Thank you for purchasing the SR series Hybrid Recorder. This manual contains information for ensuring the correct use of the SR series Hybrid Recorder. It also provides necessary information for installation, maintenance, and troubleshooting. This manual should be read by those who design and maintain equipment that uses the SR series Hybrid Recorder. Be sure to keep this manual nearby for handy reference.

Azbil Corporation
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1. Introduction

Thank you for purchasing SR series (Pen Type) with 180mm recording width. This industrial use instrument records input signals to the chart paper and stores data into the SD card. Mount this instrument on the indoor instrumentation panel etc. and record signals of temperature sensor, pressure gauge, hygrometer and flow meter. Reading signals of the recorder are thermocouple, resistance thermometer, DCmV and DCV. Make sure to read this instruction manual in advance to understand this unit well and prevent troubles from occurring. This manual is a “General” Instruction manual. For specifications with communications, read the “Communications” instruction manual separately.

Request

- To the persons doing instrumentation, installation, and sales -
  Make sure to provide this instruction manual to the person who uses the unit.

- To the users of this unit -
  Store this instruction manual with care until you scrap the unit.
  Also, write down the parameter contents set in the product and keep it for your record.

Product warranty period

This product is warranted for one year from the date of delivery. If it is damaged during the warranty period, when used normally based on the cautions in the instruction manual labels attached to the product, etc., it will be repaired without any charge (only in Japan). In the case, we are sorry to trouble you, but please contact your dealer or nearest our sales office.

However, in cases of the followings, it will be repaired at your expense even during warranty period.
1. Failure or damage caused by improper use or connection, or invalid repair or modification.
2. Failure or damage caused by fire, earthquake, wind or flood, thunderbolt, or other extraordinary natural phenomena, or pollution, salt, harmful gas, abnormal voltage, or use of unspecified power.
3. Replacement of parts or accessories that have reached the end of their life.

Furthermore, the term ‘warranty’ in this sense covers only an Azbil’s product itself. Therefore, we are not responsible for compensation for whatever the damage that is triggered by failure of our product.

Notice

1. No part of this manual can be reproduced or copied in any form without permission.
2. The contents of this manual may be altered without prior notice.
3. This manual has been documented by making assurance doubly sure. However, if any question arises or if any error, an omission, or other deficiencies are found, please contact your nearest our sales office.
4. Azbil is not responsible for any operation results of this software.

Trademark

2. SD Memory Card is the trademark of Panasonic Corporation, SanDisk Corporation in USA, and TOSHIBA CORPORATION.
3. Other described company names and product names are trademarks and registered products of the respective companies.
4. Please note that the marks “TM” and “®” are omitted throughout this manual.

Warning

Perchlorate Material
This instrument uses battery with Perchlorate Material.
Special handling may apply. see
http://www.dtsc.ca.gov/hazardous_waste/perchlorate
Before use

Make sure to check the following before use after unpacking the unit. If you have any question, please contact your dealer or our nearest office.

1. Exterior check
   Check that the appearance of the product has no damage.

2. Model code check
   Check that the model code of the purchased product is correct.
   - Model code label and application place
     The label as follows is attached on the upper surface of the product case and the chassis.

   ![Model Code Label]

   - Model code: SR-xxxxx
   - Serial number: Y7-xxxxx
   - CHINO
   - MADE IN JAPAN

3. Accessories check
   Check the following accessories attached to the product.

<table>
<thead>
<tr>
<th>Item</th>
<th>Q'ty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction manual</td>
<td>1</td>
<td>CD-R</td>
</tr>
<tr>
<td>Instruction manual [Wiring/Installation]</td>
<td>1</td>
<td>Booklet</td>
</tr>
<tr>
<td>Bracket</td>
<td>2</td>
<td>For panel mounting, 81446641-001</td>
</tr>
<tr>
<td>Terminal screw</td>
<td>5</td>
<td>M3.5, for input terminal (spares for missing)</td>
</tr>
<tr>
<td>Chart paper</td>
<td>1</td>
<td>81407861-001</td>
</tr>
<tr>
<td>Cartridge pen (Analog pen)</td>
<td>1 each</td>
<td>Red (1st pen), Green (2nd pen), Blue (3rd pen), Brown (4th pen)</td>
</tr>
<tr>
<td>Plotter pen (Digital pen)</td>
<td>1</td>
<td>Purple</td>
</tr>
</tbody>
</table>

In addition, if accessories are purchased additionally, those products may be attached.

Request

1. Do not drop the product while take it out of the box.
2. When transporting the unit, pack in the dedicated package box, and put the box in an outer case with a bed of cushion.
   With the consideration to the case above, it is recommended that the dedicated package box for the unit is stored.
3. When the unit is removed from the panel and not used for a long time, put it in the dedicated package box, and store it in a place with normal ambient temperature and less dust.
4. About attached chart paper
For the unit, the chart paper 81407861-001 (1 book) is available and attached. For the case that the chart paper is to be specified, various scales are available as follows.

<table>
<thead>
<tr>
<th>Item</th>
<th>Item number</th>
<th>Printed scale (The following numbers are printed.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folding standard chart 100 divisions</td>
<td>81407861-001</td>
<td>0,20,40,60,80,100</td>
<td>10 books</td>
</tr>
<tr>
<td>Folding standard chart 100 divisions (Recycled pulp combination ratio is 20% or more.)</td>
<td>81425049-001</td>
<td>0,10,20,30,40,50,60,200,400,600,800,1000,1200,1600,200</td>
<td>10 books</td>
</tr>
<tr>
<td>Folding standard chart 120 divisions</td>
<td>81425049-002</td>
<td>0,2,4,6,8,10,12,14,20,40,60,80,120,160,200,400,600,800,1000,1200,1600,200</td>
<td>10 books</td>
</tr>
<tr>
<td>Folding chart 140 divisions (Recycled pulp combination ratio is 20% or more.)</td>
<td>81425049-003</td>
<td>0,2,4,6,8,10,12,14,20,40,60,80,120,160,200,400,600,800,1000,1200,1600,200</td>
<td>10 books</td>
</tr>
<tr>
<td>Folding chart 80 divisions (Recycled pulp combination ratio is 20% or more.)</td>
<td>81425049-004</td>
<td>0,20,40,60,80</td>
<td>10 books</td>
</tr>
<tr>
<td>Folding chart 150 divisions (Recycled pulp combination ratio is 20% or more.)</td>
<td>81425049-005</td>
<td>0,50,100,150</td>
<td>10 books</td>
</tr>
<tr>
<td>Clean paper chart 100 divisions</td>
<td>81407937-001</td>
<td>0,20,40,60,80,100</td>
<td>10 books</td>
</tr>
</tbody>
</table>

* The chart paper has the same printed linear scale as the standard scale. Therefore, it can be shared in regardless of input types (thermocouple, resistance thermometer, or others).

5. Restriction of digital recording/printing function
(1) When the chart speed is set to 150mm/H or more, printing function for other than time line, power-on printing, data printing, list printing and setting change mark is disabled.

(2) Printing is formed with dots of one pin. Therefore, if the power is turned off while characters are being formed, they cannot be formed correctly. This is not abnormal.

6. Service parts
For the unit, service parts are available as follows.

<table>
<thead>
<tr>
<th>Item</th>
<th>Item number</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartridge pen (Analog pen) Red</td>
<td>SR-932CP000R</td>
<td>3 pieces</td>
</tr>
<tr>
<td>Cartridge pen (Analog pen) Green</td>
<td>SR-932CP000G</td>
<td>3 pieces</td>
</tr>
<tr>
<td>Cartridge pen (Analog pen) Blue</td>
<td>SR-932CP000B</td>
<td>3 pieces</td>
</tr>
<tr>
<td>Cartridge pen (Analog pen) Brown</td>
<td>SR-932CP000C</td>
<td>3 pieces</td>
</tr>
<tr>
<td>Plotter pen (Digital pen) Purple</td>
<td>81446296-001</td>
<td>3 pieces</td>
</tr>
<tr>
<td>SD card 512MB</td>
<td>SR-911SD0512</td>
<td>3 pieces</td>
</tr>
<tr>
<td>SD card 1GB</td>
<td>SR-911SD1000</td>
<td>3 pieces</td>
</tr>
<tr>
<td>SD card 2GB</td>
<td>SR-911SD2000</td>
<td>3 pieces</td>
</tr>
<tr>
<td>250Ω resistor Accuracy ±0.02%</td>
<td>81401325</td>
<td>1 resistor</td>
</tr>
<tr>
<td>250Ω resistor Accuracy ±0.05%</td>
<td>81446642-001</td>
<td>2 resistors</td>
</tr>
</tbody>
</table>
2. For Safe Use

If the unit is used in a manner not specified by the manufacturer, the protection provided by the unit may be impaired. For safe use of the unit, please read and understand the following cautions.

2-1. Preconditions for Use

The unit is a component type general product to be used mounted on an indoor instrumentation panel. Avoid using under other conditions.

Use after the system safety is implemented such as fail-safe design and periodical inspection on the final product side. Also, for wiring/adjustment/operation of the unit, ask professionals with instrumentation knowledge to perform. Furthermore, the person who actually uses the unit is required to read this instruction manual to fully understand various cautions and basic operation.

2-2. Symbol Mark

This instruction manual includes the following symbol marks. Make sure to fully understand the meaning of them.

<table>
<thead>
<tr>
<th>Symbol mark</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Warning]</td>
<td>Cautions are explained to avoid causes for death or serious injuries of users.</td>
</tr>
<tr>
<td>![Caution]</td>
<td>Cautions are explained to avoid causes for slight injuries of users or damages of the unit or peripheral devices.</td>
</tr>
</tbody>
</table>

2-3. Label

For safe use of the unit, the following labels are used.

<table>
<thead>
<tr>
<th>Label</th>
<th>&quot;Name&quot; and place</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Alert symbol mark]</td>
<td>Various terminals (back side)</td>
<td>Place to be handled with cautions to avoid &quot;electric shock,&quot; &quot;injuries,&quot; etc.</td>
</tr>
<tr>
<td>![Protective conductor terminal]</td>
<td>Right side of power terminal (back side)</td>
<td>Terminal to be grounded to avoid electric shock</td>
</tr>
<tr>
<td>100 to 240V AC* 50/60Hz, 37VA</td>
<td>&quot;Power source specification&quot; Power conductor terminals</td>
<td>Specification of power (voltage range, frequency, and power consumption) used for the unit</td>
</tr>
</tbody>
</table>

*For one pen type.
2-4. Important Explanation

1. **Switch and overcurrent protection device**
   This unit is not provided with a replaceable overcurrent protective device. Prepare a switch and an overcurrent protective device for the power supply (circuit breakers, circuit protectors or the like) within 3m of this unit in a location where the operator can access easily. Use a switch and an overcurrent protective device conforming to IEC947-1 and IEC947-3.

2. **Be sure to ground this instrument**
   To avoid electric shock, before turning the power on, connect the protective conductor terminal of this recorder to the protective conductor of the power supply equipment, and do not remove it during use.

3. **Before turning on the power supply**
   For safety, first check that the power source is within the range indicated on the power label, and then turn on the external power switch.

4. **Avoid repair and modification**
   Avoid repair and modification with parts replacement by persons other than service personnel authorized by CHINO. Not only damage or malfunction of this recorder may occur, but also dangers such as electric shock may occur. In addition, the inner unit does not have to be pulled out in the normal use.

5. **Use the unit following the instruction manual**
   For safe use, use the unit following the instruction manual. Please note that CHINO does not have any responsibilities for any claims for failures or damages occurred with abuse or misuse of this recorder.

6. **Installing the safety device**
   Regarding the use of devices that anticipates a big loss due to failure of this unit, always install a safety device for preventing these losses and implement fail safe design in the final instrumentation. Do not use this unit in important facilities related to, human life, atomic energy, aviation and space.

7. **Turn off the power supply if abnormality occurs**
   Turn off the power supply immediately and contact your local CHINO’s sales office if any abnormal odor, noise or any smoke occurs, or if this unit becomes high temperature that is too hot to be touched.

8. **Do not put hands in this product**
   Do not put your hands or tools inside of this product. It may cause electric shock or injuries. There is no operation such as pulling out an inner unit or using tools when using this product.
3. Model Code List

SR-2□□□□□□□NNN

Input point
01: 1 pen
02: 2 pen
03: 3 pen
04: 4 pen

Power
A: 100 to 240V AC

Communications
N: None
E: Ethernet
R: RS232C
A: RS422A/RS485
Q: RS232C + RS485
C: RS422A/RS485 + RS485
G: Ethernet + RS422A/RS485 + RS485

Alarm output + remote contacts
0: None
2: 2 mechanical relay ‘a’ contact alarm outputs
4: 4 mechanical relay ‘c’ contact alarm outputs + 5 remote contacts
A: 6 mechanical relay ‘a’ contact alarm outputs + 5 remote contacts
8: 8 mechanical relay ‘c’ contact alarm outputs + 10 remote contacts
B: 12 mechanical relay ‘a’ contact alarm outputs + 10 remote contacts

Addition
*1 0: None
D: With inspection results
Y: With traceability certification

*1 Additional tropical treatment products and sulfurization prevention products are available. Please contact us for these additions as there is a limit to some specifications.
4. Mounting and Wiring

4-1. External Dimensions

![Diagram of external dimensions]

4-2. Mounting

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Use the recorder mounting on an indoor installed instrumentation panel.</td>
</tr>
<tr>
<td>(2) Brackets can be attached to a panel of steel with thickness of 2 to 6mm or equivalent strength. Select thickness of a panel considering weight and depth of the unit with panel formation for actual use.</td>
</tr>
<tr>
<td>(3) When mounting the recorder on the panel, mount it according to the instruction manual for preventing injury.</td>
</tr>
</tbody>
</table>

1. Panel cutout and mounting method

- Minimum interval on multiple units mounting

![Diagram of panel cutout and mounting method]
(1) Insert the unit into the panel cutout from the front of the panel.
(2) Screw lightly two provided mounting screws into the screw holes on left/right side (two locations in total) of the recorder.
(3) Insert the hexagon heads of screws installed above into the round holes of brackets, (from the front) sliding them as shown in the figure, press it firmly against the panel, and tighten them with the provided wrench or a Phillips-head screwdriver. In addition, the tightening torque of the screw is 2Nm (for use of a Phillips-head screwdriver).

* Note that the left bracket differs from the right one (Mounting must be performed by two persons).

2. Mounting condition

<table>
<thead>
<tr>
<th>Caution</th>
<th>To avoid accidents, make sure to read and understand the following.</th>
</tr>
</thead>
</table>

**Industrial environment**
Select a location distant from sources of electric field or magnetic field and without mechanical vibration or shock.
- Overvoltage category......II (EN standard)
- Altitude......................2000m or less
- Pollution degree........2 (EN standard)
- Working place................Indoor

**Normal operating condition**
- Ambient temperature ·· 0 to 50°C(20 to 65%RH,non-condensing)
- Ambient humidity ······ 20 to 80%RH,non-condensing(5 to 45°C)
- Power voltage ············ General specification: 100 to 240V AC ±10%
- Power frequency ········· General specification : 50/60Hz ±2%

**Atmosphere**
- For safety, avoid a location with corrosive gas, explosive gas, flammable gas and combustible gas.
- Avoid a location with dust, smoke, or steam.

**Mounting angle**
- Lateral tilting ·············· 0 to 10°
- Longitudinal tilting ······· Forward tilting: 0°Backward tilting: 0 to 30°
- View angle ················· -10 to +30°with the horizon as the standard

Angles other than the above affect the recording operation.
4-3. Wiring

1. Terminal board diagram

The figure below is the diagram of the terminal board with the option [Alarm relay output (12 points 'a' contact) + remote contacts (10 points) and communication interface].

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM1</td>
<td>RS-232C</td>
<td>SG</td>
<td>SD</td>
<td>RD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS-422A</td>
<td>SG</td>
<td>SD</td>
<td>DB</td>
<td>RDA</td>
<td>RDB</td>
<td></td>
</tr>
<tr>
<td>COM2</td>
<td>RS-485</td>
<td>SA</td>
<td>SB</td>
<td>SG</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Communications terminal (option) *RS232C and RS422A/485 are specified on purchase.

Remote contacts terminal (option) Power/protective conductor terminal

Measurement input terminal TC, mV(+) RTD(A) terminator
TC, mV(-) RTD(B) terminator RTD(B) terminal

Alarm output terminal (option) N.O terminal

COM terminal

100-240V AC

Ethernet connector
The figure below is the diagram of the terminal board with the option [Alarm relay output (8 points ‘c’ contact) + remote contacts (10 points) and communication interface].
The figure below is the diagram of the terminal board with the option [Alarm relay output (2 points 'a 'contact) and communication interface].

Communications terminal (option) RS232C and RS422A/485 are specified on purchase.

<table>
<thead>
<tr>
<th>COM1</th>
<th>COM2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-232C</td>
<td>RS-485</td>
</tr>
<tr>
<td>RS-422A</td>
<td>SA</td>
</tr>
<tr>
<td>RS-485</td>
<td>SB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG</td>
<td>SD</td>
<td>RD</td>
<td>SG</td>
<td>SDA</td>
<td>SDB</td>
<td>RDA</td>
<td>RDB</td>
</tr>
</tbody>
</table>

Short between 5 and 7, 6 and 8
Power/protective conductor terminal

Measurement input terminal
TC, mV(+) RTD(A)
terminal
TC, mV(-) RTD(B)
terminal
RTD(B) terminal

Alarm output terminal
(option)

100-240V AC

Ethernet connector
**Warning**

Alert symbol mark (⚠️) and location

Mark is attached to the location to which if human body touches, an electric shock may be generated.

<table>
<thead>
<tr>
<th>Terminal name</th>
<th>Location of attached mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power terminal</td>
<td>Lower left of power terminal</td>
</tr>
<tr>
<td>Measurement input terminal</td>
<td>Upper left of terminal cover</td>
</tr>
<tr>
<td>Mechanical relay 'c' contact alarm terminal</td>
<td>Upper left of terminal cover</td>
</tr>
<tr>
<td>Mechanical relay 'a' contact alarm terminal</td>
<td>Lower left of N.O terminal</td>
</tr>
</tbody>
</table>

**Reference**

Input terminal block and alarm terminal block are removable.

For easy wiring, the input unit, alarm output/remote contacts unit, and communication unit are removable.

(1) Every unit can be removed when two mounting screws are removed.

(2) The recorder and each unit are connected with a connector.

![Input unit]

![Alarm output/remote contacts unit]

![Communications unit]

**Warning**

Turn off the power and then remove/attach

Make sure to turn off the external power switch before units are removed/attached to prevent damages on electric circuits.

**Note**

Thermocouple input unit replacement

Only thermocouple input unit cannot be replaced with other instrument unit. If done so, measurement errors are generated.
2. Precautions on wiring
Precautions on wiring are described below. Observe them to maintain safety and reliability.

1) Feed power source
For the power source for the unit, use the single-phase power source with stable voltage and without waveform strain to prevent malfunctions.

<table>
<thead>
<tr>
<th>Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Switch and overcurrent protective device Add a switch and overcurrent protective device (250V, 3A) to the feed power source to prevent an electric shock on wiring. The unit has no replaceable fuse.</td>
</tr>
<tr>
<td>(2) Connect after the power source is turned OFF When performing power and input/output wiring, make sure to turn OFF the feed power source to prevent an electric shock.</td>
</tr>
</tbody>
</table>

2) Separate from strong power circuits
For input/output wiring, avoid adjacency or parallel with strong power circuits such as power lines. Separate 50cm or more for adjacency or parallel.

3) Separate thermocouple input from heat sources.
To reduce reference junction compensation errors for thermocouple input, especially separate terminals from heat sources (heating body). Also, avoid radiation such as direct sunlight.

4) Separate from noise sources.
Separate from noise sources as much as possible. Unexpected troubles may occur. If separation from noise sources is disabled, implement countermeasures.

<table>
<thead>
<tr>
<th>Main source</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic switch or others</td>
<td>Insert noise filters between power source and input/output terminals. CR filters are used in many cases.</td>
</tr>
<tr>
<td>Power line with distortion of wave</td>
<td></td>
</tr>
<tr>
<td>Inverter</td>
<td></td>
</tr>
<tr>
<td>Thyristor regulator</td>
<td></td>
</tr>
</tbody>
</table>
5) Use crimping terminals.
   (1) To prevent looseness or disconnection of terminals and short circuit between terminals, install crimping terminals to termination of connection cables.
   (2) To prevent an electric shock, use crimping terminals with insulation sleeves.

### Terminal Type and Termination Treatment

<table>
<thead>
<tr>
<th>Terminal board</th>
<th>Diameter</th>
<th>Tightening torque</th>
<th>Termination treatment (Unit: mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power/Protective conductor</td>
<td>M4</td>
<td>1.2Nm</td>
<td>O type t: 0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>With an insulation sleeve</td>
</tr>
<tr>
<td>Communications terminal</td>
<td>M3</td>
<td>0.5Nm</td>
<td>O type t: 0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>With an insulation sleeve</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y type t: 0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>With an insulation sleeve</td>
</tr>
<tr>
<td>Terminals other than the above</td>
<td>M3.5</td>
<td>0.8Nm</td>
<td>O type t: 0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>With an insulation sleeve</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y type t: 0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>With an insulation sleeve</td>
</tr>
</tbody>
</table>

* Use O type as possible.

6) Unused terminals
   Avoid using unused terminals for relaying. Electric circuits may be damaged.

**Warning**

- Treat the wired cables properly.
- Treat the wired cable surely so that would not get tangle up on people and objects.
- Disconnection of wiring may cause an electric shock.
3. Power/protective conductor terminals wiring

1) Power/protective conductor terminals

- Turn OFF feed power source.

Before power/protective conductor terminals wiring, make sure to turn off the feed power source to prevent an electric shock.

2) Power terminal wiring

Using 600V vinyl insulated cables as the power line, install crimping terminals with insulation sleeves to the termination for wiring.

Note: Use the following standard cables.

- (1) IEC 60227-3
- (2) ANSI/UL817
- (3) CSA C22.2 No.21/49

3) Protective conductor terminal wiring

Make sure to connect to the protective conductor of the power equipment. Install crimping terminals with insulation sleeves for wiring.

- Grounding wire: Copper cable with wire diameter 2mm² or more (green/yellow)

---

Warning

- After wiring, install the terminal cover.

---

Caution

- After wiring the power terminals have power supply voltage applied. Make sure to install power terminal covers after wiring to prevent an electric shock.

---

Warning

- Pay attention to power supply voltage and noise.

The power supply voltage of the unit is indicated on power terminals. Applying power other than the indicated one causes accidents or malfunction. In addition, if the power has noise interference, implement countermeasures such as noise cut transformer installation.
4. Measurement input terminals wiring

1) Measurement input terminal
   Turn OFF the feed power source before wiring to prevent an electric shock.
   Install crimping terminals with insulation sleeves to input terminals for wiring.

2) DC voltage (current) input wiring
   Use instrumentation twisted cables for measures against noise as input cables.
   For current input, connect the shunt resistor for current input to the channel to be measured before wiring.

3) Thermocouple (TC) input wiring
   Make sure to wire thermocouple cable (or compensation lead wire) to input terminals of the unit.
   If a copper conductive wire is connected halfway, big measurement error will be generated.
   In addition, avoid parallel connection of a pair of thermocouple wires with other instruments (controller or others) that cause troubles.

4) Resistance thermometer (RTD) input wiring
   To prevent measurement errors, use 3-core cables as the input cable in which lines have the same resistance.
   In addition, one resistance thermometer cannot be connected in parallel with other instruments (a controller or others).

**Caution**

<table>
<thead>
<tr>
<th>Allowable input voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input type</td>
</tr>
<tr>
<td>Voltage, thermocouple input</td>
</tr>
<tr>
<td>Resistance thermometer input</td>
</tr>
<tr>
<td>*±60VDC for channels specified with ±10V range or more</td>
</tr>
</tbody>
</table>

**Warning**

High voltage may be applied to the measurement input terminals due to common mode noise. Allowable noise value is 30VAC or 60VDC or less. Check that the voltage is equal to or less than the allowable value. Install terminal covers after wiring to prevent an electric shock and protect input cables. For thermocouple input, installing terminal covers reduces reference junction compensation errors.
5) Input unit terminal cover mounting/removing
   (1) Raise the cover to the direction of the arrow.
   (2) Turn to the direction of the arrow.
   (3) Pull it out to the direction of the arrow to remove.

5. Alarm output terminals wiring (option)

1) Alarm output terminals
   The terminal configuration depends on the output specification.

<table>
<thead>
<tr>
<th>Alarm relay output 6 points ('a' contact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Diagram of alarm relay output 6 points]</td>
</tr>
<tr>
<td>N.O terminal (M3.5)</td>
</tr>
<tr>
<td>Alarm relay output (6 points)</td>
</tr>
<tr>
<td>COM terminal (M3.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alarm relay output 4 points ('c' contact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Diagram of alarm relay output 4 points]</td>
</tr>
<tr>
<td>N.O terminal (M3.5)</td>
</tr>
<tr>
<td>Alarm terminal (4 points)</td>
</tr>
<tr>
<td>COM terminal (M3.5)</td>
</tr>
<tr>
<td>N.C terminal (M3.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alarm relay output 2 points ('a' contact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Diagram of alarm relay output 2 points]</td>
</tr>
<tr>
<td>N.O terminal (M3.5)</td>
</tr>
<tr>
<td>COM terminal (M3.5)</td>
</tr>
<tr>
<td>ALARM RELAY</td>
</tr>
<tr>
<td>N.O terminal (M3.5)</td>
</tr>
</tbody>
</table>
2) Wiring

Turn OFF the feed power source and the power source for buffer relay before wiring to prevent an electric shock.

(1) Wire the cable to the load via the buffer relay.

(2) To the alarm output terminals, type O crimp style terminal with insulation sleeve which is connected to double insulated signal wire should be connected. (Refer to 4-3. Wiring, 2. Precautions on wiring)

<table>
<thead>
<tr>
<th>Mechanical relay 'a' contact output example</th>
<th>Mechanical relay 'c' contact output example</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Mechanical relay 'a' contact output example" /></td>
<td><img src="image2.png" alt="Mechanical relay 'c' contact output example" /></td>
</tr>
</tbody>
</table>

- Contact protective element
  (Attachment to a side is desirable.)

Maximum of 240VAC can be connected to the alarm output terminals of this unit. Basic insulation (dielectric strength 1390V) is carried out between the alarm output channels, however, from the malfunction etc. 240VAC may be output to each alarm output terminals. Double insulation or reinforced insulation to the outside circuit connected to an alarm output terminal should be set.

A buffer relay power supply is applied to the alarm output terminals after connections and so creates a risk of electric shock if touched. Terminal cover must be mounted after connection. Moreover, safety measures to the outside circuit should be set.

- Contact protective element
  (Attachment to a side is desirable.)

Caution

The alarm output of the unit may generate output failure with wrong operation, failure, abnormal input, or others. Double insulation or reinforced insulation in outside circuit side of all the channels should be set in any system for safety ensuring.
3) Precautions on wiring

The following are precautions on wiring.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical relay output specification contact capacity</strong> (Common to ‘a’ contact and ‘c’ contact)</td>
<td><strong>Power supply</strong></td>
</tr>
<tr>
<td></td>
<td>100VAC</td>
</tr>
<tr>
<td></td>
<td>240VAC</td>
</tr>
<tr>
<td></td>
<td>30VDC</td>
</tr>
<tr>
<td><strong>(Minimum load)</strong></td>
<td>100μA 100mVDC</td>
</tr>
</tbody>
</table>
| **Contact protective element Z installation** | • Install the contact protective element which fits the buffer relay.  
• It is effective to install the element to the coil side of the buffer relay (see the figure of mechanical relay ‘a’ contact output example) and prevents wrong operation with light load. |
| **Selection of buffer relay** | • Coil rating: Contact capacity or less of output terminals  
• Contact rating: Double of load current or more  
In addition, the coil surge absorption element built-in type relay is recommended. If there is no buffer relay which meets the load rating, implement another stage of buffer relay. |
| **Selection of contact protective element** | If there is no surge absorption element built-in buffer relay, install this element.  
The element of C/R (capacitor + resistor) is general.  
*C/R standard*: C: 0.01μF (Rating about 1kV)  
R: 100 to 150Ω (Rating about 1W) |
6. Remote contacts terminals wiring and operation selection (option)

Only with remote contacts terminals (option).

1) Remote contacts terminals

![Remote contacts terminals diagram]

Upper row Remote contacts terminals

2) Wiring

Turn OFF the feed power source before wiring to prevent an electric shock.

1) Use no voltage contact signals to be given to the remote contacts terminals.

2) Install crimping terminals with insulation sleeves to remote contacts terminals for wiring.

![Wiring example]

- **Remote contact enabled operation name**

  1. Recording ON/OFF and three chart speed selection (two terminals of EX1 and EX2 are used)
  2. Messages (No. 01 and 02) selection and printing execution (two terminals of EX1 and EX2 are used)
  3. Messages (No. 01 to 05) selection and execution (four terminals of EX1 to EX4 are used)
  4. Digital data printing (arbitrary one terminal)
  5. List printing (No. 1 to 3) (arbitrary one terminal for each)
  6. Integration reset (arbitrary one terminal)
  7. Messages No. 01 to 20 printing execution (each arbitrary one terminal)
  8. Time correction execution (arbitrary one terminal)

  Each function requires short-circuit for one second or more between COM terminal and each terminal.

- **Operation allocation**

  Setting of allocation of operations to each terminal (EX1 to EX10) is required.

- **Name of operations which require setting**

  1. Recording ON/OFF and three chart speed selection (See 8-7. Chart Speed Setting.)

**Warning**

For contacts connected to the remote contacts terminals, use switches or relays driven with voltage level 30VAC or 60VDC or less or manual contacts which support light load.

**Characteristics of contact input terminals**

- Voltage on contact open: About 5V
- Current on contact short: About 10mA

**Reference**

**Remote contact**
### 3) Operation for which terminal No. is decided automatically

<table>
<thead>
<tr>
<th>Operation name</th>
<th>Terminal contact signal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ON:</strong> Short-circuit</td>
<td><strong>OFF:</strong> Open</td>
</tr>
</tbody>
</table>

#### (1) 3 chart speed selection

3 chart speed setting other than the setting here is required. (See 8-7. Chart Speed Settings.)

<table>
<thead>
<tr>
<th>Recording ON/OFF and 3 chart speed selection</th>
<th>Between COM and EX[[]] terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording ON</td>
<td>EX1</td>
</tr>
<tr>
<td>CS1</td>
<td>OFF</td>
</tr>
<tr>
<td>CS2</td>
<td>ON</td>
</tr>
<tr>
<td>CS3</td>
<td>OFF</td>
</tr>
<tr>
<td>Recording OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ON</td>
</tr>
</tbody>
</table>

*Chart recording must be ON.*

#### (2) Message printing (No.01 and 02)

Message setting other than the setting here is required. (See 8-13. Message Printing 1 Settings.)

<table>
<thead>
<tr>
<th>Message No. 01</th>
<th>COM and EX1 For trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Message No. 02</td>
<td>COM and EX2</td>
</tr>
</tbody>
</table>

At the point when the trigger signals (1 second or more) are given, the selected message is printed. Message printing with key is available.

#### (3) Message printing (No. 01 to 05)

Message setting other than the setting here is required. (See 8-13. Message Printing 1 Settings.)

<table>
<thead>
<tr>
<th>Message</th>
<th>Between COM and EX[[]] terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.01</td>
<td>EX1</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td>No.02</td>
<td>ON</td>
</tr>
<tr>
<td>No.03</td>
<td>OFF</td>
</tr>
<tr>
<td>No.04</td>
<td>ON</td>
</tr>
<tr>
<td>No.05</td>
<td>OFF</td>
</tr>
</tbody>
</table>

* After message No. is selected, when the trigger signals (1 second or more) are given, the selected message is printed. Chart recording must be ON. Message printing with key is available.

### 4) Operation which can be allocated to arbitrary terminal No.

<table>
<thead>
<tr>
<th>Operation name</th>
<th>Terminal contact signal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ON:</strong> Short-circuit</td>
<td><strong>OFF:</strong> Open</td>
</tr>
</tbody>
</table>

#### (4) Digital data printing

Turn ON the terminal No. specified to “Digital data printing.”

Chart recording must be ON.
Digital data printing with key is enabled.
Even during execution, the acceptance can be repeated only once.

#### (5) List printing (List No.1, 2, and 3)

Turn ON the terminal No. specified to “List 1, List 2, or List 3 printing.”

Chart recording must be ON.
List printing with key is available.
(See 8-12. List Printing Settings)

#### (6) Integration reset

When “Collective reset with remote contacts (EX)” is selected with “Calculation programming”, turning ON the terminal No. specified to “Integration reset” resets the integration value.

(See 8-4. Calculation Settings.)

#### (7) Message printing (No.01 to No.20)

Message setting other than the setting here is required. (See 8-13. Message Printing 1 Settings.)

Turn ON the terminal No. specified to “Message printing (No. 01 to 20).”

Chart recording must be ON. Message printing with key is available.

#### (8) Time correction

When the current time (second) is within 0 to 30 seconds, the time is corrected to zero seconds by dropping the seconds. When it is within 31 to 59 seconds, the time is put forward one minute by rounding up and corrected to zero seconds.
7. Communication I/F terminal wiring (partly option)
SR can be connected for communications with RS232C, RS422A, RS485, and Ethernet.

1) Communications terminal type (option)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS232C *</td>
<td>SG</td>
<td>SD</td>
<td>RD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS422A *</td>
<td>SG</td>
<td>SDA</td>
<td>SDB</td>
<td>RDA</td>
<td>RDB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS485 *</td>
<td>SG</td>
<td>SA</td>
<td>SB</td>
<td>Short with SA</td>
<td>Short with SB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COM2</td>
<td>RS485</td>
<td>SA</td>
<td>SB</td>
<td>SG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* RS232C and RS422A/485 of COM1 are to be specified on purchase.

2) Communications cables
Please prepare communication cables before wiring in advance.
Since exclusive cables are available from us, place an order.

(1) RS232C
Connection between PC and the unit or a line converter

<table>
<thead>
<tr>
<th>Cable</th>
<th>9-pin connector ↔ Crimp type ring terminals RS232C cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PC side</td>
</tr>
<tr>
<td></td>
<td>9-pin connector</td>
</tr>
<tr>
<td></td>
<td>Cable for RS232C (Max.15m)</td>
</tr>
<tr>
<td>Internal wiring</td>
<td></td>
</tr>
<tr>
<td>RD</td>
<td>SD</td>
</tr>
<tr>
<td>RD</td>
<td>SD</td>
</tr>
</tbody>
</table>
## RS422A

### Connection between a line converter and the unit

<table>
<thead>
<tr>
<th>Cable</th>
<th>Crimp type ring terminals ↔ Crimp type ring terminals RS422A cable (for a line converter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>![Diagram of cable connection between a line converter and the unit]</td>
</tr>
<tr>
<td>Shape</td>
<td>4-core cable of twisted 2-core cables of twisted VCTF lines. Each side has a SG (signal ground) line. Since the line converter has no SG terminal, cut and use the cable.</td>
</tr>
<tr>
<td>Internal wiring</td>
<td>![Diagram of internal wiring connection between a line converter and the unit]</td>
</tr>
</tbody>
</table>

### Connection between the unit and other devices

<table>
<thead>
<tr>
<th>Cable</th>
<th>Crimp type ring terminals ↔ Crimp type ring terminals RS422A cable (for parallel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>![Diagram of cable connection between the unit and other devices]</td>
</tr>
<tr>
<td>Shape</td>
<td>4-core cable of twisted 2-core cables of twisted VCTF lines. Each side has a SG (signal ground) line.</td>
</tr>
<tr>
<td>Internal wiring</td>
<td>![Diagram of internal wiring connection between the unit and other devices]</td>
</tr>
</tbody>
</table>
(3) RS485
Connection between the unit and other devices and between a line converter and the unit

<table>
<thead>
<tr>
<th>Cable</th>
<th>Crimp type ring terminals ↔ Crimp type ring terminals RS485 cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Internal wiring</td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- 2-core cable of twisted CVVS lines. Each side has a SG (signal ground) line. Since the line converter has no SG terminal, cut and use the cable.

(4) Ethernet
- Connection between PC and devices
  For direct (one-to-one) connection, use crossover twist-pair cables with shield (available locally as STP cable).
- Connection between HUB and devices (multiple devices can be connected)
  For (one-to-N) connection between PC and devices via HUB, use straight twist-pair cables with shield (available locally as STP cable).

3) Communications line wiring
(1) RS232C wiring
PC and devices are connected one-to-one with RS232C.

Example of terminal connection
(2) RS422A wiring
PC and multiple devices are connected with RS422A. A line converter is required. RS422A cable is within 1.2km of total extension and up to 31 devices can be connected. Install a resistor of $100\,\Omega$ to the last edge of the transmission line device side. (General metal film resistors will be fine. They are available from us, place an order.)

Example of terminal connection

(3) RS485 wiring
PC and multiple devices are connected with RS485. A line converter is required. RS485 cable is within 1.2km of total extension and up to 31 devices can be connected. Install a resistor of $100\,\Omega$ to the last edge of the transmission line device side. (General metal film resistors will be fine. They are available from us, place an order.)

Example of terminal connection
(4) Ethernet wiring

- Example of connection between PC and Ethernet devices (one-to-one connection)

- Example of connection between PC and HUB/Ethernet devices (one-to-N connection)
5. Part Names

5-1. Front Section of Internal Unit

- Power switch
  Open the display board same direction as the unit door.
  The power switch is located at the upper left of the unit.

- Display

- SD card slot

- Operation/set keys

- Engineering port
  USB communication connector

Note 1 How to handle the door
The front of the door is made of glass. Avoid giving any shock to the glass or giving any strong force to the frame for preventing any injury due to breakage.

Note 2 Operation/set key
Avoid closing the door in the state of operation/set keys opened. If the door is closed in the state of the operation/set keys opened, the mechanism of the operation/set keys allows the operation/set keys to be lifted to the direction for closing to prevent damage; however, behavior for protection is not guaranteed. If the door is closed forcibly or fast, it may be damaged.
5-2. Operation/Set Keys

Status LED
- REC
  Lights in green while recording is ON. Recording is turned ON/OFF by the REC key.
  Flashes when chart ends.
- CARD
  Lights in green when SD card is recognized by the unit, or flashes in a recognition process.
- ALM
  Flashes in red when alarm occurs.

<table>
<thead>
<tr>
<th>Key names</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC</td>
<td>Record key</td>
</tr>
<tr>
<td>FEED</td>
<td>Feed key</td>
</tr>
<tr>
<td>DATAP</td>
<td>Data print</td>
</tr>
<tr>
<td>FUNC1</td>
<td>Function 1 key</td>
</tr>
<tr>
<td>FUNC2</td>
<td>Function 2 key</td>
</tr>
<tr>
<td>MENU</td>
<td>Menu key</td>
</tr>
<tr>
<td>ESC</td>
<td>Escape key</td>
</tr>
<tr>
<td>▲/▼</td>
<td>Up/Down</td>
</tr>
<tr>
<td>◀▶</td>
<td>Left/Right</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>ENTER</td>
<td>Enter key</td>
</tr>
</tbody>
</table>
6. Operation

6-1. Preparation for Operation

1. How to set chart paper

1. Pulling out the chart cassette

(1) Open the unit door.
(2) Hold the chart cassette grip and pull it toward you.
(3) Each pen rises up when pulled out the chart cassette.

2. Setting chart paper

(1) Open the chart guide and chart feeding holder.
(2) Loosen the both ends of chart to prevent double feed.
(3) Set chart in the chart housing at the back of the chart cassette. The “round” hole and “oval” hole should be at the left and right side of the chart respectively. Make sure to set chart in the correct direction.
(4) Draw out chart approximately 20cm and set holes on the both ends to the sprockets of the chart drum. Put two or three folds of chart in the chart tray at the front of the chart cassette and then close the chart guide and chart feeding holder opened in the step (1).
(5) Turn the thumb wheel downward and make sure that the holes on the both ends of chart are not released from the sprockets, and feeding is smoothly done.

3. Returning the chart cassette to the inside of the unit

(1) Align the guide of the chart cassette with the guide rail located at the both sides of the internal chassis and then insert the cassette until it is locked.
(2) Operate the FEED key to check if the chart is fed properly and smoothly. If not, reset the chart again.

Note Handling of chart cassette

Be careful of injury by dropping the chart cassette after pulling it from inner unit. Take care not to catch your fingers in the unit when putting the chart cassette back.
2. How to set plotter pen and cartridge pen

1. Recording pen types
(1) There are two types of recording pens, the plotter pens for digital printing and cartridge pen for trace printing.
(2) There are four kinds of cartridge pens for the 1st pen to the 4th pen. These are of same shape but differ in ink colors.

2. Preparation
(1) Confirm that the recorder is turned on and press \text{REC} \to \text{ENTER} key (recording is off state).
(2) Cartridge pen and plotter pen stop at standby position and rise up.
(3) Prepare each pen. After opening aluminum package, remove the pen cap.
(4) Open the door and display panel to the same direction.
(5) Replace the pens while the chart cassette is in the housing.

(1) Set to the pen replacement mode. Pressing \text{MENU} key displays menu screen (programming items).
(2) Select [Rep.Pen].
(3) Press \text{FUNC} key and start pen replacement.
(4) All the cartridge pens move to the center. Each press of \text{ENTER} key moves each pen to the far left, replace the pen in order.
3. How to set power frequency

Set the power frequency of the utilized region, setting so does not relate to operation of the unit directory, but this will result in the reduction of the power supply noise. Default setting is 50Hz, switch the power frequency in the region of 60Hz.

Refer to “8-26. System Settings” for power frequency settings.
6-2. Basic Operation

1. Power on
   Turn the power switch to ON while the chart cassette is in the housing.
   Data will be shown on the display after about 10 seconds.
   After detecting the initial position, the printer prints the date and time and then feeds chart about 5mm.

   **Note 1** Display backup
   Backup of settings, clock and display mode are made.
   However, channel number is not saved so the data with smallest channel number within set range will be displayed.

   **Note 2** While recording is OFF
   The date/time printing is not performed at power-on.

2. Switching of display
   The unit can provide seven display modes depending on the number of inputs.
   On 1-point display, 1-point + bar display, 2-point display and 2-point + bar display, either fixed or sequential display can be selected for each display mode (pressing the FUNC key switches the display between AUTO: sequential and CONST: fixed).
   With the sequential display, channel number advances every two seconds (factory default which can be changed).
   While holding down the CH key, press the ▲ key to change the display mode.
   See "8-23. Display Settings" to set default display mode at power-on.

   ![Display Modes Diagram]

   - **1-point display**
   - **1-point + bar display**
   - **2-point display**
   - **2-point + bar display**
   - **4 (3)-point display**
   - **4 (3)-point + bar display**
   - **Pointer display**

   To switch from “1-point display” to “1-point + bar display”, press the ▲ key while holding down the ESC key.
   To switch from “1-point display” to “Pointer display”, press the ▼ key while holding down the ESC key.

   CHNo. Measured value. Chart end/recording ON. Data print/list print. AUTO/CONST. Key lock. POC. SD card remaining amount.

   CHNo. Measured value. TAG. Unit. Chart end/recording ON. Data print/list print. AUTO/CONST. Key lock. POC. SD card remaining amount.

   CHNo. Measured value. TAG. Unit. Chart end/recording ON. Data print/list print. AUTO/CONST. Key lock. POC. SD card remaining amount. Key guide.

   CHNo. Measured value. TAG or Unit. Chart end/recording ON. Data print/list print. Time. Chart speed. Key lock. POC. Recoding point indicator. SD card remaining amount. Time. Key guide.
3. Chart recording operation

**Recording ON**

- ****** Quit recording? ******
  - Pressing the ENTER key turns recording OFF.

- ****** Start Digital data printing? ******
  - Press the ENTER key to start.

**Recording OFF**

- ****** Start recording? ******
  - Pressing the ENTER key turns recording ON.

* Any of the above settings can be cancelled by pressing the ESC key.
  (The setting is cancelled also after about 10 seconds without key operation.)

1) Turning ON/OFF chart recording

Recording can be turned ON/OFF by pressing the REC key → ENTER key.
While recording is ON, the "REC" status LED lights up.
Recording is not performed while it is OFF, but reading inputs, updating data and calculating alarms are performed. Data printing, list printing and message printing are unavailable.

**Note**

Pressing the REC key → ENTER key becomes invalid in some cases

(1) Key operation is unavailable when 🛠 is shown on the display indicating that keys are locked.
(2) When using remote contacts (optional), key operation becomes unavailable when recording is turned OFF by a remote contact terminal.

**Reference 1**

Up and down of pens

(1) When the printing is turned off, each pen lifts up automatically. Even if the power is turned off in this condition, this pen position is maintained.
(2) When the chart cassette is pulled out, each pen lifts up. If the printing has been turned off when pulling out the chart cassette, each pen has already been lifted up and it maintains its position.

**Reference 2**

Printing Operation

The table below explains the printing operation when the printing is ON or OFF.

<table>
<thead>
<tr>
<th>Operation</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart feeding</td>
<td>Execute</td>
<td>Stop</td>
</tr>
<tr>
<td>Trace printing (Cartridge pen)</td>
<td>Execute</td>
<td>Up at where it is</td>
</tr>
<tr>
<td>Digital data printing (Plotter pen)</td>
<td>Execute</td>
<td>Up at standby position</td>
</tr>
<tr>
<td>Up and down of pens</td>
<td>Down</td>
<td>Up</td>
</tr>
</tbody>
</table>
2) Data printing
Print numeric values of the latest measurement data as shown in the example below. Printing mode is different depending on the chart speed.
When the chart speed is 1 to 499mm/H, trace printing is continued without interruption. Printing is done by synchronized with chart feeding.
When the chart speed is 500mm/H or more, trace printing is interrupted and data printing is started.
Press the [DATA] key → [ENTER] key to perform data printing.
Use the periodic data printing function to perform data printing periodically.
This cannot be performed while recording is OFF or keys are locked.

Reference > Operation during printing and print cancel

| Operation: | Operations including measurement continue without being interrupted. |
| Cancel: | To stop data printing halfway through, press the [REC] key → [ENTER] key. Then, pressing the [REC] key → [ENTER] key returns to the previous printing status. |

Example of data printing
3) Chart feed
Chart can be fed using the FEED key. While the FEED key is pressed, chart is fed at a speed of 600mm/min. When fast-feeding chart, recording is stopped. Feed chart when a measurement target or measurement condition is changed.

Reference Feeding chart
Chart can be fed manually using the drum. However, a few millimeters of chart may not be fed due to mechanical nature of the unit. Therefore, we recommend that chart be fed by the FEED key. Also, for the same reason, use the FEED key to feed when new chart is set.

4) Aligning time line
When operating the unit with a chart speed of multiples of 12.5 (mm/H), it is advisable to align the time line print with the time scale of chart for easier view of the result.

The following shows a bad example.

Time line print

Time scale

Subsidiary time scale

This is useful only when you use a chart with 12.5mm-pitch time scale.

(1) There is a time line setting mark (⊿) on the right side of the chart guide located at the front of the chart cassette.

(2) Align a time scale line with the setting mark (⊿) as viewed from the front by pressing the FEED key (do not align it manually).

(3) It may be a good idea to set a time scale line 1 to 2mm above the setting mark (⊿) to perform a fine adjustment later.

(4) Press the REC key and turn off the “REC” status LED.

(5) Press the REC key at a desired time <xxh 00min> and turn on the “REC” status LED.

(6) After a few hours, check to see if the time line print is aligned with a time scale line. If the time line print comes behind a time scale line, press the FEED key briefly and see how it works. If it comes ahead, remove the chart and set it back for a few hours and then try again.
### 6-3. Operation

#### 1. Types and contents of chart recording

There are two types of chart recording: trace printing and digital recording/printing. Without setting particular items, trace printing and fixed time printing are performed while recording is ON.

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace printing (Cartridge pen)</td>
<td>Trend printing is executed for each pen (channel).</td>
</tr>
<tr>
<td></td>
<td>1st pen</td>
</tr>
<tr>
<td></td>
<td>Red</td>
</tr>
<tr>
<td>Alarm printing</td>
<td>Prints time or alarm point when alarm is generated/cleared.</td>
</tr>
<tr>
<td>Periodic data printing</td>
<td>Adds digital record/print on a trace print in desired intervals.</td>
</tr>
<tr>
<td>Data printing</td>
<td>Performs digital recording/printing when required.</td>
</tr>
<tr>
<td>List printing</td>
<td>Prints a list of all or specified parameters when required.</td>
</tr>
<tr>
<td>Fixed time printing</td>
<td>Prints date (year/month/date), time/time line (linked to the chart speed and printed), chart speed, max/min chart record, channel number and tag and unit.</td>
</tr>
<tr>
<td>Message printing</td>
<td>Prints a message which can contain up to 72 characters.</td>
</tr>
<tr>
<td>Calendar timer printing</td>
<td>Prints when both calendar timer is ON/OFF and printing are set to ON.</td>
</tr>
<tr>
<td>Operation recording</td>
<td>When using remote contacts (optional), the status of remote input No. (ON/OFF) is printed at the specified position with a bar line.</td>
</tr>
<tr>
<td>Setting change mark</td>
<td>When setting is changed, “∆” is printed at the right side of chart.</td>
</tr>
<tr>
<td>Power-on time printing</td>
<td>Date and time are printed at power ON.</td>
</tr>
<tr>
<td>Time axis sync. mark printing</td>
<td>(1) When the time axis synchronization (POC) is switched ON or OFF, its time, mark (*), and ON or OFF are printed.</td>
</tr>
<tr>
<td></td>
<td>(2) When it is ON, a mark (*) is printed to the right of the time print of fixed-time printing.</td>
</tr>
</tbody>
</table>

---

**Example of trace printing and fixed time printing**

![Example graph showing trace printing and fixed time printing](image-url)
2. Fixed time printing interval
When recording is ON at the time of power-on, fixed time printing is performed first.

The following table shows printing intervals which vary depending on the printing item.

<table>
<thead>
<tr>
<th>Time and time line</th>
<th>Chart speed</th>
<th>Min/max chart record, channel number and tag and unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varies depending on the chart speed</td>
<td>At approximately 84mm intervals</td>
<td>At intervals of 42mm and in order of channel number.</td>
</tr>
</tbody>
</table>

1) Printing intervals of time and time line
Time and time line are printed at the following intervals which vary by the chart speed. The start point of the intervals is 00h 00min.

<table>
<thead>
<tr>
<th>Chart speed (mm/H)</th>
<th>Time and time line</th>
<th>Time line only</th>
<th>Year/month/date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 9</td>
<td>12h 00min only</td>
<td>6h</td>
<td>00h 00min only</td>
</tr>
<tr>
<td>10 - 15</td>
<td>4h</td>
<td>2h</td>
<td></td>
</tr>
<tr>
<td>16 - 30</td>
<td>2h</td>
<td>1h</td>
<td></td>
</tr>
<tr>
<td>31 - 60</td>
<td>1h</td>
<td>←</td>
<td></td>
</tr>
<tr>
<td>61 – 119</td>
<td>1h</td>
<td>30min</td>
<td></td>
</tr>
<tr>
<td>120 - 149</td>
<td>30min</td>
<td>←</td>
<td></td>
</tr>
<tr>
<td>150 or higher</td>
<td>No printing</td>
<td>30min</td>
<td></td>
</tr>
</tbody>
</table>

Example:
(1) Time line
(2) Time
(3) POC mark (print only when time axis synchronization is ON))

2) Printing interval of max/min chart record, channels number and tag and unit
(1) These are printed at intervals of 42mm and in order of channel number.
(2) Tag is not printed if not specified.
(3) When you set the recording format, printing contents vary depending on the selected format.
(4) Printing mode is different depending on the chart speed.

Standard (Standard), automatic range-shift (Auto Range)
- Channel No.
- 1: TIC1
- 0.0/500.0°C
- Min/max chart record
- Trace printing
- Tag
- Unit

Note: When Auto Range is used, the max/min chart record of the range (one of the ranges R1 to R5) used at the time of printing will be printed.

Compressed/expanded printing (Comp. & Exp.Print)
- 1: TIC1
- 0.0/200.0/400.0/500.0°C
- zero/1st break point/2nd break point/span
- A "+" mark is printed at the first and second break points.

Zone printing (Zone Print)
- 1: TIC1
- 0.0/500.0°C
- A "+" mark is printed at the edge of the printing area to indicate it.
3. Restrictions on recording
1) Digital recording/printing unavailable at certain chart speeds
   When chart speed is set to 150mm/H or higher, printing function besides time line, power-on time printing, data printing, list printing, setting change mark are disabled.

2) Overlapping of digital recording/printing
   When the recording position is overlapped, printing may not be performed.

4. Operation at abnormal input
1) Out-of-range input
   When an input is out of the chart printing range or measuring range, the unit indicates it by the following display or printing.
   Measuring range: determined by the input type described in “8-2. Input Type Settings”.
   Chart printing range: trace printing range described in “8-2. Input Type Settings”.

<table>
<thead>
<tr>
<th>No.</th>
<th>Input status</th>
<th>Display</th>
<th>Printing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Digital</td>
<td>Digital</td>
</tr>
<tr>
<td>(1)</td>
<td>Input under the lower limit of measuring range*</td>
<td>-OVER</td>
<td>-OVER</td>
</tr>
<tr>
<td>(2)</td>
<td>Input under the lower limit of chart printing range</td>
<td>Normal display</td>
<td>Normal print</td>
</tr>
<tr>
<td>(3)</td>
<td>Input over the upper limit of chart printing range</td>
<td>Normal display</td>
<td>Normal print</td>
</tr>
<tr>
<td>(4)</td>
<td>Input over the upper limit of measuring range*</td>
<td>+OVER</td>
<td>+OVER</td>
</tr>
</tbody>
</table>

* Digital display/printing is available for an input outside the measuring range if it is within ±10% of the span.

2) Disconnection of input signal
   Display and printing made at a disconnection of input signal depends on the “Burnout” setting.

<table>
<thead>
<tr>
<th>Burnout setting</th>
<th>Display</th>
<th>Printing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Digital</td>
<td>Digital</td>
</tr>
<tr>
<td>None</td>
<td>Undefined</td>
<td>Undefined</td>
</tr>
<tr>
<td>Down</td>
<td>BURN</td>
<td>BURN</td>
</tr>
<tr>
<td>UP</td>
<td>BURN</td>
<td>BURN</td>
</tr>
</tbody>
</table>
## 7. Factory Default Settings

### 7-1. List of Factory Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Time</td>
<td>Current time (year/month/date: Japan time)</td>
</tr>
<tr>
<td>(2) Range</td>
<td>(1) Input type: V: -50.00 to 50.00</td>
</tr>
<tr>
<td></td>
<td>(2) RJ: None</td>
</tr>
<tr>
<td></td>
<td>(3) Chart printing: -50.00 to 50.00</td>
</tr>
<tr>
<td>(3) Scale</td>
<td>-50.00 to 50.00</td>
</tr>
<tr>
<td>(4) Unit</td>
<td>V</td>
</tr>
<tr>
<td>(5) Tag</td>
<td>Not set</td>
</tr>
<tr>
<td>(6) Display/printing On and OFF</td>
<td>(1) Display: All channels ON</td>
</tr>
<tr>
<td></td>
<td>(2) Trace printing: All channels ON</td>
</tr>
<tr>
<td></td>
<td>(3) Digital printing: All channels ON</td>
</tr>
<tr>
<td></td>
<td>(4) SD card recording: All channels ON</td>
</tr>
<tr>
<td>(7) Chart speed</td>
<td>25mm/H</td>
</tr>
<tr>
<td>(8) Digital recording/printing</td>
<td>Data interval: None</td>
</tr>
<tr>
<td>(9) Alarm settings</td>
<td>Not set</td>
</tr>
<tr>
<td>(10) Subtract printing settings</td>
<td>Not set</td>
</tr>
<tr>
<td>(11) Message settings</td>
<td>Not set</td>
</tr>
<tr>
<td>(12) Password</td>
<td>3571</td>
</tr>
</tbody>
</table>
8. Setting Method

8-1. Basic Rules

The following provides general information on setting operations.

Pressing the ESC key can return to the measured value display from any window.

1. Setting items and parameters
   The unit offers various condition settings to allow users to obtain various recording results and data.
   Major items of measuring/recording conditions, such as range, scale and chart speed, are called “setting items”,
   whereas detailed items of each setting item are called “setting parameters” or just “parameters”.

2. Selecting setting item
   Press the MON key on the measured value display. A list of setting items will be displayed.
   Use the keys to select a setting item and press the key to confirm your selection. Some setting items may use hierarchical display.

3. Selecting setting parameter
   Select a setting parameter of a setting item.
   A cursor is displayed at the left of each parameter. Move the cursor to a desired parameter using the keys.

4. Key acceptance and acceptance failure
   When the cursor does not move by pressing the keys or when a parameter setting window does not open by pressing the key, it indicates that the keys have been unaccepted. Make sure to press the keys properly and try again.

5. Number of setting items and parameters
   Setting items vary depending on the use of option. Also, the number of setting parameters differs by setting item.
   The items like time and chart speed have a single parameter whereas the items like range, scale and alarm have multiple parameters requiring channel specification.
   Only the parameters necessary for the current setting become available for entry. Unnecessary parameters are replaced by “*” mark and the cursor does not move to them.

6. Checking setting parameters
   There are two ways to check setting parameters: “list printing” and “display check”, the former prints all or specified setting items and the latter calls up parameters on the display.
7. Changing settings

To change settings, move the cursor (>) located at the left of a setting parameter to the parameter to be set (changed). When the target parameter is selected by pressing the ENTER key, the set value will be highlighted and become settable. Each setting item generally uses the combination of four types of setting described below.

A parameter value is selected from options. Use the ▲/▼ keys to select a desired value from options.

A parameter is set to an arbitrary value. Use the ◄/► keys to move the digit, and the ▲/▼ keys to set number or select + or -.

Note: For parameters requiring setting of decimals, a box indicating decimal point position appears at the right side when they become settable. Change the number in the box to change the decimal point position. Some parameters show the box only for reference.

Whether or not to use the parameter is set. Pressing the ENTER key checks/unchecks the check box.

A parameter is set to an arbitrary character string. Select an insert position or character with the ▲/▼/◄/► keys and press the ENTER key to enter. When all the desired characters are entered, move the cursor to Set located at the far right of the window and press the ENTER key to register. Use the ▲/▼ keys to move to the parameter entry and character selection areas. Use the ◄/► keys to select an insert or change position while “•” is displayed at the left of the parameter entry area.

When you enter a character string exceeding the valid number of digits, the last digit will be deleted.

Note: Pressing the ENTER key switches the entry mode: alphabets, numbers, symbols and katakana. (The mode to be switched depends on the parameter.)

When the ENTER key is pressed after setting (changing) a parameter value, the cursor moves to the next parameter. When all the necessary settings for each item are completed, move the cursor to Set at the bottom and press the ENTER key to register. After that, the previous window will be displayed.

At this time, if any error is detected in the settings, “Invalid setting” will be displayed and the current window will not change.

The following table is a list of setting items displayed by pressing the MENU key (with full options). Some models cannot set certain items, and such items are replaced by “*” mark. Items in field will be displayed when “Rec Adj” and “Inp Adj” are enabled according to “8-26 System Settings”. Items in the same column are related to each other. Items in field are required items.

<table>
<thead>
<tr>
<th>Range</th>
<th>Chart</th>
<th>DataInt</th>
<th>PrtForm</th>
<th>SD CARD</th>
<th>Ether</th>
<th>Timer</th>
<th>Display</th>
<th>Rec Adj</th>
<th>TmAxAdj</th>
<th>Inp Adj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm</td>
<td>POC</td>
<td>PrtTime</td>
<td>A.Range</td>
<td>USB</td>
<td>Sntp</td>
<td>Dig Inp</td>
<td>D.Order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calc</td>
<td>Sub Prt</td>
<td>ListPrt</td>
<td>Cmp&amp;Exp</td>
<td>COM 1</td>
<td>E-mail</td>
<td>Ope.Rec</td>
<td>Date</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formula</td>
<td>*</td>
<td>MsgPrt1</td>
<td>ZonePrt</td>
<td>COM 2</td>
<td>*</td>
<td>FailOut</td>
<td>System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference > List of setting items
8-2. Input Type Settings “Range”

Parameters including range, RJ (internal/external switching of reference junction compensation), scale and unit can be set collectively for each channel.

1. Parameters

1) Input
   Set the input type (INPUT), range (RANGE-L/H) and RJ internal/external (RJ) in accordance with the sensor to be connected (thermocouple or resistance thermometer) and the target measuring range.

2) Burnout
   If a sensor (thermocouple or resistance thermometer) or input cable is disconnected, chart recording jumps to the upper (UP) or lower (DOWN) limit. This can be reflected to the display or output.

Note Set “None” for parallel operation
Connecting a thermocouple in parallel with another instrument may cause a trouble. If it has to be done, make sure to select “None” for burnout. Please note that the recording accuracy is not guaranteed in this case.

3) Scale
   Set the scale used for display or recording of actual input after setting input type (INPUT) and range (RANGE-L/H).
   Scale setting (SCALE) is required when displaying/recording a voltage input from a converter with an arbitrary scale. In this case, the scale should use arbitrary scale factor of the voltage input. For thermocouple or resistance thermometer input, only the position of decimal point can be specified.

4) Chart recording range
   Set the recording range of chart. Specify 0% position of chart with REC-L and 100% position with REC-H.

Note Valid number of digits
Up to five digits (six digits when including a minus sign) can be set for the upper/lower limit of range, scale and chart recording.
For numeric value settings with a decimal fraction, the lower/upper range should be -30000 to 30000 and the lower/upper scale and chart recording should be -30000 to 99999 with decimals excluded.

5) Sensor correction
   Measurement value is offset by the specified value. Use this function to adjust the zero point.

6) Unit
   Arbitrary characters can be set as unit. However, when numeric characters are set, you may find it difficult to distinguish the unit from measured data at data printing.
   Up to six digits can be set, and upper two digits are printed only at digital printing.

   ![Unit Example]
   Unit is set to “01”.
   Measured data is “291.3” in this case.

7) Tag
   Tag name can be attached to each channel data.

8) Display, trace printing, digital recording/printing, SD card recording ON/OFF
   Select ON or OFF for each display/recording.
9) Input filter
The input filter has a function to stabilize the measuring input. A CR filter is mounted in the measuring circuit. In addition, a software filter (called as “input filter”) for the “primary delay computation” is also installed to smooth slight variations of the measuring input. The value for the programming is corresponding to “Time constant: T”.

![Input filter diagram](image)
2. Parameter setting

(1) Pressing the [MENU] key displays the menu window (list of setting items).

(2) Select “Range”.
(Set contents of all channels will be displayed.)

(3) Move the cursor to the target CH with the ▲/▼ keys and press the [ENTER] key. The cursor does not move to parameters other than CH.
Pressing the [FUNC] key on this window displays the copy window for input type settings. (See the next page for “Copying settings”.)

(4) Move the cursor to a parameter to be set with the ▲/▼/◄/► keys.

(5) Press the [ENTER] key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to Set.

(7) Press the [ENTER] key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the [ESC] key.

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.

Reference Parameter settings

CH No. is fixed to the one selected from the list of set contents. The input type, RJ, burnout and ON/OFF of each display/recording are set by selecting a value from options with the ▲/▼ keys. The upper/lower limit of range, scale and chart recording, and sensor correction are set by selecting a numeric value at each digit with the ▲/▼ keys. The unit and tag are set by selecting arbitrary characters on the window.
### List of Range setting parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT</td>
<td>Select input type</td>
<td>V: -50.00 to 50.00</td>
<td>V, MV, K, E, J, T, R, S, B, N, U, L, WWRe26, WRe5-26, NiMo-Ni, Platine2, PtRh40-20, Cr-AuFe, Au/Pt, Pt100, OPl100 (old Pt100), JPt100, Pt50, Pt-Co, UNUSED</td>
</tr>
<tr>
<td>RJ</td>
<td>Select whether to use reference junction compensation contact</td>
<td>*</td>
<td>EXT (external), INT (internal)</td>
</tr>
<tr>
<td>BURN</td>
<td>Select whether to detect burnout, and action at detection</td>
<td>*</td>
<td>None, UP, DOWN</td>
</tr>
<tr>
<td>RANGE-L</td>
<td>The lowest end of measuring range used within the range (measuring range) determined by the input type</td>
<td>-50.00</td>
<td>-30000 to 30000 Up to three digits after decimal point can be set. Example: -30.000</td>
</tr>
<tr>
<td>RANGE-H</td>
<td>The highest end of measuring range used within the range (measuring range) determined by the input type</td>
<td>50.00</td>
<td>The same decimal point position is used for the lowest/highest range.</td>
</tr>
<tr>
<td>SCALE-L</td>
<td>The lowest end of scaling range specified when selecting the voltage range (mV, etc.) for input type</td>
<td>-50.00</td>
<td>-30000 to 99999 Up to three digits after decimal point can be set. Example: -30.000</td>
</tr>
<tr>
<td>SCALE-H</td>
<td>The highest end of scaling range specified when selecting the voltage range (mV, etc.) for input type</td>
<td>50.00</td>
<td>The same decimal point position is used for the lowest/highest scaling range.</td>
</tr>
<tr>
<td>REC-L</td>
<td>Lowest end of chart recording (left)</td>
<td>-50.00</td>
<td>-30000 to 99999 Up to three digits after decimal point can be set. Example: -30.000</td>
</tr>
<tr>
<td>REC-H</td>
<td>Highest end of chart recording (right)</td>
<td>50.00</td>
<td>The same decimal point position is used for the lowest/highest recording range.</td>
</tr>
<tr>
<td>SHIFT</td>
<td>Sensor correction Set offset value to the data after scaling</td>
<td>0.00</td>
<td>-30000 to 99999 Up to three digits after decimal point can be set. Example: -30.000</td>
</tr>
<tr>
<td>FILTER</td>
<td>Time constant of input filter (sec.)</td>
<td>None</td>
<td>None, 0.5s, 1s, 2s, 3s, 4s, 5s,</td>
</tr>
<tr>
<td>UNIT</td>
<td>Set a character string of up to six characters</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>TAG</td>
<td>Set a character string of up to 10 characters</td>
<td>Not set</td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>Select ON or OFF for measured value display</td>
<td>ON</td>
<td>ON, OFF</td>
</tr>
<tr>
<td>Rec</td>
<td>Select ON or OFF for trace printing</td>
<td>ON</td>
<td>ON, OFF</td>
</tr>
<tr>
<td>DIGI.REC</td>
<td>Select ON or OFF for digital recording/printing</td>
<td>ON</td>
<td>ON, OFF</td>
</tr>
<tr>
<td>SD-CARD.REC</td>
<td>Select ON or OFF for SD card recording</td>
<td>ON</td>
<td>ON, OFF</td>
</tr>
</tbody>
</table>

### 3. Copying settings

Pressing the FUNC key on the list of set contents displays the copy window for channel settings.

Move the cursor to the item you want to copy with the ▲/▼/◀/▶ keys.

Press the ENTER key to check the check box of desired item.

After selecting items to be copied, specify the source and destination. Move the cursor to the source (Src.CH) and select CH with the ▲/▼ keys (forward/reverse) and then press the ENTER key to register. When the cursor moves to the destination (Dest.CH), select CH likewise. Settings can be copied to specified channels collectively.

When the destination setting is completed, move the cursor to Copy and press the ENTER key to start copying.

**Note**

Influence on other settings

When parameters like input type and scale upper/lower limit are changed in "input type settings", it may affect other settings (alarm settings/deadb ‰ d band, etc.).
Please bear this in mind since copying these parameters may also affect other settings.

### 4. Shortcut for input type settings

Only for "input type settings", a setting window of each channel can be displayed from the measured value display window. On the each display mode, highlight the channel number you want to set with the ▲/▼/◀/▶ keys and press the ENTER key. For the case of 1-point display, pressing the ENTER key brings the parameter setting window of the displayed channel.

* Copy function is unavailable on a setting window displayed using shortcut.
8-3. Alarm Settings “Alarm”

Various alarm points can be set for measured value of each channel. Up to four alarm points per channel can be set and the type of alarm (upper/lower, diff upper/lower, or rate-of-change upper/lower) can be set to each alarm point arbitrarily. Using the alarm settings, alarm printing, alarm display, status LED indication and relay output can be performed. Alarm output (relay output) provides up to 12 points when option is used.

1. Display and print at alarm activation/reset
   When alarm is activated, the “ALM” status LED and measured value of the channel generating the alarm will start flashing.
   Pressing the `key displays details of the alarm and a list of active alarms.
   Also, “alarm type”, “alarm level” and “alarm activation time” of the alarm generating channel are printed at the far right of chart, and “alarm level” and “alarm reset time” are printed when the alarm is reset.
   The maximum number of printing tasks of alarm activation/reset held by the unit is 48. Further printing tasks of alarm activation/reset cannot be accumulated. When 48 is exceeded, ▲ mark is printed right at the level.

2. Alarm setting parameters
   The alarm function does not work initially since it is not set prior to shipment.

   1) Alarm point (alarm type and alarm value)
      Alarm type (upper/lower, diff upper/lower or rate-of-change upper/lower) and alarm point can be set for up to four levels per channel at arbitrary points.

   2) Alarm deadband
      Alarm is activated when a measured value reaches an alarm value (see right figure).
      Alarm reset point can be set at a point toward the normal range, and the area between the alarm activation and reset points is called alarm deadband.
      The setting range is the same as the scale setting.

   3) Compared CH (for diff upper/lower alarm only)
      Specify a comparison target CH when using diff upper/lower alarm.

   4) Reference period (for rate-of-change upper/lower alarm only)
      Specify a period for comparing the amount of change.
      (See the next section for alarm type.)

   5) Delay
      Output delay time (Delay) can be set for each channel and level. Alarm is activated when a specified delay time passes after alarm condition is detected. If the alarm condition is cleared during the delay period, alarm will not be activated.
6) **Output**

Alarm condition (activation/reset) at each alarm point is output from the relay of the specified No. (alarm output terminal No.). This output is not performed initially because it is set to "-" prior to shipment. Output relay can be specified arbitrarily for each channel and level (from No.1 to 12 relay: optional). When "99" is specified, internal circuit output can be performed instead of relay output. The internal ON/OFF signal can be used as a trigger for SD card recording or mail sending (optional).

7) **Output mode (AND/OR)**

Select the circuit type (AND/OR) for output. Multiple alarm points can be assigned to one relay No.

**AND output:** Relay turns ON when all the assigned alarm points generate alarm.

**OR output:** Relay turns ON when any of the assigned alarm points generates alarm.

8) **Holding/not holding conditions of measured value display, status LED and relay output at alarm activation**

When alarm is activated, the measured value and "ALM" start flashing. When the alarm is reset, the measured value stops flashing and "ALM" is turned off (they keep flashing when alarm display and relay output is held).

You can stop flashing of measured value and status LED from the alarm status check window if the alarm has been reset. When remote contact is selected as a reset method, specify the remote contact No. which executes a reset (Hold-EX).

---

**Note**  
**Alarm confirmation and output status**

The status LED and output cannot be reset while alarm is activated. Even when alarm is reset, the condition of display, status LED and output at alarm activation are held. Specify a reset method for these items.
3. Alarm type

Alarm type can be selected from the following six types for each alarm point.

1) Upper limit alarm (H)

Alarm is activated when the measured value of specified channel reaches or exceeds an alarm value.

- **Set value**: alarm value, deadband
- **Activation condition**: specified CH data ≥ alarm value
- **Reset condition**: specified CH data < (alarm value – deadband)

2) Lower limit alarm (L)

Alarm is activated when the measured value of specified channel reaches or falls below an alarm value.

- **Set value**: alarm value, deadband
- **Activation condition**: specified CH data ≤ alarm value
- **Reset condition**: specified CH data > (alarm value + deadband)

3) Difference upper limit alarm (B)

Alarm is activated when the difference calculated by subtracting the measured value of compared channel from the measured value of specified channel reaches or exceeds an alarm value.

- **Set value**: alarm value, compared CH, deadband
- **Activation condition**: (specified CH data – compared CH data) ≥ alarm value
- **Reset condition**: (specified CH data – compared CH data) < (alarm value – deadband)

4) Difference lower limit alarm (S)

Alarm is activated when the difference calculated by subtracting the measured value of compared channel from the measured value of specified channel reaches or falls below an alarm value.

- **Set value**: alarm value, compared CH, deadband
- **Activation condition**: (specified CH data – compared CH data) ≤ alarm value
- **Reset condition**: (specified CH data – compared CH data) > (alarm value + deadband)

5) Rate-of-change upper limit alarm (U)

Alarm is activated when the measured value variation width of specified channel in the reference period [Δt sec] is at the plus side and equal to or higher than an alarm value.

- **Set value**: alarm value (absolute value with any sign), reference period [Δt sec], deadband
- **The reference period is set within the range of 0 to 600.0sec.**
- **Alarm judgment cycle**: 0.1sec (Δt is set to 2sec or less)
- **Δt/2sec (rounding up to whole number)**

6) Rate-of-change lower limit alarm (D)

Alarm is activated when the measured value variation width of specified channel in the reference period [Δt sec] is at the minus side and equal to or higher than an alarm value.

- **Set value**: alarm value (absolute value with any sign), reference period [Δt sec], deadband
- **The reference period is set within the range of 0 to 600.0sec.**
- **Alarm judgment cycle**: 0.1sec (Δt is set to 2sec or less)
- **Δt/2sec (rounding up to whole number)**
Rate-of-change alarm

Upper alarm: Variation width per unit time $[\Delta t]$ (PV2 - PV1) is at plus side.
Lower alarm: Variation width per unit time $[\Delta t]$ (PV2 - PV1) is at minus side.

Unit time $[\Delta t] = \text{measuring interval (approx. 0.1sec)} \times \text{measuring count (1 to 20)}$

Differential alarm

(Diff upper alarm)

Difference in measured value (absolute value) $\geq$ alarm value: diff upper alarm activated

(Diff lower alarm)

Difference in measured value (absolute value) $\leq$ alarm value: diff lower alarm activated
4. Parameter settings

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “Alarm”.

(3) Move the cursor to the target channel with the ▲/▼ keys and press the **ENTER** key. The cursor does not move to parameters other than CH. Pressing the **FUNC1** key on this window allows you to change the alarm level. Pressing the **FUNC2** key displays the copy window for alarm settings.

(4) Move the cursor to the parameter to be set with the ▲/▼/◄/ ► keys.

(5) Press the **ENTER** key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to **Set**.

(7) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.

**Note**

Relation with the decimal point position of scale set value

The decimal point position of alarm value/deadband is linked to that of scale set value. Therefore, when the decimal point position of scale is changed in “8-2. Input Type Settings”, the decimal point position of alarm value/deadband will also be changed. Also, alarm deadband is set to an absolute value.
### List of Alarm setting parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Select level for setting</td>
<td>1 to 4</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>Select alarm type</td>
<td>None</td>
<td>None, H (upper), L (lower), B (diff upper), S (diff lower), U (rate-of-change upper), D (rate-of-change lower)</td>
</tr>
<tr>
<td>Value</td>
<td>Set alarm judgment value</td>
<td>-30000 to 99999</td>
<td>Decimal point position is the same as scale setting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For rate-of-change alarm, use absolute value.</td>
</tr>
<tr>
<td>D.Band</td>
<td>Set alarm deadband</td>
<td>0 to 99999</td>
<td>Decimal point position is the same as scale setting.</td>
</tr>
<tr>
<td>Comp.CH</td>
<td>Set CH (reference CH) compared with</td>
<td>1 to 4</td>
<td>*- Not set</td>
</tr>
<tr>
<td></td>
<td>the setting CH (Diff upper/lower alarm only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.TIME</td>
<td>Set reference period for calculating</td>
<td>0 to 600.0</td>
<td>Set period can be narrower than measuring interval. In this case, alarm judgment is made using the measuring interval.</td>
</tr>
<tr>
<td></td>
<td>variation width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay</td>
<td>Set delay time to output after alarm</td>
<td>0 to 6000</td>
<td>Minimum set value is 1sec.</td>
</tr>
<tr>
<td></td>
<td>detection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relay No.</td>
<td>Specify output relay No.</td>
<td>- (No output), 99 (internal circuit output), 1 to 12</td>
<td></td>
</tr>
<tr>
<td>And/Or</td>
<td>Select circuit type for output</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Message No.</td>
<td>Specify message No. printed at alarm</td>
<td>-</td>
<td>*- (Message not printed at alarm activation), 1 to 20</td>
</tr>
<tr>
<td>Activation</td>
<td>activation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Message No.</td>
<td>Specify message No. printed at alarm</td>
<td>-</td>
<td>*- (Message not printed at alarm reset), 1 to 20</td>
</tr>
<tr>
<td>Reset</td>
<td>reset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hold-DISP</td>
<td>Select whether to hold the status of display</td>
<td>*</td>
<td>*- Not Hold, Hold:Reset by KEY (hold until reset by key operation)</td>
</tr>
<tr>
<td></td>
<td>and &quot;ALM&quot; status LED at alarm activation</td>
<td></td>
<td>Hold:Reset by EX (hold until reset by remote contact)</td>
</tr>
<tr>
<td>Hold-OUT</td>
<td>Select whether to hold the status of alarm</td>
<td>*</td>
<td>*- Not Hold, Hold:Reset by KEY (hold until reset by key operation)</td>
</tr>
<tr>
<td></td>
<td>output at alarm activation</td>
<td></td>
<td>Hold:Reset by EX (hold until reset by remote contact)</td>
</tr>
<tr>
<td>Hold-EX</td>
<td>Specify remote contact No. used when &quot;Hold:</td>
<td>*</td>
<td>- *- (Not used), 1 to 10</td>
</tr>
<tr>
<td></td>
<td>Reset by EX&quot; is selected for &quot;Hold-DISP&quot; or</td>
<td></td>
<td>If alarm condition is cleared, on-hold alarm output status is reset when the specified remote contact No. turns ON.</td>
</tr>
<tr>
<td></td>
<td>&quot;Hold-OUT&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 5. Copying settings

Pressing the key on the list of alarm set contents displays the copy window for alarm settings. Move the cursor to the alarm level you want to copy with the keys.

![Copy Window](image)

Press the key to check the check box of desired alarm level.

After selecting alarm levels to be copied, specify the source and destination. Move the cursor to the source (Src.CH) and select CH with the keys (forward/reverse) and then press the key to register. When the cursor moves to the destination (Dest.CH), select CH likewise. Settings can be copied to specified channels collectively.

When the destination setting is completed, move the cursor to and press the key to start copying.

### Reference

A level selected for copying “alarm settings” includes all the parameters set for the level.
6. Checking alarm status

You can check if alarm is activated on the measured value display window which is normally displayed. However, to check the detail of activated alarm (alarm type, level, etc.), press the Func key on the measured value display window to open the alarm status check window.

The alarm status check window consists of the alarm status check window per channel, calendar timer ON/OFF check window and fail output status check window. Use the ▲/▼ keys to switch the window.

- Per-channel alarm status check window

<table>
<thead>
<tr>
<th>CH</th>
<th>DATA</th>
<th>Lvl1</th>
<th>Lvl2</th>
<th>Lvl3</th>
<th>Lvl4</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>a-b</td>
<td>Hold</td>
<td>Hold</td>
<td>Hold</td>
<td>Hold</td>
</tr>
<tr>
<td>02</td>
<td>c-d</td>
<td>Hold</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Select the channel you want to check. The cursor does not move to parameters other than CH.

The current alarm status is listed on the window. For a channel to which the alarm output and display are set to "Hold", information during alarm activation (measured value and alarm type) is displayed even after the alarm condition is cleared. At this time, "Hold" is shown on the window.

When alarm condition is cleared on the channel selecting “Hold” for alarm output and display and “KEY” as a reset method (Hold:Reset by KEY), select the channel with the ▲/▼ keys and press the Func key to reset the Hold status.

This alarm status check window contains the information obtained at the time the Func key is pressed on the measured value display window. To view the latest information, press the Func key on the alarm status check window.

You can also change "alarm settings" from this window. When a CH No. is selected by the Enter key, the setting window of alarm parameters will be displayed.

- Calendar timer ON/OFF check window

<table>
<thead>
<tr>
<th>No.</th>
<th>Timer ON</th>
<th>Timer OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>2010/07/01 10:30</td>
<td>2010/07/01 15:30</td>
</tr>
</tbody>
</table>

This window shows the timer ON No. (set time has already passed), set time (Timer ON) and scheduled reset time (Timer OFF).

Pressing the Func key can reset the Timer ON status.

- Fail output status check window

Information of the Fail
[Chart End] [Burn]
[SD Card] [Battery] [System Error]

This window shows a failed status (chart end, disconnection of input, SD card capacity low, backup battery level low or other system error).

* To enable the above display, you need to select “LCD” for each item according to “8-22. Fail Output Settings”.

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**8-4. Calculation Settings “Calc”**

Configure calculation settings to perform arbitrary calculation for each individual channel. Each calculation is performed at the same intervals as input. Data (including communications input) is processed according to the calculation settings except when the “calculation type (Kind)” is set to “None”. The processed data is displayed/recorded as each channel data. Also, alarm judgment is made on the processed data.

There are 16 types of calculation including “None”. When you select “Formula” or “BrokenLine”, you need to set corresponding parameters described in “8-5. Formula Settings” or “8-6. Broken Line Approximation Table Settings”.

### 1. Calculation types and set parameters

<table>
<thead>
<tr>
<th>Kind</th>
<th>Formula</th>
<th>Set parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
| Arithmetic 1 (MUL) | Ax + By + Cxy + D  
A, B, C, D: constant  
x, y: channel data | Decimal point position for result  
Constant (A, B, C, D)  
Channel No. of data (x, y) |
| Arithmetic 2 (DIV) | Ax + y + B  
A, B: constant  
x, y: channel data | Decimal point position for result  
Constant (A, B)  
Channel No. of data (x, y) |
| Natural logarithm (LOGe) | LOGex  
x: channel data | Decimal point position for result  
Channel No. of data (x) |
| Common logarithm (LOG10) | LOG10x  
x: channel data | Decimal point position for result  
Channel No. of data (x) |
| Exponent (Power) | e^x  
x: channel data | Decimal point position for result  
Channel No. of data (x) |
| Extraction of square root (Root) | (Ss – Sz)\(\sqrt{\frac{Rx – Rz}{Rs – Rz}} + Sz\)  
Rx: channel data (input voltage, etc.)  
Rs: range upper limit  
Rz: range lower limit  
Ss: scale upper limit  
Sz: scale lower limit | Decimal point position for result  
Channel No. of data (Rx) |
| Humidity | Calculated from measured value of dry bulb (x) and wet bulb (y) using relative humidity table  
x, y: channel data | Decimal point position for result  
Channel No. of data (x, y) |
| Max value (High-Peak) | Maximum measured value (x) in an interval | Decimal point position for result  
Interval |
| Min value (Low-Peak) | Minimum measured value (x) in an interval | Decimal point position for result  
Interval |
| Avg value (Average) | Average measured value (x) in an interval | Start time  
Channel No. of measured value (x) |
| Absolute value (ABS) | | Decimal point position for result  
Channel No. of data (x) |
| Integration (INT) | | Decimal point position for result  
Data communications channel No. (Reference No. is assigned to each CH.) |
| COM.Input | Communications input data (last updated communications input data regardless of communication type)  
Preset calculation cannot be performed for communications input data, but calculation using “Formula” is available. | Decimal point position for result  
Data communications channel No. (Reference No. is assigned to each CH.) |
| Formula | Arbitrarily entered formula | Decimal point position for result  
Formula (interval, start time, unit of integration* and integration reset method* and integration reset by remote contact ON*)  
* These become effective when “integration” is specified in a formula. |
| Broken line approximation (BrokenLine) | Break line approximation table  
Channel No. of data (x) | Decimal point position for result  
Broken line approximation table  
Channel No. of data (x) |

*1: If a measured value y is 0, the following value is obtained depending on Ax value.  
Ax > 0: OVER  
Ax = 0: 0  
Ax ≤ 0: -OVER

*2: This formula is used when the measured input voltage (Rx) is 1% or more of the set range (Rs – Rz).  
When it is less than 1%, the scale lower limit (Sz) is used.
2. Channels specifying calculation  
For channels specifying calculation, data after processing the specified calculation is recorded or displayed.

3. Calculating max/min/avg value  
1) Calculation reset  
Calculation is reset automatically at specified intervals. Therefore the maximum, minimum and average values are calculated in each interval.

2) Start time of calculation  
This is valid for the first calculation after setting only. Calculation is not performed and waited until start time. The calculated data during this waiting period is invalid.

4. Integration  
Integration operation can be processed on measured value of each channel and the result can be displayed/recorded.  
For a channel No. selecting integration, an alarm value is set for calculated (integrated) value.

The data (calculation result) of a calculation set channel is obtained using the following formula.

\[
\text{INT}_n = \text{INT}_{n-1} + \frac{\left(\text{PV}_n + \text{PV}_{n-1}\right) \times (T_n - T_{n-1})}{2} \times \text{Time Unit}
\]

\[
\text{INT}_n: \text{Integration value} \quad \text{INT}_{n-1}: \text{Last integration value}
\]

\[
\text{PV}_n: \text{Current measured value} \quad \text{PV}_{n-1}: \text{Last measured value}
\]

\[
T_n: \text{Current measurement time [sec]} \quad T_{n-1}: \text{Last measurement time [sec]}
\]

Time Unit: Unit of time  

*1: When the scale width is exceeded, the value at the maximum/minimum scale is used.

1) Resetting integration  

(1) Reset by remote contact  
When using remote contacts (optional), a start and reset of integration can be executed with a remote contact signal. When a calculation is started by a remote contact reset, integration value will be reset at set intervals.  
(See “13-1. External Operation Settings”.)

(2) Reset after specified interval  
After integration operation is started, the integration value is reset automatically after a specified interval and then the operation is restarted.

2) Max integration value  
The maximum integration value is 99999 (it actually depends on the decimal point position of result: 99.999 to 99999). If integration value exceeds the maximum value, it will be reset to 0 and the integration operation continues.
5. Parameter settings

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “Calc”.

(3) Move the cursor to the target channel with the ▲/▼ keys and press the **ENTER** key. The cursor does not move to parameters other than CH.

Pressing the **FUNC** key on this window displays the integration reset window. Also, pressing the **FUNC** key displays the copy window for calculation settings.

(4) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(5) Press the **ENTER** key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to **Set**.

(7) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.
## List of Calc setting parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kind</td>
<td>Select calculation type</td>
<td>None</td>
<td>None (No calculation), Root (square root), LOGe (natural logarithm), LOG10 (common logarithm), INT (integration), Humidity (humidity/temperature calculation) COM Input (data communications input), MUL (arithmetic 1), DIV (arithmetic 2), High-Peak (max value), Low-Peak (min value), Average (average calculation), Power (exponent), ABS (absolute value calculation) Formula, BrokenLine (broken line approximation)</td>
</tr>
<tr>
<td>Decimal point</td>
<td>Set decimal point position for result</td>
<td>* 0 to 3</td>
<td></td>
</tr>
<tr>
<td>Form.No.</td>
<td>Specify formula No. when &quot;Formula&quot; is selected for Kind</td>
<td>* - (None), 1 to 12</td>
<td></td>
</tr>
<tr>
<td>Seg.Table No.</td>
<td>Specify broken line table No. when &quot;BrokenLine&quot; is selected for Kind</td>
<td>* - (None), 1 to 6</td>
<td></td>
</tr>
<tr>
<td>CH.X</td>
<td>Specify CH for X data used by each calculation</td>
<td>* - (None), 1 to 4</td>
<td></td>
</tr>
<tr>
<td>CH.Y</td>
<td>Specify CH for Y data used by each calculation</td>
<td>* - (None), 1 to 4</td>
<td></td>
</tr>
<tr>
<td>Const.A</td>
<td>Set calculation constant A when arithmetic 1 or 2 is selected for Kind</td>
<td>* -30000 to 99999 Up to three digits after decimal point can be set. Example: -30.000</td>
<td></td>
</tr>
<tr>
<td>Const.B</td>
<td>Set calculation constant B when arithmetic 1 or 2 is selected for Kind</td>
<td>* -30000 to 99999 Up to three digits after decimal point can be set. Example: -30.000</td>
<td></td>
</tr>
<tr>
<td>Const.C</td>
<td>Set calculation constant C when arithmetic 1 is selected for Kind</td>
<td>* -30000 to 99999 Up to three digits after decimal point can be set. Example: -30.000</td>
<td></td>
</tr>
<tr>
<td>Const.D</td>
<td>Set calculation constant D when arithmetic 1 is selected for Kind</td>
<td>* -30000 to 99999 Up to three digits after decimal point can be set. Example: -30.000</td>
<td></td>
</tr>
<tr>
<td>[Start]</td>
<td>Set calculation start time</td>
<td>* - (None), 00 : 00 to 23 : 59 When &quot;-&quot; is set, following operations are performed. Integration: Operated by external reset Formula: Operated at power-on or immediately after setting is made</td>
<td></td>
</tr>
<tr>
<td>[Interval]</td>
<td>Set calculation interval</td>
<td>* - (None), 00 : 00 to 24 : 59 Setting &quot;-&quot; or &quot;00 : 00&quot; disables interval.</td>
<td></td>
</tr>
<tr>
<td>TimeUnit</td>
<td>Unit of integration time</td>
<td>* Hour, Min, Sec</td>
<td></td>
</tr>
<tr>
<td>INT-Reset</td>
<td>Set integration reset method for calculations using integration</td>
<td>* None (reset not performed), Interval (specified interval), EX (All) (all reset by remote contact), EX (individual reset by remote contact)</td>
<td></td>
</tr>
<tr>
<td>INT-Reset.EX</td>
<td>Specify remote contact No. used when &quot;EX&quot; is selected for &quot;INT-Reset&quot;</td>
<td>* - (None), 1 to 10</td>
<td></td>
</tr>
</tbody>
</table>
8-5. Formula Settings “Formula”

Set a formula used when “Formula” is selected for Kind in “calculation settings”. Up to 12 formulas, which are shared by all channels, can be registered using a character string consisting of 50 characters at maximum.

1. Calculation type
Arithmetic operation
Four arithmetic operations are performed.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition</td>
<td>+</td>
<td>X + Y</td>
</tr>
<tr>
<td>Subtraction</td>
<td>-</td>
<td>X - Y</td>
</tr>
<tr>
<td>Multiplication</td>
<td>*</td>
<td>X * Y</td>
</tr>
<tr>
<td>Division</td>
<td>/</td>
<td>X / Y</td>
</tr>
<tr>
<td>Remainder</td>
<td>%</td>
<td>X % Y</td>
</tr>
<tr>
<td>Power</td>
<td>^</td>
<td>X ^ Y</td>
</tr>
</tbody>
</table>

* X and Y represent formula or numeric value.

Comparison operation
Result is expressed by 1 (true) or 0 (false).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>==</td>
<td>X == Y</td>
</tr>
<tr>
<td>Unequal</td>
<td>!=</td>
<td>X != Y</td>
</tr>
<tr>
<td>Greater than</td>
<td>&gt;&gt;</td>
<td>X &gt;&gt; Y</td>
</tr>
<tr>
<td>Less than</td>
<td>&lt;&lt;</td>
<td>X &lt;&lt; Y</td>
</tr>
<tr>
<td>Greater than or equal to</td>
<td>&gt;=</td>
<td>X &gt;= Y</td>
</tr>
<tr>
<td>Less than or equal to</td>
<td>&lt;=</td>
<td>X &lt;= Y</td>
</tr>
</tbody>
</table>

* X and Y represent formula or numeric value.

Logical operation
Logical operation is performed and either 1 or 0 is returned as a result.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical AND</td>
<td>AND</td>
<td>X AND Y</td>
</tr>
<tr>
<td>Logical OR</td>
<td>OR</td>
<td>X OR Y</td>
</tr>
<tr>
<td>Exclusive OR</td>
<td>XOR</td>
<td>X XOR Y</td>
</tr>
<tr>
<td>Negation</td>
<td>NOT</td>
<td>NOT(X)</td>
</tr>
</tbody>
</table>

* X and Y represent formula or numeric value. X and Y should indicate 0 or 1.

General calculation functions
Function calculation is performed.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round up to whole number</td>
<td>CEL</td>
<td>CEL(X)</td>
</tr>
<tr>
<td>Round down to whole number</td>
<td>FLR</td>
<td>FLR(X)</td>
</tr>
<tr>
<td>Absolute value</td>
<td>ABS</td>
<td>ABS(X)</td>
</tr>
<tr>
<td>Square root</td>
<td>SQR</td>
<td>SQR(X)</td>
</tr>
<tr>
<td>Power of e</td>
<td>EXP</td>
<td>EXP(X)</td>
</tr>
<tr>
<td>Natural logarithm (bottom e)</td>
<td>LOG</td>
<td>LOG(X)</td>
</tr>
<tr>
<td>Common logarithm (bottom 10)</td>
<td>LOG10</td>
<td>LOG10(X)</td>
</tr>
</tbody>
</table>

* X represents formula or numeric value.
Channel data calculation functions

Function calculation is performed. An error occurs when measured data contains error data (±OVER, etc.).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>CH</td>
<td>CH(X)</td>
</tr>
<tr>
<td>Calculation result</td>
<td>PCH</td>
<td>PCH(X)</td>
</tr>
<tr>
<td>Previous result</td>
<td>OCH</td>
<td>OCH(X)</td>
</tr>
<tr>
<td>Integration</td>
<td>ITG</td>
<td>ITG(X)</td>
</tr>
<tr>
<td>24-hour integration</td>
<td>ITG24</td>
<td>ITG24(X)</td>
</tr>
<tr>
<td>F value</td>
<td>FV</td>
<td>FV(X#To#Z#R)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>RH</td>
<td>RH(D#W)</td>
</tr>
<tr>
<td>Dew-point temp</td>
<td>DEW</td>
<td>DEW(T#H)</td>
</tr>
<tr>
<td>Moving average</td>
<td>AVE</td>
<td>AVE(X#T)</td>
</tr>
<tr>
<td>Past data</td>
<td>OLD</td>
<td>OLD(X#T)</td>
</tr>
<tr>
<td>First-order lag filter</td>
<td>IIR</td>
<td>IIR(X#T)</td>
</tr>
<tr>
<td>Increment per unit time</td>
<td>PLS</td>
<td>PLS(X#T)</td>
</tr>
</tbody>
</table>

* X represents channel number.

* When a formula specifies a calculation result in it and the specified channel No. is larger than the calculating channel No., the last calculation result will be used.

Function to get system information

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD card remaining amount</td>
<td>SD</td>
<td>SD(A)</td>
</tr>
</tbody>
</table>

Other functions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind display</td>
<td>AZI</td>
<td>AZI(A)</td>
</tr>
<tr>
<td>Broken line approximation</td>
<td>LIC</td>
<td>LIC(A)</td>
</tr>
</tbody>
</table>

2. Integration

The ITG or ITG24 function is used to perform integration operation. The integration function cannot be used more than once in a formula. Ignoring this causes erroneous calculation. Combining with another type of calculation is possible.

Example: \( \text{ITG}(1) + \text{ITG}(2) \) \( \text{ITG24}(1) - \text{ITG}(1) \) \( \text{ITG}(1) / 100 \)

Integration value is reset at every start time and intervals specified in “calculation settings” for ITG function, and at every start time for ITG24 function.
1) Normal integration
Integration value is reset at every reference time and interval.
Entering a formula
ITG(X)
X: Channel No. of integration target

Calculation detail
\[ D_n = D_{n-1} + \frac{(PV_n + PV_{n-1}) 	imes (T_n - T_{n-1})}{2} \]

\( D_n \): Integration result
\( D_{n-1} \): Last integration result
\( PV_n \): Integration target data
\( PV_{n-1} \): Last integration target data
\( T_n \): Calculation time
\( T_{n-1} \): Last calculation time

If error data (±OVER, etc.) is included, calculation will not be performed and the last result will be valid.

2) 24-hour integration
Integration value is reset only at reference time (start time).

Entering a formula
ITG24(X)
X: Channel No. of integration target

Calculation detail is the same as normal integration.

3. F value
Entering a formula
FV(X#To#Z#R)
X: Channel No. of calculation target, To: Reference temperature for F value calculation, Z: Z value, R: Start temperature for F value calculation

F value is obtained from the following calculation.
\[ \int 10^A dt \] where \( A = \frac{(T - To)}{Z} \)
T: Calculation target channel data

When T value exceeds R value, F value will be reset to 0.

4. Relative humidity
Entering a formula
RH(D#W)
D: Channel No. of dry bulb temperature, W: Channel No. of wet bulb temperature

Relative humidity is obtained from the following formula.
\[ \frac{((B - 0.000662 \times 1013.0 \times (Ddata - Wdata)) - A) \times 100}{A} \]
A: Dry bulb saturated water vapor pressure, B: Wet bulb saturated water vapor pressure, Ddata: Dry bulb temperature, Wdata: Wet bulb temperature

The following formula is used to obtain a value of saturated water vapor pressure.
\[ 6.1121 \times \exp \left( \frac{(17.502 \times T)}{(240.9 + T)} \right) \] T: Temperature
5. Dew-point temperature

Entering a formula

\[ \text{DEW}(T\#H) \]

- T: Channel No. of temperature data, H: Channel No. of relative humidity

Dew-point temperature is obtained from the following calculation.

\( t \): Temperature data
\( h \): Relative humidity data
\( D \): Dew-point temperature

(1) \( K = t + 273.15 \)
(2) When \( t \geq 0 \):
   \[ W = \exp\left(\frac{-5800.2206}{K} + 1.3914993 + K \times (-0.048640239 + K \times (0.41764768 \times 10^{-4} - 0.14452093 \times 10^{-7} \times K)) + 6.5459673 \times \log(K)\right) / 1000 \]
   When \( t < 0 \):
   \[ W = \exp\left(\frac{-5674.5359}{K} + 6.3925247 + K \times (-9.677843 \times 10^{-3} + K \times (0.62215701 \times 10^{-6} + K \times (0.20747825 \times 10^{-8} - 9.484024 \times 10^{-13} \times K))\right) + 4.1635019 \times \log(K) / 1000 \]
(3) \( S = \frac{W \times h}{100} \)
(4) \( P = S \times 1000 \)
(5) \( Y = \log(P) \)
(6) When \( P \geq 611.2 \):
   \[ D = -77.199 + Y \times (13.198 + Y \times (-0.63772 + 0.071098 \times Y)) \]
   When \( P < 611.2 \):
   \[ D = -60.662 + Y \times (7.4624 + Y \times (0.20594 + 0.016321 \times Y)) \]

6. Moving average

Entering a formula

\[ \text{AVE}(X\#T) \]

- X: Data channel No., T: Time-line range (x 0.1sec)

An average value in the past T seconds is calculated.

<table>
<thead>
<tr>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling period</td>
</tr>
<tr>
<td>T range</td>
</tr>
</tbody>
</table>

7. Past data

Entering a formula

\[ \text{OLD}(X\#T) \]

- X: Data channel No., T: Backward time (x 0.1sec)

Data obtained T seconds before is acquired.

<table>
<thead>
<tr>
<th>OLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling period</td>
</tr>
<tr>
<td>T range</td>
</tr>
</tbody>
</table>
8. First-order lag filter
Entering a formula
$IIR(X\#T)$

X: Data channel No., T: Time constant (x 0.1 sec)

First-order lag filter calculation is processed on the channel X data.

Calculation detail
$\{dt - (dt + t)} \times (x - d) + d$

$dt$: Sampling time
$t$: Time constant
$x$: Current value of channel X
$d$: Last calculation result

9. Increment per unit time
Entering a formula
$PLS(X\#T)$

X: Data channel No., T: Unit time (1 to 10 x 0.1sec)

Increment per unit time is calculated. Specify a channel selecting integration operation for X.

When using PLS function, the data will be invalid when a reset of integration value occurs at a set time or by another reason except overflow (because the same process as overflow reset is performed internally). Formulate the operation in consideration of reset of integration value.

10. Wind display
Entering a formula
$AZI(A)$

A: Wind data

Wind display is made by converting numeric data into direction.

See the following table for the relation between wind data and displayed direction.

When A has a decimal fraction, the nearest direction will be displayed. Example: 1.2 → NNE

<table>
<thead>
<tr>
<th>A</th>
<th>Display</th>
<th>A</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>WNW</td>
<td>11</td>
<td>WSW</td>
</tr>
<tr>
<td>-2</td>
<td>NW</td>
<td>12</td>
<td>W</td>
</tr>
<tr>
<td>-1</td>
<td>NNW</td>
<td>13</td>
<td>WNW</td>
</tr>
<tr>
<td>0</td>
<td>N</td>
<td>14</td>
<td>NW</td>
</tr>
<tr>
<td>1</td>
<td>NNE</td>
<td>15</td>
<td>NNW</td>
</tr>
<tr>
<td>2</td>
<td>NE</td>
<td>16</td>
<td>N</td>
</tr>
<tr>
<td>3</td>
<td>ENE</td>
<td>17</td>
<td>NNE</td>
</tr>
<tr>
<td>4</td>
<td>E</td>
<td>18</td>
<td>NE</td>
</tr>
<tr>
<td>5</td>
<td>ESE</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>6</td>
<td>SE</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>7</td>
<td>SSE</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Also, the scale of the channel selecting wind display as calculation type uses wind scale.
11. **Broken line approximation**

Entering a formula

\[ \text{LIC}(X\#A) \]

- X: Data channel No.
- A: Defined broken line approximation table No.

"Broken line approximation" can be added in a formula, and the first-order approximation can be performed for up to 30 broken lines.

Broken line is defined separately using up to six tables, and the table No. is specified in a formula (see "8-6. Broken Line Approximation Table Settings").

Calculation is performed using the following formula according to the specified table parameters.

\[ A_n < X_1 < A_{n+1} \frac{(B_{n+1} - B_n)}{(A_{n+1} - A_n)} \times (X_1 - A_n) + B_n \]

12. **Examples of combining different operations**

- \((\text{CH(1) } \times 3 - 20) / 6\)
  
  ("Channel 1 raw data" \( \times 3 - 20 \) \( \div 6 \))

- \((\text{CH(1)} + \text{CH(2)}) << 300\)
  
  Result will be 1 when the sum of channel 1 and channel 2 raw data is smaller than 300.

- \(\text{ABS(CH(1))} >= 50\)
  
  Result will be 1 when the absolute value of channel 1 is greater than or equal to 50.

- \((\text{PCH(1)} >= 100) \text{ AND } (\text{PCH(2)} <= 50)\)
  
  Result will be 1 when the channel 1 data is greater than or equal to 100, and the channel 2 data is less than or equal to 50.

**Note**

Combination of functions

Following functions cannot be combined together. Combining these functions causes calculation error.

- ITG, ITG2, AVE, AVEH, OLD, OLDH, IIR

Example of formula which delivers a false result: AVE(OLD(1#10)#60)
13. Parameter settings

(1) Pressing the [MENU] key displays the menu window (list of setting items).

(2) Select “Formula”.

(3) Move the cursor to the target formula No. with the ▲/▼ keys and press the [ENTER] key. The cursor does not move to parameters other than formula No. Also, pressing the [FUNC] key on this window displays the copy window for formula settings.

(4) Press the [ENTER] key to make it available for setting and then enter a formula.

(5) After completing the setting of this item, move the cursor to [Set].

(6) Press the [ENTER] key to register the setting (when chart recording is ON, a setting change mark is printed). To cancel the setting, press the [ESC] key.

[Formula setting parameter]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>Set formula used when “Formula” is selected as “calculation type” using up to 50 characters</td>
<td>Not set</td>
<td></td>
</tr>
</tbody>
</table>
### 8-6. Broken Line Approximation Table Settings “Seg.Tbl”

Set the table used when “BrokenLine” is selected as calculation type.

Up to six tables can be set, and up to 30 points can be set to each table. For channels selecting “BrokenLine” as calculation type, a table can be selected individually from six options.

(1) Pressing the <menu> key displays the menu window (list of setting items).

(2) Select “Seg.Tbl”.

(3) Pressing the <func2> key advances the table number. Press the <enter> key to select the target table.

Also, pressing the <func2> key on this window displays the copy window for table settings.

(4) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(5) Press the <enter> key to make it available for setting and then enter a value.

(6) After completing the settings of this item, move the cursor to  Set .

(7) Press the <enter> key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the <esc> key.

#### [List of Seg.Tbl setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X.Dot</td>
<td>Set decimal point position of X axis factor</td>
<td>0</td>
<td>0 to 3</td>
</tr>
<tr>
<td>Y.Dot</td>
<td>Set decimal point position of Y axis factor</td>
<td>0</td>
<td>0 to 3</td>
</tr>
<tr>
<td>X-01 to X-30</td>
<td>Set X1 to X30 of broken line approximation table</td>
<td>-</td>
<td>(Not set), -30000 to 99999</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When “-” is selected, subsequent X factor settings will be disabled.</td>
</tr>
<tr>
<td>Y-01 to Y-30</td>
<td>Set Y1 to Y30 of broken line approximation table</td>
<td>-</td>
<td>(Not set), -30000 to 99999</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When “-” is selected, subsequent Y factor settings will be disabled.</td>
</tr>
</tbody>
</table>
8-7. Chart Speed Settings “Chart”

Set the chart speed. When using remote contacts (optional), see also “13-1. External Operation Settings”.

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “Chart”.

(3) 3-speed setting is available only when using remote contacts (optional). Move the cursor to the chart speed to be set, and press the **ENTER** key to make it available for setting and then enter a value. Set a desired speed within the range of (unit: 1mm) 1 to 600mm/H or 1 to 200mm/M, but 12.5mm/H is an exception.

(4) After completing the settings of this item, move the cursor to **Set**.

(5) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

[List of Chart setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChartSpeed1</td>
<td>Set chart speed 1</td>
<td>25</td>
<td>1 to 600 (mm/H)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 to 200 (mm/M)</td>
</tr>
<tr>
<td>ChartSpeed1unit</td>
<td>Select unit of chart speed 1</td>
<td>Mm/H, mm/M</td>
<td></td>
</tr>
<tr>
<td>ChartSpeed2 (optional)</td>
<td>Set chart speed 2</td>
<td>25</td>
<td>1 to 600 (mm/H)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 to 200 (mm/M)</td>
</tr>
<tr>
<td>ChartSpeed2 unit</td>
<td>Select unit of chart speed 2</td>
<td>Mm/H, mm/M</td>
<td></td>
</tr>
<tr>
<td>ChartSpeed3 (optional)</td>
<td>Set chart speed 3</td>
<td>25</td>
<td>1 to 600 (mm/H)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 to 200 (mm/M)</td>
</tr>
<tr>
<td>ChartSpeed3 unit</td>
<td>Select unit of chart speed 3</td>
<td>Mm/H, mm/M</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1** Setting a speed at 150mm/H or higher

All types of printing excluding time line printing, power-on printing, data printing, list printing and setting change mark will be disabled. (See “6-3.3. Restrictions on recording”.)
8-8. Time axis synchronization “POC”

This function is applicable to multiple pen type (2-pen, 3-pen and 4-pen types). The function adjusts time axis gaps between the each pen and print at the same moment on the chart.

1. Pen interval

In the standard printings, data at the same moment are not able to print on the chart paper with time axis due to the time axis gaps between the each pen. When the time axis synchronization is ON, the data for the gaps are stored in memory and when the chart paper is fed to the printing start point of the 1st pen, the stored data are printed. The printing except for the 1st pen are not executed at the real time, however there will be no time axis gaps the on the chart.

1. Pen interval

In the standard printings, data at the same moment are not able to print on the chart paper with time axis due to the time axis gaps between the each pen. When the time axis synchronization is ON, the data for the gaps are stored in memory and when the chart paper is fed to the printing start point of the 1st pen, the stored data are printed. The printing except for the 1st pen are not executed at the real time, however there will be no time axis gaps the on the chart.

2. Operation at turning on the power supply

When using the recorder as first time, 2nd pen, 3rd pen and 4th pen wait at left side until the chart is fed to the 1st pen starting time axis.

Using the recorder after the first time (power OFF to power ON), 2nd pen, 3rd pen, and 4th pen move as the 1st pen, however until they reach the 1st pen starting time axis, they print previous (before power OFF) data. Subsequently, printing is done at previous data not real-time data.

Note Change of the chart speed

Changing the setting of the chart speed clears memory of 2nd pen, 3rd pen and 4th pen. Therefore, 2nd pen, 3rd pen and 4th pen wait at left side until they reach 1st pen starting time axis.
3. Parameter settings

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “POC”.

(3) Press **ENTER** key to enable settings then select set value.

(4) After setting of this item is finished, move the cursor to **Set**.

(5) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

[List of POC setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>POC ON/OFF</td>
<td>Select time axis synchronization ON/OFF.</td>
<td>OFF</td>
<td>OFF(without synchronization), ON(with synchronization)</td>
</tr>
</tbody>
</table>

Reference

Time axis synchronization mark

Print marks listed below when switching ON or OFF.

(1) Time of change
(2) POC mark
(3) ON or OFF

(1) (2) (3)
8-9. Subtract Printing Settings “Sub Prt”

Subtract printing can be set using either of the following method: (1) use channel C data as difference between channel A and channel B, or (2) use channel E data as difference between channel D and a reference value. Channels used for subtract printing are also used for normal measurement. Therefore, for 4 pen type specification, channel 1 to 4 can be used for subtract printing.

\[
\begin{align*}
(1) & \quad \text{Channel C data} = \text{Channel A data} - \text{Channel B data} \\
(2) & \quad \text{Channel E data} = \text{Channel D data} - \text{Reference value}
\end{align*}
\]

* For the case of type (1) above, the decimal point position depends on the channel data of minuend.

1. Setting chart recording range

Make sure to perform input type settings described in “8-2. Input Type Settings” before performing subtract printing (see Note 3). “Difference value” is recorded as channel C or E data in subtract printing. Therefore, the chart recording range for subtract printing is required and it is set by specifying the upper and lower limits. Also, unit is set when needed. It is necessary to estimate “difference value” beforehand to set the chart recording range.

**Example of subtract printing between 2 channels**

- Chart recording range of channel A
  - Data (325°C)
  - Chart recording range of channel B
  - Data (350°C)
- Chart recording range of channel C
  - Subtract printing (+/-) when the difference between channel A / channel B data is 0°C
  - Chart recording range of channel D
  - Subtract printing (+/-) when the reference value is 0°C

**Note 1** Setting reference value

Set Const (reference value) within five digits. The decimal point position is linked to the scale setting which is set in input type settings.

**Note 2** Specifying channel for subtract printing

You can select any channel for subtract printing. For example, CH02 can be specified to handle the result of CH01 - CH02. In this case, the display or record of CH02 (on a chart or SD card) will be “difference”.

**Note 3** For the case DC voltage is selected for INPUT in input type settings

For a scale-set channel selecting DC voltage input, difference calculation is performed using the scaling value (actual scale value).
2. Parameter settings

(1) Pressing the MENU key displays the menu window (list of setting items).

(2) Select “Sub Prt”.

(3) Move the cursor to the target channel with the ▲/▼ keys and press the ENTER key.
   The cursor does not move to parameters other than CH.
   Also, pressing the FUNC key on this window displays the copy window for subtract printing settings.

(4) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(5) Press the ENTER key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to Set.

(7) Press the ENTER key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the ESC key.

[List of Sub Prt setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kind</td>
<td>None</td>
<td>None, CH.X - CH.Y, CH.X - Const</td>
<td></td>
</tr>
<tr>
<td>CH.X</td>
<td>Set measuring CH as minuend</td>
<td>*</td>
<td>1 to 4</td>
</tr>
<tr>
<td>CH.Y</td>
<td>Set measuring CH as subtrahend</td>
<td>*</td>
<td>1 to 4</td>
</tr>
<tr>
<td>Const</td>
<td>Set reference value subtracted from CH.X</td>
<td>*</td>
<td>-30000 to 99999</td>
</tr>
<tr>
<td></td>
<td>Decimal point position is the same as CH.X scale setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub.REC-L</td>
<td>Set lowest end of recording range for subtract printing</td>
<td>*</td>
<td>-30000 to 99999</td>
</tr>
<tr>
<td></td>
<td>Decimal point position is the same as CH.X scale setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub.REC-H</td>
<td>Set highest end of recording range for subtract printing</td>
<td>*</td>
<td>-30000 to 99999</td>
</tr>
<tr>
<td></td>
<td>Decimal point position is the same as CH.X scale setting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.
8-10. Periodic (Data Interval) Data Printing Settings “DataInt”

In addition to the trace printing on a chart, measured data of each channel can be printed numerically. Measured data can be recorded or printed digitally at desired intervals. Select ON/OFF to enable or disable digital recording/printing for each channel (DIGI.REC) in input type settings described in “8-2. Input Type Settings”.

1. Pressing the [MENU] key displays the menu window (list of setting items).

2. Select “DataInt”.

3. Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

4. Press the [ENTRY] key to make it available for setting and then enter a value.

5. After completing the setting of this item, move the cursor to [Set].

6. Press the [ENTRY] key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the [ESC] key.

[List of DataInt setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>StartTime</td>
<td>Set start time of periodic data printing (When a set time is before the current time, periodic data printing is executed next day.)</td>
<td>00:00</td>
<td>00:00 to 23:59</td>
</tr>
<tr>
<td>Interval</td>
<td>Set interval between printings of numeric measured data (every 24 hours 59 minutes and 1 minute at maximum)</td>
<td>00:00</td>
<td>00:00 to 24:59</td>
</tr>
</tbody>
</table>

Reference: Calculating the shortest interval

The shortest interval depends on the chart speed and the number of digital recording/printing channels. If a set interval is inappropriate for the specified chart speed, printing will be executed with a timing of the minimum integral multiple of the interval.

\[
\text{Interval [M]} \geq \frac{180 \times \text{printing lines} \times 2}{\text{Chart speed [mm/H]}} \times 1
\]

Note: Interval less than 5 min cannot be set.
*1: The lowest speed of three speeds is used.
*2: Differs depending on the chart speed and the number of digital recording/printing channels.

<table>
<thead>
<tr>
<th>Chart speed</th>
<th>1CH</th>
<th>2CH</th>
<th>3CH</th>
<th>4CH</th>
</tr>
</thead>
<tbody>
<tr>
<td>99mm/H or less</td>
<td>1 row</td>
<td>1 row</td>
<td>2 row</td>
<td>3 row</td>
</tr>
<tr>
<td>100mm/H or more</td>
<td>1 row</td>
<td>2 row</td>
<td>3 row</td>
<td>4 row</td>
</tr>
</tbody>
</table>

Note: This differs from the number of skipped channels.
8-11. Periodic (Specified Time) Data Printing Settings “PrtTime”

When the interval described in “8-11. Periodic (Data Interval) Data Printing Settings” is set to “00:00”, printing at specified time becomes effective. Time can be specified for up to 24 points and it can be set to ON/OFF individually.

1. Pressing the MENU key displays the menu window (list of setting items).

2. Select “PrtTime”.

3. Move the cursor to the target No. with the ▲/▼ keys and press the ENTER key. The cursor does not move to parameters other than No. Pressing the FUNC key on this window turns ON/OFF printing at specified time. Also, pressing the FUNC key displays the copy window for specified time data printing settings.

4. Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

5. Press the ENTER key to make it available for setting and then enter a value.

6. After completing the setting of this item, move the cursor to Set.

7. Press the ENTER key to register the setting (when chart recording is ON, a setting change mark is printed). To cancel the setting, press the ESC key.

<table>
<thead>
<tr>
<th>PrtTime setting parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>PrintTime</td>
</tr>
</tbody>
</table>

Reference: ON/OFF setting for each print time No.

When [Print Time] is set to “-”, the setting of the relevant No. of specified time will be disabled.
8-12. List Printing Settings “ListPrt”

List printing is used to check the set contents. Contents to be printed depend on the list number.

1. Pressing the [MENU] key displays the menu window (list of setting items).
2. Select “ListPrt”.
3. Press the [ENTER] key to make it available for setting and then select the list number. Contents to be printed will be shown on the right.
4. Move the cursor to [Print].
5. Pressing the [ENTER] key moves cartridge pen to the end of the left side and the chart paper forwards slightly then starts list printing. Press the [ESC] key to cancel.

Printed contents by List No.]

<table>
<thead>
<tr>
<th>List No.</th>
<th>Printed contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Date, Time, CH.Info (channel settings), Rec.Info (recording settings), ALM.Info (alarm settings)</td>
</tr>
<tr>
<td>2</td>
<td>Additional Setting, Option Setting Time</td>
</tr>
<tr>
<td>3</td>
<td>Date, Time, CH.Info (channel settings), Rec.Info (recording settings), ALM.Info (alarm settings), Additional Setting, Option Setting Time</td>
</tr>
</tbody>
</table>

Note 1  Inexecutable case
List printing is available only when recording is ON.

Note 2  Stopping list printing
To stop list printing, turn the recording status OFF and then ON again. List printing stops when the currently printing line is finished. When list printing is stopped, it cannot be resumed, so you need to set list printing again to perform it.

Note 3  Operation at printing in process
Trace printing by cartridge pen is not executed. Other operations are executed continuously without interruption. During list printing, setting change is not available. However, setting confirmation is available.

Example of list printing
8-13. Message Printing 1 Settings “MsgPrt1”

A message consisting of 15 characters at maximum can be printed and up to 20 types of message can be registered. It is also possible to print a registered message in conjunction with the calendar timer or remote contacts (calendar timer and remote contacts should be set separately).

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “MsgPrt1”.

(3) Move the cursor to the target message No. with the ▲/▼ keys and press the ** ENTER** key. The cursor does not move to parameters other than No. Also, pressing the **FUNC1** key on this window prints the message of selected No. When “*** Start printing? ***” is displayed, press the ** ENTER** key. Pressing the **FUNC2** key displays the copy window for message settings.

(4) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(5) Press the ** ENTER** key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to **Set**.

(7) Press the ** ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

[List of MsgPrt1 setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message</td>
<td>Set a string consisting of up to 15 characters to be printed</td>
<td>Not set</td>
<td></td>
</tr>
</tbody>
</table>
8-14. Message Printing 2 Settings “MsgPrt2”

A message consisting of up to 72 characters is printed on a chart with arbitrary timing. Message is registered at the time of printing and the last registered message is shown on the setting window.

- Pressing the \textit{MENU} key displays the menu window (list of setting items).

- Select “MsgPrt2”.

- Move the cursor to the parameter to be set with the \textit{▲}/\textit{▼}/\textit{◄}/\textit{►} keys.

- Press the \textit{ENTER} key to make it available for setting and then select or enter a value.

- After completing the settings of this item, move the cursor to \textit{Print}.

- Pressing the \textit{ENTER} key displays the message “**** Start printing? ****”. Press the \textit{ENTER} key again to start message printing. Press the \textit{ESC} key to cancel printing.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message</td>
<td>Set a string consisting of up to 72 characters to be printed</td>
<td>Not set</td>
<td></td>
</tr>
</tbody>
</table>
| 5mm Feed    | No: Prints message in synchronization with chart speed while executing trace printing  
                   Yes: Interrupts trace printing and prints message regardless of chart speed | No      | No (no feed), Yes (feed) |
8-15. Recording Format Settings “PrtForm”

Set the format for trace printing depending on the intended use. This function is provided to select the format used for trace printing. Input range and its accuracy are determined by the settings made in “8-2. Input Type Settings”.

The recording format cannot be set for each individual channel. Select one from the following options which is shared by all channels. However, when selecting the automatic range-shift or compressed/expanded printing, whether or not to use the function can be specified for each channel. A channel specified not to use the function will use the standard format.

- Automatic range-shift ····················· Recording range is shifted automatically depending on the input range.
- Compressed/expanded printing ······· Chart recording area can be partially shrunk or expanded.
- Zone printing ······························· Chart recording area can be divided into four areas at maximum.

(1) Pressing the [MENU] key displays the menu window (list of setting items).

(2) Select “PrtForm”.

(3) Press the [ENTER] key to make it available for setting and then select a value.

(4) After completing the setting of this item, move the cursor to [Set]

(5) Press the [ENTER] key to register the setting (when chart recording is ON, a setting change mark is printed). To cancel the setting, press the [ESC] key.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printing Format</td>
<td>Select recording format</td>
<td>Standard, Auto Range Normal (automatic range-shift normal), Auto Range Overlap (automatic range-shift overlap), Comp.&amp;Exp.Print (compressed/expanded printing), Zone Print (parallel scale)</td>
<td></td>
</tr>
</tbody>
</table>
When “Auto Range” is selected for recording format, set the related items. There are two types of automatic range-shift: “Normal” and “Overlap”, the former has separate ranges and the latter has ranges overlapping each other partially around the lower/upper limit. Chart recording range is switched between five ranges at maximum for “Normal” or three ranges at maximum for “Overlap” depending on the measured value. To switch from “Normal” to “Overlap” or vice versa, you need to reset the related items.

- Individual setting available for channels.
- Recording range can be set arbitrarily regardless of the setting of range/chart recording upper and lower limits.
- When a measured value is near a range-shift point, chattering of recording at 0% or 100% position may occur. To prevent this, a range-shift is performed at the point where a measured value exceeds the lower (zero) or higher (span) limit of each range by 0.5mm.
- You can use a copy function for the setting. However, note that the decimal point position depends on the value at destination even if the source value has different decimal point position.

Example: Source value “120.3”, value at destination “20.05” → value after copy “12.03”
* Make sure that the recording format is set to “Auto Range (automatic range-shift)” and then perform the following settings.

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “A.Range”.

(3) Move the cursor to the target channel with the ▲/▼ keys and press the **ENTER** key. The cursor does not move to parameters other than CH.

Also, pressing the **FUNC** key on this window displays the copy window for Auto Range settings.

(4) Press the **ENTER** key while the cursor is on “Auto Range ON/OFF” and select ON.

(5) Move the cursor to the parameter to be set with the ▲/▼ keys.

(6) Press the **ENTER** key to make it available for setting and then select or enter a value.

If the set value of 1st Max is equal to or less than 1st Min value, it will not be accepted.

The set value should be: 1st Min < 1st Max < 2nd Max < 3rd Max …

(7) After completing the settings of this item, move the cursor to **Set**.

(8) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Range ON/OFF</td>
<td>Set lowest end of 1st range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>1st Min</td>
<td>Set lowest end of 1st range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>1st Max</td>
<td>Set highest end of 1st range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>2nd Min</td>
<td>Set lowest end of 2nd range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>2nd Max</td>
<td>Set highest end of 2nd range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>1st Max</td>
<td>Set highest end of 1st range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>3rd Max</td>
<td>Set highest end of 3rd range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>3rd Min</td>
<td>Set lowest end of 3rd range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>4th Max</td>
<td>Set highest end of 4th range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>2nd Max</td>
<td>Set highest end of 2nd range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>5th Max</td>
<td>Set highest end of 5th range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
<tr>
<td>3rd Max</td>
<td>Set highest end of 3rd range</td>
<td>- (None), -30000 to 99999</td>
<td>Decimal point position is the same as CH scale setting</td>
</tr>
</tbody>
</table>
When “Comp. & Exp. Print” is selected for recording format, set the related items. A specified area within the chart recording range can be shrunk or expanded.

- Individual setting available for channels.
- Recording range can be set arbitrarily regardless of the setting of range/chart recording upper and lower limits.
- Up to two break points can be set, therefore three shrunk or expanded areas can be obtained at maximum.

![Example of compressed/expanded printing settings](image)

The diagram shows how the recording range can be compressed or expanded at different points. The chart illustrates the measuring range, recording position, and scale, with arrows indicating the points at which the range is compressed or expanded. The notation ▼ indicates a set point.
* Make sure that the recording format is set to “Comp.&Exp.Print (compressed/expanded printing)” and then perform the following settings.

(1) Pressing the \textbf{MENU} key displays the menu window (list of setting items).

(2) Select “Cmp&Exp”.

(3) Move the cursor to the target channel with the \textbf{▲} and \textbf{▼} keys and press the \textbf{ENTER} key. The cursor does not move to parameters other than CH.

Also, pressing the \textbf{FUNC} 2 key on this window displays the copy window for compressed/expanded printing settings.

(4) Move the cursor to the parameter to be set with the \textbf{▲}, \textbf{▼}, \textbf{◄}, \textbf{►} keys.

(5) Press the \textbf{ENTER} key to make it available for setting and then enter a value. Set POS (recording position) to 0 to 100% for a 0-180mm chart, satisfying the following condition: POS-1st < POS-2nd.

Also, set SCALE (recording range) to a scale value at the specified position with attention to the decimal point position.

(6) After completing the settings of this item, move the cursor to \textbf{Set}.

(7) Press the \textbf{ENTER} key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the \textbf{ESC} key.

**List of Cmp&Exp setting parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCALE-0</td>
<td>Set recording scale at 0% recording position</td>
<td>*</td>
<td>- (None), -30000 to 99999 Decimal point position is the same as specified CH scale</td>
</tr>
<tr>
<td>POS-1st</td>
<td>Set percentage of recording position of 1st break point to span</td>
<td>-</td>
<td>- (Not used), 1 to 99</td>
</tr>
<tr>
<td>SCALE-1st</td>
<td>Set recording scale of 1st break point</td>
<td>*</td>
<td>-30000 to 99999 Decimal point position is the same as specified CH scale</td>
</tr>
<tr>
<td>POS-2nd</td>
<td>Set percentage of recording position of 2nd break point to span</td>
<td>-</td>
<td>- (Not used), 1 to 99</td>
</tr>
<tr>
<td>SCALE-2nd</td>
<td>Set recording scale of 2nd break point</td>
<td>*</td>
<td>-30000 to 99999 Decimal point position is the same as specified CH scale</td>
</tr>
<tr>
<td>SCALE-100</td>
<td>Set recording scale at 100% recording position</td>
<td>*</td>
<td>- (None), -30000 to 99999 Decimal point position is the same as specified CH scale</td>
</tr>
</tbody>
</table>
8-18. Zone Printing Settings “ZonePrt”

When “Zone Print” is selected for recording format, set the number of divisions and recording area. Recording area can be divided into two to four, and you can select an area for recording. This is useful to avoid overlapping of recordings.

- CH or CH range is specified for each recording area.
- The recording range in each area uses the range specified by range/chart recording upper and lower limits.
- See the following table for recording positions [mm] which vary by the number of divisions.

Example of zone printing setting

<table>
<thead>
<tr>
<th>Division</th>
<th>1st area</th>
<th>2nd area</th>
<th>3rd area</th>
<th>4th area</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0 to 81</td>
<td>99 to 180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0 to 54</td>
<td>63 to 117</td>
<td>126 to 180</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0 to 36</td>
<td>45 to 81</td>
<td>99 to 135</td>
<td>144 to 180</td>
</tr>
</tbody>
</table>
* Make sure that the recording format is set to "Zone Print (zone printing)" and then perform the following settings.

1. Pressing the **MENU** key displays the menu window (list of setting items).

2. Select “ZonePrt”.

3. Press the **ENTER** key.

4. Move the cursor to the parameter to be set with the **▲/▼/◄/►** keys.

5. Press the **ENTER** key to make it available for setting and then select or enter a value.

6. After completing the settings of this item, move the cursor to **Set**.

7. Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

---

### List of Zoneprt setting parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone</td>
<td>Set number of divisions for zone printing</td>
<td>2</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Type</td>
<td>Area specification format</td>
<td>CH.X</td>
<td>CH.X, CH.X/CH.Y, CH.X - CH.Y, CH.X/CH.Y/CH.Z, CH.X - CH.Y/CH.Z, CH.X/CH.Y - CH.Z</td>
</tr>
<tr>
<td>CH.X</td>
<td>Selected from options</td>
<td>-</td>
<td>(Not used), 1 to 4</td>
</tr>
<tr>
<td>CH.Y</td>
<td>*</td>
<td>-</td>
<td>(Not used), 1 to 4</td>
</tr>
<tr>
<td>CH.Z</td>
<td>*</td>
<td>-</td>
<td>(Not used), 1 to 4</td>
</tr>
</tbody>
</table>

---

### Reference

**Area specification (Type)**

- (CH.X)Record CH.X to the specified area.
- (CH.X)/(CH.Y)Record CH.X and CH.Y to the specified area.
- (CH.X) - (CH.Y)Record CH.X - CH.Y to the specified area.
- (CH.X)/(CH.Y)/(CH.Z)Record CH.X, CH.Y and CH.Z to the specified area.
- (CH.X) - (CH.Y)/(CH.Z)Record CH.X - CH.Y and CH.Z to the specified area.
- (CH.X)/(CH.Y) - (CH.Z)Record CH.X and CH.Y - CH.Z to the specified area.

---

### Note

**CH selection**

A channel not selected for any area will be skipped.

An error occurs when the same channel is set for multiple areas.
8-19. SD Card “SD CARD”

Measured data can be stored on an SD card at arbitrarily specified time and interval (0.1sec at maximum). Also, measurement/recording conditions including range, scale and chart speed can be stored on an SD card, and the stored data can be used to set up the instrument when needed.

SD card is an accessory part (sold separately). Use one provided by CHINO.

1. Attaching/removing SD card

   Insert an SD card with the label facing down into the insertion slot located at the front section of internal unit.
   When an SD card is inserted, the “CARD” status LED in the operation/set keys section flashes in green, and an error check is performed automatically. When the card is successfully recognized, the status LED stops flashing and stays on.
   To remove an SD card, you must take the steps for proper removal.
   (See “8-19.7. Removing SD card”.)
   SD card can be removed from the slot by pressing it inward and releasing it with your finger.

2. Operation

   There are three types of SD card operation menu: Recording data-Saving (settings related to measured data save), Setting Parameter (saving/loading setting parameters) and SD Card (removal/maintenance).
   When a recording to SD card starts, the status on the display turns from “SD” to “R”.

3. Handling

   Observe the following warnings and cautions to use SD card safely and prevent loss or damage to your property.

   **Warning**
   - Never disassemble or modify SD card. It may result in fire, electric shock or malfunction.
   - Do not use SD card in a location where it may get wet or condensation occurs. The internal circuit of SD card may be damaged in such a location.
   - Do not handle (attach/remove) SD card near small children to avoid accidental ingestion or other dangerous situations.

   **Caution**
   - Do not store SD card in a location exposed to direct sunlight, high temperature, high humidity or too much dust. It may degrade the quality by distortion or warping.
   - Do not apply strong impact by dropping, hitting or bending it. It may distort and damage SD card.
   - Store SD card with care not to allow dust to enter the connector.
   - To protect the internal circuit from static electricity, do not touch the connector (terminal) with your hand or a metal object.

   **Note**
   - Do not remove SD card or turn off the power while the “CARD” status LED is lit.
   - SD card has been formatted to FAT prior to shipment (SD card is an optional device).
   - Execution of format deletes all the stored data. Check the data before starting format.
   - While SD card is being accessed, never remove the SD card or turn off the unit connecting the SD card. Otherwise, the data of SD card may be destroyed or the unit itself may be damaged.
   - Please note that CHINO holds no responsibilities for losses resulting from damage or data loss of SD card.
   - Use SD card with 2GB or less memory and format to FAT16. Use CHINO’s SD card sold separately.
4. Settings related to measured data save
Set the format for recording measured data on SD card, trigger to start/stop recording and measuring interval.

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “SD CARD”.

(3) Make sure that the cursor is on Setting beside “Recording data-Saving” and then press the **ENTER** key.

(4) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(5) Press the **ENTER** key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to Set.

(7) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

To operate the start trigger with keys, set the start trigger to other than “None”. Even when the start trigger is set to other than “Key”, a start by key operation is given higher priority than other methods.

The same can be applied to the end trigger. Both start and end triggers can be executed on any window.

The confirmation message: ***Start recording to SD-Card? ***or ***Quit recording to SD-Card? ***will be displayed by pressing the **REC** key → **FUNC1** key. Press the **ENTER** key to execute or the **ESC** key to cancel.

Note 1 Relation between start time and start trigger
If a specified start time is before the current time, recording will start from the next day.

Note 2 Loading parameter during recording
When you load setting parameters while measured data is being recorded, the recording process will be stopped.

Note 3 Key operation for handling start trigger
To operate the start trigger with keys, set the start trigger to other than “None”. Even when the start trigger is set to other than “Key”, a start by key operation is given higher priority than other methods.

The same can be applied to the end trigger. Both start and end triggers can be executed on any window.

The confirmation message: ***Start recording to SD-Card? ***or ***Quit recording to SD-Card? ***will be displayed by pressing the **REC** key → **FUNC1** key. Press the **ENTER** key to execute or the **ESC** key to cancel.

Note 4 Measured data save
When the free space on SD card decreases to 1% or lower, the data may not be saved.
### List of Recording data-Saving setting parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>Select format for recording to SD card</td>
<td>Text</td>
<td>Binary: Uses “A4F” extension. Analysis software is required for data replay.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Text: Uses “TXT” extension. Data can be replayed with Microsoft Excel as needed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Binary (float): Binary (floating decimal point)</td>
<td>Text (float): Text (floating decimal point)</td>
</tr>
<tr>
<td>Start TRG.</td>
<td>Select trigger for recording start</td>
<td>Key</td>
<td>None (None), Key (started by REC + FUNC1 key), StartTime (specified time), Alarm (linked to alarm output), EX (linked to remote contact), Chart (linked to chart recording), Chart End (linked to chart end), Timer (linked to calendar timer)</td>
</tr>
<tr>
<td>[StartTime]</td>
<td>Set recording start time when selecting “StartTime” for Start TRG</td>
<td>*</td>
<td>00:00 to 23:59</td>
</tr>
<tr>
<td>End TRG.</td>
<td>Select trigger for recording stop</td>
<td>Key</td>
<td>Key (stopped by REC + FUNC1 key), Rec.time (specified time), Alarm (linked to alarm output), EX (linked to remote contact), Chart (linked to chart recording), Chart End (linked to chart end), Timer (linked to calendar timer)</td>
</tr>
<tr>
<td>[Rec.time]</td>
<td>Set recording time when selecting “Rec.time” for End TRG</td>
<td>*</td>
<td>00:00 to 99:59</td>
</tr>
<tr>
<td>Interval</td>
<td>Select interval of recording to SD card</td>
<td>1sec</td>
<td>0.1sec, 0.2sec, 0.5sec, 1sec, 2sec, 3sec, 5sec, 10sec, 15sec, 20sec, 30sec, 1min, 2min, 3min, 5min, 10min, 15min, 20min, 30min, 60min</td>
</tr>
<tr>
<td>PreTrigger</td>
<td>Past data for the specified number of samples is recorded to SD card when recording is started</td>
<td>00</td>
<td>0 to 10 Note: Past data is initialized when settings are changed or card is inserted/removed. When PreTrigger is set, the recording interval synchronizes with past data, so there may be a case that measured data at recording start time is not recorded.</td>
</tr>
<tr>
<td>Relay No.</td>
<td>Set alarm output No. used when “Alarm” is selected for Start TRG or End TRG</td>
<td>*</td>
<td>- (No output), 99 (internal circuit output), 1 to 12</td>
</tr>
<tr>
<td>EX No.</td>
<td>Set remote contact No. used when “EX” is selected for Start TRG or End TRG</td>
<td>*</td>
<td>- (None), 1 to 10</td>
</tr>
<tr>
<td>Timer No.</td>
<td>Set remote contact No. used when “Timer” is selected for Start TRG or End TRG</td>
<td>*</td>
<td>- (None), 1 to 5</td>
</tr>
</tbody>
</table>

### Restrictions on start/end trigger selection

<table>
<thead>
<tr>
<th>Start trigger</th>
<th>End trigger</th>
<th>Key</th>
<th>Specified time</th>
<th>Alarm output linked</th>
<th>Remote contact linked</th>
<th>Chart recording linked</th>
<th>Chart end linked</th>
<th>Calendar timer linked</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Key</td>
<td></td>
<td>O</td>
<td>O</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Specified time</td>
<td></td>
<td>O</td>
<td>O</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Alarm output linked</td>
<td></td>
<td>O</td>
<td>O</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Remote contact linked</td>
<td></td>
<td>O</td>
<td>O</td>
<td>x</td>
<td>O</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Chart recording linked</td>
<td></td>
<td>O</td>
<td>O</td>
<td>x</td>
<td>x</td>
<td>O</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Chart end linked</td>
<td></td>
<td>O</td>
<td>O</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>O</td>
<td>x</td>
</tr>
<tr>
<td>Calendar timer linked</td>
<td></td>
<td>O</td>
<td>O</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>O</td>
</tr>
</tbody>
</table>

### Note 5 File division

Measured data file is divided by a certain number of bytes.  
(The number of bytes varies by the number of recording channels, etc.)

### Reference File save location

A measured data file is saved in a folder created each year/month within the “HR_DATA” folder (for example, a folder is named “HR201101” for Jan. 2011).  
Also, a setting parameter file is saved in the “HR_SET” folder.
5. Saving setting parameters
The setting data of the unit can be saved to an SD card.

(1) Select “SD CARD” from the menu window (list of setting items).

(2) Move the cursor to Save beside “Setting Parameter” and press the Enter key.

(3) Select New to add a file. To overwrite a file, select the file No. to be overwritten. Also, pressing the FUNC key on this window can remove the data of specified file No. from SD card. When ****Delete? **** is displayed, press the FUNC key again to remove the data.

(4) Press the Enter key to make it available for setting and then enter a file name. Enter single-byte, upper-case alphanumeric characters up to eight digits.

(5) After completing the settings of this item, move the cursor to Set.

(6) Press the Enter key. When ****Start Saving? **** is displayed, press the FUNC key to start saving setting parameters to SD card. To cancel saving, press the ESC key.

Note Setting file name
You cannot specify the same name for files even if they have different numbers.

Note Number of files saved
The maximum number of setting parameter files which can be saved to a single SD card is 10.

Reference File display order
On the setting file list window, files are displayed in the chronological order with the most recent updated file listed first.

Reference Update date display
When a file name is registered on the setting parameter registration window, the update date will be reflected automatically.
6. Loading setting parameters

The setting data saved to an SD card can be loaded and set into the unit.

(1) Select “SD CARD” from the menu window (list of setting items).

(2) Move the cursor to “Load” of “Setting Parameter” and press the ENTER key.

(3) Move the cursor to the file No. to be loaded with the ▲/▼ keys and then press the ENTER key.

(4) Press the ENTER key. When “**** Start Loading? ****” is displayed, press the FUNC key to start loading setting data. To cancel loading, press the ESC key.

When you load setting parameters, all the current parameters will be overwritten. Save the current parameters to SD card before loading saved parameters.

Note 1: Save current settings
When you load setting parameters, all the current parameters will be overwritten. Save the current parameters to SD card before loading saved parameters.

Note 2: Loading cannot stop
It is not possible to stop loading saved parameters in the middle of the process.

7. Removing SD card

Make sure to take the following procedure to remove SD card.

(1) Select “SD CARD” from the menu window (list of setting items).

(2) Move the cursor to “Remove” beside “SD Card” and press the ENTER key.

(3) When “**** Stop the SD-Card? ****” is displayed, press the ESC key. Press the FUNC key to cancel.

(4) Make sure that the green “CARD” status LED in the operation/set keys section turns off, and then remove SD card.

Note: You cannot remove SD card while recording to it. Error occurs when it is attempted.
8. SD card maintenance

Format SD card or delete old setting files according to the following procedure.

(1) Select “SD CARD” from the menu window (list of setting items).

(2) Move the cursor to Maintain of “SD Card” and press the ENTER key.

(3) Perform desired maintenance.

Press the FUNC key to format SD card.

When **** Format the SD-Card? **** is displayed, press the FUNC key to start formatting.

Selecting a file No. and pressing the ENTER key can remove the selected file from SD card. When **** Delete? **** is displayed, press the FUNC key to delete the file.

Reference File display order

On the setting file list window, files are displayed in the chronological order with a file having the oldest update date listed first.

Note 1 Periodic maintenance

To use SD card at its maximum performance, format it periodically.

Note 2 Format

- Note that all the data saved on an SD card is deleted by formatting.
- You cannot format an SD card while recording.
8-20. USB Engineering Port Settings “USB”

Using the provided programming software, parameters can be set or changed on a personal computer. This port is connected to PC temporarily to set or change parameters and is not intended for long time connection. Refer to the instruction manual of provided programming software for details.

<table>
<thead>
<tr>
<th>Type</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB connection mode</td>
<td>Fixed to BULK</td>
</tr>
<tr>
<td>[Mode]</td>
<td>Dedicated protocol is used.</td>
</tr>
<tr>
<td>USB identification</td>
<td>This is used to identify each unit when connecting multiple units (up to five units) to a PC.</td>
</tr>
<tr>
<td>[USB ID]</td>
<td></td>
</tr>
</tbody>
</table>

* Set USB ID to “1” when using the provided programming software. Only one unit can be connected to a PC.

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “USB”.

(3) Press the **ENTER** key to make it available for setting and then enter a value.

(4) After completing the settings of this item, move the cursor to **Set**.

(5) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

[List of USB setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Connection mode</td>
<td>BULK</td>
<td>Fixed to BULK</td>
</tr>
<tr>
<td>USB ID</td>
<td>USB identification</td>
<td>1</td>
<td>1 to 5</td>
</tr>
</tbody>
</table>
8-21. Calendar Timer Settings “Timer”

Alarm relay output ON/OFF or message printing can be executed on a date specified arbitrarily. Up to five dates can be set, and alarm relay output ON/OFF or message No. can be specified for each date. Actual printing is executed in the following order: “Date”, “Time”, “Timer No.” and then “Message”.

(1) Pressing the \textbf{MENU} key displays the menu window (list of setting items).

(2) Select “Timer”.

(3) Move the cursor to the target calendar timer No. with the \textbf{▲} / \textbf{▼} keys and press the \textbf{KEY 1} key. The cursor does not move to parameters other than No. Also, pressing the \textbf{FUNC} key on this window displays the copy window for calendar timer settings.

(4) Move the cursor to the parameter to be set with the \textbf{▲} / \textbf{▼} \textbf{△} \textbf{▲} keys.

(5) Press the \textbf{ENTER} key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to \textbf{Set}.

(7) Press the \textbf{ESC} key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the \textbf{ESC} key.

### [List of Timer setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Select timer type</td>
<td>None</td>
<td>None, ON (specify ON time only) ON &amp; OFF (specify both ON and OFF times)</td>
</tr>
<tr>
<td>[Timer ON]</td>
<td>Set date and time for alarm output ON or message printing</td>
<td>* Jan 1, 2000 to Dec 31, 2099 00 : 00 to 23 : 59</td>
<td></td>
</tr>
<tr>
<td>[Timer OFF]</td>
<td>Set date and time for alarm output OFF</td>
<td>* Jan 1, 2000 to Dec 31, 2099 00 : 00 to 23 : 59</td>
<td></td>
</tr>
<tr>
<td>Relay No.</td>
<td>Specify relay No. for timer ON output</td>
<td>* - (No output at timer ON), 99 (internal circuit output), 1 to 12</td>
<td></td>
</tr>
<tr>
<td>And/Or</td>
<td>Select circuit type for timer ON output</td>
<td>* And, Or</td>
<td></td>
</tr>
<tr>
<td>Message No.</td>
<td>Specify message No. printed at timer ON</td>
<td>* - (Message not printed at timer ON), 1 to 20</td>
<td></td>
</tr>
</tbody>
</table>
8-22. Fail Output Settings “FailOut”

Set the alarm operation performed at an activation of system related alarm (chart end, disconnection of input, SD card error or low capacity, low backup battery level or other system error).

The SD card low-capacity alarm is activated when the free space on SD card decreases to 3% or lower.
The backup battery low-level alarm is activated when the voltage of backup battery for clock drops to 2.0V or lower.
The status information of other errors can be viewed by selecting “SysInfo” from the menu window.
Each alarm is turned off when the alarm condition is cleared or alarm operation is disabled in this setting (individual setting available).

(1) Pressing the key displays the menu window (list of setting items).

(2) Select “FailOut”.

(3) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(4) Press the key and check the check box of required items. Also, set the desired relay No. for output and circuit type.

(5) After completing the settings of this item, move the cursor to Set.

(6) Press the key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the key.

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart End</td>
<td>Set alarm operation at detection of chart end</td>
<td>Not selected</td>
<td>LCD (LCD display), LED (LED indication), E-mail, Relay (relay output)</td>
</tr>
<tr>
<td>Chart End Relay No.</td>
<td>Set alarm output relay No. at detection of chart end</td>
<td>-</td>
<td>- (No output), 99 (internal circuit output), 1 to 12</td>
</tr>
<tr>
<td>Chart End And/Or</td>
<td>Select circuit type of alarm output at detection of chart end</td>
<td>Or</td>
<td>And, Or</td>
</tr>
<tr>
<td>Burn</td>
<td>Set alarm operation at detection of input disconnection</td>
<td>Not selected</td>
<td>LCD (LCD display), LED (LED indication), E-mail, Relay (relay output)</td>
</tr>
<tr>
<td>Burn Relay No.</td>
<td>Set alarm output relay No. at detection of input disconnection</td>
<td>-</td>
<td>- (No output), 99 (internal circuit output), 1 to 12</td>
</tr>
<tr>
<td>Burn And/Or</td>
<td>Select circuit type of alarm output at detection of input disconnection</td>
<td>Or</td>
<td>And, Or</td>
</tr>
<tr>
<td>SD Card</td>
<td>Set alarm operation at detection of SD card low capacity</td>
<td>Not selected</td>
<td>LCD (LCD display), LED (LED indication), E-mail, Relay (relay output)</td>
</tr>
<tr>
<td>SD Card Relay No.</td>
<td>Set alarm output relay No. at detection of SD card low capacity</td>
<td>-</td>
<td>- (No output), 99 (internal circuit output), 1 to 12</td>
</tr>
<tr>
<td>SD Card And/Or</td>
<td>Select circuit type of alarm output at detection of SD card low capacity</td>
<td>Or</td>
<td>And, Or</td>
</tr>
<tr>
<td>Battery</td>
<td>Set alarm operation at detection of backup battery low level</td>
<td>Not selected</td>
<td>LCD (LCD display), LED (LED indication), E-mail, Relay (relay output)</td>
</tr>
<tr>
<td>Battery Relay No.</td>
<td>Set alarm output relay No. at detection of backup battery low level</td>
<td>-</td>
<td>- (No output), 99 (internal circuit output), 1 to 12</td>
</tr>
<tr>
<td>Battery And/Or</td>
<td>Select circuit type of alarm output at detection of backup battery low level</td>
<td>Or</td>
<td>And, Or</td>
</tr>
<tr>
<td>System Error</td>
<td>Set alarm operation at detection of system error</td>
<td>Not selected</td>
<td>LCD (LCD display), LED (LED indication), E-mail, Relay (relay output)</td>
</tr>
<tr>
<td>System Error Relay No.</td>
<td>Set alarm output relay No. at detection of system error</td>
<td>-</td>
<td>- (No output), 99 (internal circuit output), 1 to 12</td>
</tr>
<tr>
<td>System Error And/Or</td>
<td>Select circuit type of alarm output at detection of system error</td>
<td>Or</td>
<td>And, Or</td>
</tr>
</tbody>
</table>
8-23. Display Settings “Display”

The display mode, channel update interval, brightness and chart illumination can be set. When the display backlight and chart illumination are set to “AUTO” in ON/OFF/AUTO setting, the LCD backlight and chart illumination will be turned off when an unused period reaches three minutes. They will be turned on when any key is pressed.

1. Pressing the MENU key displays the menu window (list of setting items).

2. Select “Display”.

3. Move the cursor to the parameter to be set with the ▲/▼ keys.

4. Press the ENTER key to make it available for setting and then select or enter a value.

5. After completing the settings of this item, move the cursor to Set.

6. Press the ENTER key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the ESC key.

[List of Display setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Mode</td>
<td>Select number of channels and information</td>
<td>01CH+Bar</td>
<td>01CH, 01CH+Bar, 02CH, 02CH+Bar, 04CH (03CH), 04CH (03CH)+Bar, Indicator. Selectable display modes depend on the number of inputs.</td>
</tr>
<tr>
<td>Unit/Tag</td>
<td>Select unit or tag to be displayed</td>
<td>Unit</td>
<td>Unit, Tag, Both (tag and unit) Only 04CH (03CH)+Bar display mode is valid. For 1 pen type and 2 pen type display become [*] and unable to set.</td>
</tr>
<tr>
<td>Auto/Const</td>
<td>Select either manual (key) or auto (update</td>
<td>Auto</td>
<td>Auto, Const</td>
</tr>
<tr>
<td></td>
<td>interval) for display CH update</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH-Update Interval</td>
<td>Set update interval of display CH</td>
<td>2sec</td>
<td>1sec, 2sec, 3sec, 5sec, 10sec, 30sec</td>
</tr>
<tr>
<td>Data-update interval</td>
<td>Set data update interval.</td>
<td>0.1s</td>
<td>0.1s, 0.2s, 0.5s, 1s</td>
</tr>
<tr>
<td>Display Backlight</td>
<td>Select ON or AUTO for LCD backlight</td>
<td>ON</td>
<td>ON (always ON), AUTO</td>
</tr>
<tr>
<td></td>
<td>With AUTO selected, LCD backlight is turned</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>off after three minutes of unused</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>period.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display Backlight Level</td>
<td>Select brightness of backlight</td>
<td>5</td>
<td>1 (dark) to 5 (light)</td>
</tr>
<tr>
<td>Chart Illumination</td>
<td>Select ON, OFF or AUTO for chart illumination</td>
<td>ON</td>
<td>ON (always ON), AUTO, OFF</td>
</tr>
<tr>
<td></td>
<td>With AUTO selected, chart illumination is</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>turned off after three minutes of unused</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>period.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chart Illumination Level</td>
<td>Select brightness of chart illumination</td>
<td>5</td>
<td>0 (OFF) to 5 (light)</td>
</tr>
<tr>
<td>Display-order</td>
<td>Select whether to display measured value</td>
<td>OFF</td>
<td>ON (arbitrary order), OFF (chronological order of CH No.)</td>
</tr>
<tr>
<td></td>
<td>in chronological order of CH No. or arbitrary order.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8-24. Measured Value Display Order Settings “D.Order”

The order of CH update can be changed for measured value display. Setting is only available at multiple pen type.

1. Pressing the MENU key displays the menu window (list of setting items).
2. Select “D.Order”.
3. Set CH No. to create a desired order of update (display) from 01 to 04.
4. Press the ENTER key to make it available for setting and then enter CH No.
5. After completing the setting of this item, move the cursor to Set.
6. Press the ENTER key to register the setting (when chart recording is ON, a setting change mark is printed). To cancel the setting, press the ESC key.

[D.Order setting parameter]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH No.</td>
<td>Set CH No. to be updated (displayed)</td>
<td>1 to 4</td>
<td>- (Skipped with 1-CH display, blank display with multiple channel display), 1 to 4</td>
</tr>
</tbody>
</table>
8-25. Date and Time Settings “Date”

The unit is equipped with a clock which indicates “year/month/day/hour/minute/second”. The time has been set prior to shipment. Reset it when needed.

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “Date”.

(3) Move the cursor to the parameter to be set with the **▲▼◄►** keys.

(4) Press the **ENTER** key to make it available for setting and then enter a value.

(5) After completing the settings of this item, move the cursor to **Set**.

(6) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

[List of Date setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td></td>
<td>2000 to 2099</td>
</tr>
<tr>
<td>Month</td>
<td></td>
<td>Jan 1 to Dec 31</td>
</tr>
<tr>
<td>Day</td>
<td>Current time has been set.</td>
<td></td>
</tr>
<tr>
<td>Hour</td>
<td></td>
<td>00:00:00 to 23:59:59</td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sec</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8-26. System Settings “System”

The system related settings such as enabling/disabling settings are available.

1. Enabling and disabling settings

By entering a password, you can "disable a setting change by keys (Key Lock)", "clear memory (Initialize)", "disable/enable zero or span adjustment for printing position (Adjust of Rec position)" or "disable/enable input adjustment (Input Correction)". Set these items as a recovery process when the unit does not function properly due to misoperation or other reasons.

**Note 1** Default password

The default password is “3571”. This password cannot be changed.

**Note 2** Memory clear

When the memory clear (Initialize) is executed, parameters will be reset to default values. This cannot initialize the adjustment data (zero/span calibration).

**Note 3** Key operation

When Key Lock is enabled, settings of all items cannot be changed.
The message “Key locking ……” is displayed when you try to register a parameter.
However, checking of setting items is available.

2. Output mode settings

Alarm output mode can be set. The settings are common to all relay No. Default setting is Norm.Open mode (normally non-excitation state, at the alarm activation excitation state). Terminal configuration differs depending on the alarm output specification.

1) Mechanical relay ‘a’ contact output

<table>
<thead>
<tr>
<th>Relay mode</th>
<th>Power OFF</th>
<th>Alarm reset</th>
<th>Alarm activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norm.Open</td>
<td>N.O</td>
<td>N.O</td>
<td>N.O</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>COM</td>
<td>COM</td>
</tr>
<tr>
<td>Norm.Close</td>
<td>N.O</td>
<td>N.O</td>
<td>N.O</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>COM</td>
<td>COM</td>
</tr>
</tbody>
</table>

2) Mechanical relay ‘c’ contact output

<table>
<thead>
<tr>
<th>Relay mode</th>
<th>Power OFF</th>
<th>Alarm reset</th>
<th>Alarm activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norm.Open</td>
<td>N.O</td>
<td>N.O</td>
<td>N.C</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>COM</td>
<td>COM</td>
</tr>
<tr>
<td>Norm.Close</td>
<td>N.O</td>
<td>N.O</td>
<td>N.C</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>COM</td>
<td>COM</td>
</tr>
</tbody>
</table>
3. Parameter settings

(1) Pressing the \textit{MENU} key displays the menu window (list of setting items).

(2) Select “System”.

(3) Pressing the \textit{ENTER} key opens the password entry window.

(4) Enter a password. After that, move the cursor to \textit{Set} and press the \textit{ENTER} key.

(5) When password entry is completed, move the cursor to \textit{Set} and press the \textit{ENTER} key.

(6) Move the cursor to the parameter to be set with the \textup{▲}/\textup{▼} keys.

(7) For enabling and disabling, press the \textit{ENTER} key and check the desired item.

(8) After completing the settings of this item, move the cursor to \textit{Set}.

(9) Press the \textit{ENTER} key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the \textit{ESC} key.

Press the \textit{ENTER} key to display \textit{***Start Initializing?***} then press \textit{FUNC} key to execute memory clear.

To cancel the settings, press the \textit{ESC} key.

\begin{tabular}{|l|l|l|l|}
\hline
Parameter & Function & Default & Set value \\
\hline
Key Lock & Set disabling settings change by key. & Not set & Select at checkbox. \\
Initialize & Set memory clear. & Not set & Select at checkbox. \\
[Rec Adj]: Adjust of Rec position & Disable/enable zero or span adjustment for printing position. & Not set & Select at checkbox. \\
[Inf Adj]: Input Correction & Disable/enable input adjustment. & Not set & Select at checkbox. \\
Frequency of power & Set power frequency. & 50Hz, 60Hz & \\
Relay mode & Set alarm output mode. & Norm.Open & Norm.Open (non-excitation), Norm.Close (excitation) \\
Filter (Preamp) & Set strength of the filter. & 0 & 0 to 10 \\
\hline
\end{tabular}

Note: Actual windows are separated. Use the \textup{▲}/\textup{▼} keys to scroll and continue settings.
8-27. System Information Display “SysInfo”

The system information display shows the model, serial number, software version of CPU used (for preamplifier, printer and other application), MAC address (Ethernet specification only) and status of system.

(1) Pressing the \( \text{MENU} \) key displays the menu window (list of setting items).

(2) Select “SysInfo”.

(3) Pressing the \( \text{ENTER} \) key displays the system information.

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>Model code of the unit (&quot;--&quot; excluded)</td>
</tr>
<tr>
<td>No.</td>
<td>Serial number of the unit</td>
</tr>
<tr>
<td>MAC Adr.</td>
<td>MAC address of the unit using Ethernet option</td>
</tr>
<tr>
<td>*</td>
<td>This field is left blank when Ethernet option is not used.</td>
</tr>
<tr>
<td>SP</td>
<td>Additional information (0X00000000 displayed normally)</td>
</tr>
<tr>
<td>System Value</td>
<td>Value depends on the unit specification</td>
</tr>
<tr>
<td>P</td>
<td>Printer software version</td>
</tr>
<tr>
<td>A, E</td>
<td>Application software version</td>
</tr>
<tr>
<td>I</td>
<td>Preamplifier software version</td>
</tr>
<tr>
<td>S1 to S4</td>
<td>Analog pen control part software version</td>
</tr>
<tr>
<td>ALM1 to ALM4</td>
<td>Alarm unit software version</td>
</tr>
<tr>
<td>Battery</td>
<td>Clock backup voltage</td>
</tr>
</tbody>
</table>
9. Adjustment

The unit provides four adjustment functions. Perform a suitable adjustment depending on the situation. All adjustments are processed in the software and mechanical adjustment such as trimmer adjustment is not necessary. Available adjustments are "trace printing position adjustment", "input (measurement) adjustment", "input (measurement) shift adjustment" and "recording position (time) adjustment".

9-1. Trace Printing Position Adjustment “Rec Adj”

Perform zero/span adjustment for cartridge pen and plotter pen position on a chart. This adjustment does not affect the measured value. Before performing this adjustment, enable "Adjust of Rec position" according to "8-26. System Settings". When it is enabled, "Rec Adj" is shown on the menu window (list of setting items).

(1) Pressing the key displays the menu window (list of setting items).

(2) Select "Rec Adj".

(3) Set pen No. with the ▲/▼ keys. Each time pressing the ▼ key changes Pen1 → Pen2 → Pen3 → Pen4 → Plot. (plotter pen). The zero and span values currently set are shown on this window. These values are replaced by new values, when the key is pressed after completing the adjustments.

(4) Press the key to select zero, or the key to select span.
(5) Pressing the \textit{FUNC1} key moves the pen to the zero side and pen recording starts while feeding the chart.
(6) Move the pen with the \textit{\textless} \textgreater\ keys so that pen recording is aligned to the chart 0\% position.
(7) When the adjustment is completed, press the \textit{ENTER} key to register the zero position.

(8) While the adjustment window is displayed, you can perform adjustment by pressing the \textit{FUNC1} or \textit{FUNC2} key as many times as you need. When the adjustment is completed, press the \textit{ESC} key to exit the trace printing position adjustment.

\textbf{Reference} Pens other than set pen No.

Pens stand by near the center.

\textbf{Note 1} Dotting at zero/span side

Unless the \textit{\textless} \textgreater\ key is pressed, dotting at 0\% or 100\% position is performed using the currently set adjustment data. When adjustment is not necessary, just press the \textit{ESC} key.

\textbf{Note 2} Zero/span individual adjustment

Zero and span can be adjusted separately. To adjust the 0\% position only, press the \textit{ESC} key when the adjustment is completed.
9-2. Recording Position (time) Adjustment

When the time-axis synchronization (POC) is programmed to "ON", the gaps between the pens may change over time, resulting in error between their time-axis. "Recording Position (time) Adjustment" is for correcting these changes.

Adjustment procedure

(1) Reference pen records a straight line.

(2) Initial position of the pen adjusted.

(3) When these two lines match, press ENTER key

(4) At first, reference pen record a straight line on the chart paper. Pressing the ▼ key feeds the chart and moves cartridge pen little to the right. A cross point of a straight line recorded by a reference pen and a trajectory of the cartridge pen is adjustment ending point.

(5) After completing the adjustment of this item, press ENTER key to register the recording position.

(6) Press ESC key to complete pen recording position adjustment (time).

Display | Reference pen | Pen to be adjusted
--- | --- | ---
Pen1 | Plotter pen | 1<sup>st</sup> pen
Pen2 | 1<sup>st</sup> pen | 2<sup>nd</sup> pen
Pen3 | 1<sup>st</sup> pen | 3<sup>rd</sup> pen
Pen4 | 1<sup>st</sup> pen | 4<sup>th</sup> pen

<table>
<thead>
<tr>
<th>Ref 1</th>
<th>Pen other than pen No. being adjusted</th>
</tr>
</thead>
</table>
Pens stand by at 0% position.

<table>
<thead>
<tr>
<th>Ref 2</th>
<th>Adjusting pen selection</th>
</tr>
</thead>
</table>
Dispaly | Reference pen | Pen to be adjusted |
--- | --- | ---
Pen1 | Plotter pen | 1<sup>st</sup> pen
Pen2 | 1<sup>st</sup> pen | 2<sup>nd</sup> pen
Pen3 | 1<sup>st</sup> pen | 3<sup>rd</sup> pen
Pen4 | 1<sup>st</sup> pen | 4<sup>th</sup> pen
### 9-3. Input Adjustment “Inp Adj”

Perform scale calibration to improve accuracy which may be degraded by the surrounding environment or over time. Zero/span adjustment is performed for input (measured) data of each channel. Before performing this adjustment, enable “Input Correction” according to “8-26. System Settings”. When it is enabled, “Inp Adj” is shown on the menu window (list of setting items).

1. Pressing the **[MENU]** key displays the menu window (list of setting items).

2. Select “Inp Adj”.

3. Move the cursor to the target channel with the **▲**/**▼** keys and press the **ENTER** key. The cursor does not move to parameters other than CH.
   A tester should be connected to the target channel beforehand.

4. The Zero and Span fields show respectively the range lower limit and range upper limit set in “8-2. Input Type Settings”.

   ![Menu Window](image)

5. Apply the range lower limit specified in the Zero field by the tester.

6. Press the **FNC** key to take the input.

7. Apply the range upper limit specified in the Span field by the tester.

8. Press the **FNC** key to take the input.

9. When zero and span inputs are completed, correction values will be displayed automatically at “A” and “B”. It is also possible to enter values directly to A (tilt) and B (intercept) using the **▲**/**▼**/**◄**/**►** keys if you know these values.

10. After completing the settings of this item, move the cursor to **Set**.

11. Press the **ENTER** key to register the settings. To cancel the settings, press the **ESC** key.

#### Note 1
Attach terminal cover

The temperature of terminal varies when it is exposed to wind. Attach the terminal cover especially when using thermocouple input.

#### Note 2
For instrument safety

Energize the unit for at least 30 minutes before performing an adjustment.
9-4. Input Shift Adjustment

The amount of shift (parallel shift) for input (measurement) data can be adjusted. This adjustment is intended mainly to correct variance in sensor or input converter. The adjustment can be performed for each channel. There are two types of setting as described below.

1. Set shift value in input type settings

   After setting, measured value will be shifted by the specified amount. (See “8-2. Input Type Settings”.)

   Example of shift setting
   Shift a measured value 850.3 to a set value 850.0 (850.0 - 850.3 = -0.3).

   (1) Display the input type settings window shown on the left, and enter “-0.3” to the SHIFT entry field.
   (2) After completing the setting, move the cursor to Set.
   (3) Press the key to register the setting. To cancel the setting, press the key.

2. Set shift value with “Inp Adj” described in the previous section

   (See “9-3. Input Adjustment.”)

   (1) Display the input adjustment window shown on the left, and enter “1” to the A parameter entry field and a shift value to the B parameter entry field.
   If an input adjustment has already been performed and values have been specified in the A and B fields, add a shift value to the B parameter.
   (2) After completing the setting, move the cursor to Set.
   (3) Press the key to register the setting.
   To cancel the setting, press the key.

Note 1: Double setting

When shift value is set on the input type settings window and also on the input adjustment window, the actual shift value will be the sum of the two set values.

Note 2: Relation with input adjustment

To set a shift value using the input adjustment described in the previous page, the SHIFT on the input type settings window should be set to “0”.

Note 3: For instrument safety

Energize the unit for at least 30 minutes before performing an adjustment.
9-5. Wiring and Environment for Input Adjustment

1. Preparation
   (1) Turn OFF the power switch and perform the wiring depending on the input signal (see the figure below). Connect to the input terminal of the adjustment target channel.
   (2) Attach the terminal cover.
   (3) Turn ON the power switch and select the 1-point display (fixed) mode.
   (4) Display the adjustment target channel.
   (5) Energize the unit for at least 30 minutes (an hour or more is ideal) and then perform an adjustment.

<table>
<thead>
<tr>
<th>Wiring type 1 (DC voltage input)</th>
<th>Wiring type 2 (thermocouple input)</th>
<th>Wiring type 3 (resistance thermometer input)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Wiring diagram 1]</td>
<td>![Wiring diagram 2]</td>
<td>![Wiring diagram 3]</td>
</tr>
</tbody>
</table>

2. How to adjust
   (1) Set a tester (standard DC voltage generator or precision variable resistor) to an input value equivalent to the adjustment target value.
   (2) At this time, read the digital display and check if the error is within the specified accuracy range.
   (3) Next, change to the adjustment target channel and adjust it likewise.
   (4) Adjust also the trace printing position.

   * The accuracy of the unit is rated at an ambient temperature of 23°C ±2°C. Ensure safety of the surrounding environment.
   * When using the shift adjustment function to adjust measured value, the shifted value should be taken into account.
   * When you change the wiring with the terminal cover removed, energize the unit for at least 30 minutes after attaching the terminal cover and then perform adjustment.

---

**Note 1** Tester accuracy
The accuracy of the unit is ±0.1%. Therefore, you need to use a tester having higher degree of accuracy to perform proper adjustment. Also, attention should be paid to the thermocouple error. Note that a tester requires time to be stabilized to ensure its accuracy and stability.

**Note 2** Reference junction compensator
Make sure that the reference junction temperature is 0°C. When using an electronic reference junction compensator, read its instruction manual. Also, the compensation accuracy should be checked.

**Note 3** When reference junction temperature compensator (RJ) is not available
When you use thermocouple input and set RJ to “INT”, perform the type 1 wiring if a reference junction temperature compensator is not available. In this case, set RJ to “EXT” during adjustment only. Note that error correction of reference junction temperature compensation cannot be performed.
10. Engineering Port (Mini-USB Terminal)

An engineering port is provided in the front section of the unit to allow connection to a personal computer. This port is provided to all models as a standard feature. Use a mini-USB cable to connect to a personal computer.

Note that this engineering port is designed for temporary communication connection and not intended for always-on connection. To obtain always-on connection for communication, you need to request the model with communication interface at the time of purchase, and use the terminal located at the rear side of the unit for permanent connection.

| Caution | Make sure to attach or remove an engineering cable to/from the engineering port while the unit is turned on. |

![Engineering port (mini-USB)]
### 11. Troubleshooting

#### 11-1. Problems and Remedies

The following table lists problems that may occur on the unit (operations and functions) with description of the symptoms, their possible causes and remedies.

> **Warning** Never replace parts to repair or modify the unit. Not only does it fail to repair or modify, but it also may cause electric shock or damage to the unit.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause/Remedy</th>
</tr>
</thead>
</table>
| (1) Unit does not function even the power switch is turned ON          | (1) Check the wiring to the power terminal. (See “4-3.3. Power/protective conductor terminals wiring”.)  
(2) Make sure that the power voltage is AC100 to 240V.                |
| (2) Noise produced as printer moves                                    | (1) Check if the cartridge pen is attached properly. (See “6-1.2. How to set plotter pen and cartridge pen”.)  
(2) Open the unit door and check the printer moving area for foreign matter. Remove it if exists. |
| (3) Data displayed but not recorded                                     | (1) Make sure that the recording is ON (“REC” status LED lights up). (See “6-2.3. Chart recording operation”.)  
(2) Check if the ribbon cassette is attached properly. (See “6-1.2. How to set plotter pen and cartridge pen”.)  
(3) Check if the chart is attached properly or if it has run out (“REC” status LED flashes). (See “6-1.1. How to set chart paper”.) |
| (4) Chart does not move as printer moves                                | (1) Feed the chart paper manually and make sure that the chart can be fed smoothly.  
(2) Make sure that the chart can be fed smoothly with the FEED key. (See “6-2.3. Chart recording operation”.) |
| (5) REC, DATAP, FEED keys not accepted                                  | Check the system settings. (See “8-26. System Settings”.) While Key Lock is active,  
 is shown on the display.                                                  |
| (6) Range setting done, but data display or trace/digital printing not performed on a certain channel | (1) Check the setting (ON/OFF) of each operation in input type settings. (See “8-2. Input Type Settings”.)                  |
| (7) Parameters set correctly, but not reflected on the window when checked | When a setting is changed while the chart recording is ON, a setting change mark is printed on a chart. Check the chart to see if it is printed.  
If not, the following situation is a possible cause.  
You have not pressed the ENTER key after moving the cursor to Set, or there was an error in the set contents. |
| (8) Parameters set correctly, but normal display does not return        | Initialize setting parameters. (See “8-26. System Settings”.) When the unit is recovered, set parameters again and see how it works. |
| (9) Periodic data printing set, but not executed                       | (1) The start time set for periodic data printing has not come yet.  
(2) Parameters are not set correctly. (See “8-10 and 8-11. Periodic Data Printing Settings”.)  
* When you specify a start time which is earlier than the time of setting, periodic data printing will be executed from the next day at the specified time. |
| (10) Malfunction occurred unpredictably without warning                | Initialize setting parameters. (See “8-26. System Settings”.) When the unit is recovered, set parameters again and see how it works. |
## 11-2. Abnormal Measured Value

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause/Remedy</th>
</tr>
</thead>
</table>
| (1) Unstable measured value                                            | (1) Check if the measuring terminal is loose.  
(2) Check if the input signal is unstable.  
(3) Make sure to avoid the following condition: BURN is set to other than "None" while connecting a thermocouple in parallel with another instrument. |
| (2) Measured value display shows the followings: OVER, BURN, etc.      | (1) Make sure that the wiring to the input terminal is properly done.  
(2) Check if the input terminal is loose.  
(3) Check if the input line is disconnected.  
(4) Check if the input signal is out of the measuring range. |
| (3) Error occurs in measured value                                     | (1) Check if error occurs in the input signal.  
(2) Make sure that a compensation lead wire is connected to the input terminal (thermocouple input only).  
(3) Check the scale and perform input adjustment if error occurs. |
| (4) Measured value influenced by ambient temperature (thermocouple input only) | (1) Check if RJ is set to “EXT” (external) in input type settings (this is not a problem if reference junction compensation is performed externally).  
(2) Make sure that the terminal cover is attached. |

**Important notice**

If the troubleshooting does not help solving the problem, immediately contact the dealer or your nearest CHINO office and give the following information.

(1) MODEL  (2) Serial number  (3) Problem  (4) Other concerns
12. Inspection and Maintenance

12-1. Routine Inspection

Check the remaining amount of chart and recording condition on a daily basis to keep the unit in good condition. When any abnormality is found, take an appropriate action according to the “11. Troubleshooting”.

<table>
<thead>
<tr>
<th>Maintenance/inspection item</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plotter pen and cartridge pen replacement</td>
<td>When the trace printing (trend line) fade away or becomes less visible, replace the cartridge pen with new one. When the letters of digital printing fade away or become less visible, replace the plotter pen with new one. (See “6-1.2. How to set plotter pen and cartridge pen”.)</td>
</tr>
<tr>
<td>Chart replacement</td>
<td>A chart paper can last about a month when fed at a speed of 25mm/H continuously. When the end of chart nears, an end mark (red line on the right edge of chart) appears. In this case, replace the chart with new one. (See “6-1.1. How to set chart paper”.)</td>
</tr>
<tr>
<td>Cleaning</td>
<td>Wipe away dirt on the unit with a soft, dry cloth or a cloth dampened with warm water or neutral detergent.</td>
</tr>
</tbody>
</table>

Caution: Do not use chemical solvents including thinner and benzine to prevent the unit surface from melting. The chart guide is made of acrylic. It may produce a crack when a chemical solvent is used.

12-2. Consumable Parts and Replacement Guideline

The unit includes some consumable parts. To use the unit for a long time in good condition, we recommend that these parts be replaced regularly.

Warning: Do not replace parts other than chart and pens by yourself. Not only does it fail to replace properly, but it also may pose dangerous situation. Make sure to contact CHINO’s sales agent for replacement of consumable parts.

1. Consumable parts and recommended replacement cycle

(Usage under the condition of temperature: 20 to 25°C, humidity: 20 to 80%RH, operation time: 8hours/ a day)

<table>
<thead>
<tr>
<th>Consumable part</th>
<th>Replacement cycle</th>
<th>Other operating condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pen servo (for cartridge pen)</td>
<td>4 to 6 years</td>
<td>Use under the normal condition as below:</td>
</tr>
<tr>
<td>Pen servo (for plotter pen)</td>
<td>4 to 6 years</td>
<td>• No corrosive gas</td>
</tr>
<tr>
<td>Belt</td>
<td>4 to 6 years</td>
<td>• Dust free, oil smoke free, dry place</td>
</tr>
<tr>
<td>Chart drive mechanism</td>
<td>4 to 6 years</td>
<td>• Free from vibration and impact</td>
</tr>
<tr>
<td>Motors</td>
<td>4 to 6 years</td>
<td>• No other factors affecting operation</td>
</tr>
<tr>
<td>Electronic parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>5 years</td>
<td>At an ambient temperature of 25°C</td>
</tr>
<tr>
<td>Relay (for alarm)</td>
<td>100,000 times</td>
<td>Resistive load</td>
</tr>
<tr>
<td></td>
<td>30,000 times</td>
<td>Inductive load</td>
</tr>
<tr>
<td>Lithium battery</td>
<td>10 years</td>
<td>8-hour operation per day (at an ambient temperature of 40°C or lower)</td>
</tr>
<tr>
<td>Keys</td>
<td>500,000 times</td>
<td>Depends highly on the use and surrounding conditions.</td>
</tr>
<tr>
<td>Display (LCD)</td>
<td>4 to 6 years</td>
<td>At an ambient temperature of 25°C</td>
</tr>
</tbody>
</table>
12-3. Battery removal method for the purpose of disposal

**Caution**

Do not replace the battery. Doing so might cause damage or malfunction. Do not remove the battery except when disposing the recorder.

1. Removing the battery

   1) Removing the internal chassis
      1. Open the unit door and then open the display board in the same direction.
      2. Turn OFF the power switch.
      3. Remove two screws fixing the internal chassis.
      4. Remove one screw fixing the mechanical side panel and then pull out the internal chassis.
      5. Remove chassis back side cable.
      6. Remove two Chassis front unit fixing screw and pull out chassis front unit.

![Diagram of battery removal process](image)

- Internal chassis fixing screw
- Mechanical side panel fixing screw
- Chassis front unit fixing screw
2) Removing the battery
   (1) The battery is located at the back of the chassis front unit.

   ! Caution

   (1) The unit components include a small amount of harmful chemical substance no more than the defined amount by RoHS.
   (2) The unit must be disposed of by a waste disposal company or in accordance with the local regulations.
   (3) The unit uses a lithium battery and the battery must be disposed of by a waste disposal company.
   (4) The packing materials used for the unit, such as box, plastic bag, cushion and sticker, should be sorted for recycling in accordance with local regulations.

   (2) Using a tapered, insulated tool, remove the battery from the battery holder.
13. Option

13-1. External Operation Settings “Dig Inp”

Using remote contact signal (no-voltage contact: short or open), selection of chart speed or data printing can be executed without operating keys at the operation/set keys section. To use this function, you need to allocate operation to a terminal number. Some operations are allocated automatically to specific terminal numbers.

1. Names of the operations executed externally

<table>
<thead>
<tr>
<th>Operation name</th>
<th>Terminal used</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Select chart speed from three speeds</td>
<td>EX1 and EX2 terminals</td>
</tr>
<tr>
<td>(2) Message printing (No.01 and 02)</td>
<td>EX1 and EX2 terminals</td>
</tr>
<tr>
<td>(3) Message printing (No.01 to 05)</td>
<td>EX1 to EX4 terminals</td>
</tr>
<tr>
<td>(4) Data printing</td>
<td>One arbitrary terminal (multiple selection available)</td>
</tr>
<tr>
<td>(5) List printing (List No.1, 2 and 3)</td>
<td>One arbitrary terminal (multiple selection available)</td>
</tr>
<tr>
<td>(6) Integration value reset</td>
<td>One arbitrary terminal (multiple selection available)</td>
</tr>
<tr>
<td>(7) Message printing (No.01 to No.20)</td>
<td>One arbitrary terminal (multiple selection available)</td>
</tr>
<tr>
<td>(8) Time correction</td>
<td>One arbitrary terminal (multiple selection available)</td>
</tr>
</tbody>
</table>

2. Operation and terminal contact signal

1) Operations allocated automatically to specific terminal numbers

<table>
<thead>
<tr>
<th>Operation name</th>
<th>Terminal contact signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Select chart speed from three speeds</td>
<td>Three chart speeds should be set as well as the setting described in this section. (See “8-7. Chart Speed Settings”.)</td>
</tr>
<tr>
<td></td>
<td>Recording ON/OFF and chart speed selection</td>
</tr>
<tr>
<td></td>
<td>Between COM and EX □ terminal</td>
</tr>
<tr>
<td></td>
<td>EX1</td>
</tr>
<tr>
<td>Recording ON</td>
<td>CS1</td>
</tr>
<tr>
<td></td>
<td>CS2</td>
</tr>
<tr>
<td></td>
<td>CS3</td>
</tr>
<tr>
<td>Recording OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Chart recording should be ON to enable chart speed selection.</td>
<td></td>
</tr>
</tbody>
</table>

(2) Message printing (No.01 and 02)

<table>
<thead>
<tr>
<th>Operation name</th>
<th>Terminal contact signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message No.01</td>
<td>COM and EX1</td>
</tr>
<tr>
<td>Message No.02</td>
<td>COM and EX2</td>
</tr>
<tr>
<td>A selected message will be printed when a trigger signal (1sec or longer) is given.</td>
<td></td>
</tr>
<tr>
<td>Message printing can be executed also by keys.</td>
<td></td>
</tr>
</tbody>
</table>

(3) Message printing (No. 01 to 05)

<table>
<thead>
<tr>
<th>Operation name</th>
<th>Terminal contact signal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Between COM and EX □ terminal</td>
</tr>
<tr>
<td></td>
<td>EX1</td>
</tr>
<tr>
<td>No.01</td>
<td>OFF</td>
</tr>
<tr>
<td>No.02</td>
<td>ON</td>
</tr>
<tr>
<td>No.03</td>
<td>OFF</td>
</tr>
<tr>
<td>No.04</td>
<td>ON</td>
</tr>
<tr>
<td>No.05</td>
<td>OFF</td>
</tr>
<tr>
<td>* A selected message will be printed when a trigger signal (1sec or longer) is given after selecting message No.</td>
<td></td>
</tr>
<tr>
<td>Chart recording should be ON to enable message printing.</td>
<td></td>
</tr>
<tr>
<td>Message printing can be executed also by keys.</td>
<td></td>
</tr>
<tr>
<td>Operation name</td>
<td>Terminal contact signal</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td><strong>(4) Data printing</strong></td>
<td>Turn ON the terminal No. specified for data printing. Chart recording should be ON. Data printing can be executed also by keys. While executing data printing, another execution request can be accepted.</td>
</tr>
<tr>
<td><strong>(5) List printing (List No.1, 2 and 3)</strong></td>
<td>Turn ON the terminal No. specified for list 1, 2 and 3 printing. Chart recording should be ON. List printing can be executed also by keys. (See “8-12. List Printing Settings”.)</td>
</tr>
<tr>
<td><strong>(6) Integration value reset</strong></td>
<td>When “EX (All)” is selected for INT-Reset in calculation settings, integration value can be reset by turning ON the terminal No. specified for integration reset. (See “8-4. Calculation Settings”.)</td>
</tr>
<tr>
<td><strong>(7) Message printing (No.01 to No.20)</strong></td>
<td>Message should be set as well as the setting described in this section. (See “8-13. Message Printing 1 Settings”.) Turn ON the terminal No. specified for message printing (No.01 to 20). Chart recording should be ON. Message printing can be executed also by keys.</td>
</tr>
<tr>
<td><strong>(8) Time correction</strong></td>
<td>When the current time (second) is 0 to 30, the second value will be set to 0. When it is 31 to 59, the minute value will be increased by 1min and the second value will be set to 0. Example: Turn On the specified terminal No. at 10:10 and 30 seconds. The time will be set to 10:10:00. It will be 10:11:00 when the terminal is turned ON at 10:10 and 31 seconds.</td>
</tr>
</tbody>
</table>

**Warning**

For contact signal which is given to remote contact terminal, use a switch or relay operated at 30V AC, 60V DC or lower voltage level, or manually operated contact which can handle minute load.
3. Parameter settings

(1) Pressing the MENU key displays the menu window (list of setting items).

(2) Select “Dig Inp”.

(3) Move the cursor to the target remote contact No. with the ▲/▼ keys and press the ENTER key. The cursor does not move to parameters other than No.

(4) Press the ENTER key to make it available for setting and then select a value.

(5) After completing the setting, move the cursor to Set.

(6) Press the ENTER key to register the setting (when chart recording is ON, a setting change mark is printed). To cancel the setting, press the ESC key.

[Dig Inp setting parameter]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Allocate function to specified remote contact terminal No.</td>
<td>None</td>
<td>None (not used), ChartSpeed (chart speed), Message 1,2 (message 1 &amp; 2 printing), Message 1to5 (message 1 to 5 printing), DataPrint, ListPrint 1 (list 1 printing), ListPrint 2 (list 2 printing), ListPrint 3 (list 3 printing), INT-Reset(All) (integration reset), Clock Adj (time correction), Message 1 (message 1 printing) to Message 20 (message 20 printing)</td>
</tr>
</tbody>
</table>

The ON/OFF status of the remote contact input (No. 1 to 10: depending on the specification) can be recorded to chart. For a target remote contact No., specify the recording position for input OFF status (percentage value of chart span) and the recording position for input ON status by an offset (1 to 10mm) from the OFF position. When the input is ON, recording is made on the right side of the input OFF recording position, at the position specified by an arbitrary offset width. At this time, a straight line connects between ON and OFF.

![Operation recording line and remote contact No.](image)

(1) Pressing the **MENU** key displays the menu window (list of setting items).

(2) Select “Ope.Rec”.

(3) Move the cursor to the target remote contact No. with the ▲/▼ keys and press the **ENTER** key. The cursor does not move to parameters other than EX. Also, pressing the **FUNC** key on this window displays the copy window for operation recording settings.

(4) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(5) Press the **ENTER** key to make it available for setting and then select or enter a value.

(6) After completing the settings of this item, move the cursor to **Set**.

(7) Press the **ENTER** key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the **ESC** key.

### [List of Ope.Rec setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON/OFF</td>
<td>Select ON or OFF for operation recording</td>
<td>OFF</td>
<td>ON (enabled), OFF (disabled)</td>
</tr>
<tr>
<td>Position</td>
<td>Set recording position for input OFF status to percentage of chart zero span</td>
<td>%</td>
<td>0 to 90 (%)</td>
</tr>
<tr>
<td>Width</td>
<td>Set recording position for input ON status to millimeters of chart zero span based on the input OFF recording position.</td>
<td>mm</td>
<td>1 to 10 [mm]</td>
</tr>
</tbody>
</table>
13-3. COM Port Settings “COM1” and “COM2”

COM port 1 and COM port 2 can be set separately to use them simultaneously. These ports are mainly used to set the unit using PLC or PC, and load measured data.

This section describes the things related to settings only. For general handling information, refer to the instruction manual for “Communication Interface” provided separately.

(1) Pressing the <Menu> key displays the menu window (list of setting items).

(2) Select “COM1” or “COM2”.

(3) Move the cursor to the parameter to be set with the ▲/▼/◀/▶ keys.

(4) Press the <Enter> key to make it available for setting and then select or enter a value.

(5) After completing the settings of this item, move the cursor to <Set>.

(6) Press the <Enter> key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the <ESC> key.

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.

[List of COM1 and COM2 setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Communication mode</td>
<td>Low (To PC etc...)</td>
<td>Fixed to Low (To PC etc...)</td>
</tr>
<tr>
<td>Protocol</td>
<td>Select communication protocol</td>
<td>MODBUS RTU</td>
<td>MODBUS RTU, MODBUS ASCII, PRIVATE1 (without connection sequence), PRIVATE2 (with connection sequence)</td>
</tr>
<tr>
<td>Address</td>
<td>Set communication address of the unit</td>
<td>01</td>
<td>01 to 99</td>
</tr>
<tr>
<td>Baud rate</td>
<td>Set communication speed</td>
<td>9600</td>
<td>PRIVATE: 1200, 2400, 4800, 9600bps MODBUS: 9600, 19200, 38400bps Changes to “9600” when changing from PRIVATE to MODBUS or vice versa.</td>
</tr>
<tr>
<td>Character</td>
<td>Set transmission character</td>
<td>8N1</td>
<td>7E1, 7E2, 7O1, 7O2, 8N1, 8N2, 8E1, 8E2, 8O1, 8O2</td>
</tr>
<tr>
<td>Check SUM</td>
<td>Select whether to add checksum code</td>
<td>OFF, ON Settable only when Protocol is set to “PRIVATE”.</td>
<td></td>
</tr>
</tbody>
</table>

Reference > Character selection

Codes are used to represent character type.

<table>
<thead>
<tr>
<th>Code</th>
<th>Character length</th>
<th>Parity</th>
<th>Stop bit</th>
<th>Code</th>
<th>Character length</th>
<th>Parity</th>
<th>Stop bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7E1</td>
<td>7-bit</td>
<td>Even</td>
<td>1</td>
<td>8N2</td>
<td>8-bit</td>
<td>Non</td>
<td>2</td>
</tr>
<tr>
<td>7E2</td>
<td>7-bit</td>
<td>Even</td>
<td>2</td>
<td>8E1</td>
<td>8-bit</td>
<td>Even</td>
<td>1</td>
</tr>
<tr>
<td>7O1</td>
<td>7-bit</td>
<td>Odd</td>
<td>1</td>
<td>8E2</td>
<td>8-bit</td>
<td>Even</td>
<td>2</td>
</tr>
<tr>
<td>7O2</td>
<td>7-bit</td>
<td>Odd</td>
<td>2</td>
<td>8O1</td>
<td>8-bit</td>
<td>Odd</td>
<td>1</td>
</tr>
<tr>
<td>8N1</td>
<td>8-bit</td>
<td>Non</td>
<td>1</td>
<td>8O2</td>
<td>8-bit</td>
<td>Odd</td>
<td>2</td>
</tr>
</tbody>
</table>
13-4. IP Address etc… Settings “Ether”

Set basic parameters necessary for communication using the Ethernet interface. This section describes the things related to settings only. For general handling information, refer to the instruction manual for “Communication Interface” provided separately.

(1) Pressing the \textbf{MENU} key displays the menu window (list of setting items).

(2) Select “Ether”.

(3) Move the cursor to the parameter to be set with the \textbf{▲/▼/◄/►} keys.

(4) Press the \textbf{ENTER} key to make it available for setting and then select or enter a value.

(5) After completing the settings of this item, move the cursor to \textbf{Set}.

(6) Press the \textbf{ENTER} key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the \textbf{ESC} key.

Note: Actual windows are separated. Use the \textbf{▲/▼} keys to scroll and continue settings

[List of Ether setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Setting disabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC Address</td>
<td>Ethernet MAC address of the unit</td>
<td>Unique value</td>
<td>Setting disabled</td>
</tr>
<tr>
<td>IP Address</td>
<td>Set IP address</td>
<td>192.168.254.254</td>
<td><strong>:</strong>:<strong>:</strong></td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>Set subnet mask</td>
<td>255.255.255.0</td>
<td><strong>:</strong>:<strong>:</strong></td>
</tr>
<tr>
<td>Default Gateway</td>
<td>Set default gateway address of the network used</td>
<td>0.0.0.0</td>
<td><strong>:</strong>:<strong>:</strong></td>
</tr>
<tr>
<td>DNS ON/OFF</td>
<td>Select whether to use DNS (domain name server)</td>
<td>OFF</td>
<td>OFF (not used).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ON (used)</td>
</tr>
<tr>
<td>[DNS Servers]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Server</td>
<td>Set primary DNS server</td>
<td>0.0.0.0</td>
<td><strong>:</strong>:<strong>:</strong></td>
</tr>
<tr>
<td>Secondary server</td>
<td>Set secondary DNS server</td>
<td>0.0.0.0</td>
<td><strong>:</strong>:<strong>:</strong></td>
</tr>
<tr>
<td>Port No.</td>
<td>Set port No. for socket communication by TCP/IP</td>
<td>11111</td>
<td>0 to 65535</td>
</tr>
<tr>
<td>Password</td>
<td>Set a password consisting of up to 32 characters used for setting on the Web</td>
<td>3571</td>
<td></td>
</tr>
</tbody>
</table>

Reference Example settings for small network

To use the unit in a small network using a router without connecting to internal LAN or internet, set the IP address as shown below.

<table>
<thead>
<tr>
<th>Unit</th>
<th>IP address</th>
<th>Subnet mask</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-200 A</td>
<td>192.168.254.254</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>SR-200 B</td>
<td>192.168.254.253</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>PC A</td>
<td>192.168.254.1</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>PC B</td>
<td>192.168.254.2</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
</tbody>
</table>
13-5. SNTP Settings “SNTP”

Set SNTP related parameters for Ethernet interface. Specify whether or not to use SNTP, server to be used and query time. When SNTP is set to “ON”, a query is sent to the server according to the setting. When the time is obtained normally, it will be set automatically.

This section describes the things related to settings only. For general handling information, refer to the instruction manual for “Communication Interface” provided separately.

(1) Pressing the [menu] key displays the menu window (list of setting items).

(2) Select “SNTP”.

(3) Move the cursor to the parameter to be set with the ▲▼ keys.

(4) Press the [enter] key to make it available for setting and then select or enter a value.

(5) After completing the settings of this item, move the cursor to “Set”.

(6) Press the [enter] key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the [esc] key.

[List of SNTP setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON/OFF</td>
<td>Set whether or not to use time setting function by SNTP</td>
<td>OFF (not used), ON (used)</td>
<td></td>
</tr>
<tr>
<td>Server</td>
<td>Set SNTP server name or IP address using 32 characters maximum</td>
<td>Not set</td>
<td>Set server name when DNS is used. Set server IP address when DNS is not used.</td>
</tr>
<tr>
<td>[Std.TIME]</td>
<td>Set reference time for query</td>
<td>00:00</td>
<td>00:00 to 23:59</td>
</tr>
<tr>
<td>Offset(UTC)</td>
<td>Set difference (time) at regional time and Universal Time</td>
<td>9</td>
<td>-11 – 12</td>
</tr>
<tr>
<td>Now Update</td>
<td>Obtain the time immediately after confirming settings by Set</td>
<td>Check the check box to enable the function.</td>
<td></td>
</tr>
</tbody>
</table>
13-6. E-mail Settings “E-mail”

Set E-mail transmission related parameters for Ethernet interface. E-mail can be sent when alarm or time event occurs. This section describes the things related to settings only. For general handling information, refer to the instruction manual for “Communication Interface” provided separately.

1. Account setup

Set up necessary items for E-mail transmission such as transmission server and mail account. Although E-mail receiving function is unavailable, POP3 server needs to be set since POP3 authentication is required in some cases at transmission.

- Pressing the [MENU] key displays the menu window (list of setting items).
- Select “E-mail”.
- Make sure that the cursor is on “Account”, and press the [ENTER] key.
- Move the cursor to the parameter to be set with the ▲/▼/◀/▶ keys.
- Press the [ENTER] key to make it available for setting and then select or enter a value.
- After completing the settings of this item, move the cursor to “Set”.
- Press the [SET] key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the [ESC] key.

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.

[List of E-mail Account setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>POP3 Server</td>
<td>Set server name or IP address used for POP3 authentication using 32 characters maximum</td>
<td>Not set</td>
<td>Set server name when DNS is used.</td>
</tr>
<tr>
<td>POP3 Port</td>
<td>Set POP3 server port No.</td>
<td>110</td>
<td>Fixed to 110</td>
</tr>
<tr>
<td>SMTP Server</td>
<td>Set SMTP server name or IP address using 32 characters maximum</td>
<td>Not set</td>
<td>Set server name when DNS is used.</td>
</tr>
<tr>
<td>SMTP Port</td>
<td>Set SMTP server port No.</td>
<td>25</td>
<td>Fixed to 25</td>
</tr>
<tr>
<td>User ID</td>
<td>Set mail account using 32 characters maximum</td>
<td>Not set</td>
<td></td>
</tr>
<tr>
<td>Password</td>
<td>Set mail password using 32 characters maximum</td>
<td>Not set</td>
<td></td>
</tr>
<tr>
<td>Authentication</td>
<td>Select authentication type for accessing transmission server</td>
<td>None</td>
<td>None, POP, APOP</td>
</tr>
<tr>
<td>Sender address</td>
<td>Set sender mail address using 32 characters maximum</td>
<td>Not set</td>
<td></td>
</tr>
</tbody>
</table>
2. Address setting

Set the destination address. E-mail can be sent to up to three different addresses.

1. Pressing the [MENU] key displays the menu window (list of setting items).

2. Select “E-mail”.

3. Move the cursor to “Setting” beside “Address” and press the [ENTER] key.

4. Move the cursor to the target address No. with the ▲/▼ keys and press the [ENTER] key. The cursor does not move to parameters other than No.

5. Press the [ENTER] key to make it available for setting and then enter a destination address.

6. After completing the setting of this item, move the cursor to [Set].

7. Press the [ENTER] key to register the setting (when chart recording is ON, a setting change mark is printed). To cancel the setting, press the [ESC] key.

<table>
<thead>
<tr>
<th>E-mail Address setting parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameter</strong></td>
</tr>
<tr>
<td>Address</td>
</tr>
</tbody>
</table>
3. Transmission condition setting

Set the E-mail transmission condition. E-mail can be sent at alarm activation (when alarm is activated on the specified channel), at set time (at every interval from reference time) or at occurrence of event like chart end (see “8-22. Fail Output Settings”). Up to six conditions can be registered.

(1) Pressing the menu key displays the menu window (list of setting items).

(2) Select “E-mail”.

(3) Move the cursor to Setting beside “Condition” and press the enter key.

(4) Move the cursor to the target condition No. with the ▲/▼ keys and press the enter key. The cursor does not move to parameters other than No.

(5) Move the cursor to the parameter to be set with the ▲/▼/◄/► keys.

(6) Press the enter key to make it available for setting and then select or enter a value.

(7) After completing the settings of this item, move the cursor to Set.

(8) Press the enter key to register the settings (when chart recording is ON, a setting change mark is printed). To cancel the settings, press the esc key.

Note: Actual windows are separated. Use the ▲/▼ keys to scroll and continue settings.

[List of E-mail Condition setting parameters]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Default</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Select E-mail transmission condition</td>
<td>None (not used), Alarm (at alarm activation), Interval (send measured value at fixed intervals), FailOut</td>
<td></td>
</tr>
<tr>
<td>[Target CH]</td>
<td>Set beginning and end of target CHs to send e-mail for alarm activation or measured value</td>
<td>* 1 to 4</td>
<td></td>
</tr>
<tr>
<td>[Std.TIME]</td>
<td>Set reference time for sending measured data</td>
<td>* 00:00 to 23:59</td>
<td></td>
</tr>
<tr>
<td>[Interval]</td>
<td>Set interval for sending measured data</td>
<td>* 00:00 to 24:59</td>
<td></td>
</tr>
<tr>
<td>[Address No.]</td>
<td>Select destination address for each condition</td>
<td>Select up to three addresses from those set in the previous section by checking desired address No.</td>
<td></td>
</tr>
</tbody>
</table>

Reference

Interval setting

E-mail is sent at the following time: reference time + (interval x n) \( n = 0, 1, 2, 3 \ldots \)

Example: [Std.TIME] is set to "00:00" and [Interval] is set to "04:00"
E-mail will be sent at 00:00, 04:00, 08:00, 12:00, 16:00 and 20:00.
### 14. Specifications

#### Input specifications

<table>
<thead>
<tr>
<th>Measurement point</th>
<th>1st pen, 2nd pen, 3rd pen and 4th pen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input type</td>
<td>DC voltage</td>
</tr>
<tr>
<td></td>
<td>±13.8mV, ±27.8mV, ±910mV, ±200mV,</td>
</tr>
<tr>
<td></td>
<td>±500mV, ±1V, ±5V, ±10V, ±20V, ±50V</td>
</tr>
<tr>
<td></td>
<td>(DC current) supported by additional shunt resistor (100Ω, 2500Ω)</td>
</tr>
<tr>
<td>Thermocouple/DC voltage</td>
<td>±10V or lower range: 58mΩ or higher DC voltage</td>
</tr>
<tr>
<td>Input resistance</td>
<td>±13.8mV, ±27.8mV, ±910mV, ±200mV,</td>
</tr>
<tr>
<td></td>
<td>±500mV, ±1V, ±5V, ±10V, ±20V, ±50V</td>
</tr>
<tr>
<td></td>
<td>(DC current) supported by additional shunt resistor (100Ω, 2500Ω)</td>
</tr>
<tr>
<td>Burnout</td>
<td>None/UP/DOWNW selected for each input CH for thermocouple, resistance thermometer and DC voltage (±500mV or lower range). These cannot be selected with DC voltage (±1V or higher range). Maximum time to detect burnout is about 1 second.</td>
</tr>
<tr>
<td>Maximum input</td>
<td>Thermocouple/DC voltage (±5V or lower range): ±6MΩ or higher DC voltage (±10V or higher range): Approx. 1MΩ</td>
</tr>
<tr>
<td>voltage</td>
<td>130dB or more (50/60Hz)</td>
</tr>
<tr>
<td>Measuring current</td>
<td>Resistance thermometer: 1mA ±20%</td>
</tr>
<tr>
<td></td>
<td>Max. input voltage: ±10V or lower range: ±10V or higher range: ±60V or lower</td>
</tr>
<tr>
<td></td>
<td>Resistance thermometer: ±10V or lower</td>
</tr>
<tr>
<td></td>
<td>100 or lower per wire, the same resistance for 3 wires</td>
</tr>
<tr>
<td>Accuracy rating</td>
<td>Refer to the tables of measuring range, rated accuracy and display resolution.</td>
</tr>
<tr>
<td>Reference junction compensation accuracy</td>
<td>Refer to the table of reference junction compensation accuracy.</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>±0.01°F/°C</td>
</tr>
<tr>
<td></td>
<td>Converted into reference electromotive force</td>
</tr>
<tr>
<td>Terminal board</td>
<td>Detachable</td>
</tr>
</tbody>
</table>

#### Recording specifications

<table>
<thead>
<tr>
<th>Recording system</th>
<th>Trace printing: disposable felt-tip pen Digital printing: dot type plotter pen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording color</td>
<td>CH 1 Red, CH 2 Green, CH 3 Blue, CH 4 Brown</td>
</tr>
<tr>
<td></td>
<td>Digital recording/printing: Purple</td>
</tr>
<tr>
<td></td>
<td>*From far on the chart: CH1, CH2, CH3, CH4</td>
</tr>
<tr>
<td>Digital recording/printing</td>
<td>Year/month, date, time, CH setting, recording setting and specified area.</td>
</tr>
<tr>
<td></td>
<td>Operation recording Remote contact ON/OFF status is recorded with straight line to specified area. Specified area: Within the range of 0 to 100% Up to 10 types can be recorded. * Only for the unit using remote contact and enabling operation recording.</td>
</tr>
<tr>
<td></td>
<td>Chart illumination White LED ON/OFF/AUTO (turn OFF after 3-minute unused period can be set).</td>
</tr>
<tr>
<td></td>
<td>Chart end detection Notified on the operation screen and status LED.</td>
</tr>
<tr>
<td>Recording accuracy</td>
<td>Measurement accuracy ±0.3%</td>
</tr>
<tr>
<td></td>
<td>Chart speed set arbitrarily from 1 to 600m/min or 1 to 200m/min in 1mm intervals. 12.5mm/min can be set exceptionally. Chart speed accuracy is in 0.1% of the chart scale.</td>
</tr>
<tr>
<td></td>
<td>Chart fast-feed operated by FEED key Feed 0.1mm by one quick press of the key or feed continuously (approx. 600m/min) by holding down the key.</td>
</tr>
<tr>
<td>Display/recording</td>
<td>Select ON/OFF for trace printing to chart, digital printing to chart and recording to SD card for each CH.</td>
</tr>
<tr>
<td>UNS/OF</td>
<td>Subdivide printing Difference between reference CH value and measured value or between set value and measured value is printed.</td>
</tr>
<tr>
<td>Zone printing</td>
<td>2/3/4 divisions</td>
</tr>
<tr>
<td></td>
<td>Chart recording lower/upper limit is made non-linear, and specific chart recording lower/upper limit is shrunk or expanded.</td>
</tr>
<tr>
<td></td>
<td>Recording range is shifted automatically to another set range when measured value exceeds the current range. Overlap function available</td>
</tr>
<tr>
<td></td>
<td>Data printing Printing format differs depend on the chart speed. Printed items are time, CH No., data and unit. Consecutive requests are limited to a certain number.</td>
</tr>
<tr>
<td></td>
<td>Periodic data printing Digital printing is added to trace printing at (1) arbitrary intervals or (2) specified time. Printed items: Time, CH No., data and unit (1) Set interval and start time. Interval is limited by chart speed. (2) Set time for printing (24 points maximum)</td>
</tr>
<tr>
<td></td>
<td>Data printing Printing format differs depend on the chart speed. Printed items are time, CH No., data and unit. Consecutive requests are limited to a certain number.</td>
</tr>
<tr>
<td></td>
<td>Calendar timer printing Printing is performed with calendar timer ON and printing enabled. Trace printing is continued. Printed items: Year/month, date, time, calendar timer No. and message One message consists of up to 15 characters (alphabets, numbers, katakana, symbols, etc.). Up to 20 types can be registered. Consecutive requests are limited to a certain number.</td>
</tr>
</tbody>
</table>

Note: This table provides a summary of various specifications and settings for a specific device, including input and recording parameters, accuracy, and various printing configurations.
Analog indication
Undefined (no analog indication)

Status LED
(1) REC: Green LED
  OFF: Recording stopped
  Flash: Chart end detecting
ON: Recording
(2) CARD: Green LED
  OFF: No card inserted
  Flash: Card being accessed
ON: Card inserted
(3) ALM: Red LED
  OFF: All alarm OFF
  Flash: Any alarm ON notification

Operation/set keys
FUNCTION: Function switch 1
ENTER: Register settings
MENU: Display settings
ESC: Cancel settings
ENTER: Register settings
FUNC1: Function switch 1
REC: Recording start/stop
FEED: Chart fast feed
DATAP Print

Front engineering port
Mini-USB port

General specifications
General specification: 100 to 240V AC
General specification: 50/60Hz

Power consumption
1st pen specification: general specification, MAX 37VA
100V AC balanced*: 16VA
240V AC balanced*: 22VA
2nd pen specification: general specification, MAX 38VA
100V AC balanced*: 17VA
240V AC balanced*: 24VA
3rd pen specification: general specification, MAX 39VA
100V AC balanced*: 18VA
240V AC balanced*: 24VA
4th pen specification: general specification, MAX 40VA
100V AC balanced*: 18VA
240V AC balanced*: 26VA

* Balanced: Only recording. Alarm and communication are not operated.

Memory protection
Set contents and pen type POC data maintained by nonvolatile RAM.
Clock data maintained by lithium battery. (Under the normal operating condition 21 to 25°C and 45 to 55% RH, data saved for more than 10 years with 8-hour or more operation per day.) (Alarm message displayed when battery level drops.)

Clock accuracy
±2 minutes in 30 days (under reference operating condition, error caused by power ON/OFF excluded)

Insulation resistance
Primary terminal – protective conductor terminal: 20MD or more (500V DC)
Secondary terminal – protective conductor terminal: 20MD or more (500V DC)
Primary terminal – secondary terminal: 20MD or more (500V DC)
* Primary terminal: General power terminal (100 to 240V), alarm output terminal of mechanical relay "a" and mechanical relay "c"
Secondary terminal: All terminals other than primary and protective conductor terminals
Protective terminal is connected to the chassis metal part.

Withstand voltage
Primary terminal – protective conductor terminal: 1500V AC (one minute)
Secondary terminal – protective conductor terminal: 500V AC (one minute)
Primary terminal – secondary terminal: 1500V AC (one minute)
* Primary terminal: General power terminal (100 to 240V), alarm output terminal of mechanical relay "a" and mechanical relay "c"
Secondary terminal: All terminals other than primary and protective conductor terminals
Protective terminal is connected to the chassis metal part.

Environmental
RoHS compliant
EU new battery directive compliant
PFOs compliant
CHINO’s environmentally-conscious design compliant

Packaging material
Environmentally-friendly materials used

Weight
1st pen specification: approx.: 7g (with full options)
2nd pen specification: approx.: 7.5g (with full options)
3rd pen specification: approx.: 7.8g (with full options)
4th pen specification: approx.: 7.9g (with full options)

Power frequency
General specification: 50/60Hz ±2%
Power voltage
General specification: 100V AC ±1%
±10%
Warm-up time
30 minutes or more

Environmental
Impact 0 m/s2
Vibration 0 m/s2
Altitude 2000m or lower

Mounting condition
Single panel mounting (space required around)
Mounting brackets attached to the right and left sides

Power consumption
100V AC balanced*: 16VA
240V AC balanced*: 22VA
2nd pen specification: general specification, MAX 38VA
Power provision
General specification: 100V AC ±11%
Power provision
General specification: 50/60Hz ±0.5%

Mounting posture
Back and forth 45°, left and right 45°
Mounting condition
Single panel mounting (space required around)

Ambient temperature
0 to 50°C (20 to 65%RH, non-condensing)

Power consumption
3rd pen specification: approx.: 7.6g (with full options)

Impact
0 m/s²

Impact
0 m/s²
Wind None

Environmental
Impact
0 m/s²
Wind None

Environmental
Impact
0 m/s²
Wind None

Power frequency
General specification: 50/60Hz ±2%
Power provision
General specification: 100 to 240V AC±10%

Impact
0 m/s²

Impact
0 m/s²

Power consumption
100V AC balanced*: 16VA
240V AC balanced*: 22VA
2nd pen specification: general specification, MAX 38VA
100V AC balanced*: 17VA
240V AC balanced*: 24VA
3rd pen specification: general specification, MAX 39VA
100V AC balanced*: 18VA
240V AC balanced*: 24VA
4th pen specification: general specification, MAX 40VA
100V AC balanced*: 18VA
240V AC balanced*: 26VA

* Balanced: Only recording. Alarm and communication are not operated.

Memory protection
Set contents and pen type POC data maintained by nonvolatile RAM.

Clock data maintained by lithium battery. (Under the normal operating condition 21 to 25°C and 45 to 55% RH, data saved for more than 10 years with 8-hour or more operation per day.) (Alarm message displayed when battery level drops.)

Clock accuracy
±2 minutes in 30 days (under reference operating condition, error caused by power ON/OFF excluded)

Insulation resistance
Primary terminal – protective conductor terminal: 20MD or more (500V DC)
Secondary terminal – protective conductor terminal: 20MD or more (500V DC)
Primary terminal – secondary terminal: 20MD or more (500V DC)
* Primary terminal: General power terminal (100 to 240V), alarm output terminal of mechanical relay "a" and mechanical relay "c"
Secondary terminal: All terminals other than primary and protective conductor terminals
Protective terminal is connected to the chassis metal part.

Withstand voltage
Primary terminal – protective conductor terminal: 1500V AC (one minute)
Secondary terminal – protective conductor terminal: 500V AC (one minute)
Primary terminal – secondary terminal: 1500V AC (one minute)
* Primary terminal: General power terminal (100 to 240V), alarm output terminal of mechanical relay "a" and mechanical relay "c"
Secondary terminal: All terminals other than primary and protective conductor terminals
Protective terminal is connected to the chassis metal part.

Environmental
Impact
0 m/s²
Wind None

Environmental
Impact
0 m/s²
Wind None

Power frequency
General specification: 50/60Hz ±2%
Power provision
General specification: 100 to 240V AC±10%

Impact
0 m/s²
Wind None

Environmental
Impact
0 m/s²
Wind None

Power consumption
100V AC balanced*: 16VA
240V AC balanced*: 22VA
2nd pen specification: general specification, MAX 38VA
100V AC balanced*: 17VA
240V AC balanced*: 24VA
3rd pen specification: general specification, MAX 39VA
100V AC balanced*: 18VA
240V AC balanced*: 24VA
4th pen specification: general specification, MAX 40VA
100V AC balanced*: 18VA
240V AC balanced*: 26VA

* Balanced: Only recording. Alarm and communication are not operated.

Memory protection
Set contents and pen type POC data maintained by nonvolatile RAM.

Clock data maintained by lithium battery. (Under the normal operating condition 21 to 25°C and 45 to 55% RH, data saved for more than 10 years with 8-hour or more operation per day.) (Alarm message displayed when battery level drops.)

Clock accuracy
±2 minutes in 30 days (under reference operating condition, error caused by power ON/OFF excluded)

Insulation resistance
Primary terminal – protective conductor terminal: 20MD or more (500V DC)
Secondary terminal – protective conductor terminal: 20MD or more (500V DC)
Primary terminal – secondary terminal: 20MD or more (500V DC)
* Primary terminal: General power terminal (100 to 240V), alarm output terminal of mechanical relay "a" and mechanical relay "c"
Secondary terminal: All terminals other than primary and protective conductor terminals
Protective terminal is connected to the chassis metal part.

Withstand voltage
Primary terminal – protective conductor terminal: 1500V AC (one minute)
Secondary terminal – protective conductor terminal: 500V AC (one minute)
Primary terminal – secondary terminal: 1500V AC (one minute)
* Primary terminal: General power terminal (100 to 240V), alarm output terminal of mechanical relay "a" and mechanical relay "c"
Secondary terminal: All terminals other than primary and protective conductor terminals
Protective terminal is connected to the chassis metal part.
<table>
<thead>
<tr>
<th>Input type</th>
<th>Measuring range</th>
<th>Reference range</th>
<th>Display resolution</th>
<th>Rated accuracy</th>
<th>Exception</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DC, voltage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC (mV)</td>
<td>-13.80 to 13.80mV</td>
<td>±13.8mV</td>
<td>10µV</td>
<td>±0.1%FS ±1digit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-27.60 to 27.60mV</td>
<td>±27.6mV</td>
<td>10µV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-69.00 to 69.00mV</td>
<td>±69.0mV</td>
<td>10µV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-200.0 to 200.0mV</td>
<td>±200mV</td>
<td>100µV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-500.0 to 500.0mV</td>
<td>±500mV</td>
<td>100µV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC (V)</td>
<td>-1.00 to 1.00V</td>
<td>±1V</td>
<td>10mV</td>
<td>±0.1%FS ±1digit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-5.00 to 5.00V</td>
<td>±5V</td>
<td>10mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-10.00 to 10.00V</td>
<td>±10V</td>
<td>10mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-20.00 to 20.00V</td>
<td>±20V</td>
<td>10mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-50.00 to 50.00V</td>
<td>±50V</td>
<td>10mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thermocouple</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>-200.0 to 300.0°C</td>
<td>±13.8mV</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td>-200 to 0°C: ±0.2%FS ±1digit or equivalent of 70µV, whichever is larger</td>
</tr>
<tr>
<td></td>
<td>-200.0 to 600.0°C</td>
<td>±27.6mV</td>
<td>0.1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-200 to 1370°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>-200.0 to 200.0°C</td>
<td>±13.8mV</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td>-200 to 0°C: ±0.2%FS ±1digit or equivalent of 70µV, whichever is larger</td>
</tr>
<tr>
<td></td>
<td>-200.0 to 350.0°C</td>
<td>±27.6mV</td>
<td>0.1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-200 to 900°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>-200.0 to 250.0°C</td>
<td>±13.8mV</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td>-200 to 0°C: ±0.2%FS ±1digit or equivalent of 70µV, whichever is larger</td>
</tr>
<tr>
<td></td>
<td>-200.0 to 500.0°C</td>
<td>±27.6mV</td>
<td>0.1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-200 to 1200°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-200.0 to 250.0°C</td>
<td>±13.8mV</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td>-200 to 0°C: ±0.2%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td>-200.0 to 400.0°C</td>
<td>±27.6mV</td>
<td>0.1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 to 1200°C</td>
<td>±13.8mV</td>
<td>1°C</td>
<td>±0.1%FS ±1digit</td>
<td>0 to 400°C: ±0.2%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td>0 to 1760°C</td>
<td>±27.6mV</td>
<td>1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>0 to 1300°C</td>
<td>±13.8mV</td>
<td>1°C</td>
<td>±0.1%FS ±1digit</td>
<td>0 to 400°C: ±0.2%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td>0 to 1820°C</td>
<td>±13.8mV</td>
<td>1°C</td>
<td>±0.1%FS ±1digit</td>
<td>0 to 400°C: undefined</td>
</tr>
<tr>
<td>B</td>
<td>0 to 1820°C</td>
<td>±13.8mV</td>
<td>1°C</td>
<td>±0.1%FS ±1digit</td>
<td>0 to 400°C: undefined</td>
</tr>
<tr>
<td></td>
<td>0 to 200°C</td>
<td>±13.8mV</td>
<td>1°C</td>
<td>±0.2%FS ±1digit</td>
<td>0 to 800°C: ±0.2%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td>0 to 400°C</td>
<td>±27.6mV</td>
<td>1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 to 1370°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 to 2315°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td>±0.15%FS ±1digit</td>
<td>0 to 400°C: ±0.3%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td>W-WRe26</td>
<td>0 to 2315°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td>±0.15%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td>WRe5-WRe26</td>
<td>0 to 2315°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td>±0.2%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td>NiMo-Ni</td>
<td>0.0 to 290.0°C</td>
<td>±13.8mV</td>
<td>0.1°C</td>
<td>±0.2%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0 to 600.0°C</td>
<td>±27.6mV</td>
<td>0.1°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 1310°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td></td>
</tr>
<tr>
<td>Platinel II</td>
<td>0.0 to 350.0°C</td>
<td>±13.8mV</td>
<td>0.1°C</td>
<td>±0.15%FS ±1digit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0 to 650.0°C</td>
<td>±27.6mV</td>
<td>0.1°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 1390°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td></td>
</tr>
<tr>
<td>PtRh40-PtRh20</td>
<td>0 to 1880°C</td>
<td>±13.8mV</td>
<td>1°C</td>
<td>±0.2%FS ±1digit</td>
<td>0 to 400°C: ±1.5%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 200°C</td>
<td>±13.8mV</td>
<td>1°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 1370°C</td>
<td>±69.0mV</td>
<td>1°C</td>
<td></td>
</tr>
<tr>
<td>CR-AuFe</td>
<td>0.0 to 280.0K</td>
<td>±6.9mV</td>
<td>0.1K</td>
<td>±0.2%FS ±1digit</td>
<td>0 to 20K: ±0.5%FS ±1digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20 to 50K: ±0.3%FS ±1digit</td>
</tr>
<tr>
<td>Au/Pt</td>
<td>0.0 to 1000.0°C</td>
<td>±27.6mV</td>
<td>0.1°C</td>
<td>±0.2%FS ±1digit</td>
<td></td>
</tr>
</tbody>
</table>
### Resistance thermometer

<table>
<thead>
<tr>
<th>Input type</th>
<th>Measuring range</th>
<th>Reference range</th>
<th>Display resolution</th>
<th>Rated accuracy</th>
<th>Exception</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100</td>
<td>-140.0 to 150.0°C</td>
<td>160Ω</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td></td>
</tr>
<tr>
<td>Old Pt100</td>
<td>-140.0 to 150.0°C</td>
<td>160Ω</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td></td>
</tr>
<tr>
<td>JPt100</td>
<td>-140.0 to 150.0°C</td>
<td>160Ω</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td></td>
</tr>
<tr>
<td>Pt50</td>
<td>-200.0 to 649.0°C</td>
<td>340Ω</td>
<td>0.1°C</td>
<td>±0.1%FS ±1digit</td>
<td></td>
</tr>
<tr>
<td>Pt-Co</td>
<td>4.0 to 374.0K</td>
<td>220Ω</td>
<td>0.1K</td>
<td>±0.15%FS ±1digit</td>
<td>4 to 20K: ±0.5%FS ±1digit</td>
</tr>
</tbody>
</table>

* Measuring range conversion accuracy under reference operating condition.

Reference junction compensation accuracy is added for thermocouple input.

- W-WRe26, NiMo-Ni, Platinel II, PtRh40-PtRh20, CR-AuFe, Au/Pt: ASTM E1751
- WRe5-WRe26: ASTM E988
- U, L: DIN43710-1985
- Pt50: JIS C 1604-1981
- Pt-Co: CHINO

#### Reference junction compensation accuracy

<table>
<thead>
<tr>
<th>Input type</th>
<th>Reference junction compensation accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>K, E, J, T, N Platinel II</td>
<td>Ambient temperature: 23°C±10°C ±0.5°C or equivalent of 20μV, whichever is larger.</td>
</tr>
<tr>
<td>Except for above description</td>
<td>Ambient humidity: range except for description on the left ±1.0°C or equivalent of 40μV, whichever is larger.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Plus or minus 1 digit during scaling

Plus or minus 1 digit is the scaling value corresponding display resolution of the measuring range. For example, when scaling "±10" for ±500mV range, ±1 digit = ±0.002.
<table>
<thead>
<tr>
<th>Printed Edn.</th>
<th>Revised pages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 2014 1</td>
<td>3, 18, 21</td>
<td>4. Change lengths of the chart paper of &quot;Remarks&quot;</td>
</tr>
<tr>
<td>June 2017 2</td>
<td></td>
<td>2), (2) Change 13 pages → 4-3. Wiring, 2. Precautions on wiring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4), (8) Change the sentences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End Change AAS-511A-014-04 to AAS-511A-014-06</td>
</tr>
</tbody>
</table>
We would like to express our appreciation for your purchase and use of Azbil Corporation's products. You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place.

Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

1. Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
2. Failure caused for other reasons than Azbil Corporation's product;
3. Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
4. Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
5. Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
6. Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

1. Regulations and standards or laws that your Equipment is to comply with.
2. Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
3. Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use. Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design, *1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance, *3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

*1. A design that is safe even if the user makes an error.
*2. A design that is safe even if the device fails.
*3. Avoidance of device failure by using highly reliable components, etc.
*4. The use of redundancy.

3. Precautions and restrictions on application

Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil Limit Switch For Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area).

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

In addition, you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below.

Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

1. For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
2. For use of specific purposes, such as:
   * Nuclear energy/radiation related facilities
     [For use outside nuclear energy controlled areas] [For use of Azbil Corporation's Limit Switch For Nuclear Energy]
   * Machinery or equipment for space/sea bottom
   * Transportation equipment
     [Railway, aircraft, vessels, vehicle equipment, etc.]
   * Antidisaster/crime-prevention equipment
4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations. In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquiries or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

(1) Installation, adjustment, guidance, and attendance at a test run
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education
(4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.