output.
- The [INPUT] LED flashes if the value set with the [INPUT] switch changes from the time the internal gain was set.
  A flashing LED indicates a change has occurred since the internal gain was set.
  Note that this does not indicate an abnormality.
- The calibration value is a DC voltage, just as for other conditioner cards.
  Note that it is not an AC voltage.

7-5. TEDS Function

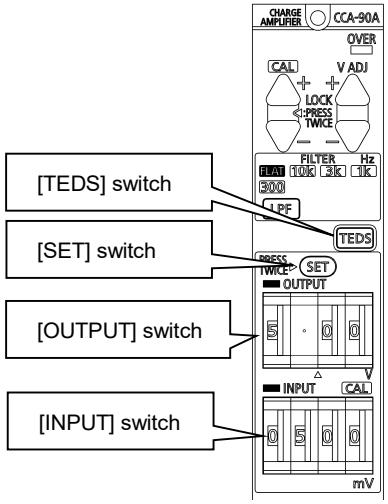
If you are using a TEDS-compatible sensor, you can also view physical quantities on the monitor meter by loading sensor information.
To display TEDS-based physical quantities, load the TEDS information as follows:

① Connect a TEDS-compatible sensor to the input connector.

② Press and hold the [TEDS] switch.
The switch lights up. TEDS mode activates.

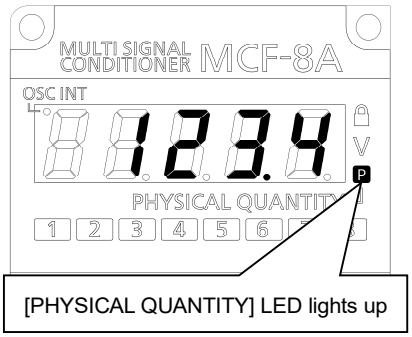
③ Configure the [OUTPUT] and [INPUT] switches.
Internal gains are set for both switches.
For more information on internal gain, see "7-2. Setting the Internal Gain" on page 58.

④ Press the [SET] switch twice.
TEDS information is loaded. Based on the information loaded, the monitor meter display changes from voltage to acceleration.
The internal gain is set as usual, using values for the [INPUT] and [OUTPUT] switches.



When the [TEDS] switch lights up, the monitor meter [VOLT] LED goes out, and the [PHYSICAL QUANTITY] LED lights up.
At this time, the monitor meter shows acceleration (a value converted from voltage). The unit is m/s^2.

Example: Display in the figure to the right shows 123.4 m/s^2.



To exit TEDS mode, press and hold the [TEDS] switch. The switch goes out, and the monitor display changes to voltage display.

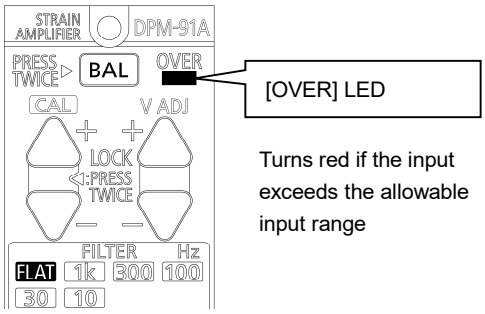
NOTE

- Unlike other conditioner cards, the CCA-90A does not support configuration of the internal gain used for the TEDS function.
  This is because the TEDS information of IEPE accelerometers does not include the rated capacity.
  The internal gain is determined by values for the [INPUT] and [OUTPUT] switches.

8. OTHER FUNCTIONS

8-1. [OVER] LED

An [OVER] LED is located at the upper right corner of each conditioner card.
The [OVER] LED turns red if the input exceeds the allowable input range.



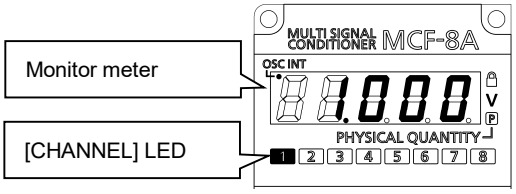
If the [OVER] LED lights up, the sensor input or the set internal gain is too large.
To resolve this issue, review the sensor input and internal gain setting.

MEMO

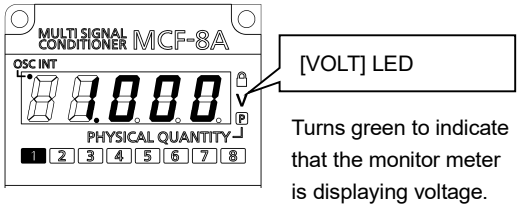
- If the conditioner card is not connected to a sensor, a voltage saturated toward the negative direction is output. Additionally, if the internal gain is set, the CTA-90A checks the sensor connection. If no sensor is connected, it switches to output a voltage saturated in the negative direction.
  If the [OVER] LED lights up and a voltage saturated toward the negative direction is output, check the sensor connection. The CFV-90A and CCA-90A output 0 V if there is no sensor output. In this case, the [OVER] LED remains unlit.
- If the [OVER] LED is flashing, the conditioner card has generated an error.
  In this case, the monitor meter will display an error message. To resolve the error, refer to "9. ERROR MESSAGES" on page 74.
- Rapid changes in input signals may prevent timely [OVER] display detection, and the [OVER] LED may not light up.

8-2. Monitor Display

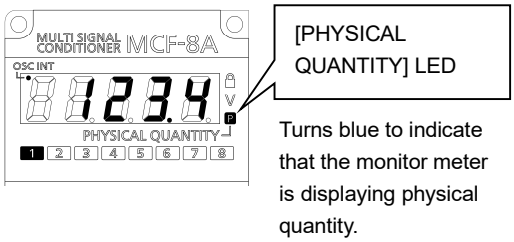
- Monitor meter
  The monitor meter indicates the conditioner card output and displays an error message.
  You can select the channel for displaying the output. The selected channel number is indicated by the [CHANNEL] LED.



Normally, the monitor meter's digital display shows a one-digit sign and a four-digit value.
The monitor meter indicates the same value as the output from the [OUTPUT] connector of the conditioner card.
If the monitor meter displays the above, the [VOLT] LED turns green to indicate that the monitor meter is displaying voltage.



If you used the TEDS function to set internal gain for the selected channel, the monitor meter will indicate the physical quantity converted from the output voltage, not the output voltage itself.
If the monitor meter indicates the above, the [VOLT] LED will go out and the [PHYSICAL QUANTITY] LED will turn blue.



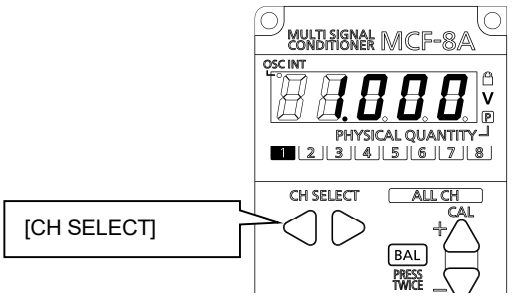
MEMO

- With the CCA-90A, the sensor signal is an AC signal, which prevents checking output using the monitor meter digital display. However, the calibration value is a DC voltage and can be checked on the monitor meter.

● Channel selection method

Use the [CH SELECT] switch to select a channel for output display. Press the left side of the [CH SELECT] switch to select the channel on the left side of the channel currently set. Press the right side of the [CH SELECT] switch to select the channel on the right side.

Operating a switch for a conditioner card will automatically change the channel displayed to that conditioner card.

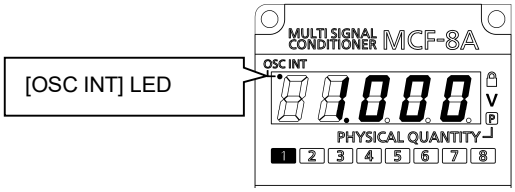


MEMO

● Operating the [INPUT] switch, [OUTPUT] switch, or [BV] switch does not change the channel displayed.

● [OSC INT] LED

The small light at the upper-left corner of the monitor meter is the [OSC INT] LED.
The [OSC INT] LED lights up when a strain amplifier card is mounted and the internal OSC is used ([OSC] select switch set to "INT").



The [OSC INT] LED does not light up when an external OSC is used ([OSC] select switch set to "EXT") or when no strain amplifier cards are used.

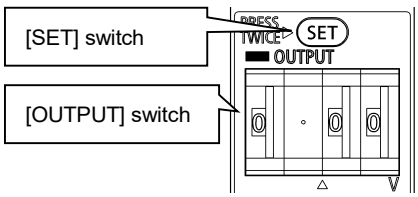
When conducting OSC synchronization with multiple MCF-A/B units, check the [OSC INT] LED to identify the master MCF-A/B unit and slave MCF-A/B units.

8-3. Output Off Function

Each conditioner card is equipped with a function to switch output off.
Setting output to off sets the output voltage close to 0 V, regardless of input. The monitor meter displays oFF.
To set output to [OFF], follow these steps:

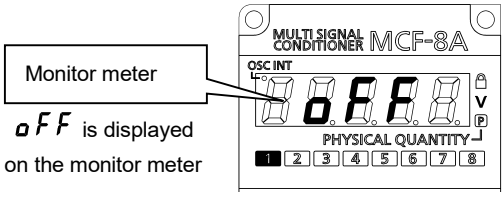
● Setting method

To turn off output on a conditioner card, set the [OUTPUT] switch to 0.00 V and press the [SET] switch twice.
oFF is displayed on the monitor meter, and output is set to off.
[OUTPUT] and [INPUT] ([TRIGGER LEVEL] on CFV-90A) LEDs go out when output is turned off.
To cancel output off, change the [OUTPUT] switch setting and set a normal internal gain setting.



NOTE

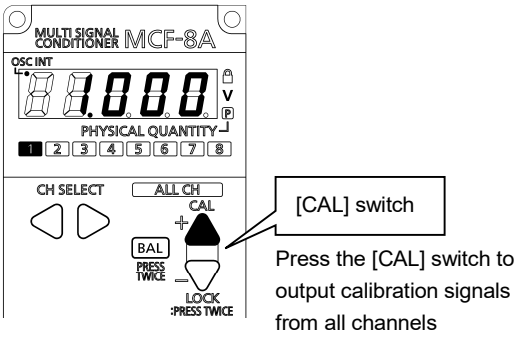
● While output is turned off, switches other than [OUTPUT] and [INPUT] ([TRIGGER LEVEL]) and their associated functions cannot be used.
● If no sensor is connected to the DPM-90A series (when input is open), the open detection function is activated, and voltage saturated in the negative direction (approx. -5.8 V) is output. This function takes precedence even when output is set to off.
● Zero adjustment using the [V ADJ] switch is applied even when output is set to off.



8-4. Batch Calibration Function and Batch Balance Adjustment Function

- Batch calibration function
  Use the [CAL] switch on the MCF-A/B to output calibration signals from all channels.
  The output calibration signals are those set with the [INPUT] switches of the individual conditioner cards.

  The steps performed are the same as for conditioner cards. Press the [+] side of the [CAL] switch to output a positive calibration signal. Press the [-] side of the [CAL] switch to output a negative calibration signal (or 0°C in the case of the CTA-90A).

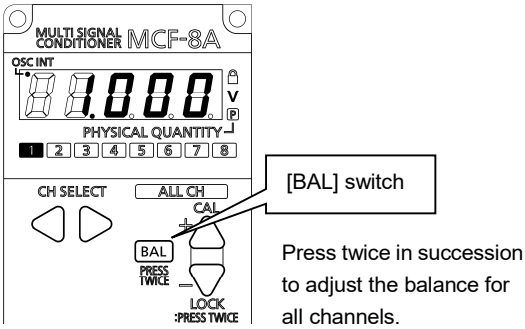


  Press the [CAL] switch twice in succession to enable the CAL lock function and output the calibration signal continuously.
  To disable the CAL lock function, press the [CAL] switch once again.

  The [CAL] switch of the MCF-A/B and those of the conditioner cards of all channels will light up while calibration signals are being output.

- Batch balance adjustment function
  Use the [BAL] switch on the MCF-A/B to adjust the balance for all channels.

  The steps performed are the same as for conditioner cards. Press the [BAL] switch twice in succession to adjust the balance for all channels, except for the CTA-90A, which lacks a balance adjustment function.



NOTE

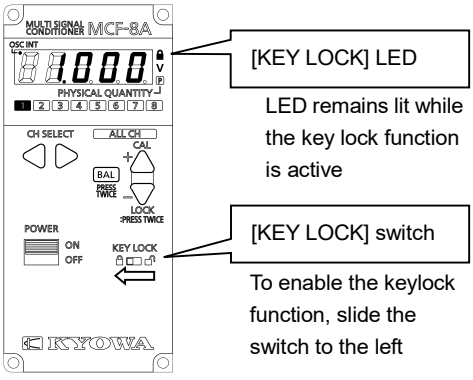
- When you use the batch calibration function or batch balance adjustment function, the calibration signal is output or the balance is adjusted for all channels, but the execution timing varies by channel.
  It is not possible to synchronize the calibration outputs of the channels.

8-5. Key Lock Function

The key lock function is enabled when the [KEY LOCK] switch on the MCF-A/B is set to the left side.

If the key lock function is enabled, the [KEY LOCK] LED on the MCF-A/B is red and the switches on the MCF-A/B and all mounted conditioner cards are disabled.

To disable the key lock function, slide the [KEY LOCK] switch to the right.



NOTE

- The following switches are not disabled by the key lock function:
  - [POWER] switch
  - [INPUT] switch
  - [OSC] select switch
  - [OUTPUT] switch
  - [COM] select switch
  - [BV] switch

8-6. [CENTRALIZED OUTPUT] Connector

The [CENTRALIZED OUTPUT] connector is connected to all channel outputs and to the remote control/command control signal terminal.
Use the supplied centralized output cable connector to implement remote control/command control and to confirm outputs for all channels without using separate cables.

8-6-1. Relationship Between Terminal Numbers and Functions

The following table gives the relationship between terminal numbers and functions.

Terminal No.	Function	Description
1	CH8 Output	Output voltage (+) of CH8
2	CH7 Output	Output voltage (+) of CH7
3	CH6 Output	Output voltage (+) of CH6
4	CH5 Output	Output voltage (+) of CH5
5	CH4 Output	Output voltage (+) of CH4
6	CH3 Output	Output voltage (+) of CH3
7	CH2 Output	Output voltage (+) of CH2
8	CH1 Output	Output voltage (+) of CH1
9	COM	Common potential (-) of the centralized output
10	NC	Do not use this terminal.
11	Remote Synchronization 1	This is used to operate multiple MCF-A units using the switches on one MCF-A unit. Used to control MCF-B via RS-485 Communication
12	Remote Synchronization 2	This is used to operate multiple MCF-A units using the switches on one MCF-A unit. Used to control MCF-B via RS-485 Communication
13	FCOM	Common potential for remote control/command control function
14	CH9 Output	Output voltage (+) of CH9 * Function for MCF-16A/B
15	CH10 Output	Output voltage (+) of CH10 * Function for MCF-16A/B
16	CH11 Output	Output voltage (+) of CH11 * Function for MCF-16A/B
17	CH12 Output	Output voltage (+) of CH12 * Function for MCF-16A/B
18	CH13 Output	Output voltage (+) of CH13 * Function for MCF-16A/B
19	CH14 Output	Output voltage (+) of CH14 * Function for MCF-16A/B
20	CH15 Output	Output voltage (+) of CH15 * Function for MCF-16A/B
21	CH16 Output	Output voltage (+) of CH16 * Function for MCF-16A/B
22	NC	Do not use this terminal.
23	KEY LOCK	This is used to operate the key lock function via the remote function.
24	ALL -CAL	This is used to operate the batch -CAL function via the remote function.
25	ALL +CAL	This is used to operate the batch +CAL function via the remote function.
26	ALL BAL	This is used to operate the batch balance adjustment function via the remote function.

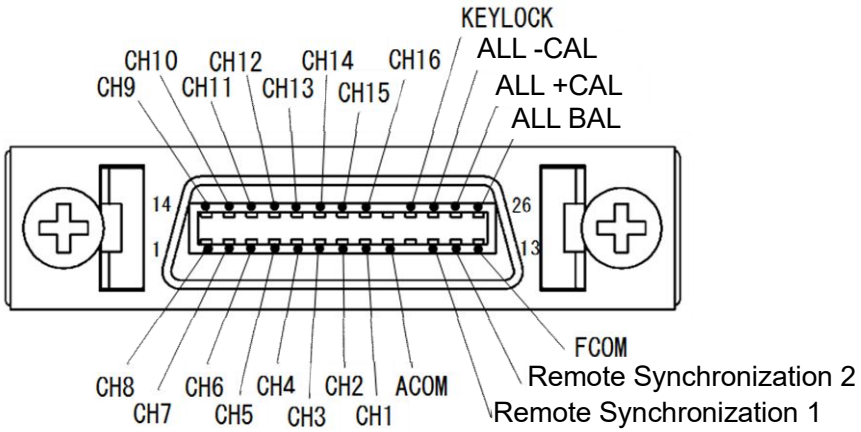
NOTE

- COM (terminal no. 9) and FCOM (terminal no. 13) are isolated from each other.
  Do not connect COM to FCOM.

NOTE

- Remote control and command control functions cannot be active at the same time.

The following shows the terminal layout.



MEMO

- The centralized output connector model and applicable plug are indicated below:
  Model: 10226-2210PE
  Manufacturer: 3M
  Applicable plug: 10126-3000PE
  10326-52F0-008 (shell kit)
  Note: A set of 10126-3000PE and 10326-52F0-008 is included with the MCF-A/B as centralized output cable connectors.

8-6-2. Centralized Output

Terminal 1 to 8 and 14 to 21 of the [CENTRALIZED OUTPUT] connector are centralized output terminals corresponding to the channels. Each terminal outputs a voltage equal to the output voltage for the corresponding channel.
The COM terminal (terminal no. 9) is the common potential of the centralized output.
Measure the voltage between the output terminal of each channel and the COM terminal.

8-6-3. Remote control/Command control function

- Remote control/command control function
  The unit provides signal lines for the MCF-A/B control in the centralized output connector.
  The MCF-A/B can be controlled as follows via remote control/command control function:
  - External control of one MCF-A/B unit (Remote control)
  - External control of multiple MCF-A/B units (Remote control)
  - Control of multiple MCF-A units using the switches on one MCF-A unit (Remote control)
    (Not available for the MCF-B.)
  - MCF-B control via RS-485 Communication (Command control)
    (Not available for the MCF-A.)
    For more information, refer to "17. RS-485 Communication" on page 108.

● External control of one MCF-A/B unit

Terminals 23 to 26 of the [CENTRALIZED OUTPUT] connector are for external remote control signaling. The MCF-A/B can be controlled remotely using external signals.

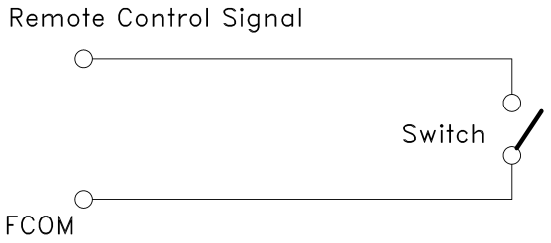
The following functions can be controlled remotely using external signals. These functions are the same as those of the [CAL] switch, [BAL] switch, and [KEY LOCK] switch on the monitor display section of the MCF-A/B.

- Key lock: Disables switch operations. (Terminal no. 23)
- Batch calibration: Outputs the calibration signals for all channels. (Terminal nos. 24 and 25)
- Batch balance adjustment: Adjusts the balance for all channels. (Terminal no. 26)

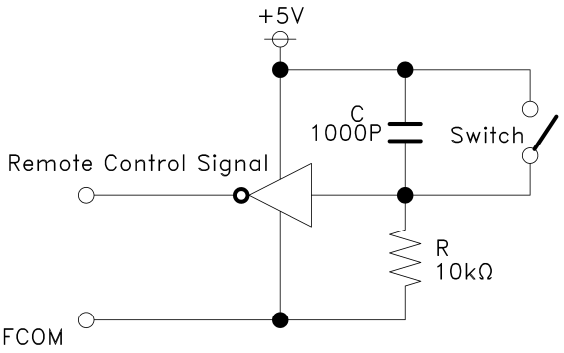
Recommended circuits

To use an external signal for remote control, add a contact circuit to the remote control signal line. Two types of recommended circuits are shown below. In both circuits, the remote control signal switches to the "L" (0V) level when the switch is turned ON.
The common potential for the remote control signal is [FCOM (terminal no. 13)].

- Direct contact input



- Contact input by way of buffer

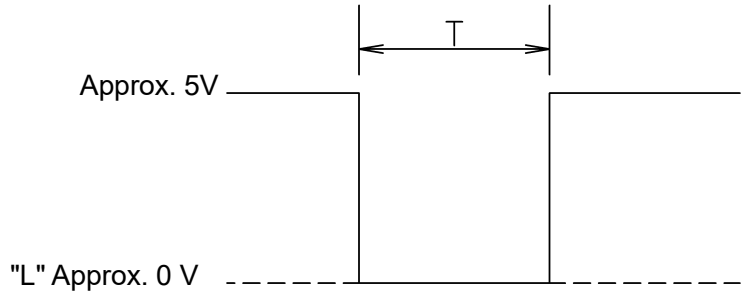


MEMO

- If the remote control signal terminal is not connected with any line, the level of the remote control signal is pulled up by the internal circuit to approximately 5 V.
- If the remote control signal is at "L" (0 V), a current of about 6 mA flows to the remote control signal terminal.
- Make sure no chattering will be generated at the rising or falling edge of the control signal. If chattering occurs, install an anti-chatter capacitor between the remote control signal and FCOM.

Remote control method

- When using the key lock function
  While the control signal [KEY LOCK (terminal no. 23)] is at the "L" (0 V) level, the key lock function is executed, enabling the key lock function.
  The function continues to be executed for as long as the signal remains at the "L" (0 V) level.

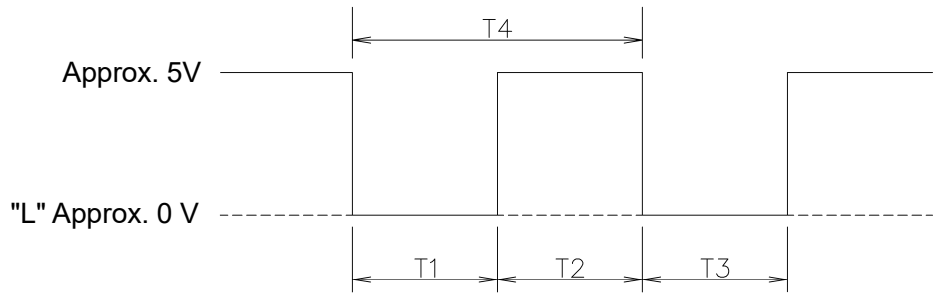


- When performing batch calibration
  As with the key lock function, the batch calibration function is enabled while the control signal [ALL +CAL (terminal no. 25)] or [ALL -CAL (terminal no. 24)] is at "L" (0 V). The function continues to be executed for as long as the signal remains at "L" (0 V).
  The positive calibration signal is output from [ALL +CAL (terminal no. 25)], and the negative calibration signal (calibration signal at 0°C in the case of CTA-90A) is output from [ALL -CAL (terminal no. 24)].

NOTE

- When performing batch calibration, make sure the valid time T (i.e., time period during which the control signal is at "L") is 500 milliseconds or more.
- When performing batch calibration using remote control signals, you cannot enable the CAL lock function by pressing the switch twice in succession.
  To maintain the calibration signal output, keep the control signal at the "L" level.

- When performing batch balance adjustment
  If the control signal [ALL BAL (terminal no. 26)] changes to "L" (0 V) level twice in succession as shown below, batch balance adjustment is executed once.

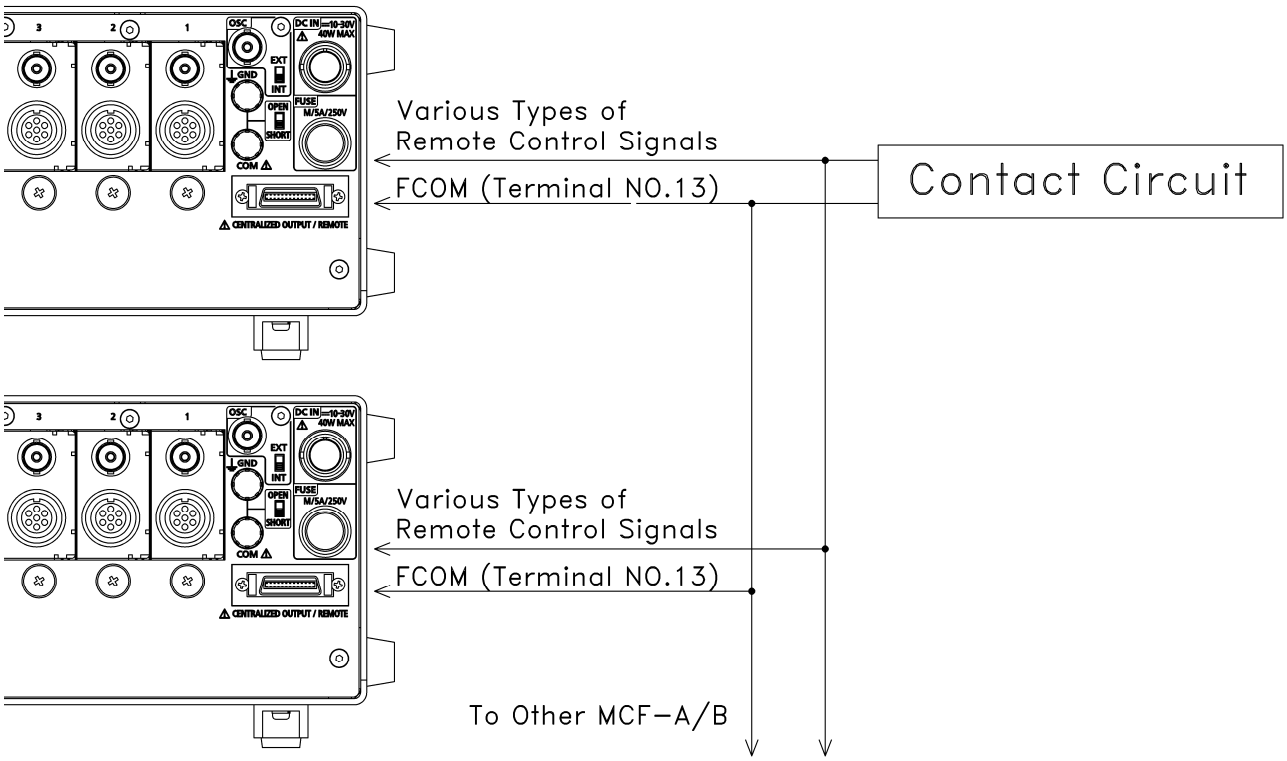


Note: Ensure that T1, 2, 3 (valivd times) are 50 msec or more,and
T4 (repeating time) is between 100 msec and 500msec

● External control of multiple MCF-A/B units

You can control multiple MCF-A/B units via remote control signals issued to each MCF-A/B unit (terminal nos. 23 to 26).

As shown below, connect the remote control signal to each MCF-A/B unit (terminal nos. 23 to 26) and FCOM (terminal no. 13) and install a contact circuit. If the remote control signal is set to "L" (0 V) by the contact circuit, remote control is executed for all MCF-A/B units.



NOTE

- The recommended contact circuit and remote control method are the same as described in the previous section, "When externally controlling a single MCF-A/B unit."
- If the remote control signal changes to "L" (0 V), a current of about 6 mA per MCF-A/B unit flows to the contact circuit. Since this current flow increases with the number of MCF-A/B units connected, note the current capacity of the contact circuit used.

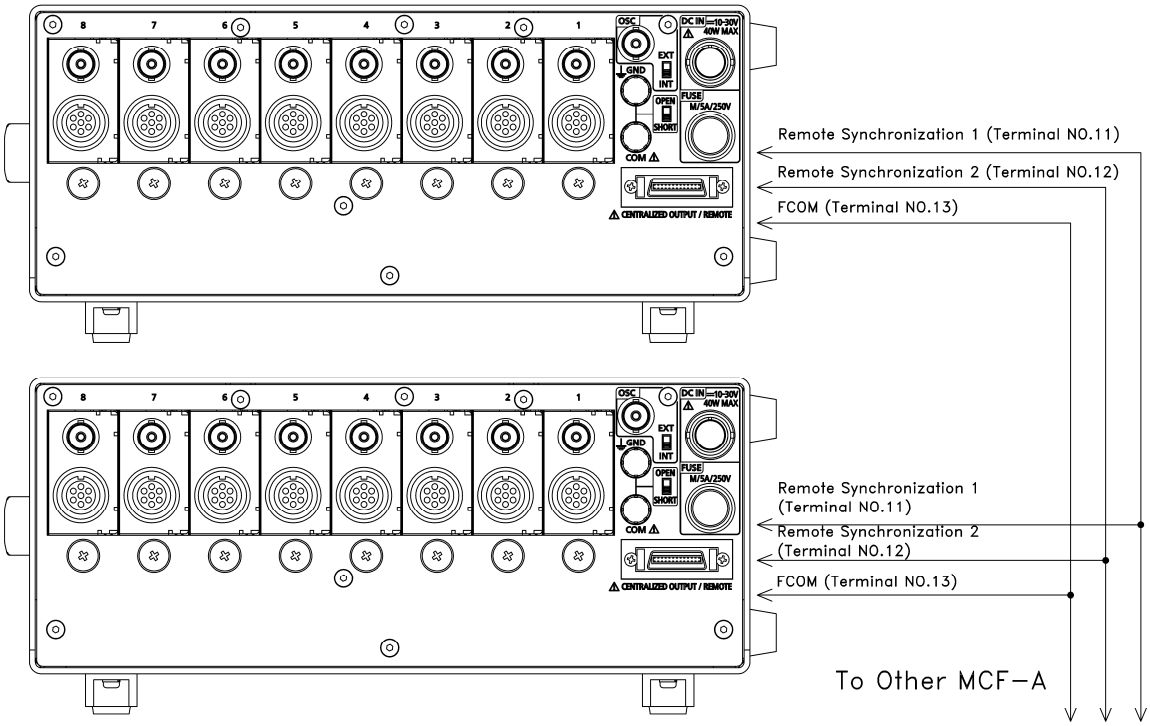
- When controlling multiple MCF-A units from a selected MCF-A unit (Not available for the MCF-B.)
  When using multiple MCF-A units, connect [Remote Synchronization 1 (terminal no. 11)], [Remote Synchronization 2 (terminal no. 12)], and [FCOM (terminal no. 13)] of the [CENTRALIZED OUTPUT] connectors of the MCF-A units to implement remote control from the selected MCF-A unit.

  Controllable switches

  The [CAL] switch and [BAL] switch on the MCF-A 's monitor display section are controllable. Operate these switches on the selected MCF-A unit to execute the batch calibration function and batch balance adjustment function on all MCF-A units.
  For information on using these switches, refer to "8-4. Batch Calibration Function and Batch Balance Adjustment Function" on page 64.

  Connection diagram

  To use this function, connect [Remote Synchronization 1 (terminal no. 11)], [Remote Synchronization 2 (terminal no. 12)], and [FCOM (terminal no. 13)] of the [CENTRALIZED OUTPUT] connectors of the MCF-A units as shown below.



  Restrictions on using the key lock function

  MCF-A units with the key lock function enabled cannot be controlled from another MCF-A unit. To control all connected MCF-A units using the remote function, disable the key lock function on all units.

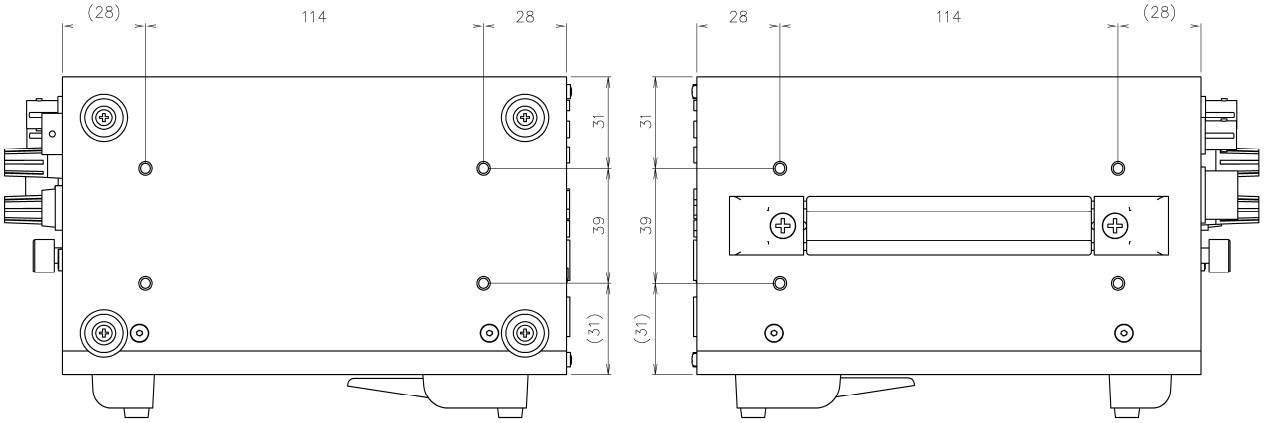
NOTE

- When controlling multiple MCF-A units, note that the controllable switches are the [CAL] switch and [BAL] switch on the MCF-A 's monitor display section. Other switches on the MCF-A or conditioner cards cannot be used.
- Note that all connected MCF-A units can execute the batch calibration function and batch balance adjustment function, but the execution timing may vary slightly from unit to unit.
- Do not operate switches on multiple MCF-A units at the same time.
- To minimize the effects of noise, use twisted pair cables for the signal wires connected to [Remote Synchronization 1 (terminal no. 11)] and [Remote Synchronization 2 (terminal no. 12)].
  Keep the total length of cables used to operate the MCF-A units to 5 meters or less.
- To use this functionality, you must configure the terminating resistors in the monitor display section.
  For more information, refer to “17-3. Device ID and terminating resistor settings” on page 110.

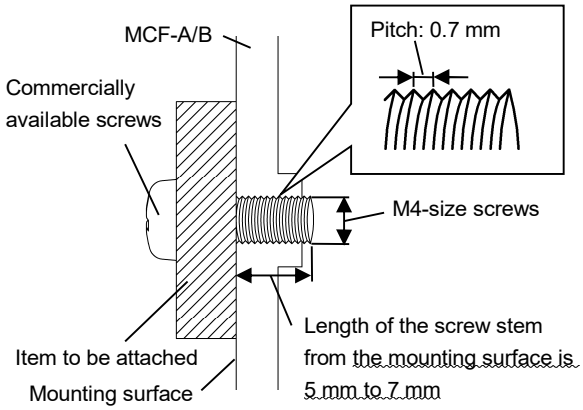
8-7. Utility Nuts

The MCF-A/B provides utility nuts (screw holes) on the left and right sides.
Use commercially available screws to attach the MCF-A/B to other items or to secure the MCF-A/B in place.

- Utility nut locations
  Four utility nuts are located on each of the left and right sides of the MCF-A/B.
  The locations of the utility nuts are shown below.



- Size of mounting screws
  The utility nuts accept M4-size screws.
  The appropriate length of the screw depends on the thickness of the item to be attached. When selecting screws, make sure the length of the screw stem from the mounting surface is 5 mm to 7 mm when tightened.
  Carefully read the NOTE below before using the utility nuts.

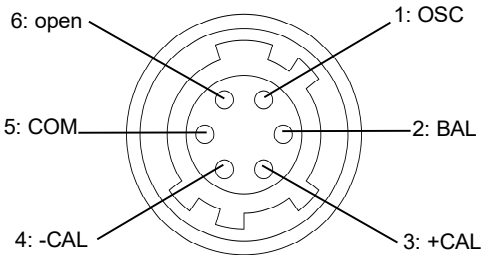


NOTE

- Screws that are too short may not achieve secure mounting. Screws that are too long may puncture the internal circuit board and cause damage. Be sure to use screws with stems that extend 5 mm to 7 mm from the mounting surface when tightened.
- When using the utility nuts, check the size of the item to be attached as well as related safety aspects.
- The recommended tightening torque is 150 [N-cm] (for mild-steel screws or stainless-steel screws).
  Screws that are not adequately tightened may fall off, resulting in injury or accidents.
  Screws tightened with excessive force may be damaged.
- Kyowa Electronic Instruments Co., Ltd., assumes no liability for any damage resulting from inappropriate tightening or the use of utility nuts with items other than optional fixtures sold by KYOWA.

8-8. Synchronization of MCD-A Functions

Certain functions of the MCF-A/B series can be used in sync with the Kyowa MCD-A series.
An MCD-A remote connector is used for synchronization. The remote connector pin assignments are indicated below:

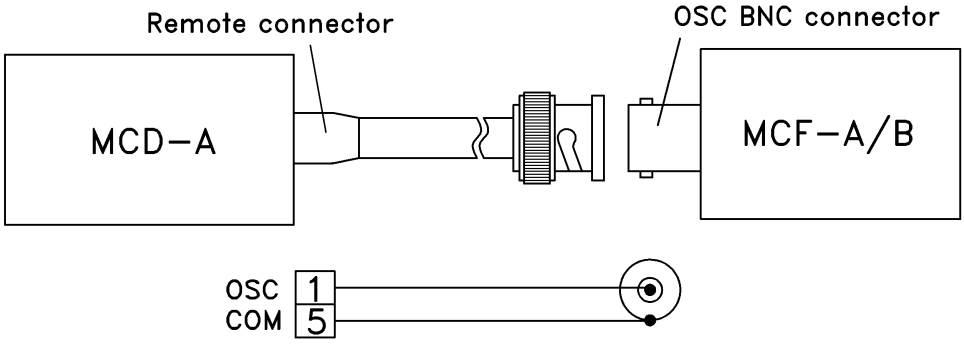


MCD-A remote connector pin assignment

Pin Number	Name	Function
1	OSC	This is used for oscillator synchronization.
2	BAL	This is used for batch balance adjustment.
3	+CAL	This is used for batch calibration (positive calibration value).
4	-CAL	This is used for batch calibration (negative calibration value).
5	COM	Common potential
6	open	Not used

- Carrier wave synchronization
  Carrier waves must be synchronized if the MCF-A/B DPM-90A series and MCD-A DPM-70A series are used simultaneously. For more information on carrier wave synchronization, see "2-4-1. Setting the OSC (DPM-90A Series)" on page 36.
  This section describes how to connect the MCF-A/B and MCD-A.

  To synchronize carrier waves, connect pins 1 and 5 of the MCD-A remote connector to the MCF-A/B OSC BNC connector. Connect as shown in the following figure:



MEMO

- Carrier wave synchronization requires you to select a master (internal oscillator) and slave (external oscillator).
  For instructions on selecting on the MCF-A/B, see "2-4-1. Setting the OSC (DPM-90A Series)" on page 36.
  The MCD-A master and slave can be switched using the sync signal selection switch.
  For more information, refer to the MCD-A instruction manual.

● External remote control synchronization

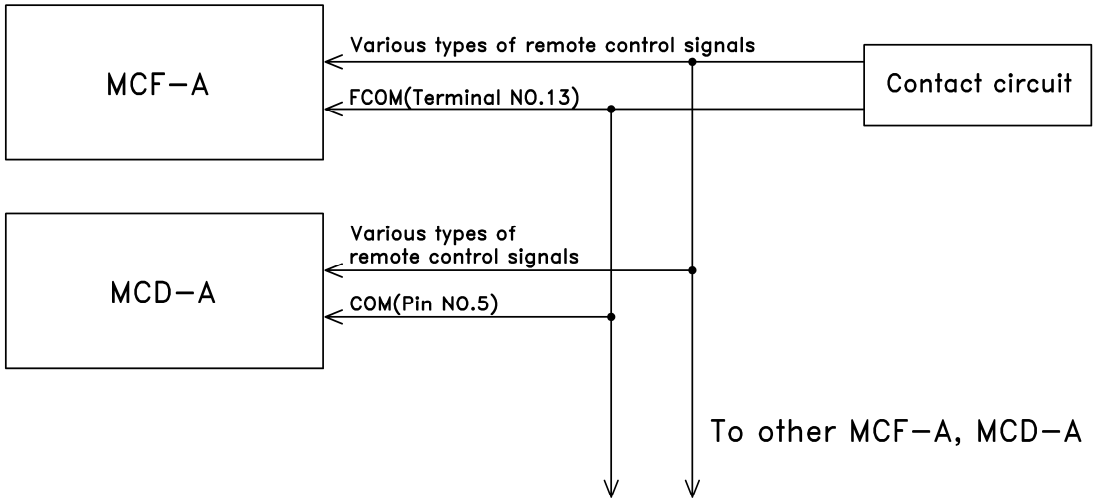
Connect the MCD-A remote connector to the corresponding remote control signal terminal of the MCF-A centralized output connector to control multiple MCF-A and MCD-A units externally.

The corresponding terminals are indicated below:

MCD-A			MCF-A	
Pin Number	Name		Terminal No.	Name
2	BAL	Corresponds to	26	Batch BAL
3	+CAL	Corresponds to	25	Batch +CAL
4	-CAL	Corresponds to	24	Batch -CAL
5	COM	Corresponds to	13	FCOM

Connecting to the terminals enables batch control of BAL and CAL for a connected MCF-A or MCD-A from an external contact circuit.

Connect as shown in the following figure.



MEMO

- For more information and instructions on remote control signal functions, see "8-6-3. Remote control/Command control function" on page 66.
- When remote control signals are connected, use MCD-A batch control switches ([BAL] or [CAL] switches) to enable simultaneous control of BAL and CAL for all connected MCF-A or MCD-A units.
  Note that MCF-A batch control switches cannot be used to control an MCD-A.
  Use an external contact circuit or MCD-A batch control switches to simultaneously control BAL and CAL for all connected MCF-A or MCD-A units.

9. ERROR MESSAGES

The MCF-A/B displays error messages accompanied by an error number and error message. When an error is generated, the [OVER] LED flashes and the monitor meter displays a scrolling error number and error message. When the monitor meter displays an error number and error message, take the corrective measures shown in the following table:

Error No.	Error Message	Description of Error	Corrective Measure
E00_	noCard	Conditioner card is not mounted.	Install a conditioner card and turn power OFF and back ON.
E01_	91or92	Both DPM-91A(-I) and DPM-92A(-I) are installed.	DPM-91A(-I) and DPM-92A(-I) cannot be installed at the same time. Install only one.
E10_	Carr	Abnormal carrier wave frequency	When the OSC is not synchronized, set the [OSC] select switch to "INT". When the OSC is synchronized, check the connected state of the amplifiers to be synchronized.
E13_		Abnormal carrier wave voltage	
E20_	CAL_OUT SET	The value set with the [OUTPUT] switch exceeds the allowable range.	The value set with the [OUTPUT] switch exceeds the allowable setting range. Set a value within the allowable setting range of the [OUTPUT] switch, then reconfigure the internal gain.
E21_		The value set with the [OUTPUT] switch is below the allowable range.	The value set with the [OUTPUT] switch is below the allowable setting range. Set a value within the allowable setting range of the [OUTPUT] switch, then reconfigure the internal gain.
E22_		The value set with the [INPUT] switch exceeds the allowable range.	The value set with the [INPUT] switch exceeds the allowable setting range. Set a value within the allowable setting range of the [INPUT] switch, and then reconfigure the internal gain.
E23_		The value set with the [INPUT] switch is below the allowable range.	The value set with the [INPUT] switch is below the allowable setting range. Set a value within the allowable setting range of the [INPUT] switch, then reconfigure the internal gain.
E24_		The internal gain is set too high.	The setting for the internal gain exceeds the allowable setting range. Change the values set with the [OUTPUT] switch and [INPUT] switch so that the internal gain will be within the allowable setting range, and then reconfigure the internal gain.
E25_		The internal gain is set too low.	The setting of the internal gain is below the allowable setting range. Change the values set with the [OUTPUT] switch and [INPUT] switch so that the internal gain will be within the allowable setting range, and then reconfigure the internal gain.
E26_		The internal gain is set too high for TEDS mode.	The setting of the internal gain exceeds the allowable setting range. Set the value configured with the [OUTPUT] switch within the allowable setting range, then reconfigure the internal gain.
E27_		The internal gain is set too low for TEDS mode.	The setting of the internal gain is below the allowable setting range. Set the value set with the [OUTPUT] switch within the allowable setting range, and then reconfigure the internal gain.
E30_	SEnSor	The sensor resistance is too high.	The bridge resistance of the connected sensor is too high. Review the bridge resistance value.
E31_		The sensor resistance is too low.	The bridge resistance of the connected sensor is too low. Review the bridge resistance value.
		Remote-sensing-compatible sensor is used.	When F and G are connected for remote sensing, the bridge voltage is halved, preventing the sensor from operating. The F and G lines need to be separated. The CAB-E strain generator can be used when F and G are separated, but DPM using a carrier wave will not satisfy specifications due to the special equivalent strain circuit used.
E40_	TEDS	TEDS read error	Connect a TEDS installed sensor. Check the connection of the sensor.
E41_		The TEDS information for the connected sensor differs from the setting.	Load the TEDS information.

10. TROUBLESHOOTING

If the product does not operate as expected or operates unstably, check to see if the problem is caused by other factors before concluding that the product is defective.
Possible causes and check methods for each symptom are described below.
If the product still fails to operate properly after it is inspected and corrective measures are taken, contact your KYOWA representative.
Note that if the product has been damaged due to use of the product in ways or for purposes other than described in this manual or if the product has been disassembled or modified by the user, KYOWA may reject requests for repairs.

10-1. Symptoms and Corrective Measures (1/4)

Symptom	Check Method or Corrective Measure
The unit does not turn ON.	● Check to determine whether the fuse has blown. → Check the fuse inside the fuse holder. If the fuse has melted, replace the fuse. ● When using the AC adapter, make sure the power supply voltage of the AC power outlet is within the range of 100 VAC to 240 VAC (50/60 Hz). → Use a tester to check the voltage. (See "2-5-1. When Using the AC Adapter (Option)" on page 38.) ● Check to determine whether the output voltage of the AC adapter is within the range of 10 VDC to 30 VDC. → If the AC adapter is not within that range, replace it. ● Check to determine whether the output voltage of the DC power supply is within the range of 10 VDC to 30 VDC. → If the DC power supply is not within that range, change the settings. ● Check to determine whether the AC cable is connected securely to the main unit (black box) of the AC adapter. → The cable that connects to an AC power outlet is detachable. Make sure the cable is properly connected to the main unit.
The unit does not respond to switch operations.	● Check to determine whether the [KEY LOCK] LED is lit. → Disable the key lock function. ● Make sure the [KEY LOCK] LED is not blinking. → If the [KEY LOCK] LED is blinking, the unit is in command control mode, which disables switch-based operation. Exit command control by referring to "17-4. Using Command Control17-4. " on page 114.
The unit does not operate according to switch operations.	● Check to determine whether any switches are stuck in the depressed position. → Since the switches are made of resin, they can become stuck in the depressed position if pressed at an oblique angle with a fingernail. Be sure to press the switch with the tip of your finger perpendicular to the switch surface.
The output voltage does not change from around 0 V.	● Check to determine whether the monitor displays oFF. → The internal gain was set after [0.00] was set with the [OUTPUT] switch. Set the [OUTPUT] switch to a value other than [0.00], then reconfigure the internal gain. ● Check to determine whether the cable is connected correctly to the [OUTPUT] connector. → Connect the cable properly to the correct [OUTPUT] connector.
When a load is applied to the strain gage, the output voltage does not change. The output voltage fluctuates.	● Check for contact failures in the connection to the bridge box. → Check for loose screws and inspect the solder and connections on the terminal block. When using a bridge box, check the short bar and make sure the mode of the intended gage method matches the connection method. ● Check for broken wires in the output cable U-59 (BNC-BNC coaxial cable). → If the numerical value on the monitor changes correctly but the output voltage does not change, the cable between the MCF-A/B and your device may be damaged.

10-1. Symptoms and Corrective Measures (2/4)

The output voltage fluctuates during thermocouple measurements (CTA-90A).	● Check to determine whether the thermocouple is disconnected from the terminal block or if there are any broken wires. → An open-circuit check is conducted when the internal gain is set. When setting the internal gain, if the monitor shows "-5.2 V" and flashes, the cable may be damaged. Check the thermocouple wire resistance with a tester to confirm that the resistance is 1 kΩ or less. Pull the thermocouple gently with your hand to make sure it does not come loose from the terminal block.
The output voltage fluctuates during thermocouple measurements (CTA-90A).	● The measurements may be affected by the electrical potential of the target being measured or noise. → If the thermocouple can be removed from the target being measured, detach the thermocouple and check to see if it measures the ambient temperature correctly. Thermocouples measure very weak voltages. They may not be make correct measurements if the target has some electrical potential. If an electrical loop is formed through grounding, the corrective measure to take will vary: - Connect a ground wire to the target being measured or separate it from grounding. - Use an isolation transformer as a power supply. - Change the thermocouple to a sheathed type or cover the thermocouple tip with an insulating material (e.g., tape).
The output voltage becomes saturated and does not change. (Voltage remains at a value higher than 5 V or lower than -5 V.)	● Check to determine whether the sensor's initial value is too high compared to the internal gain. → Adjust the balance. ● Check to determine whether the internal gain is set too high for the sensor input. → Lower the internal gain. ● Check to determine whether there is an abnormality in the connected sensor. → If the output is saturated toward the negative direction, the sensor may be disconnected or there may be a broken wire in the sensor. Check the sensor for a disconnection or an open circuit.
The internal gain differs from the [INPUT] switch or [OUTPUT] switch setting.	● Check to determine whether the sensor has been changed since the internal gain was set. → If the sensor has been changed, reconfigure the internal gain. ● Check to determine whether the [INPUT] LED or [OUTPUT] LED is flashing. → If the LED is flashing, the [INPUT] switch or [OUTPUT] switch setting has been changed since the internal gain was set. To apply the switch settings, reconfigure the internal gain. Each conditioner card is equipped with a function to make fine adjustments of the internal gain.Use that function as necessary. ● Check to determine whether the [TEDS] LED is lit. → If the TEDS function was used to set the internal gain, the settings of the switches will differ from what they appear to be.
Balance adjustment cannot be conducted.	● Check to determine whether excessive input was applied to the connected sensor. → The balance adjustment range is within ±10,000 μm/m. If the initial imbalance exceeds this range, the initial imbalance cannot be removed completely. This problem can sometimes be solved by adding a fixed resistor to one side of the bridge. In certain bridge boxes, however, the terminals of the sides are not exposed. In such cases, a fixed resistor cannot be added. ● Check to determine whether the input from the sensor is fluctuating. → If the input is unstable, the balance in some cases cannot be adjusted. Stabilize the sensor input, then readjust the balance. The DPM-90A series and CDV-90A are equipped with a zero-point fine-adjustment function. To make fine adjustments of the zero point, use that function.

10-1. Symptoms and Corrective Measures (3/4)

The output is unstable. (The output voltage fluctuates or drift when the sensor or strain gage is under no load.)	● Check to determine whether the unit is sufficiently warmed up. → Warm up the unit for 30 to 60 minutes. ● Check to determine whether the insulation of the strain gage or lead wire has decreased. → Check the wire resistance and insulation, and repair or replace. ● Check to determine whether there is a contact failure or broken wire in the sensor cable. → If an extension cable is used, check the cable resistance with a tester. ● Check to determine whether the strain gage's temperature compensation is sufficient. → Use a strain gage with sufficient temperature compensation. ● Check to determine whether the internal fixed resistor in the bridge box is damaged. → Replace the bridge box. ● Chheck to determine whether the the screw fixing on front panel and rear panel are sufficient. →If the fixing is insufficient, contact failure may occur due to vibration etc., causing malfunction. Please reinsert the card, set the internal gain again after fixing the screw.
Noise is excessive.	● Check to determine whether there is any equipment (large motors, transformer, ferroresonant constant voltage transformer, etc.) that generates a strong magnetic field at the site. ● Check to determine whether the sensor is located at too great a distance. → If so, induction noise may be generated. Take the following countermeasures: ・ Move the MCF-A/B away from the equipment that generates a strong magnetic field. ・ Use a two-conductor or three-conductor shielded cable to connect the strain gage, and connect the shield to the ground terminal of the bridge box. ・ Connect the MCF-A/B and the target of measurement to a single-point ground. ● Check to determine whether the target of measurement has DC or AC potential. → If so, take the following countermeasures: ・ Ground the MCF-A/B. ・ Connect the MCF-A/B to the frame of the measuring target. If there is induction noise or if the target of measurement has electrical potential, the problem can rarely be readily solved. In particular, if there are many machines or devices in the measurement environment, the collective noise generated may be too intense. The abovementioned countermeasures are mere examples. Fully consider the surrounding environment and take the most effective countermeasures.
The output voltage differs significantly from expected value in thermocouple measurements (CTA-90A).	● Confirm that the settings match the type of thermocouple used. Make sure the connections on the terminal block are not reversed. Sometimes, reversed connections are not noticeable at room temperature. Simple check of the card's reliability: Using a copper wire, short-circuit (H), and short-circuit (L) on the terminal block. If the temperature of the MCF-A/B is about 5°C to 10°C above the ambient temperature, the internal reference junction compensator will operate normally without major problems.
When the unit is shaken, you hear an abnormal noise from inside the unit.	● Internal parts may have come loose. → Immediately stop using the product. Contact your KYOWA representative. Continuing to use the product in this state may result in malfunctions, electrical shock, or fire.

10-1. Symptoms and Corrective Measures (4/4)

Press the [CAL] switch (calibration signal output) to saturate the output voltage. (The voltage rises above 5 V or below -5 V. The [OVER] LED lights up, and the monitor flashes.)	● The calibration signal output from the DPM-90A series or CDV-90A series is added to the present output. → Set the sensor to no-load condition, adjust the balance, and press the [CAL] switch. Alternatively, set the [INPUT] switch so that the total of the present output and calibration signal output is within ±5 V.
Input signals are supplied, but the output is 0 V (CFV-90A).	● Check whether the [TRIGGER LEVEL] LED is off. → If the LED remains unlit, signals cannot be detected. The [TRIGGER LEVEL] switch setting may be too high or low relative to input signals. Configure the [TRIGGER LEVEL] switch setting once again. ● Confirm that the measurement range is not too broad for the frequencies measured. → Select the measurement range for the frequency to be measured. ● Check whether output is set to off. → Set a normal internal gain setting to cancel output off.
Output drifts (CCA-90A).	● Confirm that you have waited long enough after startup or after attaching or removing input connectors or sensors before starting measurement. → Output may fluctuate dramatically immediately after CCA-90A startup if the input connectors are attached or removed or if an excessive input occurs. If so, wait for output to stabilize. Starting measurement before output stabilizes will cause output drift.
Output is not close to 0 V even when output is set to off.	● When using the DPM-90A series, check whether the sensor is disconnected (input is open). → The DPM-90A series features an open detection function and outputs voltage saturated in the negative direction (approx. -5.8 V) when input is open. This function takes precedence even when output is set to off. This means output is not close to 0 V when output is open. For output close to 0 V, connect a sensor as input. ● If you use the following versions of the conditioner cards, restarting the MCF-A/B may cancel output off. If so, set output to off once again. ・ DPM-90A series, version 01.05 or earlier ・ CDV-90A series, version 01.02 or earlier ・ CTA-90A series, version 01.00 For instructions on determining version, see "10-2. Checking the Version" on page 79. ● When the [V ADJ] switch is used for zero adjustment, the voltage used for zero adjustment is output.
The [OVER] LED flashes when output is set to off.	● If you are using the following versions of the conditioner cards, setting output to off during an error will keep the [OVER] LED flashing when output is switched off. While a flashing [OVER] LED normally indicates an error, the unit will operate with output off with no problems. ・ DPM-90A series, version 01.05 or earlier ・ CDV-90A series, version 01.02 or earlier ・ CTA-90A series, version 01.00 For instructions on determining the version, see "10-2. Checking the Version" on page 79.
The monitor meter [OFF] display flashes when output is set to off.	● The [OFF] display flashes when output is set to off for MCF-A/B units of version 02.00 or earlier.

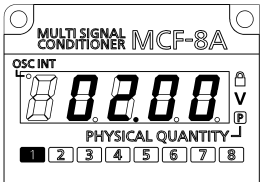
10-2. Checking the Version

This section describes how to check MCF-A/B and conditioner card versions.
If you contact a Kyowa sales office or your local dealer for inquiries, you will be asked to provide the versions of your MCF-A/B and conditioner cards, in addition to the nature of your inquiry. This section describes how to check MCF-A/B and conditioner card versions.

MEMO

- With the MCF-B, check the version using the command control function.
  Execute the get version command [GVN] as described in "17-6. Details of Control Commands" on page 119.

- Checking the MCF-A/B version
  Check the version as follows:
  ① Turn MCF-A/B power on.
  ② After you turn the MCF-A on, all LEDs illuminate. This is followed by the display of a number on the monitor meter. This number is the MCF-A/B version.
  On the MCF-B, after the version is displayed, the configured device ID will appear on the monitor meter.



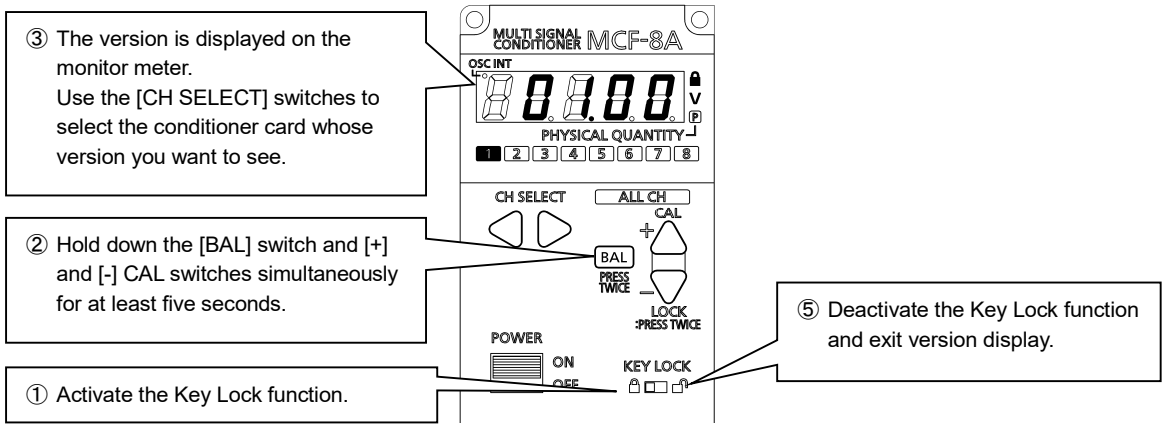
The MCF-A/B version is displayed after all LEDs illuminate.
In the example above, the MCF-A version is 02.00.

- Checking conditioner card versions
  Check the version as follows after turning the MCF-A/B on:

NOTE

- If the command control function is enabled on the MCF-B, you cannot check the version using the following procedure.
  Before proceeding, exit the command control function as described in "17-4-4. Ending the command control function" on page 115.

① Slide the Key Lock switch to the left to lock the keys.
② In the monitor display section, press and hold the [BAL] switch and [+] and [-] CAL switches simultaneously for at least five seconds.
③ The version of the conditioner card selected in the monitor meter is displayed.
Use the [CH SELECT] switches to select the conditioner card whose version you want to see, then check the version.
④ Slide the Key Lock switch to the right to unlock the keys.
Version display ends, and the unit returns to normal mode.



MEMO

- For more information on the latest versions, visit the Kyowa website.
- To update to a newer version, contact a Kyowa sales office or your local dealer.

11. MAINTENANCE

Maintaining the MCF-A/B requires calibrating the equipment and replacing limited life parts, as indicated in the table below.
The recommended maintenance intervals are also indicated in the table.

Table 6-1. Equipment calibration

Item	Description	Interval
Checking the functioning of the MCF-A/B	To ensure the proper functioning of the MCF-A/B, we recommend having the MCF-A/B inspected once a year. The product must be returned to KYOWA for periodic inspections and maintenance.	Every year
Confirming the accuracy of conditioner cards	To ensure the conditioner cards are accurate, we recommend having them inspected once a year. The conditioner cards must be returned to KYOWA for periodic inspections and maintenance.	Every year

Table 6-2. Replacement of limited life parts

Item	Description	Interval
AC adapter (option)	The AC adapter has a service life of approximately five years, depending on frequency of use, operating temperatures, and other factors. Replace the AC adapter about once every five years.	Every five years
Power supply unit	The aluminum electrolytic capacitor inside the AC adapter has a service life of approximately 15 years, depending on frequency of use, operating temperatures, and other factors. Replace the power supply unit about once every 15 years.	Every 15 years
One-touch-type terminal block (CTA-90A)	The service life of the one-touch-type terminal block is approximately one year when a lead wire is inserted and removed twice per day for 20 days a month. If a lead wire is inserted and removed repeatedly, the lead wire connection may eventually come loose.	Every year when used as indicated to the left
Nonvolatile memory (EEPROM)	The nonvolatile memory stores settings such as Balance, Set, LPF, and V ADJ. Each time a setting is changed by switch operations, the previous data is overwritten. Data in memory can be rewritten about 1 million times. If the number of rewrite operations exceeds 1 million, the settings may be reset after power is turned OFF and back ON; otherwise, the previous settings may not be read correctly. The service life of nonvolatile memory is approximately 10 years when balance adjustments are performed 250 times a day. To replace nonvolatile memory, the product must be returned to KYOWA for replacement.	Every 10 years when used as indicated to the left

Replace limited life parts about every five years when used 8 hours a day for 365 days a year. These are guideline figures; KYOWA does not guarantee trouble-free operation or provide free repair services during the abovementioned period.
To ensure reliability, perform periodic maintenance so that parts can be replaced when needed.
In particular, if you use the product continuously for extended periods, early parts replacement may be necessary to ensure continuing safe use of the product.

12.Product Specifications

12-1. Product specification of multi signal conditioner

12-1-1. MCF-A

Model	MCF-8A	MCF-16A
Number of mountable conditioner cards	8	16
Monitor meter	Indicate output voltage of selected any channel by 1-digit sign and 4-digit value. When error occurs, error No. and message are indicated.	
Control switches (Front)	CH select: Switching channels that indicate on the monitor meter. BAL: Balance adjustment is executed all channels simultaneously. +CAL,-CAL: Calibration output is executed all channels simultaneously. KEY LOCK: When set to ON, no operation switches are available.	
Control switches (Rear)	OSC select: To select the oscillator signal internal or external. COM change-over: To change open or short between COM terminal and GND terminal.	
Channel indication	CH LED lights up when the channel is monitored.	
Key-lock indication	KEYLOCK LED lights up when Key-lock set to ON.	
PHYSICAL QUANTITY indication	PHYSICAL QUANTITY LED lights up when the conditioner card in TEDS mode.	
Master indication	OSC INT LED lights up when use DPM card and when OSC select switch sets to INT as internal oscillator.	
Other function	Automatically select carrier frequency according to the types of the connected DPM card.	
Vibration resistance *	49.03 m/s^2 (5 G) 5 to 55 Hz 15 cycles each in X,Y,Z directions, 1 minute/cycle	
Operating temperature/humidity range *	-10 to 50 °C, 20 to 85 % (Non-condensing)	
Storage temperature range *	-20 to 60 °C	
Power supply	10 to 30 VDC	
Current consumption	1.5 A or less	3 A or less
	(Full equipped with CDV-90A cards, bridge excitation=2 V, bridge resistance 60 Ω, power supply 15 VDC.)	
Connector	Concentralized output connector (MDR connector, pincount 26 , female) BNC connector	
Dimensions	246.4(W)×101 (H)×170 (D) mm (Excluding protrusions.)	440(W)×101 (H)×170 (D) mm (Excluding protrusions)
Weight	Approx. 5 kg	Approx. 8 kg
	(With DPM-91A cards mounted all channels.)	

* Contains each conditioner card

12-1-2. MCF-B

Model	MCF-8B	MCF-16B
Number of mountable conditioner cards	8	16
Compatible conditioner cards	Card Model / Compatible Firmware DPM-91A, DPM-91A-I, DPM-92A, DPM-92A-I: Ver. 03.00 or later CDV-90A: Ver. 03.00 or later CTA-90A: Ver. 01.02 or later CFV-90A: Ver. 03.01 or later CCA-90A: Ver. 03.00 or later	
Monitor meter	Indicate output voltage of selected any channel by 1-digit sign and 4-digit value. When error occurs, error No. and message are indicated.	
Control switches (Front)	CH select: Switching channels that indicate on the monitor meter. BAL: Balance adjustment is executed all channels simultaneously. +CAL,-CAL: Calibration output is executed all channels simultaneously. KEY LOCK: When set to ON, no operation switches are available.	
Control switches (Rear)	OSC select: To select the oscillator signal internal or external. COM change-over: To change open or short between COM terminal and GND terminal.	
Channel indication	CH LED lights up when the channel is monitored.	
Key-lock indication	KEYLOCK LED lights up when Key-lock set to ON.	
PHYSICAL QUANTITY indication	PHYSICAL QUANTITY LED lights up when the conditioner card in TEDS mode.	
Master indication	OSC INT LED lights up when use DPM card and when OSC select switch sets to INT as internal oscillator.	
Other function	Automatically select carrier frequency according to the types of the connected DPM card.	
Vibration resistance *	49.03 m/s^2 (5 G) 5 to 55 Hz 15 cycles each in X,Y,Z directions, 1 minute/cycle	
Operating temperature/humidity range *	-10 to 50 °C, 20 to 85 % (Non-condensing)	
Storage temperature range *	-20 to 60 °C	
Power supply	10 to 30 VDC	
Current consumption	1.5 A or less	3 A or less
	(Full equipped with CDV-90A cards, bridge excitation=2 V, bridge resistance 60 Ω, power supply 15 VDC.)	
Connector	Concentralized output connector (MDR connector, pincount 26 , female) BNC connector	
Dimensions	246.4(W)×101 (H)×170 (D) mm (Excluding protrusions.)	440(W)×101 (H)×170 (D) mm (Excluding protrusions)
Weight	Approx. 5 kg	Approx. 8 kg
	(With DPM-91A cards mounted all channels.)	
Compliance	Directive 2014/30/EU (EMC) Directive 2011/65/EU, (EU)2015/863 (10 restricted substances) (RoHS)	

* Contains each conditioner card

Model	MCF-8B	MCF-16B
Signaling system	RS-485 Half duplex system	
Communication speed	9600bps	
Character length	8bit	
Parity	None	
Stop bit	1bit	
Delimiter	CR : Command output to the MCF-B. CR+LF : Data output from the MCF-B.	
Device ID **	0 to F (up to 16 units can be controlled by one computer)	
Communication range	Up to 200 m	
Command	Start command control End command control Select monitor display channel Get card type Get connected models Get version Get error number Get voltage Execute balance adjustment (DPM-90A series, CDV-90A) Set calibration output (DPM-90A series, CDV-90A, CTA-90A, CFV-90A, CCA-90A) Set internal gain (DPM-90A series, CDV-90A, CTA-90A, CFV-90A, CCA-90A) Perform zero-point adjustment (DPM-90A series, CDV-90A, CFV-90A, CCA-90A) Perform internal gain adjustment (DPM-90A series, CDV-90A, CTA-90A, CCA-90A) Set bridge voltage (CDV-90A) Switch TEDS mode on/off (DPM-90A series, CDV-90A, CCA-90A) Load TEDS information (DPM-90A series, CDV-90A, CCA-90A) Set low-pass filter cutoff frequency (DPM-90A series, CDV-90A, CCA-90A) Set high-pass filter cutoff frequency (DPM-90A series, CDV-90A) Select thermocouple type (CTA-90A) Switch measurement range (CFV-90A) Set input coupling (CFV-90A) Set trigger level (CFV-90A)	
Switch status in command control mode	Switch operations are locked (except for [CH SELECT] switches).	
Notification in command control mode	[KEY LOCK] LED flashes.	
Exiting command control mode	Canceled by command or using switch.	
Settings after exiting command control mode	Retains most recent settings.	

** Device IDs are set using the DIP switches in the monitor display section.

12-2. Product specification of conditioner cards

12-2-1. Product specification of strain amplifier card (DPM-90A series)

Model		DPM-91A	DPM-91A-I	DPM-92A	DPM-92A-I
Measuring target		Strain gages, Strain-gage transducers			
Number of measuring channels		1			
Applicable bridge resistance		60 to 1000 Ω			
Gage factor		2.00 fixed			
Bridge excitation		2 Vrms			
Balance adjustment range		Resistance : Within ±2 % (Within ±10000 μm/m) Capacitance : 2000 pF or less			
Balance adjustment methods		Resistance : Auto balance (Stored in nonvolatile memory) Accuracy : Within ±0.5 μm/m			
		Capacitance : CST (Capacitance Self Tracking)			
Frequency response range		DC to 2.5 kHz (Deviation within ±10 %)		DC to 5 kHz (Deviation within ±10 %)	
Carrier frequency		5 kHz		12 kHz	
Nonlinearity		Within ±0.2 % FS			
Calibration strain		±(1 to 9999 μm/m) Accuracy: Within ±(0.5 % + 0.5 μm/m)			
Sensitivity adjustment		Sensitivity of amplifier is set from the combination setting of INPUT switch (4-digit thumbwheel switch) and OUTPUT switch (3-digit thumbwheel switch). OUTPUT switch range : 1.00 to 5.00 V in 0.01-V step INPUT switch range : 100 to 9999 μm/m in 1-μm/m step Accuracy : Within ±(0.5 % + 5 mV) Range : ×200 to ×50000			
Fine sensitivity adjustment		×0.4 to ×1			
Low-pass filter		Transfer characteristic : 2nd order Butterworth Cutoff frequency : 10, 30, 100, 300, 1k Hz and FLAT (6 steps) Amplitude ratio : -3 ±1 dB (At cutoff point.) Attenuation : -12 ±1 dB/oct. (Except set at 1 kHz.)			
High-pass filter		Cutoff frequency : 0.2 Hz and OFF (2 steps)			
SN ratio		49 dBp-p or more	44 dBp-p or more	45 dBp-p or more	40 dBp-p or more
		(When 200 μm/m input with 5V output, 120 Ω short.)			
Stability	Temperature	Zero point : Within ±0.1 μm/m / ºC		Sensitivity : Within ±0.05 % / ºC	
	Time	Zero point : Within ±1 μm/m / 8h		Sensitivity : Within ±0.3 % / 8h	
		(When 100 μm/m input with 5 V output, zero point is measured by 120 Ω short, sensitivity is measured by 120 Ω bridge.)			
Output		Dual output (The same voltage is output to BNC connector and concentralized output connector.) Output voltage range : within ±5 V or over (Load 5 kΩ or more) Zero adjustment range : within ±0.1 V or over			
Output off function		Available			
Output impedance		2 Ω or less			
Withstand voltage		500 VAC within one minute in: •Between input and output. •Between input and case. •Between output and case.			
Over input indication		LED lights up			
TEDS		Reads the sensor's TEDS information then sets the rated output to OUTPUT switch as output voltage.			
Input open detection function		Saturates output in the negative direction when input is open.			
Connector shape		Input connector : NDIS4102 Output connector : BNC			
Dimensions		24(W)×96(H)×170(D) mm (Excluding protrusions)			
Weight		Approx. 190 g			

Cannot be used together DPM-91A(-I) and DPM-92A(-I), because of the DPM-91A(-I) and DPM-92A(-I) are different carrier frequency.

12-2-2. Product specification of signal conditioner card (CDV-90A)

Model	CDV-90A
Measuring target	Strain gage, Strain-gage transducers
Number of measuring channels	1
Applicable bridge resistance	300 Ω to 1 kΩ (When bridge excitation voltage is set as 10 V.) 60 Ω to 1 kΩ (When bridge excitation voltage is set as 2 V.)
Gage factor	2.00 fixed
Bridge excitation voltage	2 or 10 VDC, switchable
Balance adjustment range	Within ±2 % (±10000 μm/m)
Balance adjustment methods	Resistance : Auto balance (Stored in nonvolatile memory) Accuracy : Within ±1μm/m (When 200 μm/m input and 10 V bridge excitation voltage with 5V output.)
Frequency response range	DC to 50 kHz (deviation +0.5, -3 dB)
Nonlinearity	Within ±0.05 % FS
Calibration strain	±(1 to 9999 μm/m) Accuracy : Within ±(0.3 % + 1 μm/m)
Sensitivity adjustment	Sensitivity of amplifier is set from the combination setting of INPUT switch (4-digit thumbwheel switch) and OUTPUT switch (3-digit thumbwheel switch). OUTPUT switch range : 1.00 to 5.00 V in 0.01-V step INPUT switch range : 200 to 9999 μm/m in 1-μm/m step Accuracy : Within ±(0.5 % + 5 mV) Range : ×200 to ×5000
Fine sensitivity adjustment	×0.4 to ×1
Low-pass filter	Transfer characteristic : 2nd order Butterworth Cutoff frequency : 10, 30, 100, 300, 1k, 3k, 10k Hz and FLAT (8 steps) Cutoff accuracy : -3 ±1 dB (At cutoff point) Attenuation : -12 ±1 dB/oct.
High-pass filter	Cutoff frequency : 0.2 Hz and OFF (2 steps)
Noise	10 μm/m p-p (When 200 μm/m input and 10 V bridge excitation voltage with 5 V output, 350 Ω short.)
Stability	Temperature Zero point : Within ±1 μm/m / ºC Sensitivity : Within ±0.02 % / ºC
	Time Zero point : Within ±10 μm/m / 8h Sensitivity : Within ±0.1 % / 8h
	(When 1000 μm/m input and 2V bridge excitation voltage with 5V output, zero point is measured by 350 Ω short, sensitivity is measured by 350 Ω bridge.)
Output	Dual output (The same voltage is output to BNC connector and concentralized output connector.) Output voltage range : within ±5 V or over (Load 5 kΩ or more) Zero adjustment range : within ±0.1 V or over
Output off function	Available
Output impedance	2 Ω or less
Withstand voltage	500 VAC within one minute in: •Between input and output. •Between input and case. •Between output and case.
Over input indication	LED lights up
TEDS	Reads the sensor's TEDS information then sets the rated output to OUTPUT switch as output voltage.
Input open detection function	Saturates output in the negative direction when input is open.
Connector shape	Input connector : NDIS4102 Output connector : BNC
Dimensions	24(W)×96(H)×170(D) mm (Excluding protrusions)
Weight	Approx. 150 g

12-2-3. Product specification of thermocouple card (CTA-90A)

Model	CTA-90A
Applicable thermocouples	K, T, J, N, E, R (Thermocouple resistance is 1 kΩ or less)
Number of measuring channels	1
Measurement range	K (-200 to 1300 ºC), T (-200 to 400 ºC), J (-200 to 1200 ºC), N (-200 to 1300 ºC), E (-200 to 1000 ºC), R (0 to 1700 ºC)
Reference junction compensation	±2.5 ºC (-10 to 50 ºC), ±1 ºC (20 ±3 ºC)
Frequency response range	DC to 10 Hz (Deviation +0.5, -1 dB)
Linearizer accuracy	Within ±0.5 %FS (With K, J, N, E, R type) Within ±1 %FS (With T type)
Calibration	100 to 1700 ºC from step up of 100 ºC (Full scale depends on the type of thermocouple.) Accuracy: Within ±0.5 %FS
Sensitivity adjustment	Sensitivity of amplifier is set from the combination setting of INPUT switch (2-digit thumbwheel switch) and OUTPUT switch (3-digit thumbwheel switch). OUTPUT switch range : 1.00 to 5.00 V in 0.01-V step INPUT switch range : 100 to 1700 ºC in 100-ºC step
Fine sensitivity adjustment	×0.4 to ×1
Noise	30 mVp-p or less (Input short)
Stability	Temperature Zero point : Within ±0.05 %FS / ºC Sensitivity : Within ±0.05 % / ºC
	Time Zero point : Within ±0.5 %FS / 8h Sensitivity : Within ±0.5 % / 8h
	(When the setting is type K thermocouple with input of 1300 ºC and output of 5 V, zero point is measured by the input of voltage with response of 0 ºC, sensitivity is measured by the input of voltage with response of 1300 ºC.)
Output	Dual output (The same voltage is output to BNC connector and concentralized output connector.) Output voltage range : within ±5 V or over (Load 5 kΩ or more)
Output off function	Available
Output impedance	2 Ω or less
Withstand voltage	500 VAC within one minute in: •Between input and output. •Between input and case. •Between output and case.
Over input indication	LED lights up
Connector shape	Input connector : One-touch type terminal block Output connector : BNC
Dimensions	24(W)×96(H)×170(D) mm (Excluding protrusions)
Weight	Approx. 140 g

12-2-4. Product specification of F/V converter card (CFV-90A)

Model	CFV-90A
Number of measuring channels	1
Measurement target	AC signal Pulse signal (including open collector signal)
Frequency range	0.2 Hz to 100 kHz (When set to 1 V output and 20 kHz range, 100 kHz input can measure as 5 V.)
Input voltage range	±0.5 V to ±50 V
Input coupling	AC or DC Select by switch operation.
Trigger level (Input detection level)	0.0 to 5.0 V in 0.1-V step Trigger level is set from the 2-digit thumbwheel switch. (When trigger level set to 5.1 V or more, trigger level saturates at 5.0 V.)
Nonlinearity	Within ±0.1 %FS
Sensitivity adjustment (RANGE)	500, 1k, 2k, 5k, 10k, 20k Hz (6 step) Full scale of the range is output with the voltage set with the OUTPUT switch (3-digit thumbwheel switch). Accuracy Within ±(0.1 % + 5 mV) [Setting Example] When "SET" is executed with RANGE set to 20 kHz and OUTPUT switch set to 1.0 V, 1.0 V output at 20 kHz input, 5.0 V output at 100 kHz input.
Calibration (CAL)	100 % or 50 % of each RANGE AccuracyWithin ±0.5 %
Response time	When frequency continuous Less than one cycle of the input signal + 25 μs (At the start of output voltage rising) When frequency cutoff Less than two cycle of the input signal + 25 μs (At the start of output voltage falling)
Power supply for sensor	12 VDC ±10 % (At load current is 50 mA or less)
Noise	30 mVp-p or less (When input the signal: square wave, frequency 100kHz, amplitude ±0.5V)
Stability	Temperature Zero point : Within ±0.01 %FS / ºC Sensitivity : Within ±0.01 % / ºC
	Time Zero point : Within ±0.05 %FS / 8h Sensitivity : Within ±0.05 % / 8h
Output	Dual output (The same voltage is output to BNC connector and concentralized output connector.) Output voltage range : within ±5 V or over (Load 5 kΩ or more)
Output off function	Available
Output impedance	2 Ω or less
Withstand voltage	500 VAC within one minute in: •Between input and output. •Between input and case. •Between output and case.
Over input indication	LED lights up
Connector shape	Input connector : NDIS4109 Output connector : BNC
Dimensions	24(W)×96(H)×170(D) mm (Excluding protrusions)
Weight	Approx. 140 g

When using MCF-16A/B, CFV-90A maximum installed amount are 12 units. (when CFV-90A only installed)
When using mixed the other conditioner card, CFV-90A maximum installed amount are 8 units.
When using MCF-8A/B, no restriction on the number of units to be installed.

12-2-5. Product specification of charge amplifier card (CCA-90A)

Model	CCA-90A
Measurement target	IEPE accelerometer (built in amplifier type) Maximum ±5000 mV * Charge converter is necessary when using charge output accelerometer. Recommended item: CAC1R0 (Fuji ceramics corporation)
Number of measuring channels	1
Input	Input format Unbalanced input Sensor supply Built-in constant-current supply Constant current 4 mA Excitation voltage Approximately 24 VDC
Frequency response range	0.2 Hz to 50 kHz (Deviation +1, -3 dB)
Calibration (DC CAL)	±(1 to 5000 mV) Accuracy: Within ±0.3 %FS
Sensitivity adjustment	Sensitivity of amplifier is set from the combination setting of INPUT switch (4-digit thumbwheel switch) and OUTPUT switch (3-digit thumbwheel switch). OUTPUT switch range : 1.00 to 5.00 V in 0.01-V step INPUT switch range : 20 to 5000 mV in 1-mV step Accuracy : Within ±(0.5 %+5 mV) Range : ×1 to ×250
Fine sensitivity adjustment	× 0.4 to ×1
Low-pass filter	Transfer characteristic : 2nd order Butterworth Cutoff frequency : 300, 1k, 3k, 10k Hz and FLAT (5 step) Amplitude ratio of the cutoff frequency : -3 ± 1 dB (At cutoff point) Attenuation : -12 ± 1 dB/oct.
Distortion ratio	Within 1 % (When ±5 V output)
SN ratio	48 dBp-p or more (When 20 mV input and 5 V output)
Stability	Temperature Zero point Within ±0.5 mV / ºC Sensitivity Within ±0.05 % / ºC Time Zero point Within ±5 mV / 8h Sensitivity Within ±0.5 % / 8h (When 20 mV input and 5 V output, zero point is measured by 1 kΩ short)
Output	Dual output (The same voltage is output to BNC connector and concentralized output connector.) Output voltage range : within ±5 V or over (Load 5 kΩ or more) Zero adjustment range : within ±0.1 V or over
Output off function	Available
Output impedance	2 Ω or less
Withstand voltage	500 VAC within one minute in: •Between input and output. •Between input and case. •Between output and case.
Over input indication	LED lights up
Connector shape	Input connector : BNC Output connector : BNC
Dimensions	24(W)×96(H)×170(D) mm (Excluding protrusions)
Weight	Approx. 140 g

The above product specification does not include the accuracy of the charge converter of option.

13. OPTIONAL ACCESSORIES

● AC Adapter

The AC adapter is designed to be used with the MCF-A/B. The following shows the main specifications of the AC adapter:

SPU61A-106

Input voltage	90 VAC to 264 VAC (47Hz to 63Hz)
Output voltage	13 VDC to 16VDC (4.61 A to 3.75A)
Operating temperature range	0°C to 70°C

UEA360-1540

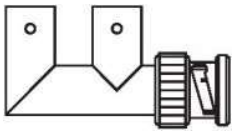
Input voltage	100 VAC to 240 VAC (50Hz / 60Hz)
Output voltage	15 VDC to 16VDC (4 A)
Operating temperature range	0°C to 40°C

● 1-Channel Dummy Card (MCF-DUMMY)

The 1-channel dummy card is mounted in a channel slot in which no conditioner card is mounted. When the CTA-90A is used, dummy cards must be installed in vacant channels.

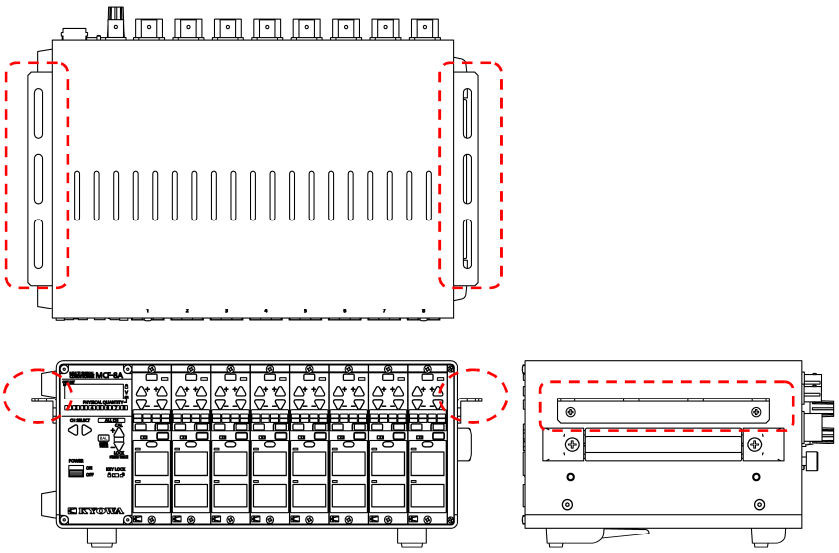
● OSC Synchronization BNC Splitter Adapter (Type F) (BNC-F-JJP)

The BNC splitter adapter is used for OSC synchronization. This adapter is used when OSC synchronization is performed with three or more MCF-A/B units.

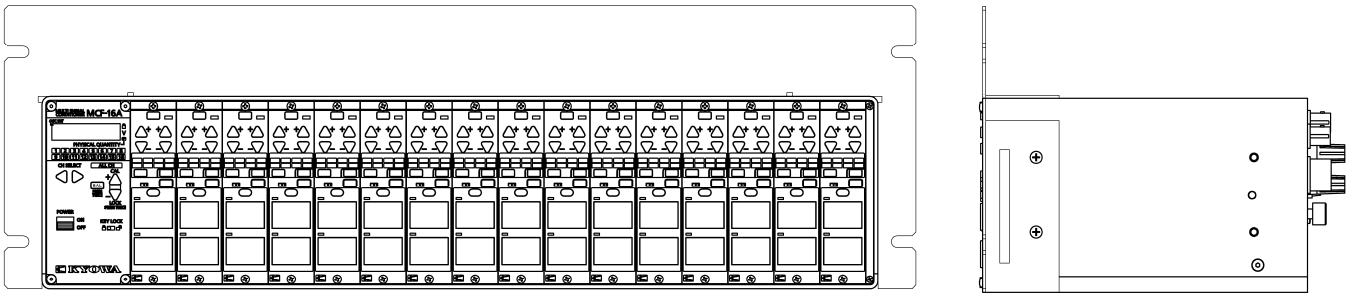


● L-Angle Fixture (MCF-L-ANGLE)

The L-angle fixture attaches to the MCF-A/B to secure the unit in place. The fixture has holes for securing belts. Use the utility nuts when installing this fixture.

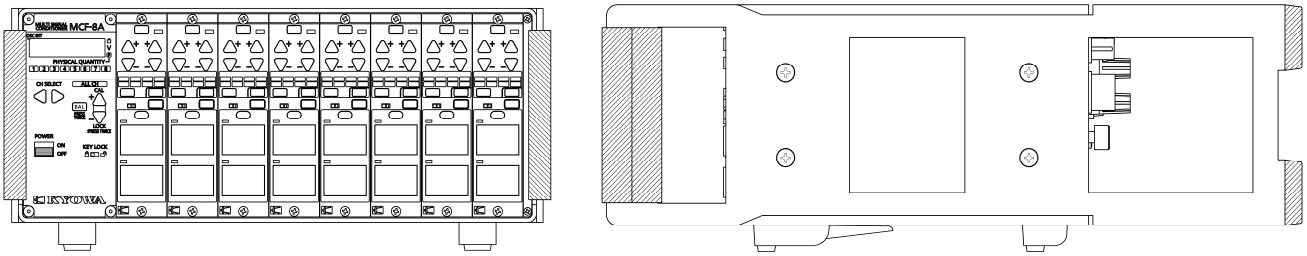


● Fixture for JIS Rack (MCF-JIS)
This fixture is used to mount the MCF-16A/B in a JIS rack.
Use the utility nuts to attach the fixture. (Remove the handle, rubber legs, and tilt legs when using this fixture.)



● Fixture for DIN Rack (MCF-DIN)
Use this fixture to mount the MCF-16A/B in a DIN rack.
Use the utility nuts to attach the fixture. (Remove the handle, rubber legs, and tilt legs when using this fixture.)

● MCF Handle Fixtures (MCF-HANDLE)
This handle is mounted to the MCF-A/B. The handles provided on the back side can be used as legs when placing the unit on a table.
Use the utility nuts to attach the handle. (Remove the handle and rubber legs when using the handle.)



● Separate Left/Right Rack Attachment Fixtures (MCF-BKT)
Separate left/right fixtures attached to the MCF-A/B for attachment to a rack.
Use the utility nuts to attach the fixture. (Remove the handle and rubber legs when using this fixture.)

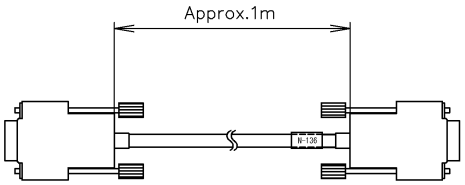
● Bridge Boxes

A bridge box is connected to a strain gage to configure a Wheatstone bridge.
Since each bridge box has a high-stability internal resistor, you can use various types of strain gage to configure a bridge.
The following table shows KYOWA's bridge boxes that can be used with the MCF-A/B series.
For more information on bridge boxes, refer to KYOWA's general product catalog.

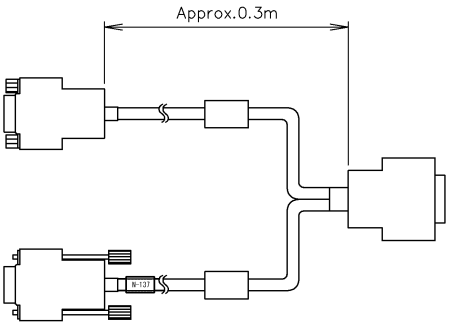
Model	Number of Channels	Measuring Target					
		Applicable Bridge Resistance	Quarter-Bridge System (2-Wire)	Quarter-Bridge System (3-Wire)	Half-Bridge System	Half-Bridge System (Opposite Side)	Full-Bridge System
DB-120A	1	120 Ω	○	○	○	○	○
DB-350A		350 Ω					
DB-120C-2	1	120 Ω	○	—	—	—	—
DB-120C-3			○	○			
DB-120L	1	120 Ω	○	○	○	○	○
DB-120T M1	1	120 Ω	○	○	○	○	○
DBV-120A-4	4	120 Ω	○	○	○	○	○
DBV-120A-4T							
DBV-350A-4		350 Ω					
DBV-350A-4T							
DBT-120A-8	8	120 Ω	○	○	○	○	○
DBT-350A-8		350 Ω					
DBS-120B-8	8	120 Ω	○	○	—	—	—
DBS-120B-8T							
DBS-350B-8		350 Ω					
DBS-350B-8T							
DBV-120A-8	8	120 Ω	○	○	○	○	○
DBV-350A-8		350 Ω					
DBB-120A	10	120 Ω	○	○	○	○	○

● Charge converter CAC1R0 (Fuji ceramics corporation)
This is used with the CCA-90A when connecting a charge output accelerometer.

● RS-485 communication cable for the MCF (N-136)
9-pin D-sub connector, one side male, one side female,
approx. 1 m
Shielded twisted pair cable
* Longer cables are available by special order.
Contact a Kyowa sales representative.

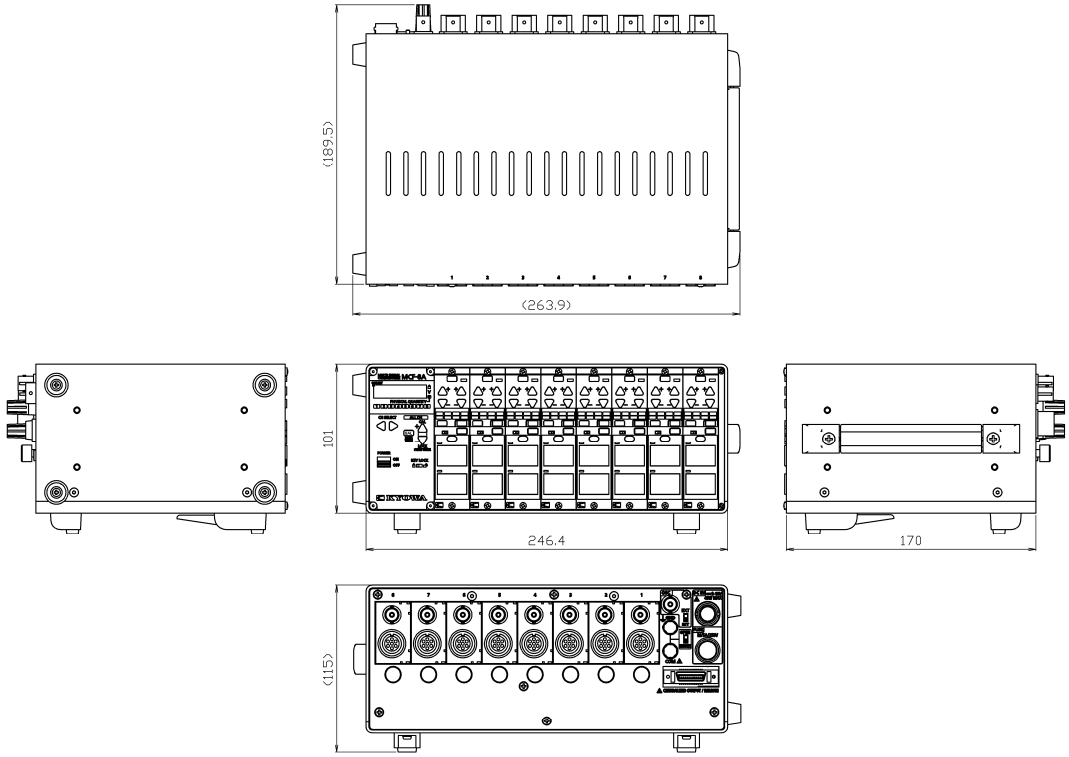


● RS-485 communication Y cable for the MCF (N-137)
9-pin D-sub connector, male
9-pin D-sub connector, female
Centralized connector, approx. 0.3 m
Shielded twisted pair cable

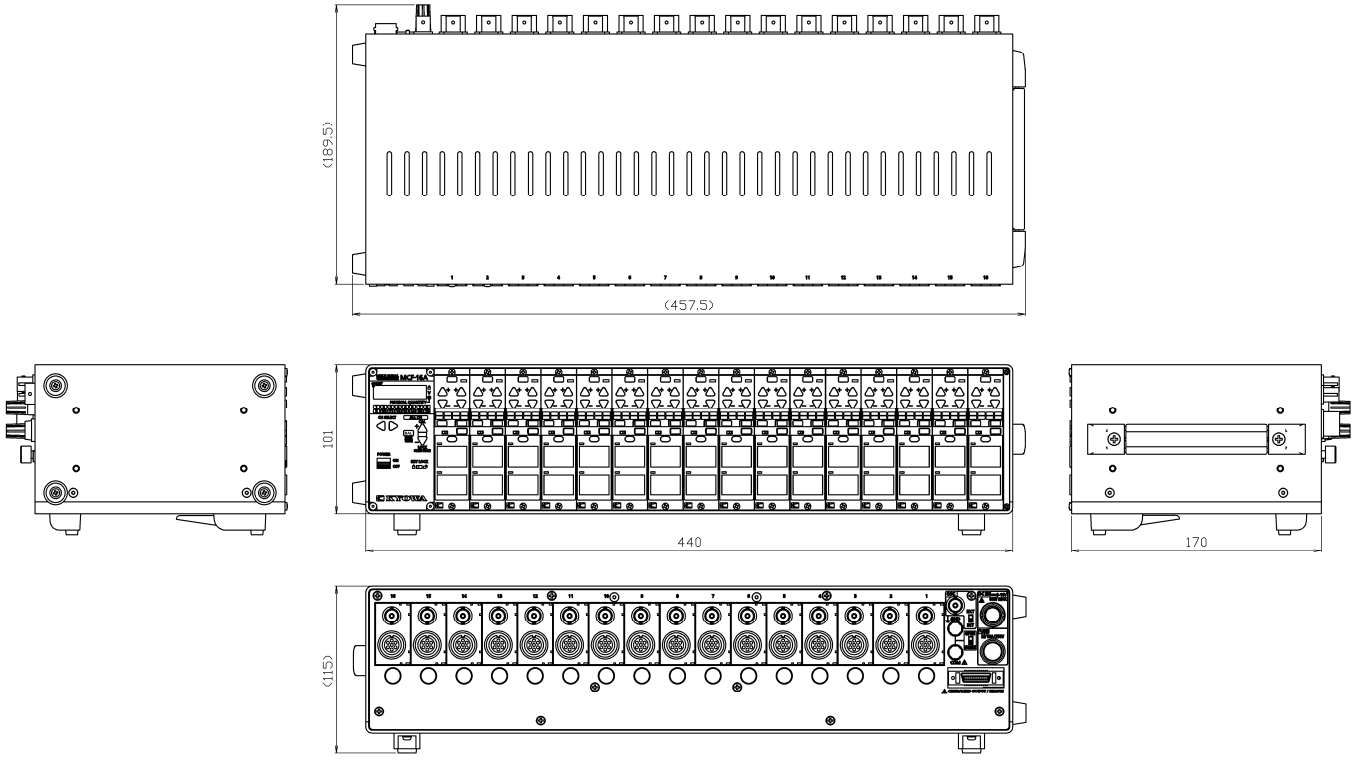


14. EXTERNAL VIEWS

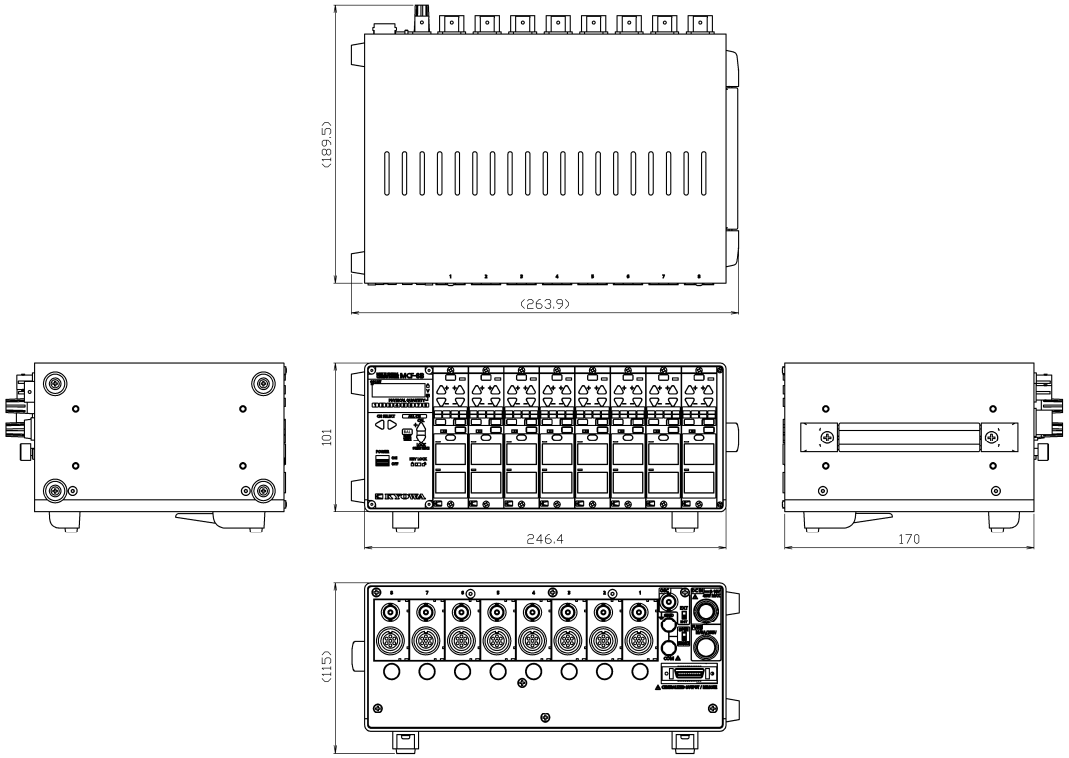
● MCF-8A



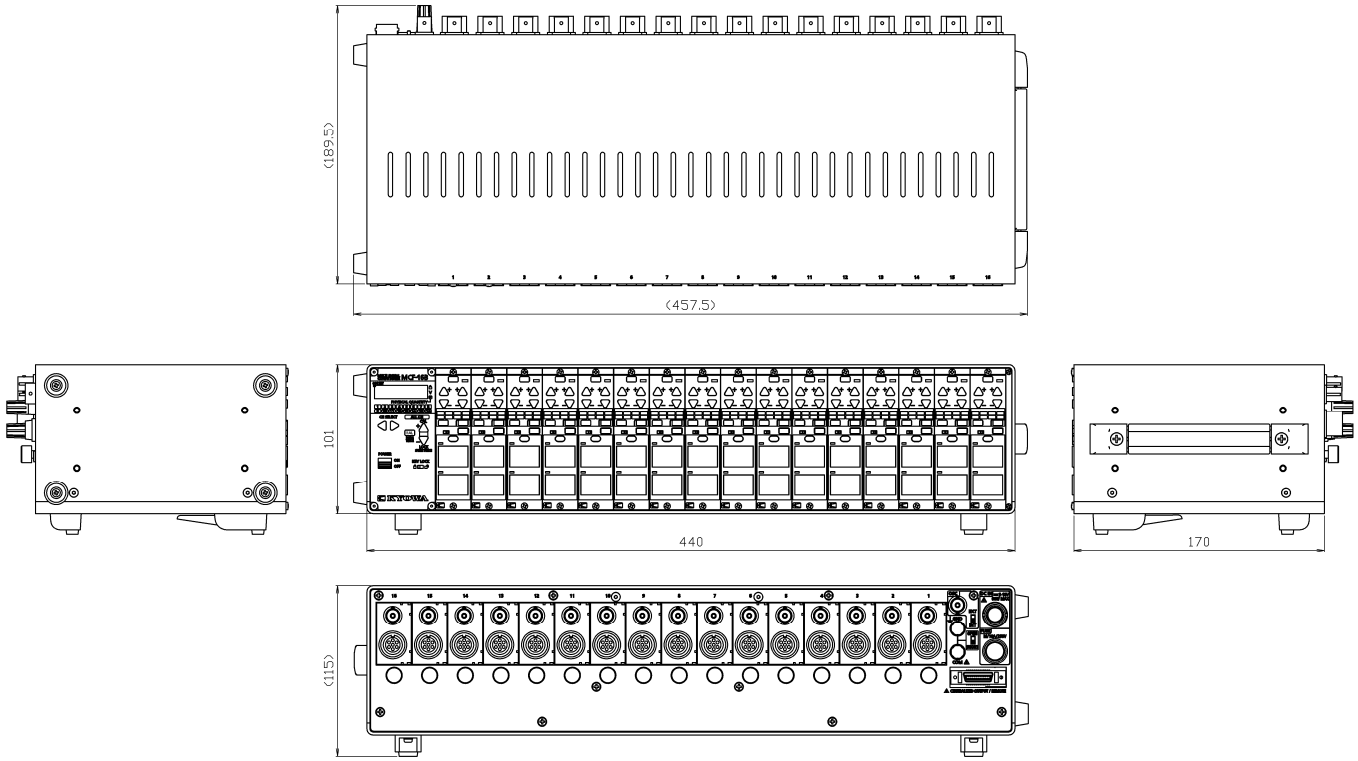
● MCF-16A



● MCF-8B

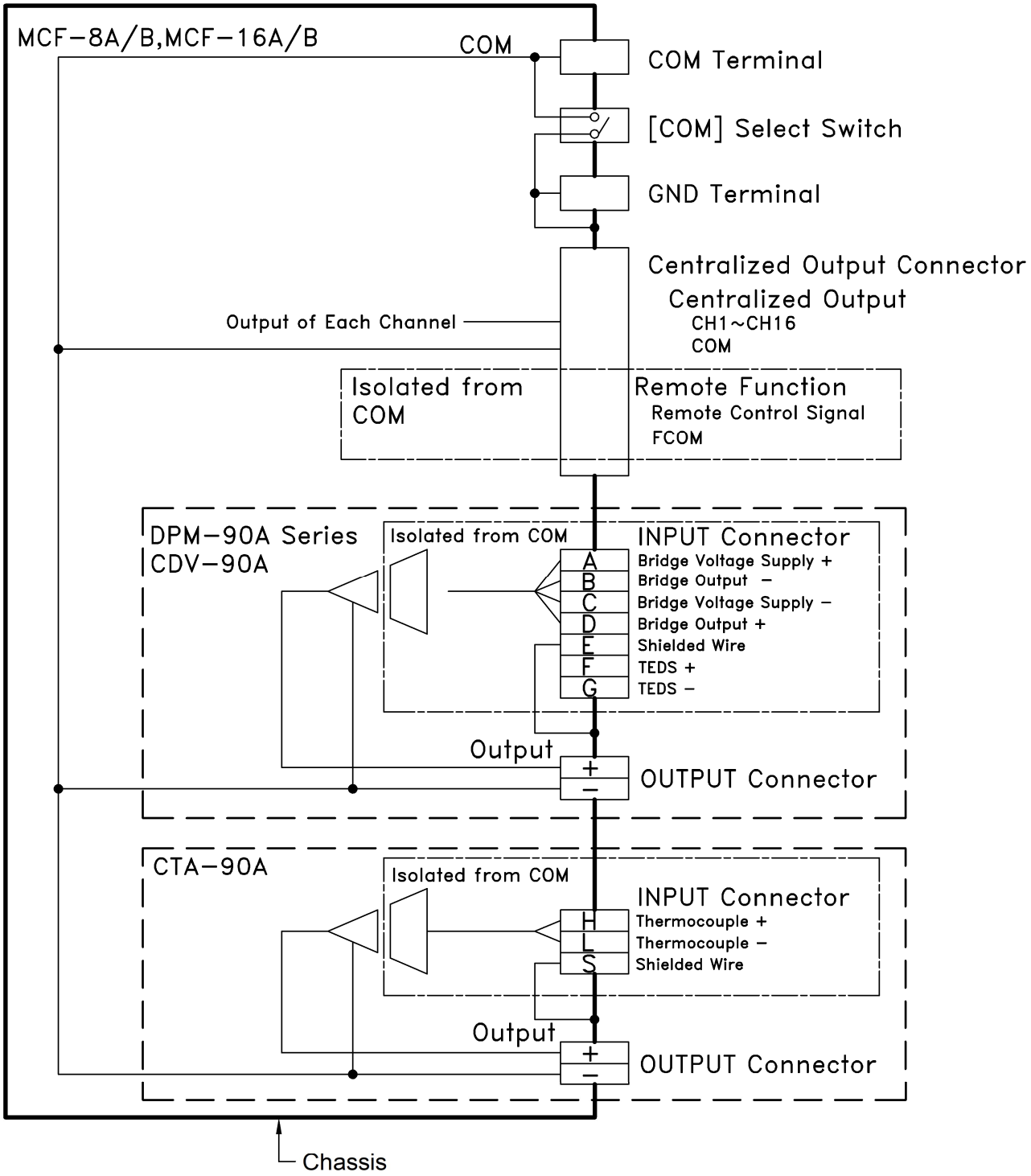


● MCF-16B

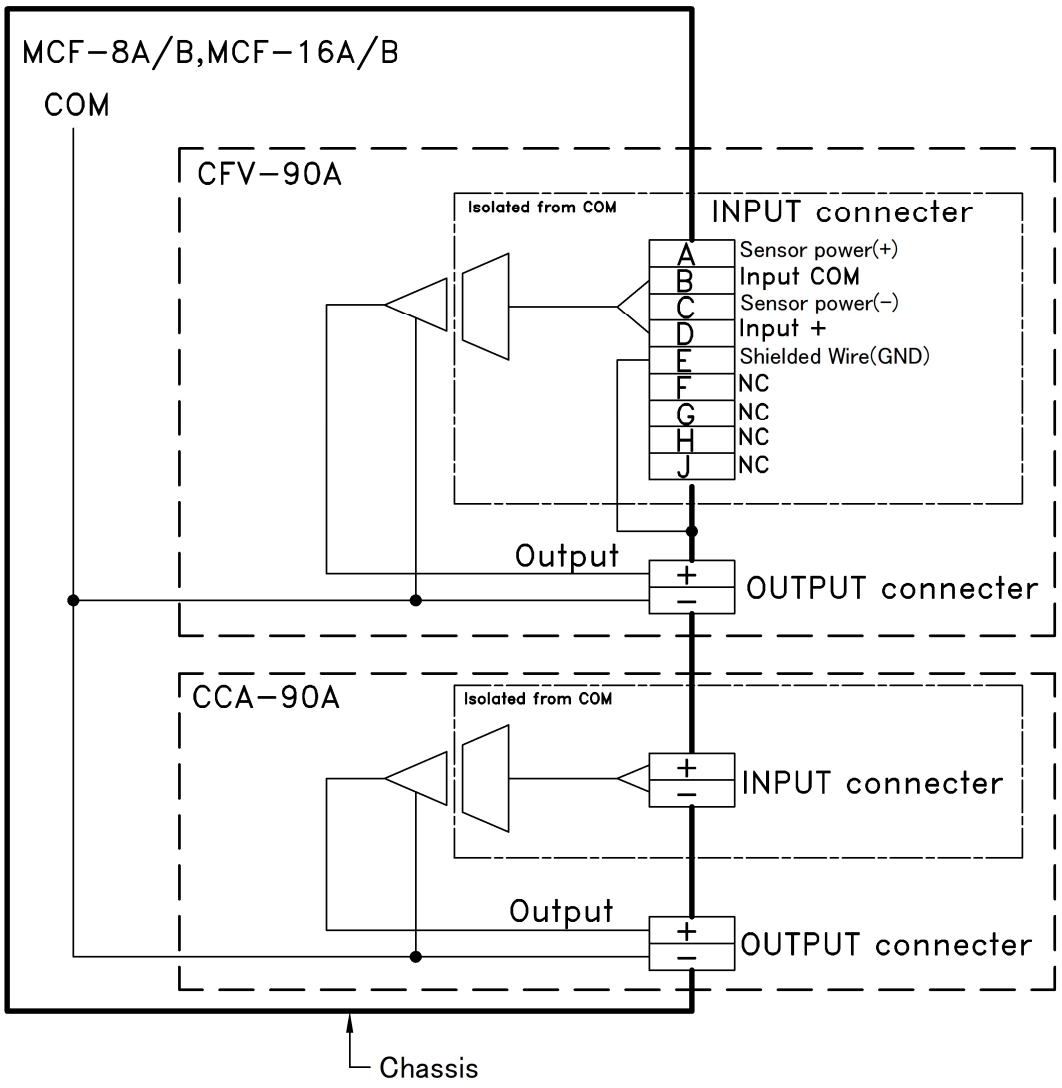


15. INTERNAL COM-GND WIRING

The following shows the internal COM-GND wiring of the MCF-A/B and conditioner cards.
Be sure to ground the [GND] terminal to ensure safety during measurements.



NOTE. INPUT connector is isolated to each conditioner card.

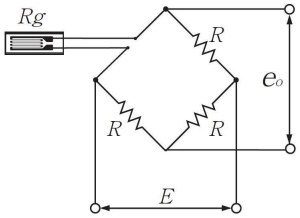
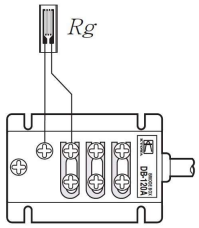
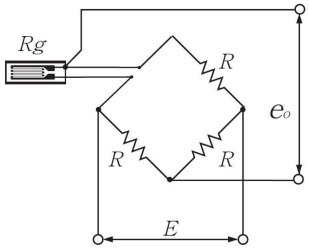
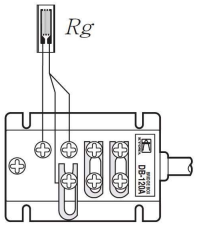
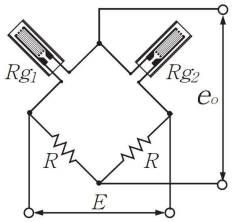
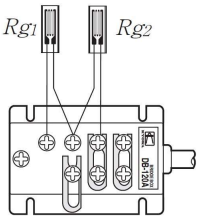
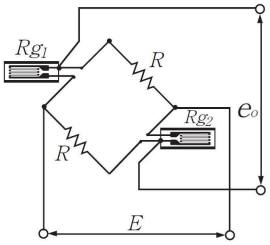
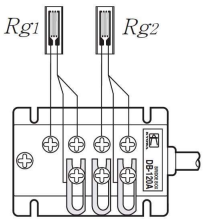
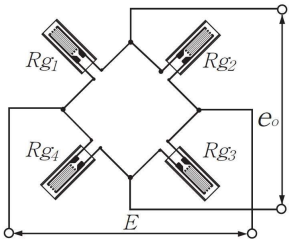
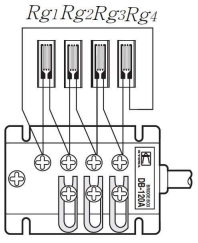


Note. INPUT connecter is isolated to each conditioner card

16. TECHNICAL INFORMATION REQUIRED FOR MEASUREMENT

16-1. Examples of Strain Gage Bridge Assembly

The following table shows examples of strain gage bridge assembly:

Measuring Method	Bridge Circuit	Wiring to a Bridge Box
Quarter-bridge system (2-wire)		
Quarter-bridge system (3-wire)		
Half-bridge system		
Opposed-side half-bridge system 3-wire active-active method		
Full-bridge system		

NOTE

- The diagrams in the "Wiring to a Bridge Box" column show how the wires are connected when using the DB-120A KYOWA bridge box.
  Note that the wiring method varies depending on the bridge box used.

16-2. How To Calculate Strains (DPM-90A series,CDV-90A)

This section describes how to measure strains and stress with the strain amplifier card DPM-90A series and signal conditioner card CDV-90A.

16-2-1. Method of Calculation Applicable to Strain Gages

Suppose you obtain the strain waveform shown in Figure 16-1.
In this diagram, a positive (+) calibration signal is recorded at the beginning of the waveform.
Suppose that this calibration signal waveform is in the direction of "elongation."
You can obtain the time factor of the strain waveform based on Tc (i.e., the interval between one time marker and another).

Various values can be obtained from the diagram shown in Figure 16-1.

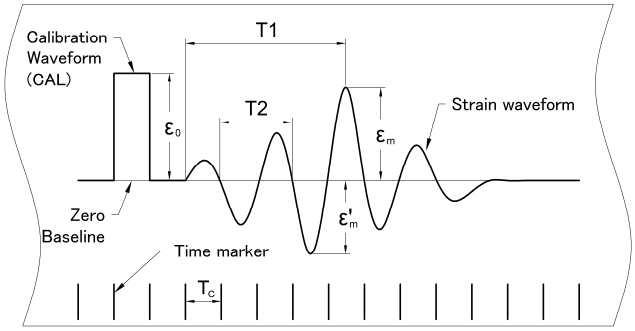


Figure 16-1. Strain waveform example

(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 point from the zero baseline with an appropriate instrument.
Suppose ε_0 is h_0 [mm] and ε_0 is h_0 [mm]. Use the equation below to calculate the maximum strain ε_m:

$$\varepsilon_m = \varepsilon_0 \times \frac{h_m}{h_0}$$

Since ε_m is in the same direction as ε_0, it indicates "elongation."
Once you obtain strain ε, you can obtain stress σ at that point (provided that it is of the monoaxial stress system) using equation $\sigma = E \times \varepsilon$.
However, E is the Young's modulus of the measuring point, and the gage axis is considered attached in the direction corresponding to the stress-axis direction. This means you can use the following equation to obtain the maximum stress $\sigma_m = E \times \varepsilon_m$.

(2) Calculating strain ε'_m, and stress σ'_m
Since strain ε'_m is in the direction opposite to the direction of $+\varepsilon_0$, it indicates "contraction." Suppose that the height of ε'_m is h'_m [mm]. Use the following equation to obtain strain:

$$\varepsilon'_m = \varepsilon_0 \times \frac{h'_m}{h_0}$$

Use the following equation to calculate stress σ'_m (provided that it is of the monoaxial stress system):

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

(3) Calculating the 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 time markers.
Measure about 10 intervals between time markers and obtain the average. Then, using that average value, obtain the length t_c [mm] against time T_c.
Suppose the length of the measurement of the time T_1 is t_1 [mm]. Use the following equation to calculate time T_1:

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

(4) Calculating the frequency of the strain waveform

If vibration is generated cyclically, you can calculate its frequency. To obtain the frequency T_2 of one cycle, measure the length of about 10 cycles and obtain the average t_2 [mm] of one cycle.
Compare the average t_2 with the time marker interval t_c and use the following equation obtain frequency T_2:

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

From T_2, use the following equation to obtain frequency f:

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

(5) Analyzing a phenomenon

If a phenomenon is so simple that a measurement at a single point is enough, it is possible to understand the phenomenon simply by calculating the relationship between strain and time in the recorded waveform.
In contrast, a complex phenomenon requires simultaneous or individual measurements at multiple points and the recording of those measurements. In such cases, the relationship between strain and the time at each point can also be obtained using the calculation method above.
However, the above information alone does not provide a full understanding of complex phenomena. We must analyze each measuring point and compare the mutual relationships of measuring points against strain and the time axis.
The analysis method varies widely depending on measuring purposes, so it is not possible to cover all cases in this document. In many cases, however, it is possible to estimate the relations between measuring points of a phenomenon. Analyze the individual waveforms recorded at the measuring points and examine the relationships between measuring points based on the above results to understand the phenomenon.

16-2-2. Correction Required Based on the Number of Strain Gages Used

The above calculation methods apply to measurements using one strain gage as an active gage, connected as shown in Figure 16-2.
When using multiple strain gages, however, you must correct the measuring results based on the number of strain gages used. Note that when strain gage transducers are used, no correction based on the number of strain gages is necessary.

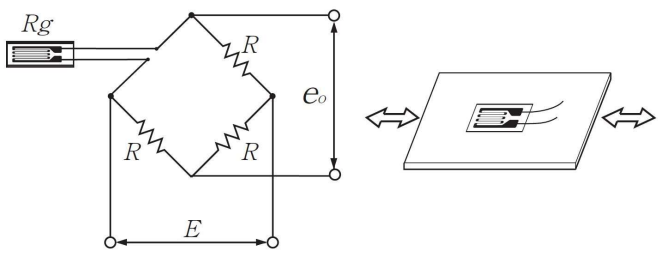


Figure 16-2. Quarter-bridge system examle

ε: Strain after correction
ε_0: Measuring result
σ: Stress
E: Young's modulus (coefficient of vertical elasticity)

(1) When using all strain gages to measure strains

① When using two strain gages arranged as shown in Figure 16-3, multiply the measurement value ε_0 by one-half.

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

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

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

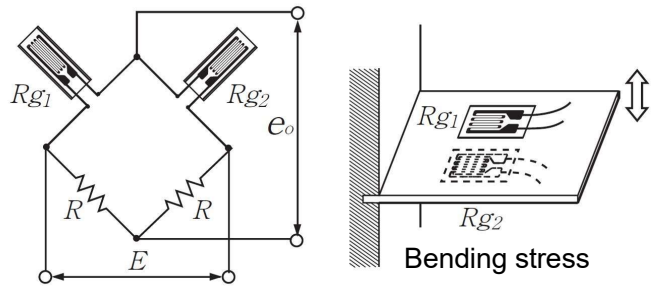


Figure 16-3. Harf-bridge system examle

② When using four strain gages arranged as shown in Figure 16-4, multiply the measurement value ε_0 by one-fourth.

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

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

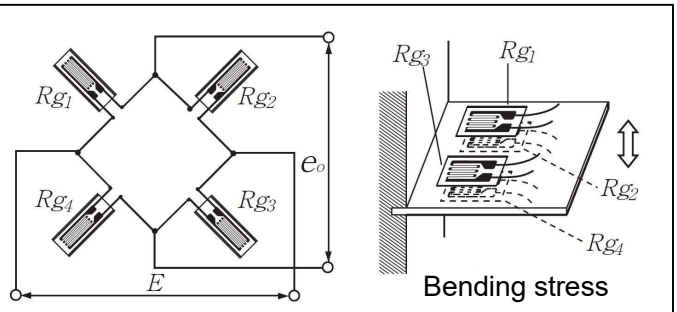


Figure 16-4. Full-bridge system examle

(2) When using active gage and dummy gage positioned at right angle

① When using two strain gages arranged as shown in Figure 16-5, multiply the measurement value ε_0 by $\frac{1}{(1+\nu)}$.

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

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

(where, ν : Poisson's ratio)

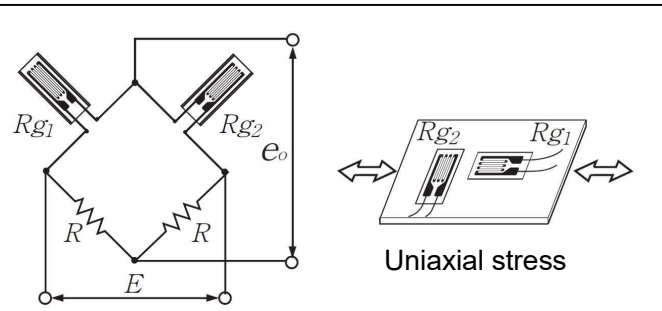


Figure 16-5. Special Harf-bridge system examle

② When using four strain gages arranged as shown in Figure 16-6, multiply the measurement value ε_0 by $\frac{1}{2(1+\nu)}$.

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

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

(where, ν : Poisson's ratio)

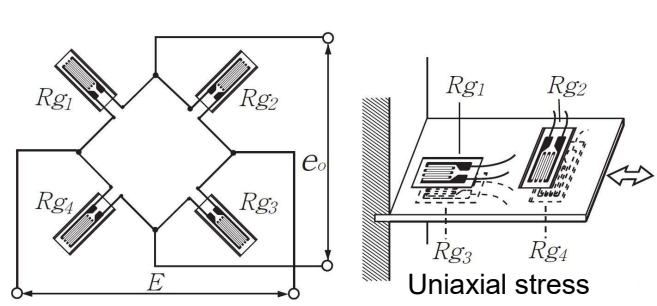


Figure 16-6. Special full-bridge system examle

16-2-3. When Using a Strain Gage with a Gage Factor Other Than 2.00

Correct the measurement value using the following equation.

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

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

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

(where, K_s: Gage factor of the strain gage used)

16-2-4. Method of Calculations for Strain Gage Transducers

A strain gage transducer obtains a physical variable, such as load, pressure, torque, displacement, or acceleration, using a strain gage and converts this measurement to an electrical signal. The strain amplifier card DPM-90A series and signal conditioner card CDV-90A are designed to measure strain. Thus, the measured strain must be converted to a physical quantity value using the calibration factor or rated output value given in the Test Data Sheet for the strain gage transducer.

(1) Method for calculating physical quantities using the calibration factor

Multiply the strain obtained using a strain gage by the calibration factor specified in the Test Data Sheet for the strain gage transducer to obtain the desired physical quantity.

< Example > Suppose that a measurement of 2,900 μm/m was obtained using a load cell with a capacity of 20 kN (2.0394 tf) and calibration factor of 0.004997 kN (0.00051 tf)/μm/m. The load applied to this load cell can be calculated as follows:

0.004997 × 2,900 = 14.4913 [kN]

(2) Method for calculating physical quantities using the rated output value

The output value (rated output or output voltage sensitivity) generated by the application of the rated load is specified in the Test Data Sheet for the strain gage transducer.
By adjusting that rated output value and the strain amplifier's calibration signal and output value, you can obtain the physical quantity applied to the transducer almost as a directly read value. Some examples are provided below.

< Example > When using the following combination: pressure transducer with a capacity of 500 kPa (5.0986 kgf/cm^2) and rated output of 3,993 μm/m and the signal conditioner card CDV-90A
Set the [INPUT] switch of the CDV-90A to 3,993 μm/m (rated output of the transducer) and the [OUTPUT] switch to 5.00 V. Press the [SET] switch twice in succession and set the internal gain.
Then, apply pressure to the transducer. 5.000 V will correspond to 500 kPa.

< Example > When using the following combination: acceleration transducer with a capacity of 196 m/s^2 (20 G), and rated output of 850 μm/m and the strain amplifier card DPM-90A series.
Set the [INPUT] switch of the DPM-90A series to 0850 μm/m (rated output of transducer) and the [OUTPUT] switch to 2.00 V. Press the [SET] switch twice in succession and set the internal gain. 2.000 V will correspond to 20 G.
When using a recorder, make adjustments so that when a calibration signal of 0850 μm/m is input, the indicator movement width on the recording sheet becomes 20 mm or 200 mm. That width will correspond to 196 m/s^2 (20 G).

16-2-5. Corrections Required When Using an Extension Cable

Measurements performed indoors seldom require extension cables. However, there may be times when the amplifier must be placed far from the measuring point. In such cases, place the bridge box near the measuring point and use an extension cable to connect the amplifier.
However, note that the measurement value will inevitably contain some errors due to the extension cable; the longer the extension cable, the greater the error.
To resolve the error, multiply the measurement value by the correction factor indicated in the following table.

NOTE

The correction factor values in the following table are used to resolve errors attributable to an extension cable based on the length of the cable.
In actual measurements, errors may also arise due to the type of extension cable and ambient temperature.

Cable lengths of DPM-91A/91A-I and correction factor values

Extension Cable / Bridge Resistance	5m	25m	50m	75m	100m	200m
120 Ω	1.005	1.017	1.030	1.047	1.061	1.123
350 Ω	1.002	1.006	1.010	1.015	1.020	1.040
1000 Ω	1.001	1.001	1.003	1.004	1.005	1.013

Cable lengths of DPM-92A/92A-I and correction factor values

Extension Cable / Bridge Resistance	5m	25m	50m	75m	100m	200m
120 Ω	1.005	1.018	1.032	1.053	1.070	1.154
350 Ω	1.003	1.015	1.028	1.048	1.057	1.120
1000 Ω	1.005	1.028	1.056	1.085	1.114	1.240

Cable lengths of CDV-90A and correction factor values

Extension Cable / Bridge Resistance	5m	25m	50m	75m	100m	200m
120 Ω	1.005	1.017	1.029	1.046	1.058	1.116
350 Ω	1.002	1.006	1.010	1.016	1.020	1.040
1000 Ω	1.001	1.002	1.004	1.006	1.008	1.015

The correction factor values shown in the above tables apply when using KYOWA extension cables (0.5 mm^2, four-conductor shielded cabtire cables). The cable resistance value is approximately 0.8 Ω/10 m in both directions.

Model	Length
N-81	5m
N-82	10m
N-83	20m
N-84	30m
N-85	50m
N-100	100m

16-3. Internal Gain and Input Strain

This section describes the ranges of input strain in the DPM-90A series and CDV-90A.

The range of the input strain depends on the internal gain setting. However, you can make fine adjustments to expand the range of the input strain. Make fine adjustments of the internal gain as shown in the table below.

DPM-90A series

Internal Gain	Switch Setting		Range of Input Strain [μm/m]		
	[INPUT] Switch [μm/m]	[OUTPUT] Switch [V]	Fine Adjustment of Internal Gain x1	to	Fine Adjustment of Internal Gain x0.4
×200	5000	1.00	±25000	to	±62500
×2000	2500	5.00	±2500	to	±6250
×20000	250	5.00	±250	to	±625
×50000	100	5.00	±100	to	±250

CDV-90, BV = 2 V

Internal Gain	Switch Setting		Range of Input Strain [μm/m]		
	[INPUT] Switch [μm/m]	[OUTPUT] Switch [V]	Fine Adjustment of Internal Gain x1	to	Fine Adjustment of Internal Gain x0.4
×200	5000	1.00	±25000	to	±62500
×1000	5000	5.00	±5000	to	±12500
×5000	1000	5.00	±1000	to	±2500

CDV-90A, BV = 10 V

Internal Gain	Switch Setting		Range of Input Strain [μm/m]		
	[INPUT] Switch [μm/m]	[OUTPUT] Switch [V]	Fine Adjustment of Internal Gain x1	to	Fine Adjustment of Internal Gain x0.4
×200	1000	1.00	±5000	to	±12500
×1000	1000	5.00	±1000	to	±2500
×5000	200	5.00	±200	to	±500

MEMO

- The internal gain of the DPM-90A series can be set within the range x200 to x50000.
  The internal gain of the CDV-90A can be set within the range x200 to x5000.
- Fine adjustments of the internal gain can be made within the range x0.4 to x1. For a discussion of making fine adjustments of internal gain, see "4-3-3. Fine Adjustments of Internal Gain" on page 46.
- For the specifications for the internal gain, see the specifications for the sensitivity adjuster and sensitivity fine adjuster in "12-2. Product specification of conditioner cards" on page 84.

16-4. Temperature Calculation Method(CTA-90A)

- Temperature calculation method

  The following explains how to measure temperatures using the thermocouple card CTA-90A. Measured temperature can be obtained from the setting value of the [INPUT] and [OUTPUT] switches and the output voltage. However, if you used the [V ADJ] switch to fine-tune the internal gain, temperature is calculated based on the calibration voltage.

(1) When a normal internal gain is set (without fine-tuning the internal gain)

To calculate temperatures, use [[INPUT] switch setting value (°C)], [[OUTPUT] switch setting value (V)] and [output voltage at measuring point temperature (V)].
Apply the following equation to obtain the temperature:

$$\text{Measuring point temperature (°C)} = \frac{\text{[[INPUT] switch setting value (°C)]}}{\text{[[OUTPUT] switch setting value (V)]}} \times \text{[output voltage at measuring point temperature (V)]}$$

The following example shows temperature calculations based on the setting values and measurements shown below:

[INPUT] switch setting value	1200°C
[OUTPUT] switch setting value	5.00 V
Output voltage at measuring point temperature	3.500 V

Substitute the values in the above equation. The equation yields 840°C as the measuring point temperature

$$\text{Measuring point temperature} = \frac{1200(°C) \times 3.500\ (V)}{5.00\ (V)} = 840°C$$

MEMO

- [[INPUT] switch setting value] and [[OUTPUT] switch setting value] in the equation above are setting values when the internal gain is set.

(2) To calculate temperatures, use [[INPUT] switch setting value (°C)], [calibration signal voltage at 0°C (V)], [+CAL calibration signal voltage (V)], and [output voltage at measuring-point temperature (V)]. Use the following equation to calculate temperatures:

$$\text{measuring - point temperature} = \frac{\text{[output voltage at measuring - point temperature (V)] − [calibration value voltage at 0 °C (V)]}}{\text{[+ CAL calibration value voltage (V)] − [calibration value voltage at 0 °C (V)]}} \times \text{[[INPUT] switch setting value (°C)]}$$

The following example shows the temperature calculation based on the setting values and measurement shown below:

[INPUT] switch setting value	1,200°C
Calibration signal voltage at 0°C	0.001 V
+CAL calibration signal voltage	5.001 V
Output voltage at measuring-point temperature	3.501 V

Substitute the values in the above equation. The equation yields 840°C as the measuring-point temperature.

$$\text{Measuring-point temperature} = \frac{3.501\ (V) - 0.001\ (V)}{5.001\ (V) - 0.001\ (V)} \times 1200\ (°C) = 840\ °C$$

MEMO

- [[INPUT] switch setting value] in the equation above is the setting value when the [+] CAL switch is pressed to output the +CAL calibration voltage.

● Overall CTA-90A Accuracy

CTA-90A accuracy can be obtained from the accuracy of the linearizer, calibration accuracy, and accuracy of the reference point-of-contact compensation.
Apply the following equation to obtain the system accuracy:

CTA-90A accuracy = within ± { full scale (FS) × accuracy of linearizer + calibration accuracy)
+ accuracy of reference point-of-contact compensation }

FS corresponds to the value set for the [INPUT] switch.
Accuracy of the linearizer, calibration accuracy, and accuracy of reference point-of-contact compensation vary depending on conditions of use.
For more information on each type of accuracy, see "12-2-3. Product specification of thermocouple card (CTA-90A)" on page 86.

Overall accuracy, including the sensor, can be obtained from CTA-90A accuracy and thermocouple card accuracy.

$$\text{Overall accuracy} = \sqrt{(\text{CTA-90A accuracy})^2 + (\text{thermocouple card accuracy})^2}$$

Type of thermocouple:	Type-K thermocouple
[OUTPUT] switch:	5.00 V
[INPUT] switch:	200°C
Ambient temperature:	20°C (constant)
Thermocouple accuracy:	±1°C

The system accuracy based on the above conditions is as follows:

System accuracy = within ±{200 [°C] × (0.5 [%FS] + 0.5 [%FC]) + 1.0 [°C]} = within ±3°C

Overall accuracy is obtained as follows:

$$\text{Overall accuracy} = \sqrt{3^2 + 1^2}$$
$$= 3.16℃$$

16-5. Calculations for Alternating Signal Output Sensor (CFV-90A)

● Calculations for alternating signal output sensor

Described below is the basic measurement method using the F/V converter card CFV-90A:
To calculate the measurement results, use [calibration voltage for 100% CAL (V)], [set range (Hz)], and [output voltage (V)]. Apply the following equation:

$$\text{Sensor output (Hz)} = \frac{\text{[set range (Hz)]}}{\text{[calibration voltage for 100\% CAL (V)]}} \times \text{[output voltage (V)]}$$

The following example shows the sensor output (frequency) calculation based on the setting values and measurement shown below:

Set range (Hz)	20 kHz
[OUTPUT] switch setting value	1.00 V
Calibration voltage for 100% CAL	1.001 V
Output voltage	3.003 V

Substitute the values into the equation above. In this case, the sensor output is 60 kHz.

$$\text{Sensor output (Hz)} = \frac{20000\ (\text{Hz})}{1.001\ (\text{V})} \times 3.003\ (\text{V}) = 60\ \text{kHz}$$

16-6. IEPE Accelerometer Calculations (CCA-90A)

- Acceleration calculations

  Described below is the basic measurement method using the charge amplifier card CCA-90A:
  To calculate the measurement results, use [[CAL] switch setting value (mV)], [+CAL calibration voltage (V)], [output voltage (V)], and [transducer sensitivity (V/m/s^2)].
  Apply the following equation to obtain acceleration:

$$\text{Acceleration} = \frac{\text{[[CAL] switch setting value (mV)]}}{\text{[+CAL calibration voltage (V)]}} \times \text{[output voltage (V)]} \div \text{[transducer sensitivity (mV/m/s}^2\text{)]}$$

  The following example shows the acceleration calculation based on the setting values and measurement shown below:

[CAL] switch setting value	500 mV
+CAL calibration voltage	5.001 V
Output voltage	3.002 V
Transducer sensitivity	1.02 mV/m/s^2

  Substitute the values into the equation above. The equation yields 294 (m/s^2) as the measuring point acceleration.

$$\text{Acceleration} = \frac{500\ (\text{mV})}{5.001\ (\text{V})} \times 3.002\ (\text{V}) \div 1.02\ (\text{mV/m/s}^2) = 294\ (\text{m/s}^2)$$

MEMO

- The CAL setting value is set for the [INPUT] switch.
  The [INPUT] switch value during calibration voltage output corresponds to the CAL setting value.

16-7. Overall Measurement System Accuracy

The accuracy of a measurement system using a transducer and amplifier must be obtained after accounting for transducer installation quality, errors due to vibration and other factors, in addition to intrinsic error associated with the transducer and amplifier and changes in ambient temperatures.
A method for calculating system accuracy is described here for cases in which the major factors affecting system accuracy are static transducer and amplifier errors. To obtain overall system accuracy, first obtain the transducer and amplifier accuracy separately, then obtain overall accuracy by calculating the square root of the sum of their squares.

$$E = \sqrt{Er^2 + El^2}$$

E: Overall accuracy
Er: Transducer accuracy
El: Amplifier accuracy

Transducer and amplifier accuracy vary by model.
In general, the accuracy of strain gage transducers is obtained by applying the following equation:

$$Er = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2} + (E_4 \times \Delta t)^2 + (E_5 \times \Delta t)^2}$$

E_1: Nonlinearity
E_2: Hysteresis
E_3: Repeatability
E_4: Temperature effect on zero balance (/°C)
E_5: Temperature effect on rated output (/°C)
Δt: Change in ambient temperature

In general, the accuracy of amplifiers is obtained by applying the following equation:

$$El = \sqrt{E_{11}^{\,2} + (E_{12} \times \Delta t)^2 + (E_{13} \times \Delta t)^2 + E_{14}^{\,2} + E_{15}^{\,2}}$$

E_{11}: Nonlinearity
E_{12}: Temperature effect on zero balance (/°C)
E_{13}: Temperature effect on rated output (/°C)
E_{14}: Aging effect on zero balance
E_{15}: Aging effect on sensitivity

- Overall CCA-90A Accuracy

  The accuracy of the charge converter must be considered if you use a charge output accelerometer with the CCA-90A. Accounting for the charge converter, overall accuracy is given by the following equation:

$$E = \sqrt{Er^2 + El^2 + Ec^2}$$

E: Overall accuracy
Er: Transducer (charge output accelerometer) accuracy
El: Amplifier (CCA-90A) accuracy
Ec: Charge converter accuracy

With the recommended charge converter (CAC1R0), accuracy (Ec) is ±2.5% of gain accuracy.
Assuming no change due to temperature or aging, CCA-90A accuracy (El) is ±(0.5%+5 mV) of sensitivity adjuster accuracy.
For the rated output of 5 V, 5 mV corresponds to 0.1%. Thus, CCA-90A accuracy (El) is 0.6%.
At this time, overall accuracy is given by the following equation:

$$E = \sqrt{Er^2 + 0.6^2 + 2.5^2}\,[\%]$$

17. RS-485 Communication

With the MCF-B, various functions can be set by command control for 1 to 16 MCF-B units via RS-485 Communication.

NOTE

- Command control function is available with firmware ver. 03.00 or later (except for the CTA-90A). Certain commands may be unavailable with other firmware versions.
  For information on checking the firmware version, refer to "10-2. Checking the Version" on page 79.

MEMO

- For the CTA-90A, the command control function is supported from firmware ver. 01.02 on.

- Note on conditioner card firmware versions
  Depending on the conditioner card firmware version, certain limitations apply regarding the functions available for the MCF-A and MCF-B.

MCF-A

Firmware version	Operation by switches	Command control	Remote control	
			External control of one or more MCF	Control of multiple MCFs from one MCF
Before ver. 03.00	○	×	○	○
Ver. 03.00 or later	○	×	○	○

MCF-B

Firmware version	Operation by switches	Command control	Remote control	
			External control of one or more MCF	Control of multiple MCFs from one MCF*1
Before ver. 03.00	○	×*2	○	×
Ver. 03.00 or later	○	○	○	×

*1 Not available for the MCF-B.

*2 For CTA-90A, command control is supported from firmware ver. 01.02 on.

NOTE

- Switch-based operation is possible even if a conditioner card with firmware ver. 03.00 or later is mounted at the same time as a conditioner card with firmware earlier than ver. 03.00.
- The command control function is available for conditioner cards from firmware ver. 03.00 on (except CTA-90A). Command control will not function correctly if commands are sent to cards with firmware before ver. 03.00.
- Proceed with care when using a combination of firmware versions.
- Switch-based and remote control operation are not available during command control.

MEMO

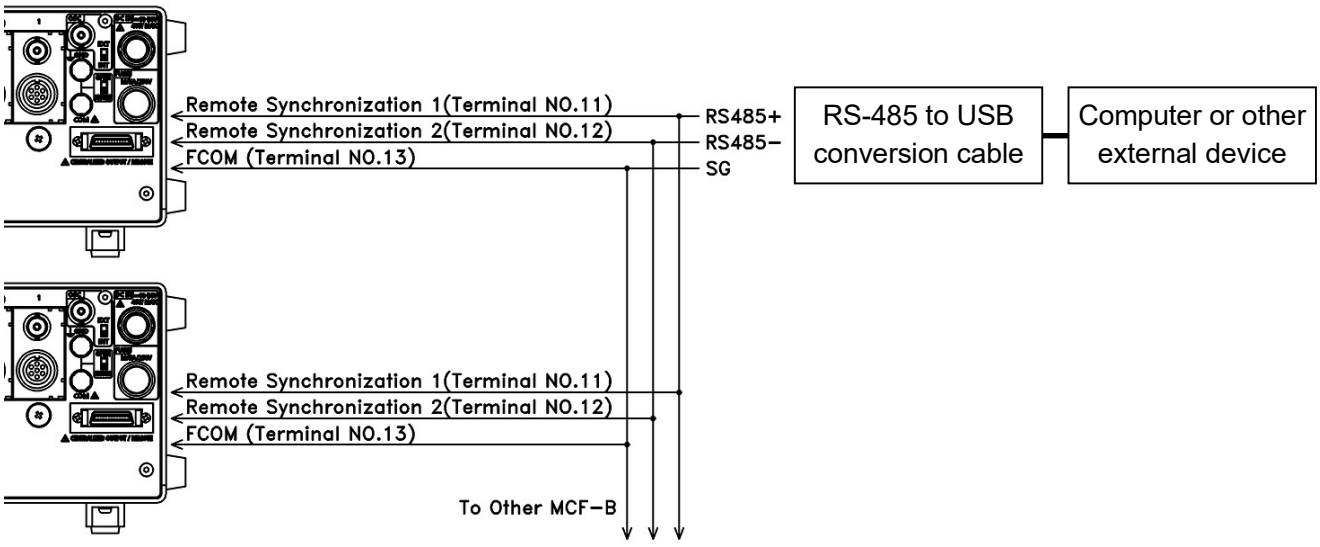
- A Kyowa service center can update already shipped conditioner cards (incurs a fee). Contact a Kyowa sales representative for more information.
- For more information on remote control, refer to "8-6-3. Remote control/Command control function" on page 66.

17-1. RS-485 Specifications

Item	Specifications
Signaling system	RS-485 Half duplex system
Communication speed	9600bps
Character length	8bit
Parity	None
Stop bit	1bit
Delimiter	[CR] : Command output to the MCF-B. [CR][LF] : Data output from the MCF-B.
Device ID	0 to F (up to 16 units can be controlled)
Communication range	Up to 200 m

17-2. Connection diagram

To use this function, connect [Remote Synchronization 1 (terminal no. 11)], [Remote Synchronization 2 (terminal no. 12)], and [FCOM (terminal no. 13)] of the [CENTRALIZED OUTPUT] connectors of the MCF-B units as shown below.
To enable command control of multiple MCF-Bs, connect [Remote Synchronization 1 (terminal no. 11)], [Remote Synchronization 2 (terminal no. 12)], and [FCOM (terminal no. 13)] of the [CENTRALIZED OUTPUT] connectors of each MCF-B in parallel, as shown in the figure below:



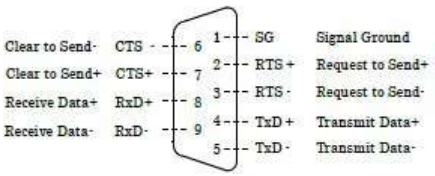
MEMO

- We recommend using shielded twisted pair cables to prevent malfunctions due to external noise. Note the following configuration when main units are near each other and connected via optional communication cables:
  - Single unit communication: one N-137 cable, no N-136 cables, and one RS-485 to USB conversion cable
  - Two unit communication: two N-137 cables, one N-136 cable, and one RS-485 to USB conversion cable
  - Three unit communication: three N-137 cables, two N-136 cables, and one RS-485 to USB conversion cable

- We recommend the following RS-485 to USB conversion cable:
  COM-1PD(USB)H (Contec Co., Ltd.)

  Set up as follows:
  - Data transmission mode: Half-duplex
  - Terminator setting : Not insert the Terminator

  Shown below are the pin assignments for the interface connectors (9-pin D-sub, male):



9-pin D-sub connector, male
1: SG
4: RS-485+
5: RS-485-

Wrap two turns of the following ferrite core around the front and back of the COM-1PD(USB)H conversion cable when using the MCF-B with COM-1PD(USB)H in Europe.
KRFC-10 (KITAGAWA INDUSTRIES CO., LTD.)

17-3. Device ID and terminating resistor settings

To use the command control function via RS-485 Communication, remove the monitor display section from the MCF-B. Use DIP switches to set the device ID and terminating resistor.
Configure as shown below:

NOTE

- Make sure the MCF-B is off before attaching or detaching the monitor display section. Inserting or removing cards while the unit is on may result in malfunctions.
- Before performing these tasks, discharge all static electricity from your body. Avoid touching any electronic parts other than the DIP switches.

17-3-1. Dismounting a monitor display section

(1) Remove the CH1 conditioner card
Remove the conditioner card mounted for CH1.
For removal instructions, refer to "2-1-2. Dismounting a Conditioner Card" on page 29.

(2) Remove the front panel mounting screws
Use a screwdriver to remove the four screws holding the front panel of the monitor display section.

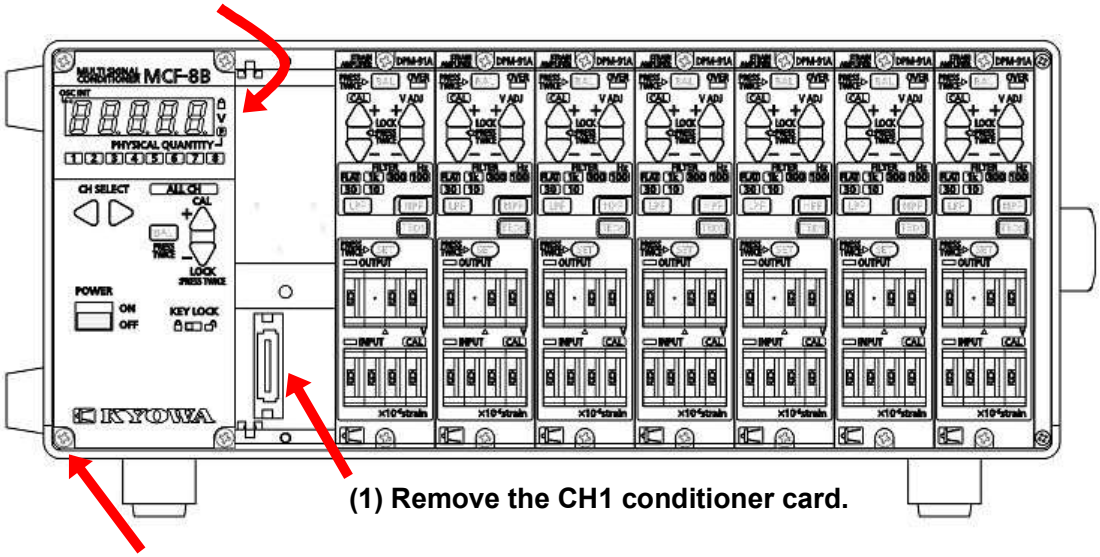
MEMO

- The size of the screws is M2.5 x 6.
  Use an appropriate screwdriver.

(3) Dismounting a monitor display section

Put your finger on the front panel of the monitor display section through the CH1 opening where the conditioner card was removed, then slowly pull out the monitor display section horizontally.

(3) Through the opening, place your finger on the front panel.
Remove the monitor display section.



(1) Remove the CH1 conditioner card.

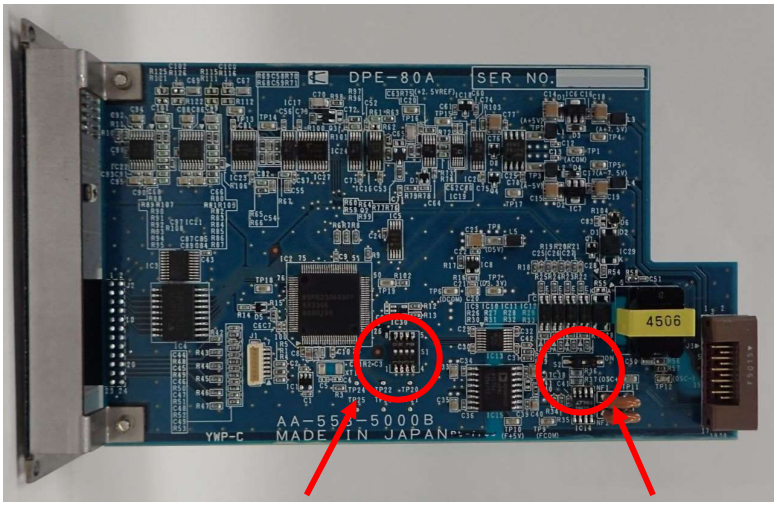
(2) Remove the four mounting screws.

NOTE

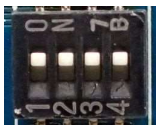
- The monitor display section is mounted by means of a guide rail in MCF-B.
  Remove the monitor display section by pulling out horizontally along the guide rail.
  Pulling it out at an angle may cause the parts to chafe and break.
- Proceed carefully to avoid hitting and damaging the board components.

17-3-2. Configuring the device ID setting

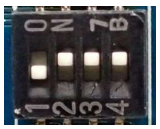
Before using command control for the unit, you must set a separate device ID for each MCF-B you control.
Set separate device IDs from 0 to F using the DIP switches on the monitor display section.
Set device IDs as shown in the following figure:
Move DIP switches gently with a precision screwdriver, tweezers, or other pointed tool.
Proceed carefully to avoid damaging other parts.



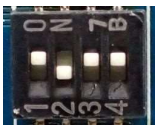
DIP switch **Terminating resistor switch**



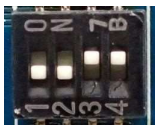
Device ID: 0



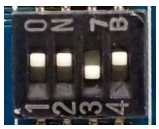
Device ID: 1



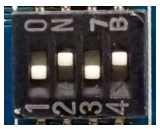
Device ID: 2



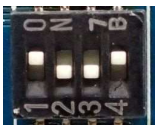
Device ID: 3



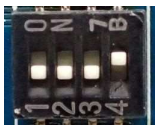
Device ID: 4



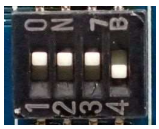
Device ID: 5



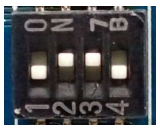
Device ID: 6



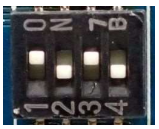
Device ID: 7



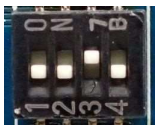
Device ID: 8



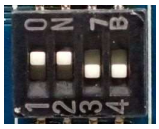
Device ID: 9



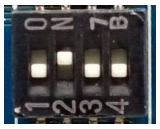
Device ID: A



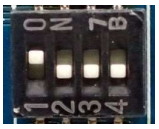
Device ID: B



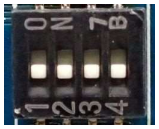
Device ID: C



Device ID: D



Device ID: E



Device ID: F

NOTE

- Each device must be assigned a unique ID to ensure proper operation.

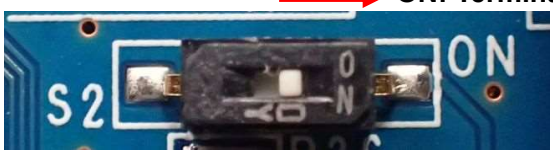
MEMO

- As shipped, the device ID is set to "F."

17-3-3. Configuring the terminating resistor

Terminating resistor switches can be set to insert terminating resistors.
Set each MCF-B terminating resistor switch to match the device connected to the MCF-B.
When the switch is set to ON, a terminating resistor is inserted.
The unit has 120 Ω of built-in termination resistance.

ON: Terminating resistor inserted



MEMO

- As shipped, the setting is ON, with terminating resistors inserted

17-3-4. Mounting a monitor display section

(1) Inserting a monitor display section

Insert a monitor display section into the guide rails inside the MCF-B.

Push the monitor display section all the way in to securely connect the monitor display section to the MCF-B.

NOTE

- The monitor display section is mounted on the far left.
  Avoid inserting into the wrong slot. Inserting into a conditioner card slot may damage the monitor display section.
- Guide rails are located in four positions (top and bottom in the front and back).
  Make sure the conditioner card passes through all guide rails.
- Inserting the conditioner card with the circuit board displaced from the guide rails may result in damage to the MCF-B or monitor display section.
  If the circuit board is displaced from the guide rails, pull out and reinsert the monitor display section.
  Make sure the circuit board passes through the guide rails.

(2) Attaching the front panel to the MCF-B

Use the four screws previously removed to secure the front panel of the monitor display section.

Use a screwdriver to tighten the screws.

(3) Inserting a conditioner card

Mount the CH1 conditioner card previously removed.

For mounting instructions, refer to "2-1-1. Mounting a Conditioner Card" on page 27.

NOTE

- Secure the front panel with the screws.
  If the attaching is insufficient, contact failure may occur due to vibration etc., causing malfunction.

MEMO

- The size of the screws is M2.5 x 6.
  Use an appropriate screwdriver.
- The recommended tightening torque is 36 [N-cm].
  Note that overtightening may damage the screws.

17-4. Using Command Control

17-4-1. Before starting the command control function

Before starting the command control function, make sure the output off function is disabled for all mounted conditioner cards.
If the output off function is currently set, disable as described in "8-3. Output Off Function" on page 63.

NOTE

- The unit may not function correctly with the command control function unless the output off function is disabled.

MEMO

- The output off function takes precedence over the command control function.
- The command control function cannot be used to set or deactivate the output off function.

17-4-2. Starting the command control function

To enable the command control function, execute the "U#,ERS" command (where # is the device ID, from 0 to F) for the MCF-B controlled.
For more information on commands, refer to "17-6. Details of Control Commands" on page 119.
The message “U#,ERS OK” is returned after successful communication. The MCF-B enters the mode required to receive control commands.
If there is no response, communication has failed.

NOTE

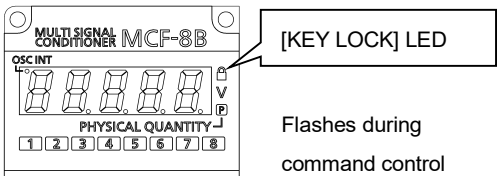
- The MCF-B responds within 5 seconds to any command received.
  No response will be received for commands sent to IDs that do not correspond to any device.
  If no response is received within 5 seconds, check the device ID, then send a command.

MEMO

- Device IDs are indicated on the monitor meter as "adr #" when the unit is turned on. (# represents a device ID, from 0 to F.)

17-4-3. Switch operation during command control

After a command is sent to start command control, the [KEY LOCK] LED begins flashing. You can now control the unit using commands.
During command control, key locking is enabled for all switches except the [CH SELECT] switch. This disables switch operations for all switches except the [CH SELECT] switch.
To operate switches other than the [CH SELECT] switch, exit the command control function.



MEMO

- Once a command has been sent to start command control, the MCF-B remains in command control mode even after it is restarted.
  To exit command control mode, issue a command or perform an exit operation on the monitor display section.

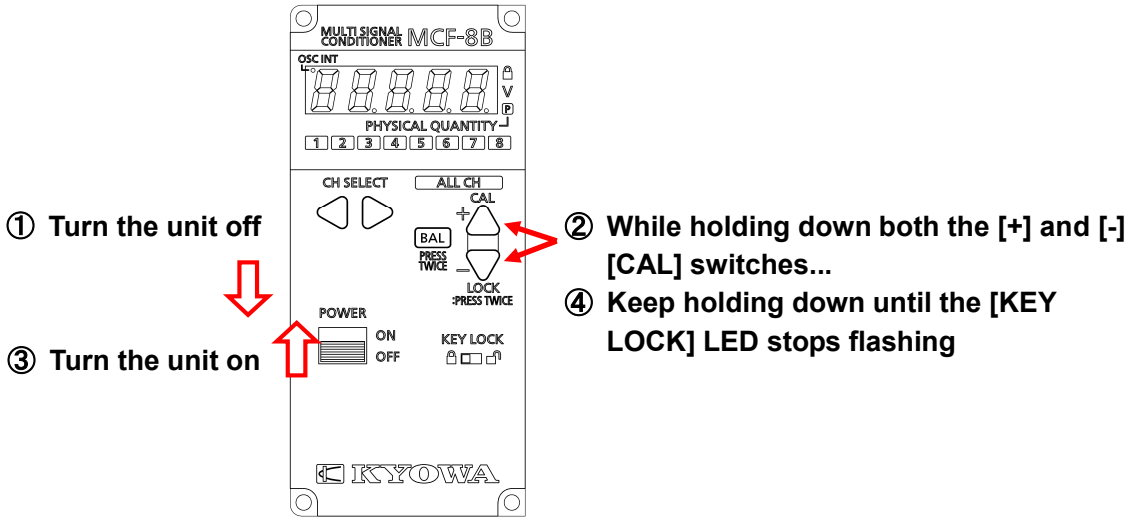
17-4-4. Ending the command control function

To end the command control function, issue a command to exit this mode or perform an exit operation on the monitor display section.

- Ending the command control function with a command
  To end the command control function, issue the command “U#,ERE” (where # is the device ID, from 0 to F) for the MCF-B controlled.
  For more information on commands, refer to "17-6. Details of Control Commands" on page 119.
  The message “U#,ERE OK” is returned after successful communication. The MCF-B enters a mode in which no control commands are received. The command control function is no longer active, and the [KEY LOCK] LED stops flashing.
  If there is no response, communication has failed.

- Ending the command control function from the monitor display section
  Turn off the power momentarily. Hold down both the [+] and [-] [CAL] switches in the monitor display section as you turn the unit on. Continue holding down the switches until the [KEY LOCK] LED stops flashing.
  When the [KEY LOCK] LED stops flashing, the command control function is no longer active.

Monitor Display Section



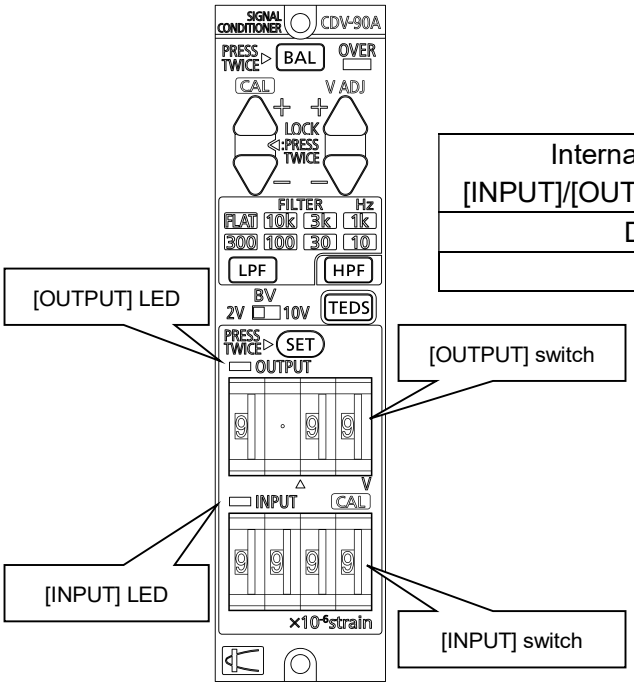
Turn the unit off ①.
While holding down both the [+] and [-] [CAL] switches ②, turn the unit on ③.
Keep holding down the switches until the [KEY LOCK] LED stops flashing ④.

MEMO

- After the command control function is disabled, the [KEY LOCK] LED stops flashing.
  Once the flashing stops, the LED will either stay off or on, depending on the status of the [KEY LOCK] switch.

17-4-5. If [INPUT]/[OUTPUT] switches do not match internal settings after ending the command control function

After ending the command control function, the internal settings configured will take precedence.
This means the internal settings of the conditioner cards and the settings of the [INPUT] and [OUTPUT] switches may conflict.
If the conditioner card [INPUT]/[OUTPUT] switches do not match internal settings after ending the command control function, the [INPUT] and [OUTPUT] LEDs of the switches with different settings will flash.



Internal settings and [INPUT]/[OUTPUT] switch settings	[INPUT] / [OUTPUT] LED
Different	Flashes.
Same	Remains lit.

NOTE

- After ending the command control function, internal settings take precedence.

MEMO

- Once the [INPUT] or [OUTPUT] switch value matches the internal setting, the [INPUT] or [OUTPUT] LED changes from flashing to steady illumination.

17-5. Control Commands

The following is an explanation of the formats and kinds of control commands which are output to the MCF-B from external equipment such as PC.

17-5-1. Outline of the control command

- Control command conforms to ASCII code (3 capital letters).
- According to the command characteristic, some control commands are suffixed by parameters.
- A Delimiter is added to the end of a control command.
  Different Delimiters are used as follows.
  [CR] (0x0D) : Command output to the MCF-B.
  [CR][LF] (0x0A) : Data output from the MCF-B.
- The control commands sent are prefixed by "U#," where "#" is the designated device ID (0 to F).
  The MCF-B does not respond to commands sent to IDs that do not correspond to any devices.
  Check the device ID before sending commands.
- Omitting "," (0x2C) will prevent identification of the device ID. The unit will not respond.
- The following 11 bytes (including delimiters) are returned if communication fails because the command is unsupported or for problems involving the command format, invalid parameter settings, or no matching commands:
  U#,□□□□NG
  □□□□: four spaces (0x20)

NOTE

- RS-485 communication by the unit is half duplex.
  Since the data is sent and received along the same path, programming to avoid collision is required.
- Send commands only after receiving a response from the MCF-B.
- Establish a wait time (wait/sleep) or take other steps to allow enough time to avoid data collision. The time required to send and receive data will vary each time, depending on the timing and other factors.

MEMO

- Depending on the command executed, it may take up to 5 seconds for conditioner cards to complete the processing.
  For this reason, if a command is sent to all channels of an MCF, it will take up to 80 seconds for the MCF-16B and up to 40 seconds for the MCF-8B.

17-5-2. List of Control Commands

Contents	Command	Relevant conditioner card
Start command control	ERS	
End command control	ERE	
Select monitor display channel	SMC	
Get card type	GCT	DPM-90A series,CDV-90A,CTA-90A,CFV-90A,CCA-90A
Get connected models	GUT	
Get version	GVN	DPM-90A series,CDV-90A,CTA-90A,CFV-90A,CCA-90A
Get error number	GCE	
Get voltage	GVV	DPM-90A series,CDV-90A,CTA-90A,CFV-90A,CCA-90A
Execute balance adjustment	EBA	DPM-90A series,CDV-90A
Set calibration output	ECO	DPM-90A series,CDV-90A,CTA-90A,CFV-90A,CCA-90A
Set internal gain	ESS	DPM-90A series,CDV-90A,CTA-90A,CFV-90A,CCA-90A
Perform zero-point adjustment	SZA	DPM-90A series,CDV-90A,CFV-90A,CCA-90A
Perform internal gain adjustment	SVA	DPM-90A series,CDV-90A,CTA-90A,CCA-90A
Set bridge voltage	GBV	CDV-90A
Switch TEDS mode on/off	ETM	DPM-90A series,CDV-90A,CCA-90A
Load TEDS information	GTD	DPM-90A series,CDV-90A,CCA-90A
Set low-pass filter cutoff frequency	SLF	DPM-90A series,CDV-90A,CCA-90A
Set high-pass filter cutoff frequency	SHF	DPM-90A series,CDV-90A
Select thermocouple type	CSK	CTA-90A
Switch measurement range	SRV	CFV-90A
Set input coupling	SIC	CFV-90A
Set trigger level	STL	CFV-90A

Note: Command control function is available with firmware ver. 03.00 or later (except for the CTA-90A).
With other firmware versions, certain commands may not be available.
Check the firmware version as described in "10-2. Checking the Version" on page 79.

MEMO

- The slot number is a parameter indicating the channel number for sending and receiving commands.

Channel Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Slot Number	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

17-6. Details of Control Commands

This section describes various control commands and parameters following after the commands.

17-6-1. Start command control [ERS]

Switches to the command control function.
Sending the start command control command switches the MCF-B to the mode in which it receives control commands.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ERS[CR] #: Device ID (0 to F)	U#,ERS□OK[CR][LF] Command control started □: space (0x20) No response No response if commands are sent to IDs that do not correspond to any devices

<Readout>
None

MEMO

- The MCF-B responds within 5 seconds after a command is sent.
  If there is no response in 5 seconds, an ID that does not correspond to any devices may have been specified, or the MCF-B and computer or other device may not be connected.
- Device IDs are shown on the monitor meter as "adr #" (where # is the device ID) after the firmware version display at startup.
- You can send a start command control command to check for the presence of an MCF-B with the corresponding device ID.
  This command can be sent and received even in command control mode, which allows use to confirm communication.
  If a corresponding device ID exists, you will receive a response within 5 seconds.

17-6-2. End command control [ERE]

Exits the command control function.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ERE[CR] #: Device ID (0 to F)	U#,ERE□OK[CR][LF] Command control ended □: space (0x20) No response No response if commands are sent to IDs that do not correspond to any devices Unable to exit command control mode

<Readout>

None

17-6-3. Select monitor display channel [SMC]

Switches channels displayed on the monitor meter.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SMCW@[CR] #: Device ID (0 to F) W: Parameter setting @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16	U#,SMC□OK[CR][LF] □: space (0x20)

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SMCR[CR] #: Device ID (0 to F) R: Parameter to get	U#,SMC□@[CR][LF] □: space (0x20) @: Channel Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16

17-6-4. Get card type [GCT]

Gets type information about mounted conditioner cards.

<Configuration>
None

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,GCT@[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16	U#,GCT@DPM-91[CR][LF] DPM-91A, DPM-91A-I U#,GCT@DPM-92[CR][LF] DPM-92A, DPM-92A-I U#,GCT@CDV-90[CR][LF] CDV-90A U#,GCT@CTA-90[CR][LF] CTA-90A U#,GCT@CCA-90[CR][LF] CCA-90A U#,GCT@CFV-90[CR][LF] CFV-90A U#,GCT@NOCARD[CR][LF] Card not mounted

17-6-5. Get connected models [GUT]

Gets model names.

<Configuration>
None

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,GUT[CR] #: Device ID (0 to F)	U#,GUT□MCF-B[CR][LF] □: space (0x20)

17-6-6. Get version [GVN]

Gets firmware versions of the MCF-B and conditioner cards.

<Configuration>
None

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,GVN@[CR] #: Device ID (0 to F) @: Slot Number (0 to F, M) 0: Channel Number 1 ʃ F: Channel Number 16 M: MCF-B	U#,GVN@**.**[CR][LF] *: 0 to 9 (ASCII code)

17-6-7. Get error number [GCE]

Gets error numbers and error message from the MCF-B.
You can get errors for each channel and errors for the MCF-B.

<Configuration>
None

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#GCE@[CR] #: Device ID (0 to F) @: Slot Number (0 to F, M) 0: Channel Number 1 ʃ F: Channel Number 16 M: Get errors for the MCF-B.	U#,GCE@E**-$$$$$$$$$$[CR][LF] **: error number $: error message U#,GCE@-OK-NoErr[CR][LF] If no error has occurred

MEMO

- For more information on error messages, refer to "9. ERROR MESSAGES" on page 74.

17-6-8. Get voltage [GVV]

Gets the output voltage displayed on the monitor meter.
You can specify a channel to get the output voltage for that channel.

<Configuration>
None

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,GVV@[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16	U#,GVV@±*.***[CR][LF] *: 0 to 9 (ASCII code)

17-6-9. Execute balance adjustment [EBA]

Sends a command to execute balance adjustment for conditioner cards.
One command executes balance adjustment for individual conditioner cards. Another, batch command, executes balance adjustment for all mounted conditioner cards (all channels).

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,EBA@[CR] #: Device ID (0 to F) @: Slot Number (0 to F, S) 0: Channel Number 1 ʃ F: Channel Number 16 S: Batch command (all channels)	U#,EBA@OK[CR][LF]

<Readout>
None

NOTE

- Balance adjustment will take up to 5 seconds per conditioner card.
- Use the get error number command to check the balance adjustment results for each card.

MEMO

- With batch commands, balance adjustment takes up to 5 seconds. Balance adjustment is performed not for each conditioner card in sequence, but at the same time for all conditioner cards for the indicated device ID.

17-6-10. Set calibration output [ECO]

Sets calibration signal output on conditioner cards.
One command executes calibration signal output for individual conditioner cards. Another, batch command, executes output for all mounted conditioner cards (all channels).
Card output under the selected parameters remains in effect after the command is sent.
The output halts when a command with the parameter "CAL OFF" is executed.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ECO@W*,$$$$[CR] #: Device ID (0 to F) @: Slot Number (0 to F, S) 0: Channel Number 1 ʃ F: Channel Number 16 S: Batch command (all channels) W: Parameter setting *: Calibration output status 0: CAL OFF 1: +CAL 2: -CAL *: Calibration output status (for CTA-90A) 0: CAL OFF 1: +CAL 2: 0℃ *: Calibration output status (for CFV-90A) 0: CAL OFF 1: 100% 2: 50% $: Input value setting (equivalent to [INPUT] switch value) $$$$←0000 to 9999	U#,ECO@OK[CR][LF]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ECO@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,ECO*[CR][LF] *: Calibration output status 0: CAL OFF 1: +CAL 2: -CAL *: Calibration output status (for CTA-90A) 0: CAL OFF 1: +CAL 2: 0℃ *: Calibration output status (for CFV-90A) 0: CAL OFF 1: 100% 2: 50%

NOTE

- Sending a batch command initiates output of the calibration signal set in the [INPUT] switch from all cards. (It is not possible to set the calibration signal level with a batch command.)
  Note that this is a fixed-length command. Configure 0000 as the input value.
  Additionally, set 0000 as the input value when executing CAL OFF or when using the CFV-90A, because the command is of a fixed length.
- Sending a batch command will set the calibration output status parameters for each conditioner card to the indicated parameters. In this case, the calibration output status for each card cannot be changed. To change the calibration output status for individual conditioner cards, execute CAL OFF in advance with a batch command.

MEMO

- Batch commands take precedence over individually executed commands.
- With batch commands, the calibration signal output is produced not by each conditioner card individually but at the same time for all cards for the indicated device ID.

17-6-11. Set internal gain [ESS]

Sets internal gain for conditioner cards.
Enabling TEDS mode and setting internal gain sets TEDS information for the mounted TEDS-compatible sensors on the MCF-B.
Note that this information cannot be read from the CTA-90A.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ESS@W$$$$,*.**[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting $: Input value setting (equivalent to [INPUT] switch value) $$$$←0000 to 9999 *: Output value setting (equivalent to [OUTPUT] switch value) *.**←0.01 to 9.99	U#,ESS@OK[CR][LF]

MEMO

Example of a command used to set the internal gain for the conditioner card for channel no. 3 (slot no. 2) of device ID 1:
Input strain 1000 μm/m ([INPUT] switch setting value)
Output voltage 5.00 V ([OUTPUT] switch setting value)
U1,ESS2W1000,5.00[CR]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ESS@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,ESS@$$$$,*.**[CR][LF] $: Input value setting (equivalent to [INPUT] switch value) $$$$←0000 to 9999 *: Output value setting (equivalent to [OUTPUT] switch value) *.**←0.01 to 9.99

NOTE

- CFV-90A has no input value. Since this is a fixed-length command, configure 0000 as the input value. No input value applies when setting internal gain using the TEDS function with the DPM-90A series or CDV-90A. Since this is a fixed-length command, configure 0000 as the input value.
- Setting internal gain can take up to 5 seconds.
  This may vary, even under identical conditions.

MEMO

- A fixed-length command is used to obtain a readout from the CFV-90A. Thus, 0000 is returned as the input value.
- The output off function is not available using the command control function.
  A parameter error occurs and NG is returned if 0.00 is the output value set.

17-6-12. Perform zero-point adjustment [SZA]

Fine-tunes conditioner card zero points.
Adjusts in roughly 0.5 mV increments, based on the command.
A change equivalent to the setting value multiplied by a certain multiple can be sent by configuring command setting values.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SZA@,$,**[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 $: Positive/negative setting 1: + 2: - *: Setting value (number of times to send the command) Setting range 01–99 (decimal)	U#,SZA@OK[CR][LF]

<Readout>
None

NOTE

- The adjustment amount applied in fine-tuning is approx. 0.5 mV but may vary due to individual variation among conditioner cards.
  This individual variation will be more apparent with more fine-tuning.

17-6-13. Perform internal gain adjustment [SVA]

Fine-tunes conditioner card internal gain.
Changes gain by the equivalent of one press of the [V ADJ] switch each time the command is issued.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SVA@,$[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 $: Positive/negative setting 1: + 2: -	U#,SVA@OK[CR][LF]

<Readout>
None

NOTE

- The adjustment amount may vary due to individual variations among conditioner cards.

17-6-14. Set bridge voltage [GBV]

Sets the bridge voltage (BV) for the CDV-90A.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,GBV@W$[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting $: Bridge voltage setting value 0: BV=2V 1: BV=10V	U#,GBV@OK[CR][LF]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,GBV@R$[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get $: Setting to get 0: Get [BV] switch setting value. 1: Get value stored internally.	U#,GBV@$[CR][LF] $: Bridge voltage setting value 0: BV=2V 1: BV=10V

NOTE

- Set the [BV] switch to 2V before starting the command control function.
  If the [BV] switch is set to 10V, the following operation is performed in command control mode to protect connected devices.
  - BV is changed to 2V when a start command control command is received.
  - Setting commands are rejected.

  To check the [BV] switch setting, send a command to get the value.
- After ending the command control function, BV is set to 2V.

17-6-15. Switch TEDS mode on/off [ETM]

Enables or disables TEDS mode for conditioner cards.
In TEDS mode, values on the monitor meter change to physical quantities. Deactivating TEDS mode changes the display to voltage values.
Setting the internal gain in TEDS mode gets the TEDS information and sets internal gain.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ETM@W$[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting $: Operating mode 0: Switch TEDS mode off 1: Switch TEDS mode on	U#,ETM@OK[CR][LF]

NOTE

- Turning on TEDS mode with this command activates the [TEDS] switch light and displays physical quantities on the monitor meter. At this point, the internal gain has not yet been set.
  (The physical quantities displayed are from the TEDS information previously read.)
  Be sure to set the internal gain.
  Turning off TEDS mode turns off the [TEDS] switch light and displays voltage values on the monitor meter, but in this state, the internal gain will be the internal gain set based on the TEDS information previously read.

MEMO

- Even if you turn off TEDS mode before turning off the unit without setting internal gain, the unit will start up the next time in TEDS mode. This is because, in this state, the internal gain is the internal gain set based on the TEDS information previously read. (This is to avoid forgetting to set the internal gain.)
- For more information on setting the internal gain with the TEDS function, refer to the following sections:
  - "4-3-2. Setting Internal Gain Using the TEDS Function" on page 45. (DPM-90A series, CDV-90A)
  - "7-5. TEDS Function" on page 61. (CCA-90A)

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,ETM@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,ETM@$[CR][LF] $: Operating mode 0: Switch TEDS mode off 1: Switch TEDS mode on

17-6-16. Load TEDS information [GTD]

Loads the TEDS information on the MCF-B.
The TEDS information loaded is as follows:

- ROM-ID
- Rated output
- Rated capacity
- Serial number
- Model number code
- Manufacturer identification code

<Configuration>
None

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,GTD@,$[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 $: Information to get 0: ROM-ID 1: Rated capacity 2: Rated capacity 3: Serial number 4: Model number code 5: Manufacturer identification code	U#,GTD@**********[CR][LF] ROM-ID : 25 bytes (including delimiter) U#,GTD@*.******E±n[CR][LF] Rated output : 20 bytes (including delimiter) U#,GTD@*.******E±n[CR][LF] Rated capacity : 20 bytes (including delimiter) U#,GTD@********[CR][LF] Serial number : 20 bytes (including delimiter) U#,GTD@****[CR][LF] Model number code : 13 bytes (including delimiter) U#,GTD@****[CR][LF] Manufacturer identification code : 13 bytes (including delimiter)

NOTE

- Merely switching to TEDS mode will not load TEDS information into the MCF-B.
  Enabling TEDS mode and setting internal gain sets the TEDS information on the MCF-B.
  Internal gain must be set in TEDS mode to load TEDS information into the MCF-B.
- An NG response will be returned if you turn on TEDS mode with a command but do not set the internal gain. This is because the TEDS information is not loaded into the MCF-B.

17-6-17. Set low-pass filter cutoff frequency [SLF]

Sets the cutoff frequency for the conditioner card low-pass filter (LPF).

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SLF@W*[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting *: LPF setting (Cutoff frequency) 0: 10Hz 1: 30Hz 2: 100Hz 3: 300Hz 4: 1kHz 5: 3kHz 6: 10kHz 7: FLAT Note: Setting ranges for each card are as follows: (A parameter error will occur if the setting falls outside this range.) DPM-90A series: 0 to 4, 7 CDV-90A: 0 to 7 CCA-90A: 3 to 7	U#,SLF@OK[CR][LF]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SLF@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,SLF@*[CR][LF] *: LPF setting (Cutoff frequency) 0: 10Hz 1: 30Hz 2: 100Hz 3: 300Hz 4: 1kHz 5: 3kHz 6: 10kHz 7: FLAT

17-6-18. Set high-pass filter cutoff frequency [SHF]

Sets the cutoff frequency for the conditioner card high-pass filter (HPF).

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SHF@W*[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting *: HPF setting 0: HPF OFF 1: HPF ON	U#,SHF@OK[CR][LF]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SHF@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,SHF@*[CR][LF] *: HPF setting 0: HPF OFF 1: HPF ON

17-6-19. Select thermocouple type [CSK]

Sets the thermocouple type for the CTA-90A.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,CSK@W*[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting *: Thermocouple Type 1: K 2: T 3: J 4: N 5: E 6: R	U#,CSK@OK[CR][LF]

<Readout>

None

17-6-20. Switch measurement range [SRV]

Sets the measurement range for the CFV-90A.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SRV@W*[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting *: Measurement Range 1: 500Hz 2: 1kHz 3: 2kHz 4: 5kHz 5: 10kHz 6: 20kHz	U#,SRV@OK[CR][LF]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SRV@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,SRV@*[CR][LF] *: Measurement Range 1: 500Hz 2: 1kHz 3: 2kHz 4: 5kHz 5: 10kHz 6: 20kHz

17-6-21. Set input coupling [SIC]

Switches between AC and DC for CFV-90A input coupling.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SIC@W*[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting *: Input coupling setting 0: Input Coupling DC 1: Input Coupling AC	U#,SIC@OK[CR][LF]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,SIC@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,SIC@*[CR][LF] *: Input coupling setting 0: Input Coupling DC 1: Input Coupling AC

17-6-22. Set trigger level [STL]

Sets the CFV-90A trigger level for signal detection.

<Configuration>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,STL@W**[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 W: Parameter setting *: Setting value Setting range 00–99 Equivalent to 0.0–9.9 using the [TRIGGER LEVEL] switch	U#,STL@OK[CR][LF]

<Readout>

Command format (→ MCF-B)	Reply format (MCF-B →)
U#,STL@R[CR] #: Device ID (0 to F) @: Slot Number (0 to F) 0: Channel Number 1 ʃ F: Channel Number 16 R: Parameter to get	U#,STL**[CR][LF] *: Setting value Setting range 00–99 Equivalent to 0.0–9.9 using the [TRIGGER LEVEL] switch

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