INST. No. INE-308H

AL3000 SERIES (PEN TYPE)
AH3000 SERIES (PEN TYPE)

HYBRID RECORDERS

INSTRUCTIONS

CHINO
Preface: Request and notice

This instruction describes pen type AL3000 series hybrid recorder (100 mm printing width) and pen type AH3000 series hybrid recorder (180 mm printing width).
In order to use your recorder correctly and safely and to prevent malfunctions, please read this instruction manual carefully.

Other instruction manuals to be provided separately

This instruction manual describes the operation under the standard specifications and also operations for the optional specifications of (1) alarm output/remote contacts and (2) printing format. For the communications interface unit and the optional specification of mathematical function/totalization, exclusive manuals are provided separately. Also for other optional specifications, of which description of operation is necessary, the relevant instruction manuals are provided respectively. Please read these together with this instruction manual if necessary.

Requests

1. To agents or distributors
   Make sure to pass this instruction manual to final customers.
2. To our valuable customers
   Keep this instruction manual until disposing of your recorder.

Notices

1. All or any part of this manual may not be duplicated or reproduced in any form, without first obtaining the permission of CHINO.
2. The details of this manual may be subject to change without notice.
3. The contents in this instruction manual have been carefully checked. However, if any question should still arise or if any error, omission or other deficiency be found, please inform your local CHINO sales agent of the details.
4. CHINO will not be responsible for any troubles resulting from the operations of your recorder.
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The items marked with ▲ in titles contain ▲ Warning and ▲ Caution. Read these items without fail.
1. **Preconditions for Use**

Your recorder is designed for indoor use by mounting it on an indoor instrumentation panel. (exception: portable types)

**International safety standards**  
- IEC standards: Conforms to safety class I (with PROTECTIVE CONDUCTOR TERMINAL) and IEC1010-1 (OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2)
- Enclosure productivity: Conforms to IEC529 (IP54)
- CE (EC Directive): EMC: Conforms to EN61326  
  Safety: Conforms to EN61010-1+A2
- UL standards: UL3111-1 (Approval pending)
- CSA (C-UL) standards: CSA C22.2 No. 1010 (Approval pending)

2. **Labels on This Instrument**

The following labels are used for safe use.

<table>
<thead>
<tr>
<th>Label</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Alert symbol mark</td>
<td>Caution on handling for prevention of an electric shock, injury or other accidents.</td>
</tr>
<tr>
<td>⬇</td>
<td>Protective conductor terminal</td>
<td>A terminal is provided for connection to the protective conductor of the power supply facility in order to prevent any electric shocks.</td>
</tr>
</tbody>
</table>

3. **Symbols in This Manual**

Cautions to be observed for preventing damage to your recorder and unexpected accidents are indicated by the following symbols according to their degree of importance.

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Meaning of symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>! Warning</td>
<td>This symbol is shown together with relevant titles (or items) where ! Warning or ! Caution is attached. Read them with care.</td>
</tr>
<tr>
<td>! Caution</td>
<td>This symbol indicates a description of cautions for avoiding the possibility of causing serious injury or death due to an electric shock or other accident.</td>
</tr>
<tr>
<td>! Caution</td>
<td>This symbol indicates a description of cautions for avoiding the possibility of causing slight injury to a person or damage to your recorder or to peripheral units.</td>
</tr>
<tr>
<td>! Remarks</td>
<td>This symbol shows a caution when your recorder does not function as specified or when such a possibility exists.</td>
</tr>
<tr>
<td>! Reference</td>
<td>This reference serves to indicate supplementary information for handling and operation for your convenience.</td>
</tr>
</tbody>
</table>
WARNINGs

This paragraph covers important warnings for safety to be observed before reading the instructions. A full understanding of the following warnings is required. These warnings are important for the prevention of danger to human bodies as well as accidents with your recorder.

1. Switch and overcurrent protective device
   Your recorder is not provided with a power switch or a replaceable overcurrent protective device. Prepare a switch and an overcurrent protective device (circuit breakers, circuit protectors or similar units) for the power supply within 3 m of your recorder in a location where you can reach easily.
   Use a switch and an overcurrent protective device conforming to IEC948-1 and IEC947-3.

2. Be sure to ground your recorder
   Before turning on the power, connect the protective conductor terminal your recorder to the protective conductor of the power supply facility. Do not disconnect this wiring in running of your recorder to prevent an electric shock.

3. Before turning on the power supply
   In order to ensure safety, before turning on the external power switch, make sure that the power voltage is within the range indicated on the power supply label.

4. Don’t repair or modify your recorder.
   Make sure that a service engineer approved by the CHINO CORPORATION is ONLY permitted to repair or modify your recorder by replacing parts. Otherwise, it may be damaged or will not function correctly, or an accident such as an electric shock may result. For usual operation, it is not necessary to pull out an internal unit from a case.

5. Use your recorder in accordance with this instruction manual.
   Use your recorder correctly and safely in accordance with this instruction manual. CHINO CORPORATION will not be responsible for any injury, damage, lost profit or any other claim, which may result from its wrong use.

6. Turn off the power supply if an abnormal symptom occurs.
   If any abnormal odor, noise or any smoke occurs, or if your recorder becomes too hot to be touched, turn off the power supply immediately and contact your local CHINO sales agent.

Reference

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHURTER</td>
<td>SPT001.2508</td>
<td>250VAC 2.5A</td>
</tr>
<tr>
<td>LITTEL FUSE</td>
<td>21502.5</td>
<td></td>
</tr>
<tr>
<td>WICKMANN</td>
<td>19181</td>
<td></td>
</tr>
</tbody>
</table>

Note: This figure is for AL3000 series.
MAJOR FEATURES AND FUNCTIONS

Your recorder can record temperature and other various industrial variables on a 100 mm (if your recorder is AL3000) or 180 mm (if your recorder is AH3000) chart for 1 to 4 channels (depending on the number of pens).

1. Trace printing by pens
2. Digital data printing to print measured values and other data

1 Features

 Major features are shown below.

- Universal input. A range can be selected optionally for every channel from 10 DC voltage ranges, 36 thermocouple ranges and 11 resistance thermometer ranges.
- Universal power supply. The working voltage range is 100 to 240 V AC, 50/60 Hz.
- International safety standards…. CE: Conformance, UL and CSA (C-UL): Approval pending
- The basic operation should be carried out after programming range numbers and the trace printing range.
- You can execute all operation by the front keyboard without pulling out the internal unit. The internal unit cannot be pulled out.

2 Functions

 Major functions are shown below.

<table>
<thead>
<tr>
<th>Display</th>
<th>Printing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Simultaneous display of the measured values for 1 to 4 channels.</td>
<td>• Trend tracing for 1 to 4 channels</td>
</tr>
<tr>
<td>• Analog indication of measured values for 1 to 4 channels with bargraphs.</td>
<td>• Fixed-time printing (time line, time, scale, engineering unit, tag)</td>
</tr>
<tr>
<td>• Six status lamps</td>
<td>• Periodic data printing (Measured values are digitally printed at preset intervals.)</td>
</tr>
<tr>
<td>• Switching the operation screens (Measured value, Clock and Alarm Activation)</td>
<td>• Digital data printing (Measured values are digitally printed on demanding.)</td>
</tr>
<tr>
<td>• Measured values blinks when alarm activates. (Note)</td>
<td>• Message printing</td>
</tr>
</tbody>
</table>

(Note) Programming of alarm is necessary. Alarm output is only available when your recorder is with the option of “Alarm Output”.
1. GENERAL

1.1 Confirmation of Model No.

Pen type AL3000 series and AH3000 series have various specifications. Confirm Model No. of your recorder. Labels showing Model No. are affixed to the top side of the case and to the inside of the internal unit.

### AL3000

- Model: AL373P-R20 – 00A
- Serial No.: AL00 X A001
- Made in Japan

### AH3000

- Model: AH374P – SA0 – 00A
- Serial No.: AH00 X A001
- Made in Japan

Note: For pulling out a chart cassette, refer to Section 5.1.

#### Models

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>3</td>
<td>7</td>
<td>P</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>AH</td>
<td>3</td>
<td>7</td>
<td>P</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- **Series name**
  - AL: AL3000 (100 mm)
  - AH: AH3000 (180 mm)

- **Universal input (Fixed)**

- **No. of input points (pens)/measuring cycle**
  - 1: 1 ch. (1 pen)/100 ms
  - 2: 2 ch. (2 pens)/100 ms
  - 3: 3 ch. (3 pens)/100 ms
  - 4: 4 ch. (4 pens)/100 ms

- **Pen type (Fixed)**

- **Communications interface (Optional)**
  - N: None
  - R: RS-232C
  - A: RS-422A
  - S: RS-485
  - E: Ethernet

- **Alarm output and remote contacts (Optional)**
  - 0: None
  - 1: 6 MOS relay outputs + remote contacts
  - 2: 6 mechanical relay “c” contact outputs + remote contacts*
  - 3: 12 MOS relay outputs + remote contacts
  - 4: 12 mechanical relay “c” contact outputs + remote contacts*
  - A: 6 mechanical relay “a” contact outputs + remote contacts
  - B: 12 mechanical relay “a” contact outputs + remote contacts

- **Printing format (Optional)**
  - 0: Standard
  - 1: Printing format

- **Math-function (Optional)**
  - 0: None
  - 1: Basic math-function
  - 2: Totalizer & flow correction
  - 3: Basic math-function + Totalizer & flow correction

- **Exterior design (Optional)**
  - 0: Standard
  - 1: With carrying handle & rubber stands
  - 2: Die-cast door for AL
  - 3: With carrying handle & rubber stands + Die-cast door for AL

- **Power supply (Fixed)**
  - A: 100 – 240 V AC

(Note) For AL3000, “0”, “1”, “2” and “A” are only available.

*Not conforming to CE marking, UL and CSA.
1. GENERAL

1.2 Accessories and Consumables

1 Accessories attached

<table>
<thead>
<tr>
<th>AL3000</th>
<th>AH3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names</td>
<td>Qty</td>
</tr>
<tr>
<td>(1) Chart</td>
<td>1</td>
</tr>
<tr>
<td>(2) Mounting bracket</td>
<td>2</td>
</tr>
<tr>
<td>(3) Channel indicating card</td>
<td>1</td>
</tr>
<tr>
<td>(4) Cartridge pen (Red)</td>
<td>1</td>
</tr>
<tr>
<td>(5) Cartridge pen (Green)</td>
<td>1</td>
</tr>
<tr>
<td>(6) Cartridge pen (Blue)</td>
<td>1</td>
</tr>
<tr>
<td>(7) Cartridge pen (Brown)</td>
<td>1</td>
</tr>
<tr>
<td>(8) Plotter pen</td>
<td>1</td>
</tr>
<tr>
<td>(9) Terminal screw</td>
<td>5</td>
</tr>
<tr>
<td>(10) Lubricating oil</td>
<td>1</td>
</tr>
<tr>
<td>(11) Instruction manual</td>
<td>1</td>
</tr>
<tr>
<td>(12) Wrench</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Separate instruction manuals are attached when your recorder is with the options of “Communications interface” and “Math-function and totalizer”.

2 Consumables

Charts and pens are consumables. For your ordering, refer to the following table.

<table>
<thead>
<tr>
<th>AL3000</th>
<th>AH3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article</td>
<td>Model</td>
</tr>
<tr>
<td>Cartridge pen</td>
<td></td>
</tr>
<tr>
<td>Red (1st pen)</td>
<td>22033-425315</td>
</tr>
<tr>
<td>Green (2nd pen)</td>
<td>22033-425316</td>
</tr>
<tr>
<td>Blue (3rd pen)</td>
<td>22033-425317</td>
</tr>
<tr>
<td>Brown (4th pen)</td>
<td>22033-425318</td>
</tr>
<tr>
<td>Plotter pen</td>
<td></td>
</tr>
<tr>
<td>Purple</td>
<td>22025-425331</td>
</tr>
<tr>
<td>Chart</td>
<td></td>
</tr>
<tr>
<td>10 meters</td>
<td>EM001 (0 - 100)</td>
</tr>
<tr>
<td>16 meters</td>
<td>KL01001 (0 to 100)</td>
</tr>
</tbody>
</table>
2. INSTALLATION

2.1 Location and External Dimensions

1 Location
Install your recorder at the following place so as not to affect the measuring accuracy and recording operation unfavorably.

(1) Industrial environment
Select a place being separated from electric field and magnetic field generating sources and also free of mechanical vibrations and shocks.
- Overvoltage Category: II
- Pollution Degree: 2
- Altitude: 2000m or lower
- Working place: Indoors

(2) Atmosphere
Install your recorder in a place where no inflammable gas exists and no dust, smoke, vapor, or other dangerous substance exists.

(3) Ambient temperature and humidity
Make sure not to expose your recorder to direct sunlight and not to closely place other materials to it for preventing rise of its temperature.
- The recommended ambient temperature and humidity are about 23°C and about 50%RH.
- Make sure not to expose your recorder to hot air higher than 70°C.
- Make sure not place any heat source near to the terminal board of your recorder.

(4) Mounting angle and display view angle
- Lateral tilting: 0° to 10°
- Longitudinal tilting: Forward tilting: 0° Backward tilting: 0 to 30°
- View angle... -10° to +30° based on horizontal

2 External Dimensions

AL3000

AH3000

*1: Recorders with the options of MOS relay or "c" contact alarm output, and communications interface
*2: Recorders with the option of "a" contact alarm output
2. INSTALLATION

2.2 Installation to a Panel

⚠️ Warning
Install your recorder to a panel.

Except portable types, your recorder is designed to install to a panel. Use a panel made of a steel plate of 2 mm to 6 mm in thickness.

**AL3000**

1. **Panel cutout size**

   ![AL3000 Panel cutout size diagram]

   - Minimum clearance for closed-installation
   - 138 (mm)
   - 200 (mm)

2. **Installation**
   (1) Insert your AL3000 (pen type) into the panel cutout from the front of the panel.
   (2) Fix your AL3000 (pen type) to the panel by the mounting brackets (screw tightening torque: 1.0 N•m). Attach 2 mounting brackets to the top and bottom of this instrument.

**AH3000**

1. **Panel cutout size**

   ![AH3000 Panel cutout size diagram]

   - Minimum clearance for closed-installation
   - 281 (mm)
   - 360 (mm)

2. **Mounting method**
   (1) Insert your AH3000 (pen type) into the panel cutout from the front of the panel.
   (2) Gently screw a mounting screw into the screw hole of the case (left, right).
   (3) Attach the mounting bracket to the case by putting the mounting screw in the large hole of the bracket. Slide the bracket downward to attach it closely to the panel and then tighten the screw with a wrench (screw tightening torque: 1.2 N•m).
3. CONFIGURATION  3.1 Front

All operations of your recorder including the loading of pens can be executed from its front.

Warning: A window of the door

The window of the door is made of glass material. To prevent injuries by destroying it, do not apply an impact or strong force to the door.

(1) Display panel
The display panel is consisted of character displays, status lamps and bargraph displays.
For loading the pens, open the display panel by swinging it out from the right side. An illumination for chart is mounted on the back of the display panel.

(2) Chart paper cassette
The chart paper cassette is for loading a chart to your recorder. Remove it for the loading of chart. When your recorder is AL3000, remove the chart paper cassette by swinging down the keyboard.

(3) Keyboard
The sheet switch type keys are used in the keyboard.

● Operation keys

<table>
<thead>
<tr>
<th>Keys</th>
<th>Operations</th>
<th>Ref. page</th>
<th>Keys</th>
<th>Operations</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISP</td>
<td>Switches operation screen.</td>
<td>6.4</td>
<td>Shift + 7</td>
<td>List printing</td>
<td>9.3</td>
</tr>
<tr>
<td>ENTRY</td>
<td>Stops blinking of display.</td>
<td>10.3</td>
<td>0 + 3</td>
<td>Message printing</td>
<td>9.4</td>
</tr>
<tr>
<td>REC OFF</td>
<td>Switches printing on/off</td>
<td>6.2</td>
<td>REC OFF + 0</td>
<td>Pen replacing mode</td>
<td>5.3</td>
</tr>
<tr>
<td>FEED</td>
<td>Fast forwarding of chart</td>
<td>6.3</td>
<td>*2 + 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DATA PRINT</td>
<td>Digital data printing</td>
<td>9.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1: Selection of List 1 or List 2.  *2: Selection of Message No. (1 to 5)

● Programming keys
The keys are different on programming items. See Section 7.3 for details.
3. CONFIGURATION

3.2 Display

(1) Characters
- Operation mode: Displays measured value, time, chart speed, and alarm status of each channel (CH).
  See Section 6.4 for details.
- Programming mode: Displays programming items and programming parameters in an interactive method.

(2) Underline
  Shows the trace printing color of each channel (CH).
  (CH 1: Red, CH 2: Green, CH3: Blue, CH 4: Brown)
  These underlines also function as a cursor appearing at the digit for programming parameter in the programming mode.

(3) Status

<table>
<thead>
<tr>
<th>Display</th>
<th>Lighting condition</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARM</td>
<td>When an alarm activates.</td>
<td>10.3</td>
</tr>
<tr>
<td>CHART END</td>
<td>When the end of chart is detected.</td>
<td>6.2</td>
</tr>
<tr>
<td>FAIL</td>
<td>When the hardware related to servo-circuit/mechanism is abnormal.</td>
<td></td>
</tr>
<tr>
<td>POC</td>
<td>When the time axis synchronization is enabled.</td>
<td>9.6</td>
</tr>
<tr>
<td>RECORD ON</td>
<td>When the printing is on (enable).</td>
<td>6.2</td>
</tr>
<tr>
<td>KEY LOCK</td>
<td>When the keys are locked.</td>
<td>11.12</td>
</tr>
</tbody>
</table>

(4) Bargraph
  The bargraphs indicate the measured value of each channel in an analog form. These indications are interlocking to the positions of the pens for trace printing.
  Resolution
  AL3000: 1/50 (2%), 51 segments
  AH3000: 1/100 (1%), 101 segments
4. CONNECTIONS

4.1 Terminal Board Arrangement

The terminal boards shown in the following figure are of recorders with the options (alarm output + remote contacts and communications interface).

*The mechanical relay “c” contact output is consisted of three terminals of N.O, COM and N.C.

Reference

The input terminal and alarm terminal blocks are removable.

The input terminal block and alarm terminal block (including the remote contacts terminal block) are removable for easy connections. Each terminal block can be taken out by removing two mounting screws. Each terminal block is connected to your recorder by a connector. For mounting or dismounting the terminal block, turn off the power switch to prevent the electric circuits from being damaged.

Removal terminals have to be remounted to the recorder to which they were originally mounted. Mounting them to other recorders may cause a malfunction in scaling.
4. CONNECTIONS

4.2 Cautions on Connections

Observe the following cautions during connections for securing safety and reliability.

1. **Power supply**
   Use a single-phase power supply having a stable voltage without any waveform distortion for the purpose of preventing wrong operations.

   **Warning** A switch and an overcurrent protective device
   Prepare a switch and an overcurrent protective device (3 A) to the power supply for preventing an accidental electric shock during connection work. This instrument is not provided with any replaceable overcurrent protective device.

   **Warning** Turn off the power supply before starting connections.
   Make sure to turn off the power supply before connecting the power and the input/output terminals to prevent an electric shock.

2. **Keep the input/output connections away from high voltage power circuits**
   Don't place the input/output cables close to or in parallel with any strong power circuits including power lines. Place the cables 50cm or more away from high voltage power circuits when they are placed close to or in parallel to other circuits.

3. **Keep the thermocouple input away from a heat source**
   For thermocouple inputs, keep the input terminals away from a heat source (a heating body) to reduce a reference junction compensation error. Don't expose the input terminals to direct sunlight, etc.

4. **Keep the input/output connections away from noise source**
   Keep all connection cables away from noise source as far as possible, otherwise a malfunction may occur. Provide a solution if the cables cannot be separated from a noise source due to unavoidable circumstances.

<table>
<thead>
<tr>
<th>Major noise sources</th>
<th>Remedial measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic switch, etc. Power line having waveform distortion, Inverter, Thyristor regulator</td>
<td>Insert noise filters between power terminals and input/output terminals. A CR filter is often used.</td>
</tr>
</tbody>
</table>

5. **Use crimp style terminals**
   (1) Mount crimp style terminals for connection cable terminations to prevent any looseness or disconnection of terminals or a short-circuit failure between terminals.
   (2) Use the crimp style terminals with an insulation sleeve to prevent an electric shocks.

6. **Unused terminals**
   Don’t use any unused terminals for relaying, otherwise the electric circuits may be damaged.

   **Warning** Secure the connected cables properly.
   Secure the connected cables so as not to allow them to be hooked by a person or a substance, otherwise the connections may be cut and disrupted, and may cause an electric shock or other accidents.

---

### Reference

**Kinds of terminals and termination**

<table>
<thead>
<tr>
<th>Terminal block</th>
<th>Screw diameter</th>
<th>Tightening torque (unit: N•m)</th>
<th>Termination (unit: mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power and protective conductor terminals</td>
<td>M4</td>
<td>1.2</td>
<td><img src="https://example.com/termmation.png" alt="Termination Diagram" /></td>
</tr>
<tr>
<td>Terminals other than described above</td>
<td>M3.5</td>
<td>0.8</td>
<td><img src="https://example.com/termmation.png" alt="Termination Diagram" /></td>
</tr>
</tbody>
</table>

*Use Type O chip (on the left) whenever possible.*
4. CONNECTIONS

4.3 Power Terminals

1. Power and protective conductor terminals

![Diagram of power terminals and protective conductor terminal]

- **Power terminals**: L, N
- **Protective conductor terminal**: Grounding wire: Copper wire 2 mm² or more (green/yellow)
- **Power supply** (voltage, frequency, power consumption): 100-240V AC 50/60Hz 60VA MAX

**Warning**

Turn off the power supply.

Make sure to turn off the power supply before the connections to the power and protective conductor terminals for preventing an electric shock.

**Caution**

Be careful with the power voltage and noises.

The power voltage of your recorder is indicated beside the power terminals. Don’t apply any voltage other than the rated voltage. Otherwise a malfunction may result. If noise is contaminated in the power supply, provide a noise reduction transformer, etc.

2. Connection of power terminals

For connection to the power terminals, use a 600 V PVC insulated cable (IEC 227-3 See “Caution”) terminated by the crimp style terminals with insulation sleeve.

Note) Use the cords approved by the following standards.

1. IEC 227-3
2. ANSI/UL817,
3. CSA C22.2 No.21/49

3. Connection of protective conductor terminal

Make sure to connect this terminal to the protective conductor of the power supply facility. For this connection, use a cable terminated by the crimp style terminals with insulation sleeve.

- **Grounding wire**: Copper wire 2 mm² or more

**Warning**

A voltage of 100 to 240 VAC is applied to the power terminals after connections. Be sure to mount the power terminal cover to prevent an electric shock.

**Remarks**

L/N indication of power terminals

This indication conforms to the CSA standard, Canada. The live side of the single-phase AC power supply is indicated as L, and the neutral side is indicated as N. Observe the L and N connections for obtaining satisfactory performance.

**Warning**

Mark at power terminals

A voltage of 100 to 240 VAC is applied to the power terminals after connections. Be sure to mount the power terminal cover to prevent an electric shock.
4. CONNECTIONS

4.4 Measuring Input Terminals

1 Measuring input terminals
Make sure to turn off the power supply to prevent an electric shock.
(1) Measuring input terminals are located on the down left of the terminal board.
(2) For the connections to the input terminals, use cables terminated by crimp style terminals with insulation sleeves.

Caution Allowable input voltage

<table>
<thead>
<tr>
<th>Input type</th>
<th>Allowable input voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage, Thermocouple input</td>
<td>±10 VDC (range: ±2 V or less) ±60 VDC (range: ±5 V or more)</td>
</tr>
<tr>
<td>Resistance thermometer input</td>
<td>±6 VDC</td>
</tr>
</tbody>
</table>

2 Connections of DC voltage (current) input
Use twisted cables for instrumentation as the input cables for the purpose of suppressing noise. For current inputs, mount shunt resistors (Section 16.2) to the channels to be measured before connections.

3 Connections of thermocouple inputs
Make sure to use thermocouple wires (or extension wires) to the input terminals of your recorder. If a copper wire is used halfway, a noticeable measuring error occurs. Don’t use a pair of thermocouple wires in parallel with other instruments (controller, etc.), otherwise a malfunction may occur.

4 Connections of resistance thermometer inputs
Use a 3-core cable where each lead wire has an equal resistance value. Don’t use one resistance thermometer in parallel with other instruments (controller, etc.).

Caution mark of measuring input terminals
A high voltage may be applied to the measuring input terminals due to common mode noise. The allowable noise value is 30 VAC or less, or 60 VDC or less. Make sure that the noise is lower than the allowable value. Mount the terminal cover after connections for the purpose of preventing an electric shock and to protect the input wires. In the case of thermocouple input, the mounting of the terminal cover can reduce the reference junction compensation error.
4. CONNECTIONS

4.5 Alarm Output Terminals

These terminals are for the alarm output (option), which is (1) MOS relay type, (2) mechanical relay “c” contact type or (3) mechanical relay “a” contact type. The mechanical relay “c” contact type does not conform to the international safety standards.

1. Alarm output terminals
The terminal arrangement depends upon the type of alarm output.

<table>
<thead>
<tr>
<th>Terminal block</th>
<th>AL3000</th>
<th>AH3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No. 1 to 6</td>
<td>No. 1 to 6</td>
</tr>
<tr>
<td>2</td>
<td>No. 1 to 12</td>
<td></td>
</tr>
</tbody>
</table>

[Remarks] Only one terminal block is provided for the remote contacts terminals.

2. Connections
Turn off the power supply and buffer relay power supply before the connections for preventing an electric shock.
(1) Connect cables to a load via a buffer relay.
(2) Use cables with crimp style terminals and insulation sleeves for the alarm output terminals.

⚠️ Caution Take safety measures.
The alarm output of your recorder may become defective. This may be caused by wrong operation, failure or other abnormal inputs. Take safety measures against an output failure before use if necessary.

3. Cautions on connections

1) Output contact rating
(1) MOS relay

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Resistive load</th>
<th>Inductive load</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 V AC</td>
<td>0.5 A</td>
<td>0.2 A</td>
</tr>
<tr>
<td>240 V AC</td>
<td>0.2 A</td>
<td>0.1 A</td>
</tr>
<tr>
<td>100 V DC</td>
<td>0.3 A</td>
<td>0.1 A</td>
</tr>
</tbody>
</table>

(2) Mechanical relay

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Resistive load</th>
<th>Inductive load</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 V AC</td>
<td>0.5 A</td>
<td>0.2 A</td>
</tr>
<tr>
<td>240 V AC</td>
<td>0.2 A</td>
<td>0.1 A</td>
</tr>
<tr>
<td>100 V DC</td>
<td>0.3 A</td>
<td>0.1 A</td>
</tr>
</tbody>
</table>

⚠️ Warning ⚠️ mark for alarm output terminals
A buffer relay power supply is applied to the alarm output terminals after connections. Don’t touch these terminals for preventing an electric shock. Make sure to mount the terminal cover after connection.

2) Mounting of contact protective element
(1) Mount a contact protective element conforming to the buffer relay.
(2) To prevent a malfunction being caused by a light load, the most effective mounting position for the element is on the coil side of the buffer relay (“a” in the above diagrams)
(3) The MOS relay will be broken, even if a signal exceeding the contact rating is momentarily applied.
4. CONNECTIONS

4.6 Remote Contacts Terminals

These terminals are for the remote contacts (option). For the remote contacts, see Section 13.

1. Remote contacts terminals

![Remote contacts terminals diagram]

2. Wiring

To prevent an electric shock, make sure to turn off the power supply before wirings.

1. The signals applied to the remote contacts terminals should be non-voltage contact signals.
2. Connect wires to the remote contacts terminals with crimp style terminals and insulation sleeves.

### Warning

**No-voltage contacts**

For the contacts to be connected to the remote contacts terminals, use a switch or relay driven at 30 VAC or lower, or 60 VDC or lower, or manual contacts for very light loads.

### Remarks

**Remote contacts terminals**

- Voltage when the contact is open: Approx. 5 V
- Current when the contact is short: Approx. 2 mA

3. Terminal allocation for operation

It is required to set operations to be allocated to each terminal (EX1 to EX4).

4. Operations to be set

1. Printing ON/OFF and chart speed selection from 3 speeds (Using 2 terminals EX1 and EX2)
2. Message (Nos. 1 to 5) selection and printing (Using all of 4 terminals EX1 to EX4)
3. Message (Nos. 1 and 2) selection and printing (Using 2 terminals EX3 and EX4)
4. Digital data printing *
5. List (Nos. 1 to 3) printing *
6. Operation record (Nos. A to D) printing *
7. "Totalizing" (option) reset *

* Using any one terminal.

---

### Reference

**Remote contacts**

1. Remote contacts operations
   1. Printing ON/OFF and chart speed selection from 3 speeds (Using 2 terminals EX1 and EX2)
   2. Message (Nos. 1 to 5) selection and printing (Using all of 4 terminals EX1 to EX4)
   3. Message (Nos. 1 and 2) selection and printing (Using 2 terminals EX3 and EX4)
   4. Digital data printing *
   5. List (Nos. 1 to 3) printing *
   6. Operation record (Nos. A to D) printing *
   7. "Totalizing" (option) reset *

2. Terminal allocation for operation
   - It is required to set operations to be allocated to each terminal (EX1 to EX4).

3. Operations to be set
   1. Printing ON/OFF and chart speed selection from 3 speeds ➔ Setting of 3 chart speeds
   2. Message selection and printing ➔ Setting of messages Nos. 1 to 5
   3. Operation recording ➔ Setting of recording positions of operation records Nos. A to D
4. CONNECTIONS  4.7 Communications terminals

These terminals are for the communications interface (option). For details of the connection, refer to the instruction manual for the “Communications Interfaces” provided separately.

1. Communications terminals

<table>
<thead>
<tr>
<th>RS-232C Terminals</th>
<th>RS-422A Terminals</th>
<th>RS-485 Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>SDA</td>
<td>SA</td>
</tr>
<tr>
<td>RD</td>
<td>SDB</td>
<td>SB</td>
</tr>
<tr>
<td>SG</td>
<td>RDA</td>
<td>AR</td>
</tr>
<tr>
<td></td>
<td>RDB</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SG</td>
</tr>
</tbody>
</table>

2. RS-232C Connections

When your recorder is with the communications interface of RS-232C, three terminals of SD, RD and SG are used but any control signal is not used. General personal computers are controlled by control signal. Wiring processing for control signal in a connector depends upon how the control signal is used in a personal computer. For details, refer to the instruction manual for your personal computer.

1) 9-pin connector

![Diagram of 9-pin connector]

Within 15 m

2) 25-pin connector

![Diagram of 25-pin connector]
4. CONNECTIONS

4.7 Communications terminals

3 RS-422A, RS-485 Connections

RS-422/485 communications interface is connected to a personal computer via a line converter (our Model SC8-10: sold separately). Three signals of SD, RD and SG are used between the line converter and the personal computer but any control signal is not used. Wiring processing for control signal in a connector is necessary in the same as RS-232C connections.

1) RS-422A

2) RS-485

*For the details of the wiring, refer to RS-232C connections.*
5. INSTALLATION 5.1 Chart Paper Loading (AL3000)

1 Chart Paper Cassette Removal
1) Open the door.
2) Swing down the keyboard.
3) Remove the chart paper cassette.
   Pens lift up when the chart paper cassette is removed.

2 Chart Paper Loading
1) Open the chart paper holders.
   Open the chart paper guide and the stripper plate.
2) Prepare a chart paper
   Shuffle both end of the chart paper to prevent two or more chart papers from fed being together.
3) Put it into the chart paper housing.
   The shapes of the sprocket holes on the right and left sides are different. The right side holes are an elliptical shape.
5. INSTALLATION

5.1 Chart Paper Loading (AL3000)

3 Chart Paper Setting
1) Draw out the chart paper approx. 20 cm and close the rear stripper plate.
2) Set the holes on the chart paper over the sprockets at both ends of the drum.
3) Use the thumb wheel to advance the chart paper for 2 to 3 folds into the chart tray.
4) Close the front chart paper guide. Make sure that the holes are set over the sprockets.

---

3) Chart paper feeding check
(1) Turn on the power supply.
(2) Press the FEED key and check the chart paper feeds smoothly.
(3) Repeat the above procedure if the chart paper is not fed smoothly.

4) Operation during chart end detection
When the chart paper cassette is returned in the internal unit during the chart end detection, the CHART END display blinks. Press ENTRY to turn it from blinking to steady lighting. Press ENTRY again. The CHART END display goes out and the chart paper is fed automatically.

---

4 Check
1) Manual check
Turn the thumb wheel by hand to make sure that the chart paper is feeding properly.

2) Place the chart paper cassette in its original position
Place the chart paper cassette with the chart paper loaded in your recorder.
(1) Guide rails for the chart paper cassette are located on the right and left side of the internal unit. Set the guides of the chart paper cassette to the guide rails and push it until it clicks into place.
(2) Return the keyboard back in its original position.

---

Chart paper folds
Don’t insert the chart paper folds reversely when inserting the chart paper into the chart paper tray, otherwise a folding failure results.

---

Remarks
Turning direction of thumb wheel
Don’t turn the thumb wheel inward. The chart paper cannot be fed backward. This action may cause a chart paper feed failure.

---

Remarks
Chart paper

---

Folding section

---

Thumb wheel
(Top view)
5. INSTALLATION

5.2 Chart Paper Loading (AH3000)

1 Chart Paper Cassette Removal

1) Open the door.

2) Remove the chart paper cassette.
   (1) Pull the grip of the chart paper cassette and take the chart paper cassette slightly out of the internal unit. (Pens lift up.)
   (2) Pull the grip slowly to take the chart paper cassette out of the internal unit completely.

2 Chart Paper Loading

1) Open the chart paper holders.
   Open the chart paper guide and the stripper plate.

2) Prepare a chart paper.
   Shuffle both end of the chart paper to prevent two or more chart papers fed being together.

3) Put it into the chart paper housing.
   The shapes of the sprocket holes on the right and left sides are different. The right side holes are an elliptical shape.

Caution

Be careful with the corners of the rear stripper plate
The sharp corners of the rear stripper plate help to feed the chart paper smoothly. Be careful not to cut your fingers when loading or replacing the chart paper.

Caution

Don’t remove the chart paper cassette during printing.
Don’t remove the chart paper cassette during printing by a plotter pen. The cassette may hit 1st pen during the automatic pen lift-up function executed.
5. INSTALLATION

5.2 Chart Paper Loading (AH3000)

3 Chart Paper Setting
1) Draw out the chart paper approx. 50 cm and close the rear stripper plate.
2) Set the holes on chart paper over the sprockets at both ends of the drum.
3) Use the thumb wheel to advance the chart paper for 2 to 3 folds into the chart tray.
4) Close the front chart paper guide. Make sure that the holes are set over the sprockets.

4 Check
1) Manual check
Turn the thumb wheel by hand to make sure that the chart paper is feeding properly.

Remarks
Turning direction of the thumb wheel
Don’t turn the thumb wheel inward. The chart paper cannot be fed backward. This action may cause a chart feed failure.

2) Place the chart paper cassette in its original position
Guide rails for the chart paper cassette are located on the right and left side of the internal unit. Set the guides of the chart paper cassette to the guide rails and push it until it clicks into place.

3) Chart paper feeding check
(1) Turn on the power supply.
(2) Press the [FEED] key and check that chart paper feeds smoothly.
(3) Repeat the above procedure if the chart paper is not fed smoothly.

4) Operation during chart paper end detection
When the chart paper cassette is returned in the internal unit during the chart end detection, the CHART END display blinks. Press [ENTRY] to turn it from blinking to steady lighting.
Press [ENTRY] again. The CHART END display goes out and the chart paper is fed automatically.
5. INSTALLATION

5.3 Recording Pen Loading

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

<table>
<thead>
<tr>
<th>Pen Type</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st pen</td>
<td>Red</td>
</tr>
<tr>
<td>2nd pen</td>
<td>Green</td>
</tr>
<tr>
<td>3rd pen</td>
<td>Blue</td>
</tr>
<tr>
<td>4th pen</td>
<td>Brown</td>
</tr>
</tbody>
</table>

2. Preparation for Installation
1) To remove the chart paper cassette
AL3000 → See Section 5.1.1.
AH3000 → See Section 5.2.1.
2) Open the display panel.
   Swing out the panel from the right edge.
3) Set to the pen replacement mode.
   (1) Turn on the power supply.
   (2) If the status RECORD ON lights, go it out by pressing REC/ONOFF and then ENTRY. (Pens lift up.)
   (3) Press and hold REC/ONOFF down for 3 seconds.
      The pens return to original positions and then move to the center.
   (4) Each press of ENTRY moves each pen to the "zero" position. Replace each pen at its "zero" position.

3. Maintenance of pens
   1. Pen tip
      The pen tip is made of felt material. If an excessive force is added to it, the top of the pen tip will be crushed making clear printing or tracing impossible.
   2. Pen cap
      Each pen is provided with a pen cap for preventing drying and protecting the pen tip. Remove and retain the pen caps before the pen installation.
   3. Before stopping recording for long hours
      When it is expected that recording will not be executed for a day or more, remove and store the pens by attaching the pen cap to them. If the pens are left installed while no recording is executed, the ink will stain the chart paper.
5. INSTALLATION

5.3 Recording Pen Loading

### 3 Plotter Pen Loading
(1) Before loading, remove the pen cap from the plotter pen and write letters on a paper, etc. for testing.
(2) Insert the plotter pen into its penholder completely.
   (Note) Incomplete insertion may result in recording troubles.
(3) For unloading of the plotter pen, pull it from the penholder.

### 4 Cartridge Pen Loading
(1) Before loading, remove the pen cap from the cartridge pen and write letters on a paper, etc. for testing.
(2) Push the cartridge pen into the penholder for the same pen No. as the pen.
(3) For unloading of the cartridge pen,
   - AL3000: Pull out the left side of the pen from the holder, and then take off it by disengage its convex part at the right side of the holder.
   - AH3000: Pull the pen from the holder.
6. BASIC OPERATION

6.1 Power Supply and Operation

1 Power Supply On/Off
Your recorder is not provided with a power switch. Prepare an external power switch for turning on or off its power supply.

2 Initial Operation
By turning on the power supply, 1) year, month and day are displayed. After initialization, 2) year, month, day and time are printed (Printing when the power is turned on) and 3) the normal operation starts.

3 Operation
1) Operation screen
   (1) Measured values for all channels (CH 1 to 4: depending on the numbers of input points) are digitally displayed.
   (2) Measured values for all channels (CH 1 to 4: depending on the numbers of input points) are displayed by bargraphs.
   (3) A corresponding status lamp lights. The default is RECORD ON.

   (Note) The above example is for AL3000. It is the same for AH3000.

   Example of operation screen (3-pen type)

   ![Example of operation screen](image)

2) Chart paper feeding
The chart paper is fed at the programmed chart paper speed. (The default speed is 20 mm/h for AL3000 and 25 mm/h for AH3000.)

3) Printing
   (1) Trace printing
   Measured values are traced by a cartridge pen.
   <Ink colors> CH 1: Red, CH 2: Green, CH 3: Blue, CH 4: Brown

   (2) Digital data printing
   a. Fixed-time printing
   The following data is printed at preset time intervals.
   • Time line • Time • Year/Month/Day • Chart speed
   • Scale • Engineering unit • Tag
   b. Other printings
   The following printings are executed according to programming and operation.
   • Periodic data printing • Digital data printing • List 1, 2 and 3 • Programming change mark
   • Alarm activation/reset • Message • Operation printing line and No. • Time axis synchronization mark

   (Note) The above example is for AL3000. It is the same for AH3000.

   Trace printing and fixed-time printing

   ![Trace printing and fixed-time printing](image)
6. BASIC OPERATION

6.2 Printing ON/OFF and chart end detection

1 Printing On/Off
Every time pressing REC ON/OFF then ENTRY within 5 sec., the printing function switches to on or off.

Status
Printing ON
REC ON/OFF
ENTRY
Printing OFF
REC ON/OFF
ENTRY

Reference 1
Printing status when turning on the power supply
When turning on the power supply, the printing maintains the condition (on or off) when it was turned off last time.

Reference 2
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.

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</td>
<td>Execute</td>
<td>Up where it is</td>
</tr>
<tr>
<td>(Cartridge pen)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital data printing</td>
<td>Execute</td>
<td>Up at standby position</td>
</tr>
<tr>
<td>(Plotter pen)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up and down of pens</td>
<td>Down</td>
<td>Up</td>
</tr>
</tbody>
</table>

3 Chart End Detection
When the chart end is detected during the printing is on, the printing is switched to off and CHART END blinks. Each pen lifts up automatically and the printing is stopped.
For continuing the printing, refer to “Chart loading” in Section 5.1 and 5.2.
6. BASIC OPERATION  6.3 Fast Feeding of Chart Paper

When pressing \textbf{FEED}, chart is fed at the speed of about 0.1 mm/sec. When pressing \textbf{FEED} more than 1 sec, chart is fed at the speed of about 10 mm/sec. This operation is used for the following purposes.

1. Setting the time scale line of the chart paper
2. Checking of chart paper feeding operation

\textbf{Remarks:} Fast feeding condition and operation

1. Condition ….. (1) For the fast feeding of the chart paper, the status \textbf{KEY LOCK} should be gone out.
   (2) This function cannot be executed during printing.
2. Operation ….. Digital data printing is not executed during the fast feeding of the chart paper.
   This function can be executed when the printing is off (\textbf{RECORD ON} goes out.).

\textbf{Reference 1} > Manual chart feeding

Pull out the chart paper cassette slightly from your recorder. Turn the thumb wheel on the left side of the drum.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart_paper_cassette}
\caption{Chart paper cassette for AL3000 and AH3000}
\end{figure}

Note: Even if the time scale line is set by manual chart paper feeding, a delay may occur due to the back lash of the thumb wheel (gear).

\textbf{Remarks 2} > Time scale (1 to 24)

Numeric values of 1 to 24 are marked on the left side of the chart paper. These are time scales when operating the printing at a chart speed of 20 mm/h for AL3000 or 25 mm/h for AH3000.
6. BASIC OPERATION

6.4 Switching Operation Screen (AL3000)

For AL3000, three operation screens, (1) measured value screen, (2) clock screen and (3) alarm activation screen, are available. Each time \[\text{DISP}\] is pressed, the screen switches. Bargraphs for analog indications are displayed in any of these screens.

(Note) The alarm activation screen is only available when an alarm activates (shown by dotted lines). When no alarm activates, this screen is skipped.

1 Measured value screen
The screen differs on Model No. (number of pens).

1) 1-pen type (CH 1)

2) 2-pen type (CH 1 and 2)

3) 3-pen type (CH 1 to 3)

4) 4-pen type (CH 1 to 4)

When the power supply is turned on, the measured value screen appears.

In each channel, the alarm level 1, 2, 3 and 4 are allocated to the digits from the left end. The alarm type shall be displayed only at the digit where an alarm activates.

For alarm types, see Section 11.5, item 1.

2 Clock screen

3 Alarm activation screen
This screen is only available when an alarm activates.

When the power supply is turned on, the measured value screen appears.

Explanation for alarm activation
In each channel, the alarm level 1, 2, 3 and 4 are allocated to the digits from the left end. The alarm type shall be displayed only at the digit where an alarm activates.
6. BASIC OPERATION  6.5 Switching Operation Screen (AH3000)

For AH3000, two operation screens, (1) measured value screen and (2) alarm activation screen, are available. Each time [DISP] is pressed, the screen switches. Bargraphs for analog indications are displayed in any of these screens.

(Note) The alarm activation screen is only available when an alarm activates (shown by dotted lines). When no alarm activates, the measured value screen only appears even if [DISP] is pressed.

1 Measured value screen
The screen below is for 4-pen type. 1-pen type - measured value is displayed in CH 1. 2-pen type - measured values are displayed in CH 1 and CH 2. 3-pen type - measured values are displayed in CH 1 to CH 3.

2 Alarm activation screen
This screen is only available when an alarm activates.

Explanation for the display
In each channel, the alarm level 1, 2, 3 and 4 are allocated to the digits from the left end. The alarm type shall be displayed only at the digit where an alarm activates.
For alarm types, see Section 11.5, item 1.
7. PROGRAMMING

7.1 Keys and Characters

1. Keys and Their Abbreviations

<table>
<thead>
<tr>
<th>Actual keys</th>
<th>Key abbreviations used in this manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>A B C D E F G H I J L M N O</td>
<td>a b c d e f g h i j l m n o</td>
</tr>
<tr>
<td>P Q R S T U V W X Y Z</td>
<td>p q r s t u v w x y z</td>
</tr>
<tr>
<td>1 2 3 4 5 6 7 8 9 0</td>
<td>1 2 3 4 5 6 7 8 9 0</td>
</tr>
</tbody>
</table>

2. Characters Displayed in Programming

Except for the leftmost digit, characters including alphabets are displayed as shown below due to the restriction with 7-segment LCD.

<table>
<thead>
<tr>
<th>A B C D E F G H I J L M N O</th>
</tr>
</thead>
<tbody>
<tr>
<td>A a B b C c D d E e F f G g H h I i J j L l M m N n O o</td>
</tr>
</tbody>
</table>

3. Key Operation

**Remarks:** Don't press keys with hard and sharp objects

The keys are composed of sheet switches containing electrical circuitry inside. If a key is pressed with a hard and sharp object, malfunctions due to wire disconnection or insulation breakdown may occur.

- Press a single key.
- Press two keys simultaneously.
- Press two keys simultaneously for 3 sec. or longer

<table>
<thead>
<tr>
<th>Example</th>
<th>Example</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>To program &quot;6&quot;:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To program an alphabet letter:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To move the &quot;Engineering&quot; programming mode:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Press the key for about 0.5 sec. and release it as soon as the display changes. If another screen appears by holding the key down for 3 sec. or more, press <SHIFT> to return to the original screen and press the key for about 0.5 sec. again*
## 7. PROGRAMMING

### 7.2 Key Functions

#### 1 Functions by Pressing Single Key

<table>
<thead>
<tr>
<th>Keys</th>
<th>Names</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>[USH^*]</td>
<td>Display</td>
<td>Stops programming and returns to the operation screen. For certain programming items, holding this key down for 2 seconds or more is required.</td>
</tr>
<tr>
<td>SPACE</td>
<td>Space</td>
<td>(1) Deletes a numeric value or decimal point at an unnecessary digit. (2) Programs “Blank” in the programming of [engineering unit] or [tag].</td>
</tr>
<tr>
<td>SET End</td>
<td>Program</td>
<td>Changes from programming mode (confirmation of parameters) to the programmable condition. The programming lamp lights and the cursor appears at the programmable leftmost digit.</td>
</tr>
<tr>
<td>SHIFT-</td>
<td>Shift</td>
<td>Press this key first for using the key functions being indicated on the lower case of each key.</td>
</tr>
<tr>
<td>[.?()]</td>
<td>Minus</td>
<td>(1) Press these keys for programming a numeric value. (2) For programming a decimal point, move the cursor to the next digit and press [COPY] before entering a numeric value. (3) For deleting a decimal point, move the cursor to the next digit and press SPACE.</td>
</tr>
<tr>
<td>[CLOCK]</td>
<td>Decimal point</td>
<td>0 to 9 Numeric values</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CLEAR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>LIST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up</td>
<td>Up</td>
<td>(1) For items to program by selecting from menu, this key steps the menu forward or backward. (2) For items to program parameters per channel in the programming mode (confirmation of parameters), this key steps the channel No. forward or backward.</td>
</tr>
<tr>
<td>Down</td>
<td>Down</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>Left cursor Moves the cursor leftward.</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>Right cursor Moves the cursor rightward.</td>
</tr>
<tr>
<td>ENTRY</td>
<td>Entry</td>
<td>(1) Programming items common to channels: Stores the programmed parameter into memory. (2) Programming items per channel: Stores temporarily the programmed parameter in the channel No. selected. Press [SHIFT] + [SET] to store it into memory. (3) Printing on/off, data printing or list printing is executed by pressing this key.</td>
</tr>
<tr>
<td>REC ON/OFF</td>
<td>Printing on/off</td>
<td>Selects on (enable) or off (disable) of printing. Press ENTRY to go this selection active.</td>
</tr>
<tr>
<td>FEED</td>
<td>Feeding</td>
<td>The chart paper is fast fed when holding this key down.</td>
</tr>
<tr>
<td>DATA PRINT</td>
<td>Data print</td>
<td>Prints the measured values at the moment the key is pressed digitally on the trace printing. Press ENTRY to go this printing active.</td>
</tr>
</tbody>
</table>

#### 2 Functions by Pressing Two Keys Simultaneously

<table>
<thead>
<tr>
<th>Keys</th>
<th>Names</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHIFT + SET End</td>
<td>End</td>
<td>Stores the programmed parameter, which is temporarily stored, into memory.</td>
</tr>
<tr>
<td>SHIFT + [.?()]</td>
<td>To</td>
<td>Inserts [~ (‘’) ] between minimum and maximum values.</td>
</tr>
<tr>
<td>SHIFT + 0</td>
<td>0 CLEAR</td>
<td>Clears (Blanks) the programmed parameter displayed.</td>
</tr>
<tr>
<td>SHIFT- + A~Z</td>
<td>Alphabetic characters</td>
<td>Each time Up is pressed, characters step in the order of A, B, C ....</td>
</tr>
<tr>
<td>SHIFT + LIST</td>
<td>List printing</td>
<td>Programmed parameters are printed as a list. Press ENTRY to go this printing active.</td>
</tr>
<tr>
<td>SHIFT + %</td>
<td>%</td>
<td>Programs “%” (percent) character.</td>
</tr>
<tr>
<td>SHIFT + / (=)</td>
<td>/ (=)</td>
<td>Programs “/” (slash) character. This is also “=” in the subtract printing programming mode.</td>
</tr>
<tr>
<td>SHIFT- + °C</td>
<td>°C</td>
<td>Programs “°C” (degree Centigrade) character.</td>
</tr>
<tr>
<td>SHIFT- + °F</td>
<td>°F</td>
<td>Programs “°F” (degree Fahrenheit) character.</td>
</tr>
</tbody>
</table>
## 7. PROGRAMMING  7.3 List of Programming Items

### 1 Parameters to be Programmed First

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Key operations</th>
<th>Programming items</th>
<th>Defaults</th>
<th>Programming ranges</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range/printing range</td>
<td>SHIFT + 7 RANGE</td>
<td>Range No.</td>
<td>07</td>
<td>01 to 10, 21 to 56, 70 to 80</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RJ enable/disable</td>
<td>0</td>
<td>0 (disable), 1 (enable: thermocouple range only)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Printing range</td>
<td>0.000 to 5.000</td>
<td>Max. 10 digits (minimum value to maximum value), Excluding decimal point.</td>
<td></td>
</tr>
<tr>
<td>°C/°F calculation</td>
<td>SHIFT + 7°F</td>
<td>°C</td>
<td></td>
<td>°C (°C calculation) °F (°F calculation) Thermocouple and resistance thermometer range only</td>
<td>8.3</td>
</tr>
<tr>
<td>Chart speed</td>
<td>SHIFT + 1 CHART</td>
<td></td>
<td></td>
<td>20/25 *</td>
<td>8.4</td>
</tr>
</tbody>
</table>

* AL3000: 20 mm/h, AH3000: 25 mm/h

### 2 Other Programmable Parameters and Functions

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Key operations</th>
<th>Programming items</th>
<th>Defaults</th>
<th>Programming ranges</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock</td>
<td>SHIFT + 4 CLOCK</td>
<td></td>
<td>Japanese time</td>
<td>2000.01.01.00:00 to 2099.12.31.23:59</td>
<td>11.1</td>
</tr>
<tr>
<td>Scale *</td>
<td>SHIFT + 4 SCALE</td>
<td></td>
<td>0.000 to 5.000</td>
<td>Max. 11 digits (minimum value to maximum value), excluding decimal point. Printing range reflects to the scale. Therefore no programming is normally necessary for thermocouple and resistance thermometer range.</td>
<td>11.2</td>
</tr>
<tr>
<td>Skip *</td>
<td>SHIFT + 7 RANGE</td>
<td></td>
<td>Not programmed</td>
<td>Programming is required in [Range/Printing range] programming mode. • Channel to be deleted → Clear the range/printing range. • Channel to be recovered → Program the range/printing range.</td>
<td>11.3</td>
</tr>
<tr>
<td>Subtract printing *</td>
<td>SHIFT + 7 RANGE</td>
<td></td>
<td>Not programmed</td>
<td>Programming is required in [Range/Printing range] programming mode. [Subtract printing CH] = [Reference CH] – [subtraction CH*] * Can be replaced with [reference value (with decimal point)].</td>
<td>11.4</td>
</tr>
<tr>
<td>CH/output type</td>
<td></td>
<td></td>
<td>Not programmed</td>
<td>Select from CH (1 to 4), Fail* or C.End (chart end). * Recorders with alarm output (option) only.</td>
<td></td>
</tr>
<tr>
<td>Level</td>
<td></td>
<td></td>
<td>Not programmed</td>
<td>Up to 4 alarm points can be programmed to each channel (CH 1 to 4).</td>
<td></td>
</tr>
<tr>
<td>Alarm types</td>
<td></td>
<td>H</td>
<td>Applicable to CH (1 to 4) selected in CH/output type mode. H/L (absolute value high/low limits) E/F (absolute value high/low limits with standby) U/d (rate-of-change increase/decrease limits) b/S (differential high/low limits) J/k (differential high/low limits with standby)</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>Relay No.</td>
<td></td>
<td>0</td>
<td>Applicable to recorders with alarm output (option). Relay No. &quot;0&quot; to &quot;n&quot; can be programmed. (&quot;0&quot;: no output), n: number of output points. For recorders without alarm output (option), the number is fixed as &quot;0&quot;.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm values</td>
<td></td>
<td>Not programmed</td>
<td>Max. 5 digits including (-) sign. Sign is not necessary when U/d, b/S or J/k is selected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring count</td>
<td></td>
<td>Not programmed</td>
<td>1 to 20. Programming required only when U/d is selected.</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>Ref. CH</td>
<td></td>
<td>Not programmed</td>
<td>1 to 4. Programming required only when b/S and J/k are selected.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Programming is required to each channel. For 1-pen type, programming is only for CH 1. The items without * mark are programming common to all channels. For "alarm", programming is required to each level of channels.
## 7. PROGRAMMING

### 7.3 List of Programming Items

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Key operations</th>
<th>Programming items</th>
<th>Defaults</th>
<th>Programming ranges</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm dead band</td>
<td></td>
<td>—</td>
<td>0.1</td>
<td>0.1 to 9.9 (%)</td>
<td>11.6</td>
</tr>
<tr>
<td>Periodic data printing</td>
<td>SHIF + 5 DATA</td>
<td>Start time</td>
<td>Not</td>
<td>00:00 to 23:59</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interval time</td>
<td>Not</td>
<td>00H05* to 23H59</td>
<td></td>
</tr>
<tr>
<td>Engineering unit *</td>
<td>SHIF + 3 UNIT</td>
<td>—</td>
<td>V</td>
<td>Max. 5 digits</td>
<td>11.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Including numeric values, alphabetic characters, °C, °F and space)</td>
<td></td>
</tr>
<tr>
<td>Tag *</td>
<td>SHIF + A-Z</td>
<td>—</td>
<td>Not</td>
<td>Max. 9 digits</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Including numeric values, alphabetic characters, °C, °F and space)</td>
<td></td>
</tr>
<tr>
<td>Message</td>
<td>0 CLEAR + A-Z</td>
<td>No.</td>
<td>Not</td>
<td>1 to 5. Five kinds of messages can be</td>
<td>11.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Message</td>
<td></td>
<td>programmed.</td>
<td></td>
</tr>
<tr>
<td>Burnout *</td>
<td>SHIF + C</td>
<td>—</td>
<td>non</td>
<td>non, UP bUm, dWN bUm</td>
<td>11.11</td>
</tr>
<tr>
<td>Passcode/ keylock</td>
<td>SHIF + C</td>
<td>Pass code</td>
<td>non</td>
<td>non (not programmed). For programming, use 4 digits from 0 to 9.</td>
<td>11.12</td>
</tr>
<tr>
<td>Time axis synchronization</td>
<td>0 CLEAR + LIST</td>
<td>—</td>
<td>oFF</td>
<td>on, oFF</td>
<td>9.6</td>
</tr>
<tr>
<td>Input filter*</td>
<td>0 CLEAR + ALARM</td>
<td>Time constant</td>
<td>0</td>
<td>0, 0 to 10 (sec.). &quot;0&quot; means no time</td>
<td>11.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>constant.</td>
<td></td>
</tr>
<tr>
<td>Copy</td>
<td>SHIF + COPY</td>
<td>—</td>
<td>—</td>
<td>Programmed parameters can be copied to other channels. Available parameters to be copied are [Range/Printing range], [Engineering unit] and [Tag].</td>
<td>11.14</td>
</tr>
</tbody>
</table>

* Programming is required to each channel. For 1-pen type, programming is only for CH 1. The items without * mark are programming common to all channels. For "alarm", programming is required to each level of channels.

### 3 Programming for Options

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Key operations</th>
<th>Programming contents</th>
<th>Defaults</th>
<th>Programming ranges</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm output</td>
<td>SHIF + ALARM</td>
<td>Relay No.</td>
<td>0</td>
<td>&quot;0&quot; to &quot;n&quot; (n: 6, 12)</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In alarm programming mode, program relay Nos. (terminal Nos.) for alarm output. * number of output points</td>
<td></td>
</tr>
<tr>
<td>AND/OR</td>
<td>0 CLEAR + C</td>
<td>AND/OR</td>
<td>or</td>
<td>AND/OR programming is required for each relay No.</td>
<td></td>
</tr>
<tr>
<td>Output mode</td>
<td>DISP + C</td>
<td>Relay coil</td>
<td>E</td>
<td>E (energize), d (not energize)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relay output</td>
<td>U</td>
<td>H (hold), U (not hold)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alarm display</td>
<td>U</td>
<td>H (hold), U (not hold)</td>
<td></td>
</tr>
</tbody>
</table>

---

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### 7. PROGRAMMING

#### 7.3 List of Programming Items

<table>
<thead>
<tr>
<th>Names</th>
<th>Programming items</th>
<th>Key operations</th>
<th>Programming contents</th>
<th>Defaults</th>
<th>Programming ranges</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote contacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chart speed</td>
<td>(3 speeds)</td>
<td>SHIFT + 1</td>
<td>Speed No. 1</td>
<td>1</td>
<td>1 to 3</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Speed</td>
<td>20/25*</td>
<td>0001 to 0600 mm/h</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>or 0001 to 0200</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>mm/min</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Terminal No. 1</td>
<td>1</td>
<td>1 to 4</td>
<td>13.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 CLEAR + 5</td>
<td>Operation non</td>
<td>Selection from 13</td>
<td>Selection from 13</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>items; non,</td>
<td>items; non,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>printing on/off &amp; 3</td>
<td>printing on/off &amp; 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kinds of chart</td>
<td>kinds of chart</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>speed, message</td>
<td>speed, message</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>printing (No. 1 to</td>
<td>printing (No. 1 to</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5), operation</td>
<td>5), operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>record (A/B/C/D),</td>
<td>record (A/B/C/D),</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>digital data</td>
<td>digital data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>printing, list</td>
<td>printing, list</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>printing (No. 1b)</td>
<td>printing (No. 1b)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3) and totalizing</td>
<td>3) and totalizing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>reset</td>
<td>reset</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Printing No. A</td>
<td>A, B, C, D</td>
<td></td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 CLEAR + 2</td>
<td>Printing position 0</td>
<td>10 to 90%.</td>
<td>Printing position</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>when the contact</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>is open. The</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>printing position</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>is at +5 mm when</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>it is shorted.</td>
<td></td>
</tr>
<tr>
<td>Automatic</td>
<td>Range shift</td>
<td>SHIFT + DISP</td>
<td>Format Sd</td>
<td>Select Ar from Sd</td>
<td>Sd</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td>(Ar)</td>
<td></td>
<td></td>
<td>(standard), Ar, SP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and PL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Channel</td>
<td>Not programmed</td>
<td>1 to 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zero for range 1</td>
<td>a (Minimum value ≤</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>a &lt; b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Span for range 1</td>
<td>b (a &lt; b &lt; c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Span for range 2</td>
<td>c (b &lt; c &lt; d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Span for range 3</td>
<td>d (c &lt; d &lt; e)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Span for range 4</td>
<td>e (d &lt; e &lt; f)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Span for range 5</td>
<td>f (e &lt; f ≤ maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>value)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record format</td>
<td></td>
<td>SHIFT + DISP</td>
<td>Format Sd</td>
<td>Select SP from Sd</td>
<td>Sd</td>
<td>14.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(standard), Ar, SP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and PL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Channel</td>
<td>Not programmed</td>
<td>1 to 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Printing position</td>
<td>0 to a (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>for broken point 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Printing position</td>
<td>a to 100 (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>for broken point 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scale at zero</td>
<td>b (Minimum value ≤</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>b &lt; c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scale for broken</td>
<td>c (b &lt; c &lt; d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>point 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scale for broken</td>
<td>d (c &lt; d &lt; e)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>point 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scale for span</td>
<td>e (d &lt; e ≤ maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>value)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone scale</td>
<td>(PL)</td>
<td>SHIFT + DISP</td>
<td>Format Sd</td>
<td>Select PL from Sd</td>
<td>Sd</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(standard), Ar, SP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and PL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CH for area 1</td>
<td>Not programmed</td>
<td>1 to 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CH for area 2</td>
<td>Not programmed</td>
<td>1 to 4 (Except</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>channels for area 1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CH for area 3</td>
<td>Not programmed</td>
<td>1 to 4 (Except</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>channels for area 1 and 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CH for area 4</td>
<td>Not programmed</td>
<td>1 to 4 (Except</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>channels for area 1 to 3)</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>Interface</td>
<td>SHIFT + SPACE</td>
<td>For details, refer to</td>
<td>AL3000: 20 mm/h,</td>
<td></td>
<td>15.1</td>
</tr>
<tr>
<td>Specifications</td>
<td></td>
<td>COPY</td>
<td>the separate instruction manual for</td>
<td>AH3000: 25 mm/h</td>
<td></td>
<td>15.2</td>
</tr>
</tbody>
</table>

* AL3000: 20 mm/h, AH3000: 25 mm/h
This section explains the basic programming parameters.

1 Basic of Programming Flow Chart

Programming is interrupted to return to the operation screen at any programming stage by pressing DISP key before storing.

Keys to be pressed depending on programming items.

This action is necessary for some programming items.

For parameters to be programmed for each channel, check the programmed parameters of other channels with ▲ or ▼.

(1) Programming lamp lights.
(2) The cursor appears at a programmable digit.

Character display
Memory colon
Character display (Abbreviation of a programming item)

If this procedure is omitted, programmed parameters are not stored into memory.

(Note) Common programmed parameters are stored only by pressing ENTRY key.

(1) Memory colon starts blinking.
(2) Programming change mark is printed.*

Programmed parameter (including temporarily stored programmed parameters) are stored. During this storing operation, measurement is interrupted.

* The change mark is printed on the right side of chart paper. However the △ mark will not be printed completely until the chart paper advances several lines.

2 Key Operation

1) Numeric keys and cursor
- Cursor shifts rightward when pressing numeric keys (CLEAR to LIST and 0°C).
- Press ▲F or ▼C for moving the cursor.

2) How to add or delete a decimal point
- To add the decimal point move the cursor to ▼C and press 0CLOCK. To delete the decimal point, press SPACE COPY). (Numeric value is also deleted.)

3) Clearing a displayed programmed parameter
- The programmed parameter is cleared by pressing SHIFT and CLEAR simultaneously.
7. PROGRAMMING

7.5 Programming Errors and Remedial Measures

An error for the programmed parameter is judged when pressing [ENTRY] during [Storing] or [Temporarily storing] procedures.

1 Error Judgement Flow Chart

![Error Judgement Flow Chart Diagram]

2 Type of Errors and Error Display

If a programmed parameter is in error, a long tone (approx. 0.5 sec.) sounds and no storing (or temporarily storing) is executed.

<table>
<thead>
<tr>
<th>Error type</th>
<th>Format error</th>
<th>Programming error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>For Error →Blinks</td>
<td>SET Error →Blinks</td>
</tr>
<tr>
<td>Details</td>
<td>Programmed parameter format is in error. [1234] was programmed to [12-34] or the like, for example.</td>
<td>A numeric value out of programming range was programmed.</td>
</tr>
</tbody>
</table>

3 Remedial measures when an error occurs

If any key other than [SHIFT] is pressed, it returns to the programmed parameter display. The cursor appears and reprogramming can be executed. Reprogram by entering correct value.
8. BASIC PROGRAMMING

8.1 Programming Parameters Before Operation

Certain parameters are to be programmed for starting operation after turning on the power supply.

1 Turning On the Power supply

By turning on the power supply for the first time, the display and printing operation start with default parameters. Perform the basic programming to match your purpose before operation.

<table>
<thead>
<tr>
<th>Default parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range/Printing range</td>
</tr>
<tr>
<td>°C/°F selection</td>
</tr>
<tr>
<td>Chart speed</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

2 Basic Programming Parameters

Be sure to program the following three parameters before operation.

- Turning on the power supply
- Programming range/printing range
- Is thermocouple or resistance thermometer range used?
- Selecting °C/°F computation
- Programming chart speed
- Basic programming end

Parameters to be programmed depending on functions:
- (1) Scale
- (2) Skip (channel deletion and recovery)
- (3) Subtract printing
- (4) Alarms (absolute value, rate-of-change and differential)
- (5) Periodic data printing
- (6) Clock
- (7) Engineering unit
- (8) Tag
- (9) Burnout enable/disable
- (10) Pass code/Keylock
- (11) Alarm dead band
- (12) Message
- (13) Time axis synchronization

Parameters to be programmed depending on options:
- (1) Alarm output
- (2) Communications interface (Note)
- (3) Remote contacts
- (4) Printing format (automatic range shift, compressed/expanded, zone record)

* When the printing range is set, that value reflects to the "Scale" setting. For the scaling with voltage input, read the Section 11.2.

* Refer to the separate instruction manual for "Communications Interface".
8. BASIC PROGRAMMING  8.2 Range/Printing Range

Program the following parameters before operation. Press \( \text{SHIFT} \) and \( \text{SWEE} \) simultaneously at the operation screen to display the “Range/Printing range” programming screen. Programming of the parameter is required in every channel.

1  Programming Mode and Parameters

1) Programming mode

2) Parameters

Program the following three parameters for every channel.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>(1) Range No.</th>
<th>(2) RJ selection</th>
<th>(3) Printing range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Selection of input types and measuring ranges</td>
<td>Selection of reference junction compensation (RJ) enabled or disabled</td>
<td>Specifying of the input range to be printed on the chart paper.</td>
</tr>
<tr>
<td>Programming values</td>
<td>Range No. (2-digit numeric value) For a range No. table, see item 4.</td>
<td>0: Disable (external compensation) 1. Enable (internal compensation) Program to “0” for all inputs other than thermocouple input.</td>
<td>Minimum value to maximum value (within 5 digits) This range can be programmed irrespective of the measuring range being specified in the range No. selected. (Note)</td>
</tr>
</tbody>
</table>

(Note) Input exceeding the measuring range or printing range is printed as an over-range.

2  Cautions on Programming and Reference

Read the following cautions and reference items. The programming flow charts are described on the next page.

1) Minimum printing range

Read the “minimum printing range” on Section 22.1 (Input Specifications). A programming error occurs if the minimum value and the maximum value are set to the same figure.

2) Position of decimal point

The printing range reflects to the scale value. The decimal point position on actual display/printing is fixed by the range No. selected. For changing it, refer to the scale programming.

<table>
<thead>
<tr>
<th>Range No. (Measuring range)</th>
<th>Printing range</th>
<th>Scale</th>
<th>Actual position of decimal point</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 (-5.000 to 5.000 V)</td>
<td>0 to 5</td>
<td>0 to 5</td>
<td>0.000 to 5.000</td>
</tr>
<tr>
<td>21 (-200.0 to 300.0°C)</td>
<td>0 to 200</td>
<td>0 to 200</td>
<td>0.0 to 200.0</td>
</tr>
<tr>
<td>23 (-200 to 1370°C)</td>
<td>0.0 to 800.0</td>
<td>0.0 to 800.0</td>
<td>0 to 800</td>
</tr>
</tbody>
</table>

3) When “Range/Printing range” is changed, the last scale value becomes ineffective and is replaced with the new printing range.

4) Channel for subtract printing

Different range programming procedure is required. Read Section 11.4 (Programming Subtract Printing).

5) Programming a same range to other channels

The [copy] function is useful. Read Section 11.14.

6) Scaling

Printing range reflects to the scale value. For scale programming to the channel with voltage input, read Section 11.2.
8. BASIC PROGRAMMING
8.2 Range/Printing Range

Programming Flow Chart

<Example> Range No. for channel 3: 22, RJ: Enable, Printing range: -50 to 450°C

Error message appears?

Keys other than \[\text{SHIFT}\] 

Temporarily stored 

YES 

Programming other channels?

NO

SHIFT + SET 

STORED 

Channel 1 range. 
Other channels can be checked with \[\text{RANGE}\] or \[\text{RANG}\]. 

- Cursor and programming lamp light. 
- Cursor moves rightward when pressing a numeric key. 
  Cursor moves rightward. 
  Cursor moves leftward.

Press \[\text{+}\] or \[\text{-}\], and select [3], then press \[\text{F}\]. 

Press \[\text{TAG}\] and then press \[\text{TAG}\] again (range No. 22). See the next page for the range No. table. 

RJ (Reference Junction compensation): 
0 → Disable* 
1 → Enable 
*For all inputs other than thermocouple input, program to “0”. 

Adding/deleting decimal point: Move the cursor rightward and press \[\text{DEC}\] or \[\text{DEC}\]. 
- Programming “to”: Press \[\text{SHIFT}\] and \[\text{ENTRY}\] simultaneously. 
- Decimal point is not included in the number of programming digits. 

An error occurs if a value exceeds the programming range or unnecessary space is entered. 

Display moves to the next channel for programming. 

Store the [temporarily stored] programmed values into memory. 
Memory colon blinks and the programming change mark \[\text{△}\] is printed. 

* Unused digits should be filled with spaces.
8. BASIC PROGRAMMING

8.2 Range/Printing Range

4  Range No. Tables

1) Voltage input

<table>
<thead>
<tr>
<th>No.</th>
<th>Input type</th>
<th>Measuring range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>DC (mV)</td>
<td>-13.80 to 13.80 mV</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>DC (mV)</td>
<td>-27.60 to 27.60 mV</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>DC (mV)</td>
<td>-69.00 to 69.00 mV</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>DC (mV)</td>
<td>-200.0 to 200.0 mV</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>DC (mV)</td>
<td>-500.0 to 500.0 mV</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>DC (V)</td>
<td>-2.00 to 2.000 V</td>
<td>For current input, see Item 16.2.</td>
</tr>
<tr>
<td>07</td>
<td>DC (V)</td>
<td>-5.00 to 5.000 V</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>DC (V)</td>
<td>-10.00 to 10.00 V</td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>DC (V)</td>
<td>-20.00 to 20.00 V</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>DC (V)</td>
<td>-50.00 to 50.00 V</td>
<td></td>
</tr>
</tbody>
</table>

2) Thermocouple input (*1)

<table>
<thead>
<tr>
<th>No.</th>
<th>Input type</th>
<th>Measuring range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>K</td>
<td>-200.0 to 300.0 °C</td>
<td>-320.0 to 570.0 °F</td>
</tr>
<tr>
<td>22</td>
<td>K</td>
<td>-200.0 to 600.0 °C</td>
<td>-320.0 to 1110 °F</td>
</tr>
<tr>
<td>23</td>
<td>K</td>
<td>-200.0 to 1370 °C</td>
<td>-320.0 to 2490 °F</td>
</tr>
<tr>
<td>24</td>
<td>E</td>
<td>-200.0 to 200.0 °C</td>
<td>-320.0 to 390.0 °F</td>
</tr>
<tr>
<td>25</td>
<td>E</td>
<td>-200.0 to 350.0 °C</td>
<td>-320.0 to 660.0 °F</td>
</tr>
<tr>
<td>26</td>
<td>E</td>
<td>-200.0 to 900 °C</td>
<td>-320.0 to 1650 °F</td>
</tr>
<tr>
<td>27</td>
<td>J</td>
<td>-200.0 to 250.0 °C</td>
<td>-320.0 to 480.0 °F</td>
</tr>
<tr>
<td>28</td>
<td>J</td>
<td>-200.0 to 500.0 °C</td>
<td>-320.0 to 930.0 °F</td>
</tr>
<tr>
<td>29</td>
<td>J</td>
<td>-200.0 to 1200 °C</td>
<td>-320.0 to 2190 °F</td>
</tr>
<tr>
<td>30</td>
<td>T</td>
<td>-200.0 to 250.0 °C</td>
<td>-320.0 to 480.0 °F</td>
</tr>
<tr>
<td>31</td>
<td>T</td>
<td>-200.0 to 400.0 °C</td>
<td>-320.0 to 750.0 °F</td>
</tr>
<tr>
<td>32</td>
<td>R</td>
<td>0 to 1200 °C</td>
<td>32 to 2190 °F</td>
</tr>
<tr>
<td>33</td>
<td>R</td>
<td>0 to 1760 °C</td>
<td>32 to 3200 °F</td>
</tr>
<tr>
<td>34</td>
<td>S</td>
<td>0 to 1300 °C</td>
<td>32 to 2370 °F</td>
</tr>
<tr>
<td>35</td>
<td>S</td>
<td>0 to 1760 °C</td>
<td>32 to 3200 °F</td>
</tr>
<tr>
<td>36</td>
<td>B</td>
<td>0 to 1820 °C</td>
<td>32 to 3300 °F</td>
</tr>
<tr>
<td>37</td>
<td>N</td>
<td>-200.0 to 400.0 °C</td>
<td>-320.0 to 750.0 °F</td>
</tr>
<tr>
<td>38</td>
<td>N</td>
<td>-200.0 to 750.0 °C</td>
<td>-320.0 to 1380 °F</td>
</tr>
<tr>
<td>39</td>
<td>N</td>
<td>-200.0 to 1300 °C</td>
<td>-320.0 to 2370 °F</td>
</tr>
</tbody>
</table>

3) Resistance thermometer input (*2)

<table>
<thead>
<tr>
<th>No.</th>
<th>Input type</th>
<th>Measuring range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>Pt100</td>
<td>-140.0 to 150.0 °C</td>
<td>-220.0 to 300.0 °F</td>
</tr>
<tr>
<td>71</td>
<td>Pt100</td>
<td>-200.0 to 300.0 °C</td>
<td>-320.0 to 550.0 °F</td>
</tr>
<tr>
<td>72</td>
<td>Pt100</td>
<td>-200.0 to 850.0 °C</td>
<td>-320.0 to 1550 °F</td>
</tr>
<tr>
<td>73</td>
<td>Pt100</td>
<td>-140.0 to 150.0 °C</td>
<td>-220.0 to 300.0 °F</td>
</tr>
<tr>
<td>74</td>
<td>Pt100</td>
<td>-200.0 to 300.0 °C</td>
<td>-320.0 to 550.0 °F</td>
</tr>
<tr>
<td>75</td>
<td>Pt100</td>
<td>-200.0 to 649.0 °C</td>
<td>-320.0 to 1200 °F</td>
</tr>
<tr>
<td>76</td>
<td>Pt100</td>
<td>-140.0 to 150.0 °C</td>
<td>-220.0 to 300.0 °F</td>
</tr>
<tr>
<td>77</td>
<td>Pt50</td>
<td>-200.0 to 300.0 °C</td>
<td>-320.0 to 550.0 °F</td>
</tr>
<tr>
<td>78</td>
<td>Pt50</td>
<td>-200.0 to 649.0 °C</td>
<td>-320.0 to 1200 °F</td>
</tr>
<tr>
<td>79</td>
<td>Pt50</td>
<td>-200.0 to 649.0 °C</td>
<td>-320.0 to 1200 °F</td>
</tr>
<tr>
<td>80</td>
<td>Pt-Co</td>
<td>4.0 to 374.0K</td>
<td>4.0 to 374.0K</td>
</tr>
</tbody>
</table>

*1: (1) No.21 to 39: IEC584, JIS C 1602-1995
   (2) No.40 to 50: ASTM
   (3) No.51 to 56: DIN43710

*2: (1) No.70 to 72: IEC751(1995), JIS C 1604-1997
   (2) No.73 to 75: IEC751(1983), JIS C 1604-1989
   JIS C 1606-1989
   (3) No.76 to 78: JIS C 1604-1981
   JIS C 1606-1989
   (4) No.79: JIS C 1604-1981

Remarks

Decimal point position and engineering units

Decimal point position: Even if the decimal point position is programmed in the printing range, the actual display/printing position is shown as described in the table above depending on the range No. For changing the decimal point position, see Section 11.2 “Scale programming”.

Engineering units: Engineering unit is shown as described in the table above depending on range No. (Temperature unit is fixed to °C except No. 47 and 80). For changing the engineering unit, see Section 11.8 “Unit programming”. 

- 42 -
8. BASIC PROGRAMMING  8.3 °C/°F Computation Selection

This programming is to select a "°C" or "°F" computation for a temperature range (thermocouple or resistance thermometer). The default setting is "°C". Press \( \text{SHIFT} \) and \( \Delta \) simultaneously 3 seconds or more in the operation screen to display the "°C/°F computation" selection screen. Select "°F" if necessary.

1 Programming Mode

```
Character display
Cursor     Computation unit (Fixed)
```

2 Programming Flow Chart

<Example> From "°C" computation to "°F" computation

```
Operation screen

[Check]

\[ \text{dEgC/dEgF} \text{ dEgC} \]

[To be ready for programming]

\[ \text{dEgC/dEgF} \text{ dEgC} \]

[Selecting "°F"

\[ \text{dEgC/dEgF} \text{ dEgF} \]

```

"°C" ↔ "°F" conversion formula

\[ °C = \frac{5}{9} (°F - 32),  °F = \frac{9}{5} °C + 32 \]

The selected computation unit can be checked. The unit in the left flow is "°C".

Cursor and programming lamp light.

Each time \( \uparrow \) or \( \downarrow \) is pressed, \( \text{dEgC} \) or \( \text{dEgF} \) is displayed alternately.

The selected computation unit is stored into memory.

Memory colon blinks and the programming change mark \( \Delta \) is printed.

Remarks  

1) In case of temperature unit "K"

The temperature unit for the range No.47 (AuFe-CR) and 80 (Pt-Co) is "K". It does not affect this programming.

2) Influence onto other programmed parameters

The programmed parameters for "Range/Printing range", "Scale" and "Alarm setpoint" are not changed automatically. If the programmed parameters cannot be used for the selected computation unit, reprogram them again. Even if "°C" or "°F" is programmed at the "Engineering unit programming", it does not change the computation.
8. BASIC PROGRAMMING 8.4 Chart Speed Programming

Program the chart speed before operation.

- Press \( \text{SHIFT} \) and \( \text{CHART} \) simultaneously in the operation screen to display the [Chart speed] programming screen.
- For the remote contacts (option), read Section 13.3.
- 0000 mm/h can be set for AH3000. When 0000 mm/h is set, chart is fed at the speed of 12.5 mm/h.

1. Programming Mode

<table>
<thead>
<tr>
<th>Speed unit (H/M)</th>
<th>Cursor</th>
<th>Chart speed (4 digits programming)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Programming Flow Chart

<Example> From 20 mm/h to 50 mm/h

![Flow Chart Diagram]

- Changing the speed unit (h/m)
  Move the cursor to the character display (a digit on the left) then press \( \text{SHIFT} \) or \( \text{CHART} \) to switch "M" and "H" alternatively.

- Programmed chart speed
  - Cursor and programming lamp light.
  - Cursor moves rightward when pressing a numeric key.
  - Cursor moves rightward.
  - Cursor moves leftward.

- Program the chart speed within 0001 to 0600 mm/h or 0001 to 0200 mm/min.

- An error occurs if a value exceeds the programming range or any space or decimal point is entered.

- The new programmed value is stored into memory.
  - Memory colon blinks and the programming change mark is printed.

Remarks:
- If 150 mm/h or more is programmed for the chart speed
  - No printing, except time line, data printing and programming change mark, is executed.

Influence to periodic data printing
- When changing the chart speed, the programmed parameters for periodic data printing (Section 11.7) is cleared. (Default: Not programmed)
9. PRINTINGS

9.1 Printing Types and the Details

Printing comprises trace printing and digital printing. The fixed-time printing and trace printing are executed even if any operation is not programmed.

## 1 Printing Types and the Details

<table>
<thead>
<tr>
<th>Printing type</th>
<th>Printing details</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace printing (Cartridge pen)</td>
<td>Trend printing is executed for each pen (channel)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1st pen 2nd pen 3rd pen 4th pen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Red Green Blue Brown</td>
<td></td>
</tr>
<tr>
<td>Fixed-time printing</td>
<td>The following details are printed on the fixed time. (1) Year/Month/Day (2) Time (3) Time line (4) Chart speed (5) Scale, Engineering unit, Tag</td>
<td>10-1</td>
</tr>
<tr>
<td>Periodic data printing</td>
<td>Measured values are printed on the trace printing with programmed intervals. The printing starts from the programmed start time line. The printing mode is different depending on chart speed.</td>
<td>11-7</td>
</tr>
<tr>
<td>Digital data printing</td>
<td>Measured values are printed on the trace printing. The printing mode is different depending on chart speed.</td>
<td>9-2</td>
</tr>
<tr>
<td>List 1 printing</td>
<td>Major parameters (Range/Printing range, Scale, Subtract printing, Periodic data printing) are printed as a table.</td>
<td>9-3</td>
</tr>
<tr>
<td>List 2 printing</td>
<td>The parameters (such as time axis synchronizing, message, items relating to options) other than those involved in List 1 are printed as a table.</td>
<td>9-3</td>
</tr>
<tr>
<td>List 3 printing</td>
<td>All parameters (List 1 + List 2) are printed as a table.</td>
<td>9-3</td>
</tr>
<tr>
<td>Message printing</td>
<td>Message is printed on the right side of the chart paper by selecting the programmed message No.</td>
<td>9-4</td>
</tr>
<tr>
<td>Alarm printing</td>
<td>Alarm details (time, alarm points, alarm type) are printed on the right side of the chart paper when an alarm activates or an alarm is reset.</td>
<td>10-4</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 (<em>), and ON or OFF are printed on the right side of the chart paper. (2) When it is ON, a mark (</em>) is printed to the right of the time print of fixed-time printing.</td>
<td>9-6 10-1</td>
</tr>
<tr>
<td>Power-on printing</td>
<td>Year/Month/Day and time are printed on the left side of the chart paper when the power is turned on.</td>
<td>6-1</td>
</tr>
<tr>
<td>Operation printing line and Operation printing No.</td>
<td>For the remote contacts (option), it is required to program the &quot;Operation printing position&quot; and select one of Act 1 to 4 in the &quot;Remote contacts&quot; programming. (1) Printing line: When a contact signal (on) is applied to the allocated terminal, the line is printed by 5 mm to the right of the programmed printing line position. (2) Operation printing No.: Operation printing No. (A to D) is printed at constant intervals to the left of the programmed printing line position.</td>
<td>13-4</td>
</tr>
<tr>
<td>Printer check printing</td>
<td>When hardware check is executed by selecting the printer (plotter pen) characters are printed for checking purpose.</td>
<td>19-2</td>
</tr>
</tbody>
</table>
9. PRINTINGS

9.1 Printing Types and the Details

2 Printing Examples

1) AL3000 (Printing width: 100 mm)

2) AH3000 (printing width: 180 mm)
9. PRINTINGS

9.2 Digital Data Printing

The measured value at the moment pressed is digitally printed with the plotter pen.

(1) Press\[DATA\] and then press\[ENTRY\]. Digital printing of measured value at the moment pressed starts.

(Note) When \[DATA\] is pressed, \[PUSH\ \[ENTRY\] appears for about 5 sec. Press \[ENTRY\] while this message appears.

- Printing mode is different depending on the chart speed.

<table>
<thead>
<tr>
<th>Chart speed</th>
<th>Printing mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 499 mm/h</td>
<td>Analog printing is continued without interruption.</td>
</tr>
<tr>
<td>500 mm/h or more</td>
<td>Analog printing is interrupted and data printing is started.</td>
</tr>
</tbody>
</table>

(2) For interrupting the printing, press \[REC\] \[ON/OFF\] and then press \[ENTRY\]. Your recorder returns to the normal operation but the printing operation is turned off. For turning on the printing operation, press \[REC\] \[ON/OFF\] and then press \[ENTRY\] again.

(3) When the digital data printing completes, your recorder returns to the normal operation.

* With this procedure, the printing operation turns off. Press \[REC\] \[ON/OFF\] and \[ENTRY\] again to turn it on.

Example of Digital data printing (4-pen type)

(Note) The above examples are for AL3000. They are the same for AH3000.
9. PRINTINGS 9.3 List Printing

The details of programming such as "Range/Printing range" and "Scale" can be printed as a list with the plotter pen. As this includes large amount of data and takes time, it enables to divide the data into two and select printing of "List 1" or "List 2".

- List 1: Major parameters .... “Range/Printing range”, “Chart speed”, “Printing format”, etc.
- List 2: Parameters other than the above .... “Message”, “Time axis synchronization.” and “option-related-items”
- List 3: All parameters .... “List 1” + “List 2”

1 List 1 Printing

(1) Press [SHIFT] and [LIST] simultaneously, and then press [ENTRY]
(2) The selection screen from [List 1] to [List 3] appears. Move the cursor to “1”.
(3) When [ENTRY] is pressed, PUSH ENTRY appears for about 5 sec. For execution, go to procedure (4). For no execution, press [DISP]
(4) Press [ENTRY] to start “List 1” printing. The cartridge pen moves to the end of the left side and the chart paper forwards slightly.
(5) For interrupting the printing, press [REC ON/OFF] and [ENTRY] simultaneously. Your recorder returns to the normal operation but the printing operation is turned off. For turning on the printing operation, press [REC ON/OFF] and then press [ENTRY] again.
(6) When the list printing completes, your recorder returns to the normal operation.

List 1: Major parameters .... “Range/Printing range”, “Chart speed”, “Printing format”, etc.
List 2: Parameters other than the above .... “Message”, “Time axis synchronization.” and “option-related-items”
List 3: All parameters .... “List 1” + “List 2”

Reference

Operation during printing
(1) Trace printing with a cartridge pen is interrupted. Other functions are continued without being interrupted.
(2) Programming any parameters (Range/Printing range, Scale, Alarm, etc.) cannot be executed during printing. Program them after the printing ends.
9. PRINTING

9.3 List Printing

2  List 2 Printing

<table>
<thead>
<tr>
<th>Operation screen</th>
<th>DISP</th>
</tr>
</thead>
<tbody>
<tr>
<td>[List No. selection]</td>
<td>[List 1, 2, 3]</td>
</tr>
<tr>
<td>Cursor</td>
<td>ENTRY</td>
</tr>
<tr>
<td>[List 2 printing starts.]</td>
<td></td>
</tr>
<tr>
<td>YES*</td>
<td>Interrupt?</td>
</tr>
<tr>
<td>NO</td>
<td>ENTRY</td>
</tr>
<tr>
<td>[List 2 printing ends.] (Approx. 30 min. for printing)</td>
<td></td>
</tr>
</tbody>
</table>

(1) Press \[SHIFT\] and \[LIST\] simultaneously, and then press \[ENTRY\].
(2) The selection screen from [List 1] to [List 3] appears. Move the cursor to “2”.
(3) When \[ENTRY\] is pressed, \[PUSH\] \[ENTRY\] appears for about 5 sec. For execution, go to procedure (4). For no execution, press \[DISP\].
(4) Press \[ENTRY\] to start “List 2” printing. The cartridge pen moves to the end of the left side and the chart paper forwards slightly.
(5) For interrupting the printing, press \[REC\] \[ON/OFF\] and \[ENTRY\] simultaneously. Your recorder returns to the normal operation but the printing operation is turned off. For turning on the printing operation, press \[REC\] \[ON/OFF\] and then press \[ENTRY\] again.
(6) When the list printing completes, your recorder returns to the normal operation.

List 2 printing details

<table>
<thead>
<tr>
<th>(1) Year/month/day, Time</th>
<th>(2) Chart speed (Note)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3) Alarm outputs</td>
<td>(4) Time axis sync</td>
</tr>
<tr>
<td>(5) Message</td>
<td>(6) Operation record</td>
</tr>
<tr>
<td>(7) Remote contacts</td>
<td>(8) Mathematics</td>
</tr>
</tbody>
</table>

(Note) For the remote contacts (option), which can program 3 speeds (No.1 to No.3), is added, all programmed 3 speeds are printed.

Example of the List 2 printing

(Note) The above example is for AL3000. It is the same for AH3000.

3  List 3 Printing

Move the cursor to “3” at the [List No. selection] and execute the same procedure as item 2. All of the programmed parameters are printed.

* With this procedure, the printing operation turns off. Press \[REC\] \[ON/OFF\] and then press \[ENTRY\] again to turn it on.

Remarks

List 2 printing cannot be executed in the following conditions.

(1) \[RECORD\] \[ON\] status lamp is not lit.
(2) \[KEY\] \[LOCK\] status lamp lights.
Chart speed does not affect this operation.
Chart paper forwards at a fixed speed.

Reference

Operation during printing

Trace printing with a cartridge pen is not interrupted. Other functions are continued without being interrupted.
9. PRINTING

9.4 Message Printing

For printing of a pre-programmed message, select the message No. and press ENTRY.

(1) Press \[ 0 \text{ CLEAR} \] and \[ 6 \text{ A-Z} \] simultaneously for 3 seconds or more.

(2) Select the message No. (1 to 5) to be printed with \[ \uparrow \text{ or } \downarrow \text{.} \]

(Note) Refer to Section 11.10 for programming of message.

(3) Press ENTRY to start “Message” printing with a plotter pen on the right side of the chart paper.

(Note) The “message” will not be printed completely until the chart paper forwards several lines.

(4) For interrupting the printing, press \[ \text{REC ON/OFF} \] and then press \[ \text{ENTRY} \]. The printing operation is turned off and your recorder returns to the normal operation. For turning on the printing operation, press \[ \text{REC ON/OFF} \] and \[ \text{ENTRY} \] simultaneously again.

(5) When the message printing completes, your recorder returns to the normal operation.

* With this procedure, the printing operation turns off. Press \[ \text{REC ON/OFF} \] and then press \[ \text{ENTRY} \] again to turn it on.

**Remarks**

Message printing cannot be executed in the following conditions.

1. RECORD ON status lamp is not lit.
2. KEY LOCK status lamp lights.
3. For the chart speed programmed at 150 mm/h or faster

**Execution with external contact signal**

When the remote contacts (option) is added, message printing can also be executed by a contact signal. However, this requires the programming of the "terminal allocation". See Section 13.2 for details.

(Note) The above example is for AL3000. It is the same for AH3000.
9. PRINTING  9.5 Printing Format Selection

This selection is only applicable to the printing format function (option). Four types of analog printing format are available.

1 Types of Printing Format
Before the selection, the programming of the desired format is required. See Section 14. The default is the standard format (S d).

2 Selection Flow Chart
<Example> From Standard printing to Zone printing

---

Types of format and programming

<table>
<thead>
<tr>
<th>Types</th>
<th>Programming</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Standard (S d)</td>
<td>Not required</td>
</tr>
<tr>
<td>(2) Automatic range shift (R r)</td>
<td>Section 14.1</td>
</tr>
<tr>
<td>(3) Compressed/expanded (S P)</td>
<td>Section 14.2</td>
</tr>
<tr>
<td>(4) Zone (P L)</td>
<td>Section 14.3</td>
</tr>
</tbody>
</table>

---

Reference 1 > Printing format check
Decimal point appears in the current format.
(1) S d : Standard
(2) R r : Automatic range shift
(3) S P : Compressed/expanded
(4) P L : Zone

Reference 2 > Storing procedure
1. To store the standard format; Press \[ENTRY\] key.
2. To store the format other than the standard; Press \[ENTRY\] and then press \[SHIFT\] simultaneously.

Reference 3 > Storing
The selected format is stored into memory. The trace printing is executed in the stored format.
(Programming change mark \(\Delta\) is printed.)

---

Operation screen

[Check]

[To be ready for programming]

[Selecting format]

YES

"Standard" selected?

NO

Programming screen for the selected format appears.

Stored
9. PRINTING  9.6 Time Axis Synchronization (POC)

1 Time Axis Synchronization (POC)

(1) This function is applicable to 2-pen, 3-pen and 4-pen types. In the standard printings, data at the same moment are printed on the chart paper with time axis gaps due to the difference in pen positions between 1st pen and 2nd to 4th pens. (When POC = OFF)

(2) The time axis synchronization functions to store the data of 2nd to 4th pens for the gaps and to print the stored data after the chart paper is fed to the printing start point of the 1st pen. (When POC = ON)

(3) The time axis synchronization is not available in 1-pen types.

2 Flow Chart for Selecting Time Axis Synchronization

<Example> From time axis synchronization Off to On

<table>
<thead>
<tr>
<th>Operation screen</th>
<th>Disp</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Check]</td>
<td></td>
</tr>
<tr>
<td>P O C  off</td>
<td></td>
</tr>
<tr>
<td>[To be ready for programming]</td>
<td></td>
</tr>
<tr>
<td>P O C  off</td>
<td></td>
</tr>
<tr>
<td>[Select ON]</td>
<td></td>
</tr>
<tr>
<td>P O C  on</td>
<td></td>
</tr>
<tr>
<td>ENTRY</td>
<td></td>
</tr>
</tbody>
</table>

Stored

Reference 1 Storing

Selected time axis synchronization (on or off) is stored into memory. (Programming change mark \(\checkmark\) is printed.)

Reference 2 Time axis synchronization mark

A marking as shown below is printed when the time axis synchronization is switched to on or off.

0 9 : 2 5 * ON

Program changed time
POC mark
On or off

<Ex.> Installation positions for AL3000

Chart feeding direction

<Printing EX. 1> Time axis synchronization not executed

2nd pen 1st pen

Printing off

Time axis synchronization
Not executed

<Printing EX. 2> Time axis synchronization executed

2nd pen 1st pen

G1: Even when the printing is off, the data for the gaps to 1st pen are stored in memory.

G2: The data for the gaps to 1st pen, which have been stored in memory in the printing off, are printed.

<Printing EX. 3> Power supply on/off

2nd pen 1st pen

G: The data for the gaps is erased. An option to backup this data is available.
10. OPERATIONS 10.1 Fixed-Time Printing and Intervals

After your recorder is turned on, parameters including time, chart speed and scale are printed at specified intervals.

The place of printing is in principle on the left side of the chart paper.

<table>
<thead>
<tr>
<th>Printing items</th>
<th>Printing intervals, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Year/Month/Day, Time</td>
<td>When power or printing is switched on</td>
</tr>
<tr>
<td></td>
<td>&lt;Ex.&gt; 2000.10.03.14:25* (*: Only when time axis synchronization is on)</td>
</tr>
<tr>
<td>2. Year/Month/Day</td>
<td>24-hour period (Printing every 00 hour 00 minute)</td>
</tr>
<tr>
<td></td>
<td>&lt;Ex.&gt; 2000.10.04</td>
</tr>
<tr>
<td>3. Chart speed</td>
<td>Approx. 84 mm intervals</td>
</tr>
<tr>
<td></td>
<td>&lt;Ex.&gt; 20 mm/h</td>
</tr>
</tbody>
</table>

Approx. 42 mm intervals, in order of channel No. When the printing format (option) is added, the printing contents vary depending on the selected format as shown in the following examples.

When the printing format is not added (standard), the printing is as shown in (1).

<table>
<thead>
<tr>
<th>Printing format (option)</th>
<th>Printing contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Standard (Sd)</td>
<td>1: TIC1 0.0/500.0℃</td>
</tr>
<tr>
<td>(Note) In 5 ranges (R1 to R5), the range when the printing is being executed is printed as the scale.</td>
<td></td>
</tr>
<tr>
<td>(2) Automatic range shift (Ar)</td>
<td>1: TIC1 0.0/500.0℃</td>
</tr>
<tr>
<td>(3) Compressed/expanded (SP)</td>
<td>1: TIC1 0.0/200.0/400.0/500.0℃</td>
</tr>
<tr>
<td>(Note) The “+” mark is printed at the positions of break points 1 and 2.</td>
<td></td>
</tr>
<tr>
<td>(4) Zone record (PL)</td>
<td>1: TIC1 0.0/500.0℃</td>
</tr>
<tr>
<td>(Note) The “+” marking identifying zones is printed at its boundary.</td>
<td></td>
</tr>
</tbody>
</table>

Printing of “time line” and “time” is interlocked with chart speed and is executed at the following intervals. The start point of intervals is 00:00 hours.

<table>
<thead>
<tr>
<th>Chart speed (mm/h)</th>
<th>Time line</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 9</td>
<td>6 hours</td>
<td>12:00 only</td>
</tr>
<tr>
<td>10 to 15</td>
<td>2 hours</td>
<td>4 hours</td>
</tr>
<tr>
<td>16 to 30</td>
<td>1 hour</td>
<td>2 hours</td>
</tr>
<tr>
<td>31 to 60</td>
<td>1 hour</td>
<td>1 hour</td>
</tr>
<tr>
<td>61 to 119</td>
<td>30 minutes</td>
<td>1 hour</td>
</tr>
<tr>
<td>120 to 149</td>
<td>30 minutes</td>
<td>30 minutes</td>
</tr>
<tr>
<td>150 or faster</td>
<td>30 minutes</td>
<td>No printing</td>
</tr>
</tbody>
</table>

<Example> 10:30 * 1 Time line 2 Time 3 POC mark (Note: Printed only when the time axis synchronization is on)

(Note) See Section 9.6 for details.

Reference > When the chart speed is 150 mm/h or faster

No printing is executed except time line, data and programming change mark.
10. OPERATIONS

10.2 Operations at Abnormal Inputs

1  Over-range input

The following table shows displays and printings for input exceeding a printing range or a measuring range.

- Measuring range:
  Determined by the range No. programmed in “Range/Printing range”. See Section 8.2.
- Printing range:
  Trace printing range programmed in “Range/Printing range”.

<table>
<thead>
<tr>
<th>区分</th>
<th>Input</th>
<th>Display</th>
<th>Bar graph</th>
<th>Printing</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Lower than minimum measuring range*</td>
<td>— — — — —</td>
<td>□□□……□□□ (All go off.)</td>
<td>— — — —</td>
</tr>
<tr>
<td>(2)</td>
<td>Lower than minimum printing range</td>
<td>Normal</td>
<td>□□□……□□□ (All go off.)</td>
<td>Normal</td>
</tr>
<tr>
<td>(3)</td>
<td>Higher than maximum printing range</td>
<td>Normal</td>
<td>■■■……■■■ (All light.)</td>
<td>Normal</td>
</tr>
<tr>
<td>(4)</td>
<td>Higher than maximum measuring range*</td>
<td>— — — — —</td>
<td>■■■……■■■ (All light.)</td>
<td>+ — — —</td>
</tr>
</tbody>
</table>

* For the digital display and printing, the measured values can be displayed and printed up to about ±10% of the span even when the values are outside the measuring range.

2  Input Disconnection

The display and printing, when the input is disconnected, differ depending on the “Burnout enable/disable” programming. However, for channels of a voltage (mV or V) range, the burnout function is “disable (non)” even when “Burnout Enable/Disable” is programmed. Program “Burnout enable/disable” to each channel. See Section 11.11.

<table>
<thead>
<tr>
<th>Programming burnout</th>
<th>Display</th>
<th>Printing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Digital</td>
<td>Bar graph</td>
</tr>
<tr>
<td>Disable (non)</td>
<td>Undefined</td>
<td>Undefined</td>
</tr>
<tr>
<td>Enable - downscale (doWn bUm)</td>
<td>bUrn</td>
<td>□□□……□□□ (All go off.)</td>
</tr>
<tr>
<td>Enable - upscale (UP bUm)</td>
<td>bUrn</td>
<td>■■■……■■■ (All lights.)</td>
</tr>
</tbody>
</table>
10. OPERATIONS

10.3 Alarm Display and Printing

1 Display of Alarm Activation

The alarm activation information can be checked in the operation screen.

1) Measured value display screen

Display in case alarm activated

(1) [ALARM] status lamp lights.
(2) The measured value of the channel in alarm blinks.
(To cancel blinking)
Press [ENTRY]. The measured value is displayed steadily.

<Ex.> Alarm activated at CH 1 in 3-pen type

<table>
<thead>
<tr>
<th>Time</th>
<th>Channel</th>
<th>Type</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:59</td>
<td>1</td>
<td>H</td>
<td>I</td>
</tr>
</tbody>
</table>

(Note) The above example is for AL3000. It is the same for AH3000.

2) Alarm display screen

Display in case of alarm activated

(1) The character display shows “า”.
(2) The alarm type at the level, of which the alarm is activated, is displayed for each channel.
(3) [ALARM] status lamp lights.
(Note) If no alarm activates, the alarm display screen is not displayed even when [DISP] is pressed.

<Ex.> Alarm activated at CH 1 in 3-pen type

<table>
<thead>
<tr>
<th>Time</th>
<th>Channel</th>
<th>Hyphen</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:05</td>
<td>1</td>
<td>-1</td>
<td>I</td>
</tr>
</tbody>
</table>

(Note) The above example is for AL3000. It is the same for AH3000.

2 Alarm Activation/Reset Printing

Alarm activation and reset are printed on the right side of the chart paper.

1) Printing format when an alarm activates

<table>
<thead>
<tr>
<th>Time</th>
<th>Channel</th>
<th>Type</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:59</td>
<td>1</td>
<td>H</td>
<td>I</td>
</tr>
</tbody>
</table>

Printing example of alarm activation

[Diagram]

2) Printing format when an alarm is reset

<table>
<thead>
<tr>
<th>Time</th>
<th>Channel</th>
<th>Hyphen</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:05</td>
<td>1</td>
<td>-1</td>
<td>I</td>
</tr>
</tbody>
</table>

Printing example of alarm reset

[Diagram]
11. OTHER PROGRAMMING

11.1 Time

For programming date and time, press \[\text{SHIFT}\] and \[\text{CLOCK}\] simultaneously to display the “Clock” programming screen. The default is Japanese time.

1 Programming Mode

<table>
<thead>
<tr>
<th>Cursor</th>
<th>Year</th>
<th>Month</th>
<th>Day</th>
<th>Hour</th>
<th>Minute</th>
<th>Time</th>
</tr>
</thead>
</table>

2 Programming Flow Chart

<Example> From 00:00 hours on January 1st, 2000 to 15:40 hours on October 19th, 2000

Clock circuit

Clock data is maintained with a lithium battery. The clock keeps on working during the time that the power supply is off or if the power supply is interrupted. The service life of the battery is for eight years under the condition of eight hours operation in a day.

Reference 1  Time display during programming

Time display stops during programming. Press \[\text{ENTRY}\] to start the display again.

Reference 2  Programming time

The time is programmed with a 24-hour display, which means that the programming range is 00:00 to 23:59.
11. OTHER PROGRAMMING

11.2 Scale

“Scale” programming is necessary to display a voltage input from a converter, etc. with an actual scale. However, the scale is programmed with the same characteristic scale (not linearized scale) as the voltage input. This programming is also necessary when the decimal point position is changed in thermocouple or resistance thermometer input channels. Press \( \text{SHIFT} \) and \( \text{SCALE} \) simultaneously in the operation screen to display the “scale” programming.

1 Programming Scale

This is the actual scale (physical quantity) programming for the printing range being programmed in the [Range/Printing range].

2 Printing range will be copied

When programming the [Range/Printing range], the printing range is copied to the programming value of the scale. If the scale copied from the printing range is used, the decimal point positions programmed by the printing range are neglected and the measured values with decimal point positions fixed by range number are displayed. The following table shows the cautions to be observed according to the input types.

<table>
<thead>
<tr>
<th>Voltage ranges</th>
<th>Temperature ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale programming is not required when the scale is equal to the printing range. They are copied to scale programming, but be careful with the decimal point positions for the scale. See item 3.</td>
<td>Since the printing range is copied to the scale, no programming scale is necessary, but the decimal point position of the measured value is fixed by the range number. For changing the decimal places, refer to 3.</td>
</tr>
</tbody>
</table>

3 Example of Decimal Point Programming

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>Temperature ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range/Printing range</td>
<td>Scale programming</td>
</tr>
<tr>
<td>03/0.0 to 50.0</td>
<td>0.0 to 50.0</td>
</tr>
<tr>
<td>03/0.0 to 50</td>
<td>0.0 to 50.0</td>
</tr>
<tr>
<td>Note 1: Decimal point position of the measured value is fixed by range number when the printing range is equal to the scale.</td>
<td>Note 2: Decimal point positions of the programmed scale become effective because different decimal place are programmed on printing range and scale. See item 2.</td>
</tr>
<tr>
<td>Note 2: Decimal point positions of the programmed scale become effective because different decimal place are programmed on printing range and scale. See item 2.</td>
<td>(1) When the printing range is equal to the scale;</td>
</tr>
</tbody>
</table>

(2) When the scale is programmed with a different value from the printing range. The decimal point position of the programmed scale becomes effective.

<table>
<thead>
<tr>
<th>(1) To move the decimal point to higher digit</th>
<th>(2) To move the decimal point to lower digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range/Printing range</td>
<td>Scale programming</td>
</tr>
<tr>
<td>23/0 to 1200</td>
<td>00/1200.0</td>
</tr>
<tr>
<td>3900 to 12000</td>
<td>00/12000.0</td>
</tr>
<tr>
<td>Note 1: Decimal point position of the measured value is fixed by range number when the printing range is equal to the scale.</td>
<td>Note 1: Due to the decimal point position rule.</td>
</tr>
</tbody>
</table>

3 Remarks

Decimal point position rule.

- If the decimal point positions of the lower-limit and higher-limit values are different, the lower decimal point position is adopted. <Example> 0.00 to 100.0 \( \rightarrow \) 0.0 to 100.0

Remarks

For programming the same scale to the other channels; The [Copy] function is convenient. See Section 11.14.
11. OTHER PROGRAMMING

4 Programming Mode

- Programming Mode

5 Programming Flow Chart

- Programming Flow Chart

Remarks

To clear (none) the scale programmed

(1) Select the channel to program to “none” with \[ \frac{A}{B} \] or \[ \frac{C}{D} \].

(2) Press [\(\text{SHIFT}\)] and \[\text{CLEAR}\] simultaneously to clear and execute [temporarily storing] and [storing].

* If a channel is programmed by a numeric value, not by up and down keys, and cleared, the channel before programming change is programmed to scale “none”.

Note) The scale of the channel, of which scale was programmed to “none”, is reflected by the printing range being programmed in the [Range/Printing range]. Tag and alarms are cleared (not programmed).

Reference 1> Other channels check

Press \[ \uparrow \] or \[ \downarrow \] to check the programmed scale of other channels.

Reference 2> Various keys

- Adding/deleting decimal point
  Move the cursor to the right: \[\text{CLOCK}\] or \[\text{SPACE}\] → Numeric keys
- Programming “to” : \[\text{SHIFT} + \frac{1}{1}\]
- Space: \[\text{SPACE} + \text{COPY}\]

Reference 3> Storing

Store the [temporarily stored] parameters into the memory. (A programming change mark is printed.)

* Fill unused digits with spaces.
11. OTHER PROGRAMMING 11.3 Skip (Channel Deletion)

When “CLEAR” (non-programming condition) is stored in the [Range/Printing range] programming, printing and display of specific channels are skipped. Press \[\text{SHIFT}\] and \[\text{RANGE}\] in the operation screen to display the [Range/Printing range] programming screen. The default is no skip function programmed to any channel.

1 **Skipping**

If the skip function is programmed to the specified channel, programmed parameters of [scale], [alarm], [engineering unit] and [tag] of this channel are also cleared. Program the parameters again if the channels are restored to no-skipped status.

![Operation of skipped channels](image)

Your recorder functions assuming that these channels do not exist.

1. Measured value: Disappear
2. Bargraph: Disappear
3. Data printing: Disable
4. Trace printing: Overshooting to the minimum limit.

2 **Programming Skip Flow Chart**

**<Example> Skipping CH 3 (3rd pen)**

![Flow chart](image)

- **Remarks**: To select channels
  - Select a channel with [↑] or [↓]. If a channel is selected with a numeric key and the “CLEAR” is executed, the channel being displayed before changing programming ([1] in the flow chart) is deleted.

- **Reference 1**: Other channel check
  - You can check the range programming of other channels. Press [↑] or [↓] to change channels. The skipped channels are not displayed.

- **Reference 2**: Storing
  - Store the [temporarily stored] skip into the memory. (A programming change mark is printed.)
11.3 Skip (Channel Deletion)

3 New Programming Flow Chart of Skipped Channel

*Example* To the range of 0 to 1200 °C (K) for skipped channel (CH 3)

**Operation screen**

[Check]  
[To be ready for programming]  
[Select the channel to be programmed newly]  
[Programming range/printing range]

**Other programming parameters**

The programmed parameters of [scale], [alarm], [engineering unit] and [tag] are cleared at the skipped channels.

1) Select a computing unit in the [°C/°F computing selection] if the channels are newly programmed to temperature range.
2) Program the required [scale] if the channels are newly programmed to voltage range.
3) Program [alarm], [engineering unit] and [tag] if necessary.

**Error message appears?**

NO: Temporarily stored

YES: Programing other channels?

**YES**

Temporarily stored

**NO**

Programing other channels?

**YES**

Temporarily stored

**NO**

Stored

**Reference 1** Skipped channel check

You can check the range programming of other channels. Press \[\text{\textregistered}\] or \[\%\] to change channels. The skipped channels are not displayed.

**Reference 2** Starting channel

This programming can be started at any channel. With the example flow chart, the programming starts from CH 1. As the programmed parameters of CH 1 are not changed, they are same as original parameters.

**Reference 3** Channel No. for new programming

In the example, CH 3 is a channel to be newly programmed. If CH 3 has not been programmed as a skip channel, new range/printing range is displayed.

**Reference 4** Range/Printing range programming

Refer to Section 8.2.

**Reference 5** Storing

Store the [temporarily stored] parameters into the memory. (A programming change mark is printed.)

* Fill used digits with spaces.
11. OTHER PROGRAMMING  11.4 Subtract Printing

This programming is for printing a difference between channels or between a channel and a reference value. Press \( \text{SHIFT} \) and \( \text{RANGE} \) simultaneously to display the [Range/Printing range] programming screen to program the subtract printing.

1 Subtract Printing Types

Two types of subtract printings are provided.
1. Printing a difference between a reference channel and a subtraction channel
2. Printing a difference between a reference channel and a specified subtraction value (reference value).

Remarks 1

Programming reference channel and subtraction channel
Be sure to program [Range/Printing range] of both the reference channel and the subtraction channel in advance.

Remarks 2

Place a decimal point to the reference value
Program the reference value with the scale programmed value within 5 digits. For identifying the reference value to a channel No., be sure to place a decimal point to the reference value having no decimal point.

<Ex. 2 → 2.0>

2 Programming Modes

1) Mode 1

Character display

Unused digits are filled with spaces.

Subtraction channel or reference value (within 5 digits)

Min. value (within 5 digits) to

Scale value to print 0%

Max. value (within 5 digits)

Scale value to print 100%

Character display

"R" stands for the subtract printing mode 1.

2) Mode 2 (To move from Mode 1 to Mode 2, press \( \text{ENTRY} \) after completing the programming for the Mode 1.)

Character display

Unused digits are filled with spaces.

Subtract printing range (11 digits by left justify)

Character display

"D" stands for the subtract printing mode 2.

<Example>

Printing the difference between CH 1 and CH 2 at CH 3

<table>
<thead>
<tr>
<th>CH 1</th>
<th>0</th>
<th>300</th>
<th>500°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 2</td>
<td>0</td>
<td>200</td>
<td>500°C</td>
</tr>
<tr>
<td>CH 3</td>
<td>250</td>
<td>100</td>
<td>250°C</td>
</tr>
</tbody>
</table>

Printing range
## 11. OTHER PROGRAMMING

### 11.4 Subtract Printing

#### Programming Flow Chart

*Example* Printing [Channel 1 – Channel 2] at Channel 3 within a printing range of ±250

Reference channel | Subtraction channel | Subtract printing channel
--- | --- | ---

**Operation screen**

![Flow Chart Diagram](image)

**Reference 1** Other channels check

You can check the range programming (including subtract printing) of other channels. Press \( \uparrow \) or \( \downarrow \) to change channels.

**Reference 2** Programming reference channel and subtraction channel

If a specified value (reference value) is programmed instead of the subtraction channel in the flow chart, the difference with the reference value will be printed. Add a decimal point to the reference value.

**Reference 3** Various keys

- Programming "to": \( \text{SHIFT} + \frac{1}{2} \)
- Decimal point: \( \text{CLOCK} \) in the next digit
- Deletion of decimal point: \( \text{SPACE} \) in the next digit

**Reference 3** Storing

Store the [temporarily stored] parameters into the memory. (A programming change mark is printed.)

\* Fill unused digits with spaces.
11. OTHER PROGRAMMING

11.5 Alarm

Alarm parameters (alarm types, alarm value, etc.) can be programmed for each alarm point (channel, level). By programming the alarm parameters, alarm activation can be displayed and also the activation and reset can be printed. See Section 10.3. Press [Shift] and [ALARM] simultaneously to display the [Alarm] programming screen. Alarm output is an option. The alarm outputs for "FAIL (failure)" and "C. End (chart paper end)" are available in addition to measured values.

1. Alarm Parameters

The default is no alarm programmed.

1) Alarm points (Channel, level)

Alarm point can be programmed up to level 4 for each channel. "FAIL" and "C. End" can be programmed instead of the channels.

FAIL...Alarm when the hardware except servo-circuit/mechanism is abnormal
In this condition, the status lamp is not lit.
C. End...Alarm at just before when the chart paper ends.

2) Alarm types

10 different alarm types can be selected for each alarm point.

<table>
<thead>
<tr>
<th>Absolute value</th>
<th>H: High alarm</th>
<th>L: Low alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate-of-change</td>
<td>U: Increase limit</td>
<td>D: Decrease limit</td>
</tr>
<tr>
<td>Differential</td>
<td>I: Differential high alarm</td>
<td>Q: Differential low alarm</td>
</tr>
<tr>
<td></td>
<td>J: Differential high alarm with standby</td>
<td>R: Differential low alarm with standby</td>
</tr>
</tbody>
</table>

3) Alarm value

Value for alarm activation

2. Alarm Types

The high alarm for the absolute value activates when the measured value equals to or is higher than the alarm value. The low alarm activates when the measured value equals to or is lower than the alarm value.

For the rate-of-change alarm and the differential alarm, refer to the followings.

Rate-of-change alarm

Increase limit alarm: Change width (PV2 to PV1) per unit time \((\Delta t)\) is plus.
Decrease limit alarm: Change width (PV2 to PV1) per unit time \((\Delta t)\) is minus.

Unit time \((\Delta t)\) = Measuring interval (about 0.1 sec.) x Measuring count (1 to 20)

* Do not apply a "minus" symbol to the alarm value of the decrease limit alarm \((D)\).

Differential alarm

(Differential high alarm)

Alarm value

Difference of measured value (absolute value)

Difference of measured value (absolute value) equals to or is higher than alarm value: Differential high alarm activation
Difference of measured value (absolute value) equals to or is lower than alarm value: Differential low alarm activation

(1) The above figure shows programming alarm point up to level 4 on CH 1.
(2) Alarm is in active at level 2 (high alarm) as the measured value (55) is higher than the alarm value (50).

*No alarm output is provided to the standard specifications and the relay No. is fixed to "0". Refer to Section 12.2 for the programming of relay No.

Alarms with standby

This is the function not to activate an alarm until the alarm becomes in reset condition, even if the alarm is in active condition. This function is only available when the power supply is turned on. When changing parameters, this function is only available by reprogramming it after clearing once.

4. Others

Rate-of-change alarm: Program measuring count (1 to 20)
Differential alarm: Program channels to be compared.

Relations between alarm parameters and alarm activation

<table>
<thead>
<tr>
<th>Alarm points</th>
<th>Absolute value</th>
<th>Rate-of-change</th>
<th>Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel</td>
<td>Level</td>
<td>Alarm type</td>
<td>Alarm value</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>(Relay No.)*</td>
<td>70</td>
</tr>
</tbody>
</table>

Measured value 100

(55)
11. OTHER PROGRAMMING

3 Programming Mode

1) Absolute value alarms (H, L, E, F)

(Note) Program the alarm value within the scale range.

2) Range-of-change alarm (U, d)

(Note 1) Program the alarm value with the change width (without sign) per unit time.
(Note 2) Unit time = measuring interval (about 0.1 sec.) x measuring count
Program this measuring count (1 to 20).

3) Differential alarm (b, s, j, h)

(Note 1) Program an alarm value with a difference (without sign) between measured values of channels.
(Note 2) Program another channel to be compared.

* In the standard specifications, the relay No. is fixed to “0” and the cursor does not appear. Program the relay No. for the alarm output (option) only. See Section 12.2.
11. OTHER PROGRAMMING

11.5 Alarm

4 Programming Flow Chart

1) Without alarm output (option)

- Operation screen
  [Check]  
  [Programming alarm point]  
  [Selecting alarm type]  
  [Relay No.]  
  [Selecting alarm value]

To delete an alarm point

Follow the [Programming alarm point] procedure and select the alarm point to be deleted with \( \uparrow \) .
Clear it by pressing \( \text{SHIFT} + \text{CLEAR} \) simultaneously and perform [temporarily stored] and [stored] operation.

Reference 1 Other alarm point check

By pressing \( \text{SET} + \text{ENTRY} \), the level advances from 1 to 4 and the channel advances to the next channel and then the level of the next channel advances. Press \( \text{SET} + \text{ENTRY} \) for reverse operation.

Reference 2 Programming alarm point

1. Channel can be selected also with \( \text{SET} + \text{ENTRY} \) or \( \text{SCALE} + \text{ENTRY} \).
2. Channel advances by pressing \( \text{SET} + \text{ENTRY} \). Then “Fail” and “C.End” appear but these functions are only available in the alarm output (option).

Reference 3 Relay No.

Relay No. is fixed to “0” and no cursor appears as the alarm output (option) is not added. The relay No. for AH is displayed with 2 digits of “00”.

Reference 4 Cursor appears only for rate-of-change alarm.

Programming range is 1 to 2U.

Reference 5 Cursor appears only for differential alarm.

Reference channel to be compared is programmed in 1 to 4. (The differential alarm cannot be selected in a 1-pen type recorder because no channel to be compared is existed.)

Reference 6 Storing

Store the [temporarily stored] parameters into the memory. (A programming change mark is printed.)
11. OTHER PROGRAMMING  11.5 Alarm

2) With alarm output (option)

Operation screen

[Output check]
[Programming check]

To be ready for programming

[Programming alarm point]

[Selecting alarm type]

[Alarm type]

[Programming relay No.]

[Programming alarm value]

[Only rate-of-change alarm]

[Only differential alarm]

When an error appears press any key other than 

PROGRAMMING OTHER ALARM POINTS?

YES

NO

STORAGE

To delete alarm point

Follow the [Programming alarm point] procedure and select the alarm point to be deleted with .

Clear it by pressing simultaneously and perform [temporarily stored] and [stored] operation.

Reference 1  Output check

The relay Nos. in alarm output are displayed. This will be blank unless all of the relays are operated.

Reference 2  Other alarm point check

By pressing , the level advances from 1 to 4 and the channel advances to the next channel and then the level of the next channel advances. Press for reverse operation.

Reference 3  Programming alarm point

1. Channel can be selected also with or .

2. Channel advances by pressing . Then “Fail,” and “C.End” appear. If these functions are selected, program relay Nos. only.

Reference 4  Relay No.

This is for specifying terminal Nos. for alarm output.

The relay No. for AH is displayed with 2 digits such as “00”. See Section 12.2. When programming “1” to “9”, two entering methods of 1 to 9 or 01 to 09 are available. ( : space)

Reference 5  Cursor appears only for rate-of-change alarm.

Programming range is 1 to 20.

Reference 6  Cursor appears only for differential alarm.

Reference channel to be compared is programmed in 1 to 4. (The differential alarm cannot be selected in a 1-pen type recorder because no channel to be compared is existed.)

Reference 7  Storing

Store the [temporarily stored] programmed values into the memory. (A programming change mark is printed.)
A deadband can be programmed between alarm-activation and alarm-reset. Press [SHIFT] and [°C] simultaneously in the operation screen for 3 seconds or more to display the [Alarm deadband] programming screen. This programming is common to all alarm points.

1 Alarm Deadband

- An alarm activates when a measured value exceeds the alarm value. The alarm reset is executed at a value that is lower than the alarm value. This difference is called the deadband and is specified with a scale width (%).
- The programming range is 0.1 to 9.9% and can be programmed in 0.1% increments. The default is 0.1%.

2 Programming Flow Chart

<Example> From 0.1% to 0.5%

```
Operation screen

[Check] (SHIFT + °C) 3 sec. or more

[To be ready for programming] SET END

[Programming deadband] ENTRY

Decimal point is fixed.

[Programmed deadband] MAX

Stored
```
This programming is for digital printing (data printing) at fixed intervals. The printing overlaps with trace printing. Press \[\text{SHIFT} + \text{DATA}\] simultaneously to display [Periodic data printing] screen. As the default is no programming of parameters for the periodic data printing, the periodic data printing is not executed.

**1 Periodic Data Printing**

1. Program start time and interval time.
2. The printing format with a chart speed of 99 mm/h or slower is shown below.
   
   **Example**: 18:30 1: 225°C 2: 316°C

**2 Programming Mode**

(Fixed)

<table>
<thead>
<tr>
<th>P</th>
<th>04H00</th>
<th>→</th>
<th>12H00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour</td>
<td>Minute</td>
<td>Hour</td>
<td>Minute</td>
</tr>
</tbody>
</table>

**3 Programming Flow Chart**

<Example> Periodic data printing with a start time of 12:00 and interval time of 4 hours

An example of periodic data printing (AL3000)

<Chart paper speed: 100 mm/h or faster>

The programmed values in the [Periodic data printing] are cleared and the periodic data printing stops. Reprogram it if necessary.

In case electric power failure occurs and the power is turned on in the following day, reprogramming is required if 24 is not an integer. (T: Interval time)
11. OTHER PROGRAMMING

11.8 Engineering Units

Engineering units up to 5 digits can be assigned for digital data printing and scale printing. Press \( \text{SHIFT} \) and \( 3 \text{ UNIT} \) simultaneously to display [Engineering unit] programming screen.

---

**Examples of engineering unit printing**

<table>
<thead>
<tr>
<th>(Digital data printing)</th>
<th>(Scale printing)</th>
<th>(List printing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 25 1: 0.00mV 2: 1.20°C 3: 1.60kΩ/2 4: 1.00L/2</td>
<td>CH SCALE 1: 0.00mV 2: 1.20°C 3: 0.500kΩ/2 4: 0.500L/2</td>
<td></td>
</tr>
</tbody>
</table>

1. **In case no engineering unit is programmed;**

An engineering unit is decided by the range number programmed in the [Range/Printing range] programming.

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>mV (01 to 05)</td>
<td>°C (Nos. other than ones shown on the right)</td>
</tr>
<tr>
<td>V (06 to 10)</td>
<td>K (47, 80)</td>
</tr>
</tbody>
</table>

2. **Programming Mode**

- *1: Engineering unit character*
  - The character at the digit where the digit number is pointed by the cursor is displayed.

- *2: Digit No. of engineering unit character* *2* (Up to 5 digits.)
  - Numeric numbers (1 to 5) appear for the digit not programmed by pressing \( \text{SHIFT} \).

*To decrease the digit No.*

Press \( \text{SHIFT} \) and \( 0 \text{ CLEAR} \) simultaneously to clear the digit No. and press \( \text{F} \) for reprogramming a new digit No.

---

**If the range No. is changed;**

A programmed engineering unit is deleted and the engineering unit determined by the range No. is displayed.

**If clear is stored at scale programming;**

If the scale is cleared in a channel; the engineering unit of this channel is deleted, and it becomes the engineering unit determined by range No.
11. OTHER PROGRAMMING

11.8 Engineering Units

3 Programming Flow Chart

<Example> From PPM to G/MIN in CH 3

Operation screen

[Check]
P U C H 1 1 2 3

Engineering Channel Decimal point
unit character

[To be ready for programming]

P U C H 1 1 2 3

Temporary stored

YES

Programming other channels?

NO

STORED

References

To program engineering unit to “none”

(1) Select the channel to be “none” with or .

(2) Press and simultaneously to clear and perform [temporarily stored] and then [stored].

* If the channel is programmed by a numeric value and cleared, the engineering unit of channel before programming change is programmed to be “none”.

Reference 1

To check all programmed digits

- Press or to change channels.
- The digit displaying an engineering unit character (digit No. with decimal point) shifts with or .

Reference 2

Programmable characters and key operation

- Numeric value (0 to 9): .

- Alphabetic characters (A to Z): Press and simultaneously and select a character by pressing or .

- Special characters (%, /, °C, °F)

  % ( )

  / ( )

  °C ( )

  °F ( )

* A space corresponding to 2 digits is used.

Reference 3

°C, °F engineering unit

These engineering units are treated as a printing unit only. They are not treated as computing units.

Reference 4

Storing

Store the [temporarily stored] parameters into the memory. (A programming change mark is printed.)
Tags up to 9 digits can be assigned for digital data printing and scale printing.
Press $\text{SHIFT}$ and $\text{TAG}$ simultaneously to display the [Tag] programming screen. The default is no programming of tags.

**Example of tag printing (AL3000)**

<table>
<thead>
<tr>
<th>(Scale printing)</th>
<th>(List printing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: TIC-01</td>
<td>TIC-01</td>
</tr>
<tr>
<td>0-100°C</td>
<td>TIC-02</td>
</tr>
</tbody>
</table>

1 Programming Mode

Note) The default is no programming of tags. The following figure is an example of a 9-digit tag programmed.

| ![Diagram](image) |

*1: Tag character
The character at the digit where the digit number is pointed by the cursor is displayed.

*2: Digit No. of tag character
A digit No. 1 to 9 is displayed by pressing $\text{F}$.

<To decrease the digit No.>
Press $\text{SHIFT}$ and $\text{CLEAR}$ simultaneously to clear the digit No. and press $\text{F}$ for reprogramming a new digit No.

If the scale is cleared in a channel; the tag of this channel is deleted. Reprogram it if necessary.
### Programming Flow Chart

*Example* From TIC to 10 in CH 3

1. **Operation screen**
   - [Check]
   - **Channel**
   - **To be ready for programming**
   - **Programming channel**
   - **Tag character**
   - **Programming tag character**
   - **Temporarily stored**
   - **Programming other channels?**
   - **YES**
   - **NO**
   - **STORED**

#### Reference 1
To check all programmed digits

- Tag characters are displayed only for the programmed channels (Digit Nos. appear).
  - Press \( \uparrow \) or \( \% \) to change channels.
  - The digit displaying a tag character (digit No. with decimal point) shifts with \( \uparrow \) or \( \downarrow \).

#### Reference 2
Programmable characters and key operation

- **Numeric value** (0 to 9):
  - \( \text{CLEAR} \) to \( \text{LIST} \), and \( \text{REF} \)
  - **Alphabetical characters** (A to Z):
    - Press \( \text{SHIFT} \) and \( \text{A-Z} \) simultaneously and select a character by pressing \( \uparrow \) or \( \downarrow \).
- **Special characters** (%, /, °C, °F):
  - \( \% \) (\( \text{SHIFT} + \% \))
  - \( / \) (\( \text{SHIFT} + \% \))
  - \( °C \) (\( \text{SHIFT} + \% \))
  - \( °F \) (\( \text{SHIFT} + \% \))

*All spaces corresponding to 2 digits are used.
- **SPACE** (space): A space is treated as a character.

#### Reference 3
Storing

Store the temporarily stored parameters into memory. (A programming change mark is printed.)

#### Remarks

- To program tag to "none"
  1. Select the channel to be "none" with \( \uparrow \) or \( \% \).
  2. Press \( \text{SHIFT} \) and \( \text{CLEAR} \) simultaneously to clear and perform [temporarily stored] and then [stored].

*If the channel is programmed by a numeric value and cleared, the engineering unit of channel before programming change is programmed to be "none".

### Table
- **Channel**
- **Tag character**
- **Set**
- **End**
- **Unit**
- **Entry**
- **Disp**
- **Shift**
- **Copy**
- **List**
- **Clear**

---

- **To be ready for programming**

- **Check**

- **Programming channel**

- **Programming tag character**

- **Temporarily stored**

- **Programming other channels?**

- **YES**

- **NO**

- **STORED**

---

- **Remarks**: To program tag to “none”

1. Select the channel to be “none” with \( \uparrow \) or \( \% \).
2. Press \( \text{SHIFT} \) and \( \text{CLEAR} \) simultaneously to clear and perform [temporarily stored] and then [stored].

*If the channel is programmed by a numeric value and cleared, the engineering unit of channel before programming change is programmed to be “none”.

---

- **Reference 1**: To check all programmed digits

- **Tag characters are displayed only for the programmed channels (Digit Nos. appear.)**
- **Press \( \uparrow \) or \( \% \) to change channels.**
- **The digit displaying a tag character (digit No. with decimal point) shifts with \( \uparrow \) or \( \downarrow \).**

---

- **Reference 2**: Programmable characters and key operation

- **Numeric value** (0 to 9):
  - \( \text{CLEAR} \) to \( \text{LIST} \), and \( \text{REF} \)
  - **Alphabetical characters** (A to Z):
    - Press \( \text{SHIFT} \) and \( \text{A-Z} \) simultaneously and select a character by pressing \( \uparrow \) or \( \downarrow \).
- **Special characters** (%, /, °C, °F):
  - \( \% \) (\( \text{SHIFT} + \% \))
  - \( / \) (\( \text{SHIFT} + \% \))
  - \( °C \) (\( \text{SHIFT} + \% \))
  - \( °F \) (\( \text{SHIFT} + \% \))

*All spaces corresponding to 2 digits are used.
- **SPACE**: A space is treated as a character.
11. OTHER PROGRAMMING

11.10 Message

Messages are printed from (1) key operation or (2) remote contacts signal*. A message up to 15 digits and 5 different messages (No.1 to No. 5) can be programmed. Press 0 CLEAR and 6 A-Z simultaneously for 3 seconds or more to display the [Message] programming screen.

* This function is only available in the remote contacts (option). See Section 13.1.

1 Programming Mode

Note) The default is no programming of messages. The following figure is an example of 8-digit message programmed for No.1.

- Example of message printing

- Example of message printing

*1: Message character
   The character at the digit where the digit number is pointed by the cursor is displayed.

*2: Digit No. of message character
   A digit No. 1 to 15 is displayed by pressing SHIFT 0 CLEAR .
   (Up to 15 digits.)

   (Numeric numbers (1 to 15) appear for the digit not programmed by pressing .)

   <To decrease the digit No.>
   Press SHIFT and CLEAR simultaneously to clear the digit No. and press for reprogramming a new digit No.
### 11. OTHER PROGRAMMING

#### 11.10 Message

**Programming Flow Chart**

*Example* From "none" to "MOTOR ON".

- **Operation screen**
  - [Check]
  - No.
  - [To be ready for programming]
  - [Programming No.]
  - Message character
  - No.
  - Temporarily stored
  - Programming other Nos.?

**Remarks**

To program message to "none"

1. Select the channel to be "none" with \( \uparrow \) or \( \downarrow \) *.
2. Press \( \text{SHIFT-1} \) and \( \text{CLEAR} \) simultaneously to clear and perform [temporarily stored] and then [stored].

* If the channel is programmed by a numeric value and cleared, the engineering unit of channel before programming change is programmed to be "none".

**Reference 1**

To check all programmed digits

Message characters are displayed only for the programmed channels. (Digit Nos. appear.)

- Press \( \uparrow \) or \( \downarrow \) to change channels.
- The digit displaying a tag character (digit No. with decimal point) shifts with \( \uparrow \) or \( \downarrow \).

**Reference 2**

Programmable characters and key operation

- Numeric value (0 to 9): \( \text{CLEAR} \) to \( \text{LIST} \), and \( \text{SHIFT} \)
- Alphabetical characters (A to Z): Press \( \text{SHIFT} \) and \( \text{A-Z} \) simultaneously and select a character by pressing \( \uparrow \) or \( \downarrow \) .
- Special characters (\%, /, °C, °F): \( \text{SHIFT} \) \( \% \), \( \text{SHIFT} \) \( / \), \( \text{SHIFT-1} \) \( °C \), \( \text{SHIFT-1} \) \( °F \) *.

* A space corresponding to 2 digits is used.

- \( \text{SPACE} \) (space): A space is treated as a character.

**Reference 3**

Storing

Store the [temporarily stored] parameters into the memory. (A programming change mark is printed.)
11. OTHER PROGRAMMING

The channel where the temperature range is programmed becomes effective. Press \text{SHIFT} and \text{\%} simultaneously in the operation screen for 3 seconds or more to display the [Burnout] programming screen. This programming is necessary for each channel.

1. **Burnout**
   - If a sensor (thermocouple or resistance thermometer) is disconnected, trace printing overshoots maximum or minimum limit.
   - The default parameter of burnout is “disable (n\_n) in all channels.

2. **Programmed Flow Chart**

   <Example> From burnout “disable” to “up scale burnout”

   ![Flow Chart Diagram]

   **Remarks 1**
   - “n\_n” programming on parallel operation
   A parallel connection of a thermocouple with other instrument causes a problem. Select (n\_n) if your recorder uses the thermocouple being connected with other instrument.

   **Remarks 2**
   - Voltage range is ineffective
   Even if the burnout is programmed to a channel where the voltage range (No. 01 to 07) is programmed, this programming becomes ineffective (burnout disable).

   **Reference 1**
   - Burnout operation
   For the burnout operation (display and printing), read Section 10.2.

   **Reference 2**
   - Other channels check
   Press \text{\%} or \text{\%} to change channels. The programmed burnout of other channels can be checked.

   **Reference 3**
   - Storing
   Store the [temporarily stored] parameters into memory. (Programming change mark is printed.)
11. OTHER PROGRAMMING  11.12 Passcode/Key Lock

The procedure for [Key lock] programming differs depending on whether a passcode is programmed or not. Press \(\text{SHIFT} + \text{PASS CODE} \) simultaneously in the operation screen for 3 seconds or more to display the [Passcode programmed/not programmed] check screen. If a passcode has been already programmed, it is not allowed to go to the [Key lock] programming screen unless entering the correct passcode.

1 Passcode

- [Key lock] programming cannot be allowed unless entering the correct passcode.
- As the default is no passcode programmed, you can program [Key lock].

**Passcode programming range**
Program a passcode with a 4-digit numeric value. Programming range: 0001 to 9999
If "0000" is programmed, a programming error occurs.

**Remarks:** Keep your passcode in mind
Keep the passcode programmed in mind or somewhere safe. If you lose the passcode, no [Key lock] operation will be available.

2 Key Lock

When [Key lock] is programmed to "LOCKED", no key operation for the following functions is accepted.
(1) Reprogramming of various parameters
(2) Operations (printing ON/OFF, chart paper feeding, digital data printing, printing format selection, and time axis synchronization selection)
The following operations are exceptional.
(1) Checking various parameters
(2) Programming the key lock to be ineffective (UNLOCKED)
(3) Selection of operation screens

**Reference** In key lock
The status [KEY LOCK] (blue) lights when the key lock is effective.

3 Programming Flow Chart
The flow differs depending on whether a passcode is programmed or not. See next page for details.

![Programming Flow Chart Diagram]

(Note) In case an error message appears, press any key other than \(\text{SHIFT}\) and reprogram.
When a passcode has not been programmed

<Example> Program the passcode and [key lock] effective

Operation screen

[Passcode programmed/not programmed]

PASS CoDE non

SHIFT + 3 sec. or more

[Programming passcode]

PASS CoDE

[Checking key lock]

KEY Lock UNLOCRED

[Selecting key lock]

KEY Lock LOCRED

When a passcode has not been programmed

PASS code programmed/not programmed

non: Passcode has not been programmed.

: Passcode has been programmed. See Section 5 on the next page.

When a passcode programmed

(1) The numeric figures for the passcode will not appear.
(2) If a passcode has been programmed, the [Key lock] selection is not available without entering the correct passcode. The flow chart shown in 5 is for the procedure of [Key lock] selection when a passcode has been programmed.

Selection of key lock ineffective or effective

Press or  to select the key lock to be effective or ineffective.
**11. OTHER PROGRAMMING**

**11.12 Passcode/Key Lock**

**5** When a passcode has been programmed

*Example*  Key lock to be effective when the passcode is changed or unchanged

---

**Operation screen**

[Ready for programming passcode]

P**ASS Code**

(Cursor) (Move the cursor to “.”)

[Programming passcode]

P**ASS Code**

(GO CLEAR to LIST)

[Ready for changing passcode]

P**ASS CHAN GE LoCK**

(Cursor)

Change passcode?

[Ready for programming a new passcode]

P**ASS Code**

(GO CLEAR to LIST)

[No passcode change]

P**ASS CHAN GE LoCK**

(3 sec. or more)

[Checking key lock]

K**EYLoCK uNLoCRAEd**

(Ineffective)

[Selecting key lock]

K**EYLoCK LoCRAEd**

(Effective)

Execute

---

**Reference 1**  To program passcode to “none”

In this procedure, press **SHIFT** and **CLEAR** simultaneously and then press **ENTRY** to clear the passcode. The screen shifts to the [Key check] screen.

**Reference 2**  Selection of key lock ineffective or effective

Press **%** or **°** to select the key lock to be effective or ineffective.
11. OTHER PROGRAMMING

11.13 Input Filter

The input filter has a function to stabilize the measuring input. This function can be programmed for each channel. Press \[ \text{CLEAR} \] and \[ \text{ALARM} \] simultaneously for 3 seconds or more to display the [Input filter] programming screen.

1 Input Filter

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”.

2 Programming Flow Chart

<Example> To the time constant 5 seconds in CH2

- Operation screen
- [Check] (CLEAR + ALARM) 3 sec. or more
- [To be ready for programming]
- [Programming channel]
- [Programming time constant]
- Error message appears?
- Keys other than \( \text{SHIFT} \)
- Temporarily stored
- Program other channels?
- Stored

![Diagram showing programming flow chart](image)

Input filter

- Input filter: 0 (none)
- Input filter: T
  \( T = 1 \text{ to } 10 \)

Input filter

- Channel
- Time constant
- Cursor
- Cursor

- Programming range of time constant
  0, 1 to 10
  If “0” is programmed, the input filter is disabled.

- Storing
  Store the [temporarily stored] parameters into memory.
  (A programming change mark is printed.)
11. OTHER PROGRAMMING 11.14 Copying to Other channels

For the parameters, such as [range/printing range], [scale], [engineering unit] and [tag], which are needed to be programmed in each channel, the parameters of the specific channel as a reference channel can be copied to a desired channel.

1 Programming Mode …Example of [range/printing range]

2 Programming Flow Chart

<Example> Copying of parameters for [range/printing range] in CH 1 to CH 2 to 4.

Character display

Programming lamp*

R: Range/Printing range
S: Scale
U: Engineering unit
T: Tag

Remarks 1
Check if any skip channel is programmed

Press \( \Delta \) or \( \nabla \) to check if any skip channel is programmed.

Remarks 1
Various keys

- Programming “to”: \( \text{SHIFT} + \text{COPY} \)
- Decimal point: \( \text{CLOCK} \) in the next digit
- Deletion of decimal point: \( \text{DISP} \) in the next digit

Reference 2
Storing

Store the [temporarily stored] parameters into memory.
(A programming change mark is printed.)

* Fill unused digits with spaces.
12. ALARM OUTPUT | 12.1 Alarm Output Programming Items

This explanation is only for the alarm output (option). The alarm output programming is necessary after programming the "alarm".

1 Programming Items for Alarm Output

1) Relay No. Setting of the relay No. where the alarm information (activation/reset) of each alarm point is to be output. Set them to each alarm point.

2) Output wiring Setting to AND or OR for each relay No.. When one relay is used by multiple alarm points, you can select AND or OR for the output wiring.

3) Output mode

   (1) Relay coil phase: Setting whether N and O terminals are shorted (Energized) or opened (Non-energized) when an alarm activates.

   (2) Relay output latch: Setting whether the alarm status is to be continued until ENTRY is pressed (Hold) even if the alarm becomes reset condition, or it is reset (Not hold) at the same time as resetting of the alarm.

   (3) Alarm display latch: Setting whether the alarm display is kept displayed until ENTRY is pressed (Hold) even if the alarm becomes reset condition or turned off (Not hold) at the same time as resetting of the alarm.

   * Alarm display: ALARM status lamp

2 Details of Programming Items

1) Relay No. and default values

<table>
<thead>
<tr>
<th>Alarm *</th>
<th>Alarm point</th>
<th>Alarm type</th>
<th>Relay No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 1</td>
<td>Level 1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CH 2</td>
<td>Level 1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>(2 to 4-pen types only)</td>
<td>Level 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CH 3</td>
<td>Level 1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>(3 and 4-pen types only)</td>
<td>Level 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CH 4</td>
<td>Level 1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>(4-pen type only)</td>
<td>Level 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FAIL</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. End</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

2) AND/OR, output mode and default values

<table>
<thead>
<tr>
<th>Relay</th>
<th>AND/OR</th>
<th>Output Mode</th>
<th>Alarm display latch</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td></td>
<td>Relay coil phase</td>
<td>Relay output latch</td>
</tr>
<tr>
<td>Rly1</td>
<td>or</td>
<td>Energized</td>
<td>Not hold</td>
</tr>
<tr>
<td>Rly2</td>
<td>or</td>
<td>Common to all relays</td>
<td>Common to all relays</td>
</tr>
<tr>
<td>Rly3</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly4</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly5</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly6</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly7</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly8</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly9</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly10</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly11</td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rly12</td>
<td>or</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* AL3000: Relay No. is 1 to 6.
AH3000: it is variable depending on the number of output points (Relay No. is 1 to 12 for 12-point outputs.).

*This is the "Alarm" programming. The relay No. is fixed at 0 in the standard specifications (AH is fixed at 00). 1 to n (Note) should be set only when alarm output (option) is added. (0 means no output.)
(Note) n: 6 or 12 depending on the number of output points.
AL3000: 6 only
12. ALARM OUTPUT

12.2 Programming of Relay No.

This explanation is only for the alarm output (option). Program the relay No. for each alarm point by referring the “Programming relay No.” screen in “Section 11.5 Alarm, Programming flow chart, 2) With alarm output (option)”.

1  Alarm Output Terminals and the Status

When an alarm is in active at an alarm point, the relay No. (alarm output terminal No.) specified for the point is activated.*

*The terminal activation differs depending on the programming of the relay coil to “Energize” or “Non energize”. ⇒ See Section 12.4.

2  Programming Relay No.

For programming [Relay No.], refer to the programming flow chart in “Section 11.5 Alarm, Programming flow chart, 2) With alarm output (option)”. The default is “0” and no alarm output is available. Select an alarm type and press \( \text{[Programming alarm point]} \). The cursor moves to the relay No. to specify relay Nos. for each alarm point.

Each relay No. is composed of two digits. For relay Nos. 0 to 9, set \( 0 \) or \( 9 \). Select an alarm type and press \( \text{[Selecting alarm type]} \) to move the cursor to the relay No. screen. No output is available when the relay No. is programmed to “0”. The relay No. for AH is displayed as “00”.

Program a relay No. from “0” to “n”. The example is for programming to “3”. Program “0” if no output is necessary.

The programming after this step or before the alarm type selection, refer to the flow chart in Section 11.5. 2).

### Alarm outputs terminals

<table>
<thead>
<tr>
<th>MOS relay</th>
<th>Mechanical relay “a” contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. O</td>
<td>COM</td>
</tr>
<tr>
<td>N. C</td>
<td></td>
</tr>
</tbody>
</table>

### Number of relay No. digits

Each relay No. is composed of two digits. For relay Nos. 0 to 9, set \( 0 \) or \( 9 \).

### Remarks 1

Number of alarm point and number of output point \( n \)

The total numbers of alarm points are number of channels \( x \) number of levels (4) + 2 (READ and C. End). Number of output points is 6 or 12 points. (AL3000: 6 points only)

### Remarks 2

**FAIL, C. End**

Place the cursor to the column of channel in “Selecting alarm type” and press \( \text{[Selecting alarm type]} \) until “Fail.” or “C. End” is displayed. In this condition, select a relay No. to output when the corresponding phenomenon occurs.
12. ALARM OUTPUT  12.3 Output Wiring (AND/OR) Setting

This explanation is only for the alarm output (option). Press \[\text{ CLEAR} \] and \[\text{ °C} \] simultaneously for 3 seconds or more to display the “Output Wiring (AND or OR)” programming screen. Program it for each relay No. The default is “OR” for all relay Nos.

1  AND/OR

Multiple alarm points can be allocated to one relay No.

- **AND output:** The relay turns on when all alarm points allocated are in active.
- **OR output:** The relay turns on when any of the alarm points allocated is in active.

2  Selecting Flow Chart

*Example* From OR to AND in relay No. 3

```plaintext
Operation screen
[Check]
[To be ready for programming]
[Selecting relay No.]
[Programming AND or OR]

Reference 1  Checking other relay No.
Press \[\text{ \uparrow} \] or \[\text{ \downarrow}\%\] to change relay No. AND/OR status of other channels can be checked.

Reference 2  Storing
Store the [temporarily stored] parameters into memory. (Programming change mark is printed.)
```
### 12. ALARM OUTPUT  
#### 12.4 Programming Output Mode

This explanation is only for the alarm output (option). Press [↓][↑] and [←] simultaneously for 3 seconds or more to display the “Output mode” programming screen. Two output modes, 1) relay coil (energize/not energize), 2) latched alarm display/relay (hold/not hold), are available. The programming is common to all relay Nos..

1. **Relay Coil Energize/Not energize**
   - The default is “Energize”.
   - The terminal configuration differs depending on the type of relay.

   **1) MOS relay and mechanical relay “a” contact alarm output**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Power off</th>
<th>Alarm reset</th>
<th>Alarm activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energized (E)</td>
<td><img src="diagram1" alt="Diagram" /></td>
<td><img src="diagram2" alt="Diagram" /></td>
<td><img src="diagram3" alt="Diagram" /></td>
</tr>
<tr>
<td>Not energize (e)</td>
<td><img src="diagram4" alt="Diagram" /></td>
<td><img src="diagram5" alt="Diagram" /></td>
<td><img src="diagram6" alt="Diagram" /></td>
</tr>
</tbody>
</table>

2. **Mechanical relay “c” contact alarm output**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Power off</th>
<th>Alarm reset</th>
<th>Alarm activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energize (E)</td>
<td><img src="diagram7" alt="Diagram" /></td>
<td><img src="diagram8" alt="Diagram" /></td>
<td><img src="diagram9" alt="Diagram" /></td>
</tr>
<tr>
<td>Not energize (e)</td>
<td><img src="diagram10" alt="Diagram" /></td>
<td><img src="diagram11" alt="Diagram" /></td>
<td><img src="diagram12" alt="Diagram" /></td>
</tr>
</tbody>
</table>
12. ALARM OUTPUT

12.4 Programming Output Mode

2 Latched Alarm Display/Relay (Hold/Not hold)

The default is “Not hold”.
The alarm display refers to the blinking of the measured value and the lighting of ALARM status lamp.

1) Not hold (≠)
The output is not affected by ENTRY.
Alarm activation
Alarm reset
Measured value blinking
Measured value lighting
Alarm lighting
Alarm not lighting
Relay output on
Relay output off

2) Hold (≠)
The output is held until ENTRY is pressed. The output differs depending on the timing of pressing ENTRY.
Alarm activation
Alarm reset
Measured value blinking
Measured value lighting
Alarm lit
Alarm not lighting
Relay output on
Relay output off

Reference Blinking of measured value
The measured value blinks when an alarm activates and lights steadily when it is reset.
However, the blinking is continued when the alarm display/relay is hold.
The blinking is turned to steadily light by pressing ENTRY regardless of the programming of “Hold” or “Not hold”.

ENTRY
ENTRY
12. ALARM OUTPUT

12.4 Programming Output Mode

4 Programming Mode

[Image: Diagram showing the programming process]

5 Programming Flow Chart

<Example> Programming the relay coil phase to Energize, relay output/display to Hold and alarm display to Hold:

- Operation screen
- [Check]
- 3 sec. or more
- Relay coil
- Relay output and display
- Reference 1: Checking
  - The parameters are displayed in order of (1) relay coil phase, (2) relay output and (3) alarm display.
  - Relay coil phase: E: Energize, Not energize
  - Relay output/display: H: Hold, U: Not hold

- Reference 2: Stored
  - Store the parameters into memory.
  - Programming change mark is printed.

- Stored
- Ref. 2
13. REMOTE CONTACTS

13.1 Remote Contacts Function

This explanation is only for the remote contacts (option).

1 Remote Contacts

(1) The following functions are available with the contact signals at remote contacts terminals (EX1 to 4). However, the functions are limited due to four terminals (EX1 to 4) provided. Moreover, some functions are automatically allocated to a certain terminal Nos.

(2) Programming to allocate the functions to terminal Nos. is necessary.

<table>
<thead>
<tr>
<th>Functions</th>
<th>Terminals</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Printing on/off and selection of three chart speeds</td>
<td>2 terminals (EX1, EX2)</td>
<td>Programming 3 speeds, See Section 13.3. (Note 1)</td>
</tr>
<tr>
<td>(2) Execution of message printing (No.1 to 5)</td>
<td>4 terminals (EX1 to EX4)</td>
<td>Programming message, See Section 11.10. (Note 2)</td>
</tr>
<tr>
<td>(3) Execution of message printing (No.1 and 2)</td>
<td>2 terminals (EX1, EX2)</td>
<td>Programming message, See Section 11.10. (Note 3)</td>
</tr>
<tr>
<td>(4) Execution of digital data printing</td>
<td>Any 1 terminal</td>
<td></td>
</tr>
<tr>
<td>(5) Execution of list printing (list 1, 2, 3)</td>
<td>Any 3 terminals</td>
<td></td>
</tr>
<tr>
<td>(6) Execution of operation record (No.A to D)</td>
<td>Any 4 terminals</td>
<td>Programming operation record, See Section 13.4.</td>
</tr>
<tr>
<td>(7) Reset of totalization</td>
<td>Any 1 terminal</td>
<td>Available in totalization (option)</td>
</tr>
</tbody>
</table>

(Note 1) Free terminals left are EX3 and EX4.
(Note 2) No free terminals are left.
(Note 3) Free terminals left are EX3 and EX4.

2 Functions and Terminal Contact Signals

<table>
<thead>
<tr>
<th>Functions</th>
<th>Contact signal at terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Printing on/off and selection of 3 chart speeds</td>
<td>With COM</td>
</tr>
<tr>
<td></td>
<td>EX1</td>
</tr>
<tr>
<td>Printing: On</td>
<td>CS1</td>
</tr>
<tr>
<td></td>
<td>CS2</td>
</tr>
<tr>
<td></td>
<td>CS3</td>
</tr>
<tr>
<td>Printing: Off</td>
<td></td>
</tr>
</tbody>
</table>

(Note) Program “Printing on/off” to on with a key operation in advance.

| (2) Execution of message printing (No. 1 to 5) | With COM |
|                                               | EX1 | EX2 | EX3 | EX4* |
| Message No.1                                  | OFF | OFF | OFF |      |
| Message No.2                                  | ON  | OFF | OFF |      |
| Message No.3                                  | OFF | ON  | OFF |      |
| Message No.4                                  | ON  | ON  | OFF |      |
| Message No.5                                  | OFF | OFF | ON  |      |

* When the trigger signals is sent (for 1 sec. or more) after selecting the message No., the printing of programmed message starts.

(Note) Program “Printing on/off” to on with a key operation in advance.
Execution of message printing with key operation is also available. See Section 9.4.
### 13. REMOTE CONTACTS

#### 13.1 Remote Contacts Functions

<table>
<thead>
<tr>
<th>Functions</th>
<th>Contact signal at terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(3) Execution of message printing (No.1 and 2)</strong></td>
<td>• Program messages first. See Section 11.10.</td>
</tr>
<tr>
<td></td>
<td><strong>Message</strong></td>
</tr>
<tr>
<td>No.1</td>
<td>OFF</td>
</tr>
<tr>
<td>No.2</td>
<td>ON</td>
</tr>
<tr>
<td><strong>(4) Execution of digital data printing</strong></td>
<td>Turn on (for 1 second or more) the terminal No. which the digital data printing is allocated.</td>
</tr>
<tr>
<td></td>
<td>(Note 1) Program “Printing on/off” to on with a key operation in advance. Execution of message printing with key operation is also available. See Section 9.2.</td>
</tr>
<tr>
<td></td>
<td>(Note 2) During execution, retry of the execution can be accepted just once.</td>
</tr>
<tr>
<td><strong>(5) Execution of list printing (List 1, 2, 3)</strong></td>
<td>Turn on (for 1 sec. or more) the terminal No. which the printing of list 1, 2 or 3 is allocated.</td>
</tr>
<tr>
<td></td>
<td>(Note) Program “Printing on/off” to on with a key operation in advance. Execution of message printing with key operation is also available. See Section 9.3.</td>
</tr>
<tr>
<td><strong>(6) Execution of operation record (No. A to D)</strong></td>
<td>Programming of the operation record position is necessary. See Section 13.4.</td>
</tr>
<tr>
<td></td>
<td>Turn on (for 1 sec. or more) the terminal No. which the operation record (No. A to D) is allocated. During ON time, the recording position shifts to 5 mm to the right from the programmed operation record position.</td>
</tr>
<tr>
<td></td>
<td>(Note) Program “Printing on/off” to on with a key operation in advance.</td>
</tr>
<tr>
<td><strong>(7) Reset of totalization</strong></td>
<td>Available in “Totalization” (option). The totaled value can be reset at an interval time programmed. It can be reset with a contact signal, too.</td>
</tr>
</tbody>
</table>

---

**Warning** Contact signal to terminals

For the contact signal applied to the remote contacts terminals, use a switch or a relay driven at 30V AC or less or 60V DC or less or a manual contact for a very light load.
13. REMOTE CONTACTS

13.2 Terminal Allocation for Operation

This explanation is only for the remote contacts (option). Press \(+\) and \(-\) simultaneously for 3 seconds or more to display the “Terminal Allocation for Operation” programming screen. This allows allocation of the desired functions to terminal Nos. 1 to 4 (EX 1 to 4).

1 Programming Mode

2 Programming Flow Chart

Example: To allocate a chart speed of 3 and stop to terminal Nos. 1/2 and operation record A to terminal No. 3:

Operation screen

[Check]

To be ready for programming

Selecting operation

Selecting operation record A

Temporarily stored

Stored

Press \(+\) or \(-\) to change terminal Nos. Functions allocated can be checked. The default allocation is as follows:

Terminal No. 1:

Terminal No. 2:

Printing on/off and 3 chart speed selection

Terminal No. 3:

Digital data printing

Terminal No. 4:

List printing (List 1)

With \(+\) and \(-\) simultaneously, the terminal Nos. are allocated automatically. Therefore, when one of these functions is selected, terminal Nos. 2 to 4 are not displayed. See Section 13.1.

Reference 1

Reference 2

Reference 3

Terminal No.

Function

Ref. 1

3 sec. or more

(\(+\) or \(-\))

Display other terminal Nos.

Terminal Nos. 2 to 4 are not displayed.

Types of functions

Press \(+\) or \(-\) to change functions.

Displays

Reference 3
13. REMOTE CONTACTS

13.3 Programming 3 Chart Speeds

The “3 chart speeds” programming screen appears only in the remote contacts option.
Press \( \text{SHIFT} \) and \( \text{CHART} \) simultaneously to display the “3 chart speeds” programming screen. Program 3 chart speeds (CS1 to 3) and select the desired speed with a contact signal. See section 13.12.

### 3 Programming Mode

<table>
<thead>
<tr>
<th>Unit for the speed</th>
<th>Cursor</th>
<th>Speed No.</th>
<th>Chart speed (4 digits programming)</th>
</tr>
</thead>
</table>

### 4 Programming Flow Chart

**<Example> From 20 mm/h to 40 mm/h for CS2**

- **Operation screen**
  - Speed unit
  - Speed
  - [Check] [SHIFT] + [CHART] Ref. 1

- **[To be ready for programming]**
  - Cursor
  - \( \uparrow \) \( \downarrow \) \( \% \) \( \rightarrow \) \( \rightarrow \) Ref. 2

- **[Selecting CS No.]**
  - Speed
  - Speed unit

- **[Selecting speed]**
  - Speed

**Error display appears?**

- **YES**
  - Any key other than \( \text{SHIFT} \)
  - Temporarily stored
  - Programming other Nos.?

- **NO**
  - \( \text{SHIFT} \) + \( \text{SET END} \)

**Stored**

### Defaults parameters and programming range

- Default: 20 (AL3000), 25 (AH3000)
- Programming range: 0001 to 0600 (mm/h) or 0001 to 0200 (mm/min.)
- 0000mm/h can be set for AH3000. When 0000mm/h is set, chart is fed at the speed of 12.5mm/h.

### Remarks 1

If the chart speed is programmed at 151 mm/h or faster;

- All printings except time line, digital data printing and programming change mark will not be executed. See Section 10.1.

### Influence to periodic data printing

- If the chart speed is changed, the parameters programmed in the [Periodic data printing] (Section 11.7) is cleared.

### Changing the speed unit (h/min.)

- Place the cursor on the character display (left digit) and press \( \uparrow \) or \( \downarrow \) to switch \([M]\) and \([H]\) alternately.

### Storing

- Store the [temporarily stored] parameters into memory. (Programming change mark is printed.)
This explanation is only for the remote contacts (option). Press \( \text{CLEAR} \) and \( \text{TAG} \) simultaneously for 3 seconds or more to display the "Operation printing position" programming screen. Printing Nos. are A, B, C and D. The default values are A = 20, B = 40, C = 60 and D = 80.

1. **Operation Record**

The programmed recording positions are recorded by the plotter pen. When the contact signal is shorted, the recording position shifts to 5 mm to the right from the programmed operation record position. The record Nos. (A to D) are also recorded at a fixed interval.

2. **Programming Mode**

   - Record No.
   - Record position

3. **Programming Flow Chart**

   - Example: Setting of the record position of record No. B to 40%

   - Operation screen

   - [Check]
     - Printing No.
     - Printing position
     - To be ready for programming
     - Cursor

   - [Selecting printing No.]
     - Printing No.

   - [Programming printing position]
     - Printing position
     - If any error occurs, press any key other than \( \text{SHIFT} \).

   - Temporarily stored

   - Programming other channels?

   - Reference 3

   - YES

   - NO

   - Storing

   - Reference 4

   - STORE

   - CLEAR

   - 10 0 4

   - Programming range

   - 90%

   - Record No. B

   - Record line when the contact is open

   - 5 mm

   - Record line when the contact is shorted

   - 5 mm

   - Remarks

   - The terminal allocation is necessary.

   - For operation record, the "Terminal Allocation for Operation", allocations of record Nos. (A to D) to terminal Nos. (EX 1 to EX 4), is necessary. See Section 13.2.

   - Reference 1

   - Other speed No. check

   - Press \( \text{ENTRY} \) or \( \text{ENTRY} \) to change record Nos. record positions can be checked.

   - Reference 2

   - Record position range

   - Record position is programmable from 10% to 90% of the printing range.

   - Reference 3

   - Error display

   - Error is displayed when the programmed value is between 0% and 9% or between 91% and 99%.

   - Reference 4

   - Storing

   - Store the [temporarily stored] parameters into memory. (Programming change mark is printed.)
This programming display only appears for the printing format (option). This programming is to change the trace printing range automatically.

1. **Automatic Range-shift**

   The automatic range-shift function changes the trace printing range up to 5 stages according to the measured values.

   (1) This programming can be applied to each channel.
   (2) The total printing range can be programmed optionally irrespective of the programmed range in the [Range/Printing range].
   (3) For each range, refer to the minimum printing range in section 22.1 (Input Specifications). The printing may be dispersed if each range is programmed to be less than the minimum printing range.
   (4) The range shifting is executed when the measured value exceeds approx. 0.5 mm from the minimum (zero) or the maximum (span) range.

2. **Programming Mode**

   1) **Screen 1 (Printing format check)**

   - Standard Automatic range-shift Compressed/expanded

   Dots appear at the selected format.

   By pressing [SEL], the dots disappear and the cursor appears instead.

   2) **Screen 2 (Programming channel)**

   - Automatic range selection Channel Cursor

   By selecting automatic range-shift ( ), the cursor appears at the channel programming position.

3) **Screen 3 (Zero programming at No.1 range)**

   - Range No. Zero

   Programming value (Max. 5 digits by left-justify)

   (1) The default programmed value is the minimum value in the [Range/Printing range]. This programming can be changed as required.
   (2) When all programming are completed, return to the above display and execute [Storing].

4) **Screen 4 (Span programming at No. 1 to 5 ranges)**

   - Range No. Span

   Programming value (Max. 5 digits by left-justify)

   (1) When the programming a span, the range number advances. Program the span up to the required range number.
   (2) After pressing [ENTRY] up to range No.5, press [ENTRY] again to return to Display 3.
14. PRINTING FORMAT 14.1 Programming Automatic Range-Shift Printing

3 Programming Flow Chart

<Example> Programming the details on the left page for CH 1

- Operation screen

1. [Checking printing format] SHIFT + DISP Ref. 1
   - Standard
   - Cursor: Automatic range shift

2. [To be ready for programming] SET END
   - Automatic range shift

3. [Selecting automatic range shift]
   - Channel

4. [Programming channel]
   - Channel
   - Programming zero for range No. 1

5. [Programming span for range No. 1]
   - Zero

6. Range No. changes to 2. Program the span for the range No. 2. Program No. 2 to 4 spans as the procedure shown above. Press ENTRY key for every programming.

7. [Returning to the step (5)]

Other channel programming

This programming is for each channel. For programming other channels, repeat the procedure from the [Operation screen].

Remarks 1: Remedial measure to error display
Press any key other than SHIFT and program again. When it is normal, the next screen appears.

Remarks 2: Programming for the range No. 2 to No. 5
Program the span and press ENTRY to advance the range Nos. The range No. advances up to No. 5. For the range No. which no span programming is required, press key to skip it.

Remarks 3: Return to the screen of Step (5)
For storing parameters into memory, return the screen to Step (5).

Reference 1: Checking parameters
Press ENTRY to display parameters. The parameters are displayed sequentially each time ENTRY is pressed. Press or to change channels.

Reference 2: Storing
Store the parameters into memory. (Programming change mark is printed.)

Reference 3: Cancellation of programming
For canceling the stored parameters, press SHIFT and CLEAR simultaneously at Steps (4) to (7), and then press ENTRY to store the cancellation.

Reference 4: Returning to standard printing
Point the cursor to (5) at Step (2) and press ENTRY. To return to the automatic range-shift function, execute the procedure of Steps (1) to (3) and store it.

Reference 5: Scale printing at fixed-time printing
Scale is printed in the order of channels. Range Nos. (R1 to R5) are also printed.

* Fill unused digits with spaces.
14. PRINTING FORMAT

14.2 Programming Compressed/Expanded Printing

This programming display only appears for the printing format (option). This programming is to print the specified range in the [compressed/expanded] printing mode.

1 Compressed/Expanded printing

A specified range in the trace printing range can be printed in the compressed or expanded printing mode.

(1) This programming can be executed for each channel.

(2) The printing range can be programmed optionally irrespective of the programmed range in the [Range/Printing range].

(3) Up to 2 break points can be programmed.

2 Programming Mode

1) Screen 1 (Printing format check)

Dots appear at the selected format.

By pressing [SET], the dots disappear and the cursor appears instead.

2) Screen 2 (Programming channel)

By selecting compressed/expanded (C P), the cursor appears at the channel programming position.

3) Screen 3 (Programming break point printing position)

(1) Program each break point printing position (%) in the range of 10 to 90.

(2) When all programming are completed, return to the above display and execute [Storing].

(Note) No.1 break point should be lower than No.2 break point. When no programming for the No.2 break point is required, leave it as spaces.

4) Screen 4 (Scale programming of each printing position)

(1) When programming a scale, the printing position advances to the next position. Program scales up to the 100% position.

(2) After completing the programming for 100%, press [ENTRY] to return to Screen 3.
### 14. PRINTING FORMAT

#### 14.2 Programming Compressed/Expanded Printing

#### Programming Flow Chart

**<Example> Programming the details on the left page for CH 2**

1. **Operation screen**
   - [Checking printing format]
   - [To be ready for programming]

2. **[Selecting compressed/expanded]**
   - [Programming channel]
   - [Programming printing position for each break point]

3. **[Programming scale of printing position 0%]**
   - Printing position (%) changes. Program the corresponding scale and press [ENTRY] for every programming. Continue this programming up to 100% scale.

4. **Returning to the step (5)**

5. **Other channel programming**
   - This programming is necessary for each channel. For programming other channels, repeat the procedure from the "Operation screen".

**Remedial measure to error display**
- Press any key other than [SHIFT] and program again. When it is normal, the next screen appears.

**No programming of No. 2 break point necessary**
- Leave it as spaces and press [ENTRY].

**Return to the screen of Step (5)**
- For storing parameters into memory, return the screen to Step (5).

**Checking parameters**
- Press [ENTRY] to display parameters. The parameters are displayed sequentially each time [ENTRY] is pressed. Press [↑] or [↓] to change channels.

**Storing**
- Store the parameters into memory. (Programming change mark is printed.)

**Cancellation of programming**
- For canceling the stored parameters, press [SHIFT] and [CLEAR] simultaneously at Steps (4) to (7), and then press [ENTRY] to store the cancellation.

**Returning to standard printing**
- Point the cursor to (5 d) at Step (2) and press [ENTRY]. To return to the compressed/expanded function, execute the procedure of Steps (1) to (3) and store it.

**Scale printing at fixed time printing**
- Scales at each printing position are printed like as –100, 600, 800 or 1200.
- "+" mark is printed at the printing position for break points.

* Fill unused digits with spaces.
14. PRINTING FORMAT

14.3 Programming Zone Printing

This programming display only appears for the printing format (option). This programming is to print the printing area by dividing it into 2 to 4 zones. (AL3000: 2 zones only)

1 Zone Printing

The printing area is divided into two zones (AL3000) or four zones (AH3000) and the printing zone can be selected. This function is effective when printings overlap each other.

(1) The printing zone can be selected for each channel.
(2) The printing range for each zone is the programmed printing range in the [Range/Printing range].
(3) The followings are printing position (mm) at the number of zone.

- **AL3000**
  - Zone No. 1: 0 to 45
  - Zone No. 2: 55 to 100

- **AH3000**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Zone No. 1</th>
<th>Zone No. 2</th>
<th>Zone No. 3</th>
<th>Zone No. 4</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>

2 Programming Mode

1) Screen 1 (Printing format check)

- Standard
- Automatic range shift
- Compressed/expanded

Dots appear at the selected format.
By pressing [SET], the dots disappear and the cursor appears instead.

2) Screen 2 (Programming number of zones)

... Displays in AH3000 only

3) Screen 3 (Programming channel for zone No.1)

4) Screen 4 (Programming channel for zone Nos. 2 to 4)

(Note) For AL3000 (2 zones only), Screen 2 is skipped and Screen 3 appears.

(Note) The programming for zones No. 3 and 4 are for AH3000 only.
3 Programming Flow Chart (AL3000)

<Example> Programming CH 1 and CH 3 to zone No.1, and CH 2 and CH 4 to zone No. 2

[Checking printing format]  
SHIFT + DISP  Ref. 1

(1) F S. d. Ar SP PL
Standard

[To be ready for programming]  
SET END

(2) F S. d. Ar SP PL
Cursor...

[Selecting zone printing]  
Zone
(3) FPA  

(3 time) → ENTRY

[Programming channel of 1st area]  
Various keys → ENTRY  Remarks 1

(4) FPA 1 3

[Programming channel of 2nd area]  
Various keys

(5) FPA 2 4

[To display step (4)]  
ENTRY

(6) FPA 1 3

SHIFT + SET END

Stored  Ref. 2

Remarks 1  Remedial measure to error display
Press any key other than SHIFT and program again. When it is normal, the next screen appears.

Remarks 2  Return to the screen of Step (4)
For storing parameters into memory, return the screen to Step (4).

Remarks 3  Selection and overlapping of channels
The channel not selected in any zone is skipped. Also, if the selection of channel is overlapped or the skipped channel is selected, error display appears.

Reference 1  Checking parameters
Press ENTRY to display parameters. The parameters are displayed sequentially each time ENTRY is pressed.

Reference 2  Storing
Store the parameters into memory. (Programming change mark is printed.)

Reference 3  Border mark
"+" mark is printed at the border of the area.

*Fill unused digits with spaces.
4  Programming Flow Chart (AH3000)

*Example* Programming CH 1 and CH 3 to zone No. 1, and CH 2 and CH 4 to zone No. 2

![Flow Chart Diagram]

- **Operation screen**
  - Checking printing format
  - Standard
  - To be ready for programming
  - Zone scale
  - Selecting zone printing
  - Programming numbers of area
  - Numbers of divided area
  - Programming channel of 1st area
  - Programming channel of 2nd area
  - Program 3rd area also. Program 4th area with same procedure.
  - To display step (4)
  - Stored

- **Remarks 1** Remediial measure to error display
  - If error display appears during programming, press any key other than \( \text{SHIFT} \) and program again. When it is normal, the next screen appears.

- **Remarks 2** Channels programming for 3rd or 4th zones
  - When zones are divided into 3 or 4, program channels up to 3 or 4 zones.

- **Remarks 3** Return to the display of Step (4)
  - For storing the parameter into memory, return the screen to Step (4).

- **Remarks 4** Selection and overlapping of channels
  - The channel not selected in any zone is skipped. Also, if the selection of channel is overlapped or the skipped channel is selected, error display appears.

- **Reference 1** Checking parameters
  - Press \( \text{ENTRY} \) to display parameters. The parameters are displayed sequentially each time \( \text{ENTRY} \) is pressed.

- **Reference 2** Storing
  - Store the parameters into memory. (Programming change mark is printed.)

- **Reference 3** Border mark
  - \(^*\) mark is printed at the border of the area.
  - \(^*\) Fill unused digits with spaces.
15. COMMUNICATIONS INTERFACE

This explanation is only for the communications interface (option). Press \( \text{SHIFT} \) and \( \text{SPACE} \) simultaneously for 3 seconds or more to display the "communications protocol" programming screen.

**Remarks:**
- Communications interface
  - This section only explains programming of the communications interface. For details of the communications interface, refer to the separate instruction manual for "Communications Interface".
  - When EnG is selected and then MODBUS is selected, it is fixed to RTU mode.

**Reference 1**
- Port selection
  - Select the port type from the followings.
    1. \( \text{Con} \): Higher level communications
    2. \( \text{Eng} \): Engineering

**Reference 2**
- Protocol selection
  - Select the protocol from the followings.
    1. \( \text{Private} \): Private protocol
    2. \( \text{MODBUS} \): MODBUS protocol

**Reference 3**
- Mode selection
  - When \( \text{MODBUS} \) is selected, the mode selection screen is displayed.
    Select the mode from the followings.
    1. \( \text{RTU} \): RTU mode
    2. \( \text{ASCII} \): ASCII mode

**Reference 4**
- Return to the port selection screen
  - After "temporarily storage", the "Port selection" screen appears again. For storing parameters, press \( \text{DISP} \).

**Reference 5**
- Storing
  - Store the [temporarily stored] parameters into memory.
  - (Programming change mark is printed.)
15. COMMUNICATIONS INTERFACE

15.2 Programming communications

This explanation is only for the communications interface (option). Press \( \text{SHIFT} \) and \( \text{ENTRY} \) simultaneously for 3 seconds or more to display the “communications” programming screen.

Reference 1 > Communications type check

Communications type is displayed. The communications type cannot be changed.

Reference 2 > Address programming range

01 to 99: \( Pr \) (private) protocol
(01 to 31: MODBUS) protocol
(Note) “01” is displayed only when “private” is changed to “MODBUS”.

Reference 3 > Transmission speed selection range

1200, 2400, 4800, 9600, 19200 bps
Only 9600 and 19200 bps are available with the MODBUS protocol.
(Note) “9600” is displayed only when “private” is changed to “MODBUS”.

Reference 4 > Character selection

Characters are displayed with codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Character length</th>
<th>Parity</th>
<th>Stop bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7E1</td>
<td>7 bits</td>
<td>Even</td>
<td>1</td>
</tr>
<tr>
<td>7E2</td>
<td>7 bits</td>
<td>Even</td>
<td>2</td>
</tr>
<tr>
<td>701</td>
<td>7 bits</td>
<td>Odd</td>
<td>1</td>
</tr>
<tr>
<td>702</td>
<td>7 bits</td>
<td>Odd</td>
<td>2</td>
</tr>
<tr>
<td>8N1</td>
<td>8 bits</td>
<td>Non</td>
<td>1</td>
</tr>
<tr>
<td>8N2</td>
<td>8 bits</td>
<td>Non</td>
<td>2</td>
</tr>
<tr>
<td>8E1</td>
<td>8 bits</td>
<td>Even</td>
<td>1</td>
</tr>
<tr>
<td>8E2</td>
<td>8 bits</td>
<td>Even</td>
<td>2</td>
</tr>
<tr>
<td>801</td>
<td>8 bits</td>
<td>Odd</td>
<td>1</td>
</tr>
<tr>
<td>802</td>
<td>8 bits</td>
<td>Odd</td>
<td>2</td>
</tr>
</tbody>
</table>

(Note) “8N1” is displayed only when “private” is changed to “MODBUS”.

Reference 5 > Checksum selection range

\( \bigcirc \) : Checksum ON
\( \bigcirc \) : Checksum OFF
(Note) No display appears for the MODBUS protocol.

Reference 6 > From “temporarily stored” to “stored”

Pressing \( \text{ENTRY} \) for each programming executes temporary storing. Pressing \( \text{DISP} \) for 2 seconds or more executes storing and returns to the operation screen.

Reference 7 > Returning to operation screen

If the screen returns to the operation screen before pressing \( \text{ENTRY} \), the parameter is returned to the parameter before programming.
16. Math Expressions and Totalization

**Remarks**

Math expressions and totalization

This section outlines math expressions and totalization. For programming, read the separate instruction manual for “Math Expressions and Totalizations (Option)”.

1 Math Expressions

(1) Measured values are computed and the results are displayed and stored into memory.
(2) Math expressions comprise basic calculations, totalization, flow rates, etc., which are depending on the relevant model code.
(3) 18 types of math expressions are provided and they can be programmed to any channel.

<table>
<thead>
<tr>
<th>Display characters</th>
<th>Names</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) None</td>
<td>None</td>
<td>No computation (Display and printing of measured values)</td>
</tr>
<tr>
<td>(2) AaX + By + Cxy + D</td>
<td>Arithmetical operation 1</td>
<td>+, -, x (AaX + By + Cxy + D)</td>
</tr>
<tr>
<td>(3) (Ax/y + B)</td>
<td>Arithmetical operation 2</td>
<td>÷ (Ax/y + B)</td>
</tr>
<tr>
<td>(4) Logₑ X</td>
<td>Natural Logarithm</td>
<td>LoGₑ X</td>
</tr>
<tr>
<td>(5) Log₁₀ X</td>
<td>Logarithm</td>
<td>LoG₁₀ X</td>
</tr>
<tr>
<td>(6) Exp X</td>
<td>Exponential</td>
<td>e&lt;sup&gt;x&lt;/sup&gt;</td>
</tr>
<tr>
<td>(7) Sqrt X</td>
<td>Square root</td>
<td>√ (Rx – Rz/Rs - Rz)</td>
</tr>
<tr>
<td>(8) Humidity</td>
<td>Temperature/humidity</td>
<td>Computation of measured values by the dry and wet bulbs by using the relative humidity tables</td>
</tr>
<tr>
<td>(9) Mₚₖₜₚₜ</td>
<td>Maximum</td>
<td>Maximum value at the programmed “interval period”</td>
</tr>
<tr>
<td>(10) Minₚₖₜₚₜ</td>
<td>Minimum</td>
<td>Minimum value at the programmed “interval period”</td>
</tr>
<tr>
<td>(11) Aveₚₖₜₚₜ</td>
<td>Average value</td>
<td>Average value at the programmed “interval period”</td>
</tr>
<tr>
<td>(12) Abs X</td>
<td>Totalizing</td>
<td></td>
</tr>
<tr>
<td>(13) Comm</td>
<td>Data communications input</td>
<td>Displayed only for the communications Interface (option)</td>
</tr>
<tr>
<td>(14) Int</td>
<td>Totalization</td>
<td>Displayed only for the totalization (option)</td>
</tr>
<tr>
<td>(15) Rₚₖₜₚₜ</td>
<td>Flow correction computation 1</td>
<td></td>
</tr>
<tr>
<td>(16) S</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>(17) Rₚₖₜₚₜ</td>
<td>Flow correction computation 7</td>
<td></td>
</tr>
</tbody>
</table>

2 Totalizing

(1) Measured values and computed results are totalized and the results are displayed and printed. The reset of the totalization is executed with the programmed interval or a contact signal for the “remote contacts” (option).
(2) Totalization is displayed as “int”. This can be programmed to any channel.

3 Instruction manual

An instruction manual (INST. No. INE-288) for “Math expression and totalization (option)” is attached separately.
17. Other Options

17.1 Shunt Resistor for Current Input

DC current input can be measured by attaching a shunt resistor (option) to the input terminals.

1 Shunt resistor (Option) and Measurement current range
- A shunt resistor converts the DC current input into a DC voltage. The two types shown in the right table are available.
- The current measuring ranges are shown in the right table, too.

2 Connection
Connect a shunt resistor to each channel for the DC current measurement.

[Remarks] Caution on connections
Only one shunt resistor is to be connected to a channel.

3 [Range/Printing range] and [Scale]
1) Range No.
The converted voltage with any shunt resistor is ±5 V DC and the range No. is “07”.

2) Printing range
Program the printing range with the value after being converted into a voltage.
- Minimum value:
  Min. input current x shunt resistor value
- Maximum value:
  Max. input current x shunt resistor value

3) Scale
Program the scale with the physical quantity against the input current.
- Minimum value:
  Physical quantity of the minimum input current
- Maximum value:
  Physical quantity of the maximum input current

Shunt resistor and measuring range

<table>
<thead>
<tr>
<th>Code</th>
<th>Resistance value*</th>
<th>Measuring range</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZ-RX100</td>
<td>100Ω</td>
<td>±50mA DC</td>
</tr>
<tr>
<td>EZ-RX250</td>
<td>250Ω</td>
<td>±20mA DC</td>
</tr>
</tbody>
</table>

Accuracy: 100Ω - Rated value ±0.05%
           250Ω – Rated value ±0.1%

Ex) Connection of a shunt resistor to CH1

Using Range No.

<table>
<thead>
<tr>
<th>Resistance value</th>
<th>Measuring range</th>
<th>Converted voltage</th>
<th>Range No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100Ω</td>
<td>±50mA DC</td>
<td>±5VDC</td>
<td>07</td>
</tr>
<tr>
<td>250Ω</td>
<td>±20mA DC</td>
<td>±5VDC</td>
<td>07</td>
</tr>
</tbody>
</table>

Example of printing range

<Input to be printed with the trace printing: 4 to 20mA>
Use the shunt resistor of 250Ω for the maximum measuring current of 20mA.
- Minimum value: 4 (mA) x 250 (Ω) = 1 (V)
- Maximum value: 20 (mA) x 250 (Ω) = 5 (V)

Example of scale programming

<Physical quantity of 4 to 20mA is 0 to 500 litter/m²>
- Minimum value: 0  •  Maximum value: 500
Transmitter Power Supply

This power supply unit, which is designed to install on the rear panel (terminal board) of the instrument, supplies power (24VDC) to a transmitter that transmits the measurement input signals to your recorder.

[Model] RZ-TPS01
[Instruction manual] INST. No. INE-277
18. ADJUSTMENT

18.1 Adjustment of Measured Values

■ Adjustment

Adjustment comprises four kinds shown below. (1), (3) and (4) have already been adjusted. However, it is recommended for maintaining the measuring and printing accuracy to adjust them once a year.

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Details</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Measured values adjustment</td>
<td>Adjustment to keep the measured value against input within the accuracy ratings.</td>
<td>Sec.18.1</td>
</tr>
<tr>
<td>(2) Shift programming of measured value</td>
<td>Programming to shift a measured value</td>
<td>Sec.18.2</td>
</tr>
<tr>
<td>(3) Adjustment of printing position</td>
<td>Adjustment to set the printing range to the zero and span lines on the chart</td>
<td>Sec.18.3</td>
</tr>
<tr>
<td>(4) Adjustment for time-axis synchronization of pens</td>
<td>Adjustment of the gaps between pens for the time-axis synchronization</td>
<td>Sec.18.4</td>
</tr>
</tbody>
</table>

1 Adjustment of measured values

It is recommended for maintaining measuring and printing accuracy to adjust them once a year.

(1) Execute the adjustment for each channel.
(2) Execute the adjustment under the reference condition. (See the right table.)

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Details</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Measured values adjustment</td>
<td>Adjustment to keep the measured value against input within the accuracy ratings.</td>
<td>Sec.18.1</td>
</tr>
<tr>
<td>(2) Shift programming of measured value</td>
<td>Programming to shift a measured value</td>
<td>Sec.18.2</td>
</tr>
<tr>
<td>(3) Adjustment of printing position</td>
<td>Adjustment to set the printing range to the zero and span lines on the chart</td>
<td>Sec.18.3</td>
</tr>
<tr>
<td>(4) Adjustment for time-axis synchronization of pens</td>
<td>Adjustment of the gaps between pens for the time-axis synchronization</td>
<td>Sec.18.4</td>
</tr>
</tbody>
</table>

2 Preparation

1) Preparation of tools

<table>
<thead>
<tr>
<th>Tools</th>
<th>DC voltage</th>
<th>Thermocouple</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC standard voltage/current generator</td>
<td>○</td>
<td>○</td>
<td>Accuracy: Should be better than ±0.05%.</td>
</tr>
<tr>
<td>Reference junction compensator</td>
<td>○</td>
<td></td>
<td>0°C ±0.2°C or less</td>
</tr>
<tr>
<td>Thermocouple for test</td>
<td>○</td>
<td></td>
<td>Same type of thermocouple as input type</td>
</tr>
<tr>
<td>Standard variable resistor</td>
<td>○</td>
<td></td>
<td>Accuracy: Should be better than ±0.05%.</td>
</tr>
<tr>
<td>3-core copper wire</td>
<td>○</td>
<td></td>
<td>Same resistance for each 3 cores</td>
</tr>
</tbody>
</table>

2) Connection

Connections depend upon the input types. See the next page.

3) Before starting adjustment

(1) After the connection, mount the terminal board cover and turn on the power supply.
(2) Before starting adjustments, warm up your recorder for at least 30 minutes until it becomes stable. (It is recommended to warm it up for at least one hour if possible.)

Remarks Adjustments

Check and adjustments of the measured values need meticulous work in addition to the standard tools and reference conditions.

If you need checks or adjustments of the measured values, please consult your nearest CHINO’s agent.
18. ADJUSTMENT

18.1 Adjustment of Measured Values

3 Connections

Connections depend upon the input types. Connect the standard tools to the input terminals to be adjusted.

⚠️ Caution Make sure to connect after turning off the power supply.

To prevent any injury caused by electric shock, be sure to turn off the power supply before connections.

(1) In case of thermocouple input

The electromotive force of the thermocouple input is reduced by an amount proportional to the temperature at the terminals. The recorder itself compensates (reference junction compensation) for this reduction. The adjustment is executed by inputs based on the reference electromotive force (0°C reference). In case the “RJ selection” is set to “1” (Enable) in the “Range/Printing range” programming, an amount equivalent to the reference junction compensation has to be subtracted using a reference junction compensator.

(2) DC voltage input

(3) Resistance thermometer input
18. ADJUSTMENT

18.1 Adjustment of Measured Values

Programming Flow Chart

<Example> Adjustment of CH 01 (Printing range: -50 to 150)

Operation screen

[Engineering mode selection]

Cursor Adjustment

[Selecting adjustment]

→

[Selecting measured value]

Cursor Measured value

[Programming channel]

Cursor Channel

[To zero adjustment display]

Entry

Zero adjustment

Apply an input equivalent to the minimum value with a standard tool.

To span adjustment display

Entry

Span adjustment

Apply an input equivalent to the maximum value with a standard tool.

[To programming channel screen]

[Remarks 1] By returning to the operation screen

Computed correction data are canceled if the screen is returned to the operation screen in the procedures before [Storing].

[Remarks 2] Skipped channel does not accept any [ENTRY] key

When a skipped channel is programmed, [ENTRY] operation is not accepted.

[Remarks 3] Other channels adjustment

Change the connection to other input terminals to be adjusted and repeat the same procedure from the programming channel screen (indicated by a dotted line).

[Remarks 4] Initialization of correction data

In zero adjustment or span adjustment screen, when [SHIFT] and [CLEAR] are pressed simultaneously and then [ENTRY] is pressed, the correction data of its channel are initialized.

[Reference 1] Engineering mode types

CLR: Memory clear
CAL: Adjustment
CHR: Hardware check

[Reference 2] Adjustment types

DS: Measured value adjustment
SH: Shift programming for measured value
RE: Printing position adjustment
PE: Time-axis adjustment for pens

[Reference 3] Storing

Store the computed correction data into memory.
18. ADJUSTMENT  18.2 Shift Programming of Measured Value

This programming is for slight-shifting a measured value. After programming, measured values are shifted by the programmed amount.

1  Shift Programming

(1) This programming is necessary for each channel.
(2) The cursor shifts to the least significant digit. Execute this programming with [▼] or [▲].

2  Programming Flow Chart

<Example> Changing measured value of CH 1 from 850.3 to 850.0

Example of shift programming

Measured value … 850.3

Programming … 850.0

Shift value = 850.0 - 850.3 = -0.3

Before starting this programming, wait for at least 30 minutes after turning on the power supply.

Remarks 1: Skipped channel does not accept any [ENTRY]
When a skipped channel is programmed, [ENTRY] operation is not accepted.

Remarks 2: Other channels adjustment
Change the connection to other input terminals to be adjusted and repeat the same procedure from the programming channel display (indicated by a dotted line).

Remarks 3: Initialization of shift data (0)
In zero adjustment or span adjustment screen, when [SHIFT] and [CLEAR] are pressed simultaneously and then [ENTRY] is pressed, the correction data of its channel are initialized.

Remarks 4: Memory clear
When [CLEAR] is pressed, measured data are cleared.

Remarks 5: Adjustment
Change the connection to other input terminals.

Remarks 6: Hardware check

Remarks 7: Printing position adjustment

Remarks 8: Time-axis adjustment for pens

Reference 1: Engineering mode types
- CLR: Memory clear
- CAL: Adjustment
- CHK: Hardware check

Reference 2: Adjustment types
- OS: Measured value adjustment
- SH: Shift programming for measured value
- RE: Printing position adjustment
- PE: Time-axis adjustment for pens

Reference 3: Storing
Store the programmed shifting data into memory.
18. ADJUSTMENT  18.3 Adjustment of Printing Position

This is the adjustment for the printing position of the cartridge pen for use in trace printing. It is recommended to adjust it once a year for maintaining the printing accuracy.

■ Adjustment Flow Chart

Zero/span adjustment procedure

Pressing \( \text{ENTRY} \) once moves 0.1 mm to right. Pressing \( \text{ENTRY} \) once moves 0.1 mm to left. Press \( \text{ENTRY} \) when the printing position matches to zero or span of the chart.

Other pens than the pen being adjusted

Pens stand by near the scale center.

Remark

By returning to the operation screen

Computed correction data are canceled if the screen is returned to the operation screen in the procedures before [Storing].

*During zero and span adjustments, \( \text{DISP} \) operation is not accepted.

Reference 1  Engineering mode types

- \( \text{CLR} \): Memory clear
- \( \text{CAL} \): Adjustment
- \( \text{CHR} \): Hardware check

Reference 2  Adjustment types

- \( \text{OS} \): Measured value adjustment
- \( \text{SH} \): Shift programming for measured value
- \( \text{RE} \): Printing position adjustment
- \( \text{PE} \): Time-axis adjustment for pens

Reference 3  Pen No.

1: 1st pen
2: 2nd pen (2-pen type to 4 pen type)
3: 3rd pen (3-pen type, 4-pen type)
4: 4th pen (4-pen type only)

Reference 4  Storing

Store the computed correction data into memory.
18. ADJUSTMENT

18.4 Time-axis Adjustment of Pens

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. This adjustment is for correction of these changes. It is recommended to adjust them once a year for maintaining the time-axis synchronization.

Adjustment Flow Chart

1. [Operation screen]  
   - Disp: 2 sec. or more

2. [Engineering mode selection]  
   - (SHI6F + A-Z) 3 sec. or more

3. [Selecting adjustment]  
   - F:  ENTRY

4. [Selecting time-axis]  
   - F:  ENTRY

5. [Selecting an adjusting pen]  
   - (1) (2) (3) (4)

   When (1) the reference pen prints a straight line on 0% to 100% of the chart and (2) Press , the chart is fed and then the printing of the adjusting pen coincides with the straight line (Note)

   - ENT (Starting adjustment)

   - Stored

6. Note) If you press while it does not coincide with the straight line, re-execute the procedure from the beginning of [Selecting an adjusting pen].

Adjustment procedure

1. (1) Reference pen prints a straight line.

2. (2) Initial position of the pen adjusted

3. When these two lines match, press .

Other pens than the pen being adjusted

Pens stand by at 0% position of scale.

Reference 1  
- CLR: Memory clear
- CAL: Adjustment
- CHA: Hardware check

Reference 2  
- OS: Measured value adjustment
- SX: Shift programming for measured value
- RE: Printing position adjustment
- PE: Time-axis adjustment for pens

Reference 3  
- Adjusting pen selection

<table>
<thead>
<tr>
<th>Display</th>
<th>Reference pen</th>
<th>Pen to be adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 1 P</td>
<td>Plotter pen</td>
<td>1st pen</td>
</tr>
<tr>
<td>(2) 2 P</td>
<td>1st pen</td>
<td>2nd pen</td>
</tr>
<tr>
<td>(3) 3 P</td>
<td>1st pen</td>
<td>3rdt pen</td>
</tr>
<tr>
<td>(4) 4 P</td>
<td>1st pen</td>
<td>4th pen</td>
</tr>
</tbody>
</table>

Reference 3  
- Storing

Store the computed correction data into memory.
19. HARDWARE CHECK

19.1 ROM Version Check

Hardware check

Hardware check comprises the following seven items. Items (5) to (7) only apply to corresponding options added.

<table>
<thead>
<tr>
<th>Check items</th>
<th>Details</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ROM version check</td>
<td>Checking of versions for ROM and linearization</td>
<td>Sec. 19.1</td>
</tr>
<tr>
<td>(2) Printer test</td>
<td>Checking of printing with the cartridge pens and the plotter pen</td>
<td>Sec. 19.2</td>
</tr>
<tr>
<td>(3) Display test</td>
<td>Checking of LCD on the display</td>
<td>Sec. 19.3</td>
</tr>
<tr>
<td>(4) Measuring input check</td>
<td>Checking of real data (A/D converted value) of each channel</td>
<td>Sec. 19.4</td>
</tr>
<tr>
<td>(5) Alarm output check</td>
<td>Output of on or off signal from terminals</td>
<td>Sec. 19.5</td>
</tr>
<tr>
<td>(6) Remote contacts input check</td>
<td>Checking of input condition (open or short) at terminals</td>
<td>Sec. 19.6</td>
</tr>
<tr>
<td>(7) Communications interface check</td>
<td>Checking of communications function</td>
<td>Sec. 19.7</td>
</tr>
</tbody>
</table>

Check Flow Chart

![Check Flow Chart Diagram]

Press or to check the versions of ROM or linearization.

Reference 1 > Engineering mode types
- CLR: Memory clear
- CAL: Adjustment
- CHR: Hardware check

Reference 2 > Types of check 1
- (1)SF: ROM version check
- (2)Pr: Printer check
- (3)dP: Display check
- (4)mn: Measuring input check

Press or to check the versions of ROM or linearization.

Reference 3 > ROM and linearization check
19. HARDWARE CHECK  19.2 Printer Check

This is for checking of trace printing with the cartridge pens and digital data printing with the plotter pen.

1 Example of Printing Check – When the time-axis synchronization (POC) is “off” in 3-pen type

2 Check Flow Chart

- Operation screen
- [Engineering mode selection] [Selecting check] [Selecting check items] [Selecting printer] [Displaying check] [Executing check]

- Check printing details
  1. Digital data printing (Plotter pen)
     Two lines are printed. The number of characters per line is 40 with AL and 72 with the AH (repetition of A to Z, 1 to 9 and 0).
  2. Trace printing (Cartridge pens)
     Each pen prints a sine curve.

(Note) Even when the time-axis synchronization is on, printing is executed in condition of the time-axis synchronization “off” during printing check.

* DISP is not accepted during printing check.

- Cancellation of printing check
  For cancellation of printing check, press [REC ON/OFF] and then press [ENTRY]. By pressing [DISP] for 2 seconds or more, the screen returns to the operation screen, but the printing disables. For changing the printing to enable, press [REC ON/OFF] and then press [ENTRY] again.

Reference Types of engineering mode and check
See Reference 1 and Reference 2 in section 19.1.
19. HARDWARE CHECK  19.3 Display Check

This is for checking of 16- or 7-segment LCD, status lamps and bargraphs.

1 Display .... (Note) The following is for AL3000. It is same for AH3000.

2 Check Flow Chart

Order of check lighting
(1) All segments and lamps light.
(2) 16-segment LCD and underbar
(3) 7-segment LCD and underbars
   (From left to right)
(4) Programming lamp, memory colon
   and status lamps (all)
(5) Bargraph on the upper row
   (5-segment at a time, from left to right)
(6) Bargraph on the second row
   (Same as the upper row) → On the third row → On the fourth row
(7) All segments and lamps light out.

Cancellation of display check
For cancellation of display check, press [DISP] for 2 seconds or more.
The screen returns to the operation screen.

Reference 1 Engineering mode types
(C: : Memory clear
C: : Adjustment
C: : Hardware check

Reference 2 Types of check 1
(1) S F : ROM version check
(2) P : Printer check
(3) D P : Display check
(4) M : Measuring input check
The measuring input can be checked by counts after A/D conversion.

**Check Flow Chart**

1. **Operation screen**
   - **[Engineering mode selection]**
     - 3 sec. or more
     - **Cursor**
     - **Check**
     - **ENTRY**
   - **[Selecting measuring input]**
     - **Cursor**
   - **[Displaying check]**
   - **ENTRY**
   - **[Displaying count: 1]**
   - **ENTRY**
   - **[Displaying count 2]**

**Reference 1** Engineering mode types
- **CLR**: Memory clear
- **CAL**: Adjustment
- **CHR**: Hardware check

**Reference 2** Types of check 1
1. (1) ROM version check
2. (2) Printer check
3. (3) Display check
4. (4) Measuring input check

**Reference 3** Count 1 display
CH1 to CH4 show the counts after A/D conversion of inputs to channels 1 to 4.
For AH3000, the RJ (reference junction compensation) count is displayed next to CH4.

**Reference 4** Count 2 display
RJ is the counts after A/D conversion of the reference junction compensation (RJ). AH3000 has no Count 2 display as RJ is displayed in Count 1 display. RJ is displayed only when there is a channel, of which RJ is programmed to “1: enable” in the range programming. When all channels are programmed to “0: disable”, (- - - -) is displayed.
19. HARDWARE CHECK  19.5 Alarm Output Check

This check is only available for the alarm output (option). It checks the relay drive circuits and relays by outputting the shorted (on) or open (off) signals at the specified alarm output terminals (relay Nos.).

Check Flow Chart

- Operation screen
  - [Engineer mode selection]
    - DISP
    - 2 sec. or more
  - [Selecting check]
    - →
  - [Displaying check 1]
    - Cursor
  - [Displaying check 2]
    - Cursor
  - [Selecting alarm output]
    - Cursor
  - [Displaying relay No.]
    - CURSOR
  - [Programming relay No.]
    - CURSOR
  - [Selecting output]
    - CURSOR

Relay No. for alarm output terminals

- N.C terminals are provided for the mechanical relay “c” contact output.

Resistance values between terminals

<table>
<thead>
<tr>
<th>Output condition</th>
<th>N.O - COM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOS relay</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>10MΩ or more</td>
</tr>
<tr>
<td>Mechanical relay (Common for “a” and “c” contacts)</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>10MΩ or more</td>
</tr>
<tr>
<td></td>
<td>On</td>
</tr>
<tr>
<td></td>
<td>0.1Ω or less</td>
</tr>
</tbody>
</table>

Check 1 and 2 switching

Press % or ↑ to switch Check 1 and 2.

Types of check 2

1. Alarm output check
2. Remote contacts input check
3. Communications interface check

Programming relay No.

The programming range of relay Nos. are 1 to 6 for AL and 01 to 12 for AH.

Output

The selection of output (on or off) is effective at the moment [ENTRY] is pressed. The previous output status is kept until then.
This check is only available for the remote contacts (option). It checks the input signals (shorted or open) at the remote contacts terminals.

**Check Flow Chart**

1. **Operation screen**
   - **[Engineering mode selection]**
     - (SHIFT + 6) A 2
     - 3 sec. or more
   - **[Selecting check]**
     - ENTRY
   - **[Displaying check 1]**
     - EX1 SF Pr dP Rd
     - Cursor
   - **[Displaying check 2]**
     - EX2 AL Eb in
     - Cursor
   - **[Selecting remote contacts]**
     - ENTRY
   - **[Selecting input signal]**
     - ENTRY

**Remote contacts terminals**

Eleven kinds of operations are available by the remote contacts signals. The operation allocated to each terminal (EX1 to EX4) can be checked. ⇒ See Section 13.2.

**Reference 1**
- **Check 1 and 2 switching**
  - Press ↑ or ↓ to switch Check 1 and 2.

**Reference 2**
- **Types of check 2**
  - (1) R L: Alarm output check
  - (2) Eb: Remote contacts input check
  - (3) n: Communications interface check

**Reference 3**
- **Input signal**
  - The input signals at EX1 to EX4 are:
    - 0: Open
    - 1: Shorted

---

**Operation screen**

- **DISP**
- 2 sec. or more

**Remote contacts terminals**

- EX1
- EX2
- EX3
- EX4
- COM
This check is only available for the communications interface (option). It checks the communications function by displaying the signal received after transmitting it.

1 Connections

Except for RS-485, short the transmission and reception terminals.

<table>
<thead>
<tr>
<th>RS-232C</th>
<th>RS-422A</th>
<th>RS-485</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- Short SD and RD terminals.
- Short SDA and RDA terminals.
- Short SDA and RDA terminals.

Open circuit.
(No need to short.)
19. HARDWARE CHECK | 19.7 Communications IF Check

2 Check Flow Chart

Operation screen

[Engineering mode selection]

[Selecting check]

[Displaying check 1]

[Displaying check 2]

[Selecting communications]

[Communications check]

Reference 1  Check 1 and 2 switching
Press \( \uparrow \) or \( \downarrow \) to switch Check 1 and 2.

Reference 2  Types of check 2
(1) \( R \) : Alarm output check
(2) \( L \) : Remote contacts input check
(3) \( C \) : Communications interface check

Reference 3  Communications check
1. Communications type
Communications type installed is displayed.
- RS232C
- RS422A
- RS485

2. Communications status display
- Normal condition:
Displays one digit by one digit as 0 \( \rightarrow \) 1 \( \rightarrow \) 2 \( \rightarrow \) ...9, and after 9, repeat from 0 again.
- Abnormal condition:
One of 0 to 9 blinks. In this case, communications circuit is abnormal.
20. MEMORY CLEAR

This is for initializing parameters and correction data to the default values.

1 Initialization items

<table>
<thead>
<tr>
<th>Items</th>
<th>Clear function details and cautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>Initializes all parameters excluding [time] to the default values. Refer to Section 7.3 (List of programming items) for the default values.</td>
</tr>
<tr>
<td>Correction data</td>
<td>Initializes all correction data to the default values.</td>
</tr>
<tr>
<td>Clock</td>
<td>The time is preprogrammed to Japanese time at shipment. When initializing the time, it becomes 00:00 hours on January 1, 2000. If the operation screen is not shown due to a failure of the LSI for time, clear the programmed time.</td>
</tr>
</tbody>
</table>

2 Operation Flow Chart

<Example> Initializing parameters

- Press [ENTRY] to initialize the selected item. After initialization, the screen returns to the [Displaying items] screen.
21. MAINTENANCE

21.1 Daily Inspection

Check the residual quantity of chart paper, displaying/printing conditions, etc. on a daily basis in order to use your recorder under good conditions.

1 Consumable parts check

<table>
<thead>
<tr>
<th>Check items</th>
<th>Checking methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Residual quantity of chart</td>
<td>Check the residual quantity of chart. When the residual quantity becomes less, a message “Prepare a new chart” or “New Paper Required” appears with red ink on the left of the chart paper. • Loading chart paper → See Section 5.1. • Ordering chart paper → See Section 1.2.</td>
</tr>
<tr>
<td></td>
<td>Reference Continuous printing days of chart paper</td>
</tr>
<tr>
<td></td>
<td>AL3000 AH3000</td>
</tr>
<tr>
<td>Chart speed</td>
<td>Continuous printing days</td>
</tr>
<tr>
<td>Standard</td>
<td>16 m</td>
</tr>
<tr>
<td>10 mm/h</td>
<td>Approx. 40 days</td>
</tr>
<tr>
<td></td>
<td>Approx. 60 days</td>
</tr>
<tr>
<td>20 mm/h</td>
<td>Approx. 20 days</td>
</tr>
<tr>
<td></td>
<td>Approx. 30 days</td>
</tr>
<tr>
<td>25 mm/h</td>
<td>Approx. 30 days</td>
</tr>
<tr>
<td>50 mm/h</td>
<td>Approx. 15 days</td>
</tr>
</tbody>
</table>

| 2. Plotter pen              | If the text on the digital data printing becomes unclear or pale, replace the plotter pen with a new one. See Section 5.2. |
| 3. Cartridge pen            | If the line on the trace printing becomes unclear or pale, replace the cartridge pen with a new one. See Section 5.2. |

2 Operation check

<table>
<thead>
<tr>
<th>Check items</th>
<th>Checking details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Printing conditions</td>
<td>(1) Chart feeding condition Check that there is no paper jam or dislocation from the sprocket. (2) Text and trend line printing condition Check that no disorder or abnormal condition is found in the text and trend line printing.</td>
</tr>
<tr>
<td>2) Display conditions</td>
<td>Check that no abnormalities are found in the displays of measured values, status and bar-graph.</td>
</tr>
<tr>
<td>3) Others</td>
<td>(1) Check that the measured values are normal. (2) Check if any noise or strange odors are generated.</td>
</tr>
</tbody>
</table>
21. MAINTENANCE  21.2 Cleaning and Lubrication

Clean the main shaft of each pen once a year in order to maintain a satisfactory printing performance.

1  Main Shaft of Plotter Pen
   (1) Turn off printing. Pull out the chart cassette and open the display section.
   (2) Wipe off dirt from the main shaft with a cotton bud or similar tool. (Dirt can be wiped off more easily with a cotton bud soaked in alcohol.)
   (3) Apply one or two drops of the provided lubricating oil to the main shaft.

2  Main Shaft of Cartridge Pen
   (1) Turn off printing. Pull out the chart cassette and open the display section.
   (2) Wipe off dirt from the main shaft with a cotton bud or similar tool.
   (3) Apply one or two drops of the provided lubricating oil to the main shaft.

Remarks  Caution on cleaning and lubrication
   (1) Do not move the plotter pen or cartridge pen by hand.
   (2) Use the provided lubricating oil. Do not use any other oil.

3  Cleaning the Door
   The door is made of plastic*. Clean it with a dry soft cloth or with a soft cloth moistened with lukewarm water or a neutral detergent.
   * Aluminum die-cast door is available an option. (AL3000)

Caution  Do not use any chemicals
   Do not use thinner, benzene or other chemicals that may damage the plastic components. These may cause deformation or breakage to the door.
21. MAINTENANCE

21.3 Measured Values Check

It is recommended for check measured values once a year for maintaining the measuring and printing accuracy.

1 Channels to be checked

Check the measured value for each channel. Different errors may occur for different channels even in the same range.

Remarks

Totalization channel

To check a channel for which a math-function or totalization (optional) has been programmed, program the math expression to “\( n \times n \)” before starting the checking.

Reference conditions

<table>
<thead>
<tr>
<th>Items</th>
<th>Reference conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>23 ±2°C</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>55 ±10%RH</td>
</tr>
<tr>
<td>Power voltage</td>
<td>100 V AC ±1%</td>
</tr>
<tr>
<td>Power supply frequency</td>
<td>50 or 60 Hz ±0.5 Hz</td>
</tr>
</tbody>
</table>

(Note) Add ±0.01% per 1°C for a case other than 23 ±2°C.

2 Preparation

1) Preparation of tools

<table>
<thead>
<tr>
<th>Tools</th>
<th>Input types</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC standard voltage/current generator</td>
<td>☑</td>
<td>Accuracy: Should be better than ±0.05%.</td>
</tr>
<tr>
<td>Reference junction compensator</td>
<td>☑</td>
<td>0°C ±0.2°C</td>
</tr>
<tr>
<td>Thermocouple for test</td>
<td>☑</td>
<td>Same type of thermocouple as input type</td>
</tr>
<tr>
<td>Standard variable resistor</td>
<td>☑</td>
<td>Accuracy: Should be better than ±0.05%.</td>
</tr>
<tr>
<td>3-core copper wire</td>
<td>☑</td>
<td>Three copper wires shall have the same resistance values.</td>
</tr>
</tbody>
</table>

2) Connection

Connections depend upon the input types. See the next page.

3) Before starting adjustments

(1) Mount the terminal board cover and turn on the power supply.
(2) Before starting adjustments, warm up your recorder for at least 30 minutes until it becomes stable. (It is recommended to warm up for at least one hour if possible.)

Remarks

Checking

Check and adjustments of the measured values need meticulous work in addition to the standard tools and reference conditions.

If you need checks or adjustments of the measured values, please consult your nearest CHINO’s agent.
21. MAINTENANCE

21.3 Measured Values Check

3 Connections
Connections depend upon the input types. Connect both standard and other tools to the measuring input terminals to be adjusted.

⚠️ Caution  Turn off the power source before starting connections
In order to prevent electric shock, turn off the power source before starting connections.

(1) In case of thermocouple input
The electromotive force of the thermocouple input is reduced by an amount proportional to the temperature at the terminals. The recorder itself compensates (reference junction compensation) for this reduction. The adjustment is executed by inputs based on the reference electromotive force (0°C reference). In case the “RJ selection” is set to “1” (Enable) in the “Range/Printing range” programming, an amount equivalent to the reference junction compensation has to be subtracted using a reference junction compensator.

(2) DC voltage input

(3) Resistance thermometer input

4 Checking Method
Input the printing range (T) of 0%, 50% and 100% from a standard tool and obtain an error (e) by reading the measured values (M).

\[
e(\%) = \frac{M - T}{T} \times 100
\]
21. MAINTENANCE 21.4 Troubleshooting

Troubleshooting methods are shown classified by symptoms. Read the item that corresponds to the symptom.

⚠️ **Caution**  Repair and modifications

Never repair or modify the instrument by replacing assembled component units or parts, otherwise correct repair or modifications cannot be executed and also electric shock or damage of your recorder may occur.

## 1. Not Working

<table>
<thead>
<tr>
<th>Check</th>
<th>Causes and remedial measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Check if power is supplied to the power terminals.</td>
<td>Turn on the external power supply source.</td>
</tr>
<tr>
<td>2) Check if the power supply is as specified.</td>
<td>Supply the specified power (100 to 240V AC and 50/60 Hz).</td>
</tr>
<tr>
<td>3) Check if the connections to the power terminals are correct.</td>
<td>Connect the cable to the power terminals (L, N) correctly.</td>
</tr>
<tr>
<td>4) Try turning off or on the external power supply source.</td>
<td></td>
</tr>
<tr>
<td>5) Initialize the parameters and check if your recorder recovers to normal conditions. See Section 20. (Caution) All parameters become the default values. Program them again.</td>
<td></td>
</tr>
</tbody>
</table>

## 2. Measured Value Abnormal

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Causes and remedial measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Measured values are unstable.</td>
<td>• Check if the measuring terminals are loose. • Check if the input signal is unstable. • Check if the thermocouple is connected with another instrument in parallel and the burnout function is programmed to [Enable].</td>
</tr>
<tr>
<td>2) Check if the measured value is displayed as shown below.</td>
<td>• Check if the input terminals are connected correctly. • Check if the input terminals are loose. • Check if the input signal wires are disconnected. • Check if the input signal exceeds the measuring range.</td>
</tr>
<tr>
<td>3) An error occurs.</td>
<td>• Check if the selection of ºC/ºF computation is correct. • Check if the input signal is correct. • Check if an extension wire is connected to the input terminal. (Thermocouple input type only) • Check the scale and adjust the measured values if any error is detected. (See Section 18.1.)</td>
</tr>
<tr>
<td>4) Influences by ambient temperature (Thermocouple input type only)</td>
<td>• Check if the RJ selection is 0 (disable) in [Range/Printing range] programming. (This is negligible if reference junction compensation is executed externally.) • Check if the terminal cover is mounted.</td>
</tr>
</tbody>
</table>
### 21. MAINTENANCE

#### 21.4 Troubleshooting

#### 3 Display Abnormal

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Causes and remedial measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Measured value blinks.</td>
<td>Measured value of the channel in which an alarm activates. See Section 10.3.</td>
</tr>
<tr>
<td>2) Measured value is blank.</td>
<td>No measured value is displayed for the skipped channel.</td>
</tr>
<tr>
<td>3) Year, month, day, hour and minute are displayed.</td>
<td>This is one of the operation screens (Clock display). See Section 6.4.</td>
</tr>
<tr>
<td>4) “قترن” is displayed at the left end.</td>
<td>This is one of the operation screens (Alarm activation screen). See Section 6.4.</td>
</tr>
</tbody>
</table>

#### 4 Printing Abnormal

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Causes and remedial measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) No printing is executed.</td>
<td>• Check if the printer is turned off. See Section 6.2. • Check if the cassette ribbon is mounted normally.</td>
</tr>
<tr>
<td>2) Digital printing is not executed.</td>
<td>All digital printings are not executed if the chart speed is programmed to be faster than 150mm/h. See Section 10.2.</td>
</tr>
<tr>
<td>3) Printing color is pale.</td>
<td>Replace the cartridge pen or the plotter pen.</td>
</tr>
<tr>
<td>4) Chart paper feed is abnormal.</td>
<td>• Check if the chart paper is unlatched from the sprocket. • Check if the chart paper cassette is securely inserted into the internal unit. • Check if the chart paper has been shuffled before loading it.</td>
</tr>
</tbody>
</table>

#### 5 Other Troubles

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Causes and remedial measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Keys are not acceptable.</td>
<td>Keys are locked. Unlock them. See Section 11.12.</td>
</tr>
<tr>
<td>2) Parameters cannot be changed.</td>
<td>To store parameters to be programmed for each channel, press [SHIFT] and [SHIFT+1] simultaneously. If not, parameters are not stored into memory. See Section 8.2 and other sections for programming.</td>
</tr>
<tr>
<td>3) Parameters remain unchanged after changing them.</td>
<td></td>
</tr>
</tbody>
</table>

#### Request

If the above troubleshooting cannot solve your problem, certain parts may be defective. Check the following items and contact your CHINO’s sales agent.

1. Model
2. Serial No.
3. Details of trouble
4. Other symptoms found
21. MAINTENANCE

21.5 Recommended Parts Replacement Intervals

It is recommended to replace parts periodically as a preventive measure to enable the use of your recorder under ideal conditions over long periods of time.

⚠️ Caution ⚠️ Replacement of parts

Do not replace any parts other than consumable chart paper and pens, otherwise your recorder cannot be recovered correctly and a dangerous accident may occur. Consult CHINO’s sales agent for replacing parts.

1. Operation conditions

The recommended parts replacement intervals apply when your recorder is used under the following conditions. The replacement intervals could be shortened if the ambient conditions are worse than the followings.

<table>
<thead>
<tr>
<th>Items</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>20 to 25°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH</td>
</tr>
<tr>
<td>Operation hours</td>
<td>8 hours/day</td>
</tr>
<tr>
<td>Corrosive gas</td>
<td>Shall be free of corrosive gases</td>
</tr>
</tbody>
</table>

2. Recommended intervals of parts replacement

1) Parts to be mounted (Consumable parts)

<table>
<thead>
<tr>
<th>Part names</th>
<th>Recommended intervals</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart paper (AL3000)</td>
<td>10 m (Standard)</td>
<td>20 days In case of continuous use with a chart speed of 20 mm/h</td>
</tr>
<tr>
<td></td>
<td>16 m (Option)</td>
<td>30 days In case of continuous use with a chart speed of 25 mm/h</td>
</tr>
<tr>
<td>Chart paper (AH3000)</td>
<td>30 days</td>
<td></td>
</tr>
<tr>
<td>Cartridge pen</td>
<td>2km</td>
<td>Could be shorter than 2 km depending on chart paper speed, pen speed and ambient temperature/humidity.</td>
</tr>
<tr>
<td>Plotter pen</td>
<td>100,000 characters</td>
<td>Could be less than 100,000 characters depending on chart paper speed and ambient temperature/humidity.</td>
</tr>
</tbody>
</table>

2) Component parts

<table>
<thead>
<tr>
<th>Part names</th>
<th>Recommended intervals</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen servo (for cartridge pen)</td>
<td>4 to 6 years</td>
<td></td>
</tr>
<tr>
<td>Pen servo (for plotter pen)</td>
<td>4 to 6 years</td>
<td></td>
</tr>
<tr>
<td>Chart drive mechanism</td>
<td>6 to 8 years</td>
<td></td>
</tr>
<tr>
<td>Motor (for chart paper)</td>
<td>4 to 6 years</td>
<td></td>
</tr>
<tr>
<td>Motor (for plotter pen)</td>
<td>4 to 6 years</td>
<td></td>
</tr>
<tr>
<td>Motor (for cartridge pen)</td>
<td>4 to 6 years</td>
<td></td>
</tr>
<tr>
<td>Power supply unit</td>
<td>5 years</td>
<td>Under an ambient temperature of 25°C</td>
</tr>
<tr>
<td>Display unit</td>
<td>4 to 6 years</td>
<td></td>
</tr>
<tr>
<td>Sheet switch (key)</td>
<td>4 to 6 years</td>
<td></td>
</tr>
<tr>
<td>Mechanical relay for alarm output</td>
<td>70,000 times</td>
<td>Resistive load (rated contact capacity or less)</td>
</tr>
<tr>
<td></td>
<td>20,000 times</td>
<td>Inductive load (rated contact capacity or less)</td>
</tr>
<tr>
<td>EEPROM</td>
<td>7 years</td>
<td>Able to re-write about 100,000 times or less</td>
</tr>
<tr>
<td>Lithium battery</td>
<td>7 years</td>
<td></td>
</tr>
</tbody>
</table>
22. SPECIFICATIONS

1 Input Specifications

Number of measuring points: 1, 2, 3 and 4 points

Input signals: DC voltage (mV) … ±13.8, ±27.6, ±69.0, ±200 ±500
   DC voltage (V) … ±2, ±5, ±10, ±20, ±50 (Built-in voltage divider for ±5 V or more)
   DC current…Available by adding shunt resistor (option)
Thermocouple…B, R, S, K, E, J, T, N,
NiMo-Ni, CR-AuFe, PtRh40-PtRh20
WRe5-WRe26, W-WRe26, PlatineI I, U, L
Resistance thermometer…Pt100 (1), Pt100 (2), JPt100, Pt50, Pt-Co

Range: Program range number and printing range for each channel with key operation. (See Section 8.2 for range No. list)

Scale: Program minimum and maximum values with key operation.
   Programming range…-9999 to 99999
   Decimal point … Program arbitrary

Measuring range: Refer to the list of range No. in Section 8-2.

Minimum printing range: Refer to the following table

| Input signal source resistance: | DC voltage | ±1/5 or higher than the measuring range. |
| Resistance thermometer | Pt100 | 100°C span or more |
| Pt50 | 200°C span or more |

Accuracy rating: Refer to item 8 (at reference operating condition).

Temperature drift: ±0.01% full scale/°C (converted into reference range)

Measuring cycle: About 100 msec (CH1 to CH4)

Reference junction compensation: Inside (enable) or external (disable) is selectable.

Reference junction compensation accuracy: K, E, J, T, N and PlatineII : ±0.5°C or less
   Other than the above*: ±0.1°C or less
   *Except PtRh40-PtRh20

Input resolution: Approx. 1/56000 (converted into reference range)

Burnout: Effective input… Thermocouple, resistance thermometer
   Programming range …Selection from up-scale, down-scale or disable for each channel

Allowable signal source resistance:
   DC voltage inputs, thermocouple inputs
      …1kΩ or less*
   Resistance thermometer inputs
      …10Ω or less
   * Without burnout

Input resistance: Thermocouple input …About 8MΩ
   DC voltage inputs (range of ±2 V or less)
      …About 8MΩ
   DC voltage inputs (range of ±5 V or less)
      …About 1MΩ

Maximum input voltage

| DC voltage | ±10 V DC or less (range of ±2 V or less) |
| Resistance thermometer | ±6 V DC or less |

Input correction: Shift programming for each channel

Input filter: Program primary delay filter 1 to 10 sec. and "0" (none) for each channel.

Maximum common mode voltage: 30VAC
Common mode rejection ratio: 140 dB or more (50/60 Hz)
Series mode rejection ratio: 50 dB or more (50/60 Hz)
Terminal board: Detachable and removable for wiring

2 Printing

Printing accuracy: Measuring accuracy + ±0.3% of printing range (under the reference operation condition)

Printing dead and: 0.2% of printing range

Printing system:
   Trace printing… Disposable cartridge pen
   Digital data printing … Plotter pen

Step response:
   AL3000 … 1 sec. or less (90% response)
   AH3000 … 1.5 sec. or less (90% response)

Print color:
   Trace printing … 1st pen (Red), 2nd pen (Green),
   3rd pen (Blue), 4th pen (Brown)
   Digital data printing … Purple

<<Digital printing>>

1. Periodic : Printing of time, channel No., measured values and engineering unit with programmed interval
2. Digital data : Printing of time, channel No., measured values and engineering unit with trace printing on demand
3. Year, Month, day, time, time line
   : Printing of year, month, day and time when turning on the power. Printing time line and time every on the hour. Printing year, moth and day at 00:00 and every specific interval
4. Channel No., scale, tag : Printing of scale, channel No. and tag (only if they are programmed) with every specific interval
5. Chart speed : Printing of chart speed with every specific interval
6. Alarm : Printing of time, channel No., alarm type and alarm level when an alarm activates. Printing time, channel No. and alarm level when the alarm is reset. Memory volume is max. 48 data
7. Programming change mark : Marking when changed parameters are stored
8. POC mark : Marking when time-axis synchronization is programmed
9. List printing : Printing of parameters (list 1 or 2) on demand
   List 1: Chart speed, range/printing range, scale, subtract printing, periodic data printing, printing format and alarm
   List 2: Chart speed (3 speeds), alarm output, time-axis synchronization, remote contacts and math expression
   List 3: All parameters (List 1 + List 2)
22. SPECIFICATIONS

Message: Printing of message in message No. selected
Numbers of message: Max. 5
Message programming: Max. 15 digits

Chart paper: Depending on models

<table>
<thead>
<tr>
<th>Model</th>
<th>System</th>
<th>Printing width</th>
<th>Total width</th>
<th>Total length</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL3000</td>
<td>Folding type</td>
<td>100mm</td>
<td>114mm</td>
<td>10m</td>
</tr>
<tr>
<td>AH3000</td>
<td>Folding type</td>
<td>180mm</td>
<td>200mm</td>
<td>20m</td>
</tr>
</tbody>
</table>

Chart speed: 1 to 600mm/h, 1 to 200mm/h
Default AL3000: 20mm/h
AH3000: 25mm/h

Chart speed accuracy: Within ±0.1%, For the chart scale after feeding 1000mm or more.

Skip function: No display or printing is executed for the channels for which no range is programmed.

Time axis synchronization: On or off selectable with key operation

Subtract printing: Printing of difference between measured value and reference channel (or reference value)

Pen lift: Pens are automatically lifted up when printing is off.

3 Indication and Display

Trace printing indication: Bargraph display for each channel

<table>
<thead>
<tr>
<th>Model</th>
<th>No. or segment</th>
<th>Channel color segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL3000</td>
<td>51</td>
<td>5-segment each</td>
</tr>
<tr>
<td>AH3000</td>
<td>101</td>
<td>10-segment each</td>
</tr>
</tbody>
</table>

Digital display: 16- and 7-segment LCD with cursor
- 16-segment: Character height: 7.5 mm, orange
- 7-segment: Character height: 6.5 mm, white

<table>
<thead>
<tr>
<th>Model</th>
<th>Model</th>
<th>Segment</th>
<th>No. of digits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL3000</td>
<td>16-segment</td>
<td>7-segment</td>
<td>20 digits</td>
</tr>
<tr>
<td>AH3000</td>
<td>16-segment</td>
<td>7-segment</td>
<td>30 digits</td>
</tr>
</tbody>
</table>

Display items: Simultaneous display of measured values for all channels, Year/month/day (only AL3000)
- Time
- Chart speed
- Alarm status

Display switching: Each time DISP key is pressed, the display item changes.
AL3000: [□] → [□] → [□] → [□]
AH3000: [□] → [□] → [□] → [□]

Measured value display: -9999 to 99999 for each channel
Decimal point can be placed at desired position with the scale programming.

Status: Following 6 status lamps are available.

<table>
<thead>
<tr>
<th>Display text</th>
<th>Condition to light</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECORD ON</td>
<td>Printing ON</td>
<td>Green</td>
</tr>
<tr>
<td>KEY LOCK</td>
<td>Key lock</td>
<td>Blue</td>
</tr>
<tr>
<td>ALARM</td>
<td>Alarm occurrence</td>
<td>Red</td>
</tr>
<tr>
<td>CHART END</td>
<td>Just before chart paper ends</td>
<td>Red</td>
</tr>
<tr>
<td>FAIL</td>
<td>Hardware related to servo mechanism abnormal</td>
<td>Red</td>
</tr>
<tr>
<td>POC</td>
<td>Time axis sync. ON</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Chart illumination: CFL

4 Alarm

Alarm point: Numbers of channel x numbers of level (4)

Alarm display: Alarm status lamp lights and the measured value blinks at alarm activated channel.
Alarm display screen indicates alarm channel and alarm type at level digit.

Alarm type: Selectable from the following 10 types for each alarm point

<table>
<thead>
<tr>
<th>Absolute value</th>
<th>E: High limit with standby</th>
<th>F: Low limit with standby</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate-of-change</td>
<td>U: Increase limit</td>
<td>D: Decrease limit</td>
</tr>
<tr>
<td>Difference</td>
<td>B: Differential high limit with standby</td>
<td>J: Differential low limit with standby</td>
</tr>
</tbody>
</table>

*1: Variation range per unit time (Note)
(Note) Measuring cycle x measuring count (1 to 20)
*2: Difference between two channels

Alarm deadband: 0.1 to 9.9% of scale programming range
Alarm output: Option

5 Programming and Operation

Key types: See Section 7.1.
Key functions: See Section 7.2.

Basic operation: Basic operation with keys
- Printing ON/OFF
- Chart paper feeding
- Operation screen switching

Operation: Operation with keys
- Selection of Digital data printing
- List printing
- Message printing
- Printing format
- Operation record position

*1: Operation with remote contacts (option) is also available
*2: Only available with option

Pen change mode: Pen moves to the position to be easily changed.

Standard programming:
- Range/printed range, °C/°F computation, chart speed, time, scale, skip, subtract printing, alarm, alarm deadband, periodic time printing, engineering unit, tag, message, burnout, passcode/key lock, input filter

Optional programming:
- Alarm output...Relay No., AND/OR, output mode
- Remote contacts...Terminal allocation for operation, chart speeds, operation record position
- Printing format...Automatic range-shift printing, compressed/expanded, zone printing
- Communications interface...Communications protocol, communications specifications
- Math expression...Selection of types, parameters

Totalization: Starting time, interval

Engineering port: All parameters can be programmed with engineering software "PASS" (option) installed on a personal computer
## 22. SPECIFICATIONS

### 6 Operation Conditions

**Operation conditions:** Refer to the following table

<table>
<thead>
<tr>
<th>Items</th>
<th>Reference operation</th>
<th>Normal operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>21 to 25°C</td>
<td>31 to 50°C*</td>
</tr>
<tr>
<td>Max. ambient humidity</td>
<td>80%RH</td>
<td>80%RH</td>
</tr>
<tr>
<td>Min. ambient humidity</td>
<td>20%RH</td>
<td></td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>100VAC ± 1%</td>
<td>90 to 264VAC</td>
</tr>
<tr>
<td>Power supply frequency</td>
<td>50/60Hz ± 0.5%</td>
<td>50/60Hz ± 2%</td>
</tr>
<tr>
<td>Posture</td>
<td>Left/right: 0°</td>
<td>0 to 10°</td>
</tr>
<tr>
<td></td>
<td>Forward tilting: 0°</td>
<td>0°</td>
</tr>
<tr>
<td></td>
<td>Backward tilting: 0°</td>
<td>0 to 30°</td>
</tr>
</tbody>
</table>

*Decrease from 80% RH at 31°C, and decrease to 50% at 40°C

**Transportation condition:**
- Ambient temperature/humidity: -20 to 60°C, 5 to 90%RH (without condensation)
- Vibration: 10 to 60Hz, 4.9 m/s²
- Impact: 392 m/s²
* When shipping out from a factory

**Storage condition:**
- Ambient temperature/humidity: -20 to 60°C, 5 to 90%RH (without condensation)

### 7 General specifications

**Rated power voltage:** 100 to 240 VAC, 50/60 Hz

**Power consumption:** Maximum 60V A

**Power failure protection:** Programmed parameters stored into EEPROM memory. Clock circuit sustained for minimum 8 years by a lithium battery. (8 hours operation per day)

**Insulation resistance:**
- Between primary and protective conductor terminals: …20MΩ or more at 500 V DC
- Between secondary and protective conductor terminals: …20MΩ or more at 500 V DC
- Between primary and secondary terminals: …20MΩ or more at 500 V DC

**Dielectric strength:**
- Between primary and protective conductor terminals: …1 minute at 1500 V AC
- Between secondary and protective conductor terminals: …1 minute at 500 V AC
- Between primary and secondary terminals: …1 minute at 2300 V AC

**Primary terminals:** Power terminals, Alarm output terminals (MOS relay, mechanical relay “a” contact)

**Secondary terminals:** Measuring input terminals, Remote contacts terminals, Communications interface terminals, Alarm output terminals (Mechanical relay “c” contact)

**Case assembly material:** Door Frame … ABS resin
- Front plate: Polycarbonate
- Enclosure: Steel

**Color:** Door … Frame: Black (equivalent to Munsell N3.0)
- Front plate: Transparent
- Enclosure: Gray (equivalent to Munsell N7.0)

**Mounting:** Panel mounting

**Terminal screws:** Power terminals … M4.0
- Terminals other than above … M3.5

**Weight:** AL3000 … Approx. 4.0 kg (with fully options)
- AH3000 … Approx. 9.0 kg (with fully options)

**Dimension:** AL3000 … 144 x 144 x 258 (mm)
- AH3000 … 288 x 288 x 220 (mm)

**Panel cutout:** AL3000 … 138 x 138 (mm)
- AH3000 … 281 x 281 (mm)

**Clock accuracy:** Within ±2 minutes per 30 day
- (Under reference operating conditions, Excerpt errors when power supply is turned on or off)

**Packing material:** Layered cardboard is used as cushion material

### 8 Safety Regulations

**CE:** Conforms to EMC and low voltage directives

**UL:** UL3111-1 (Approval pending)

**CSA (C-UL):** CSA … C22.2 No.1010 (Approval pending)

**IP:** Conforms to IEC629 IP54
# 22. SPECIFICATIONS

## 9. Accuracy Ratings

<table>
<thead>
<tr>
<th>No.</th>
<th>Input type</th>
<th>Measuring range</th>
<th>Reference range</th>
<th>Accuracy rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>DC (mV)</td>
<td>-13.80 to 13.80mV</td>
<td>±13.8mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>02</td>
<td>DC (mV)</td>
<td>-27.60 to 27.60mV</td>
<td>±27.6mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>03</td>
<td>DC (mV)</td>
<td>-69.00 to 69.00mV</td>
<td>±69.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>04</td>
<td>DC (mV)</td>
<td>-200.0 to 200.0mV</td>
<td>±200.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>05</td>
<td>DC (mV)</td>
<td>-500.0 to 500.0mV</td>
<td>±500.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>06</td>
<td>DC (mV)</td>
<td>-2.000 to 2.000V</td>
<td>±200.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>07</td>
<td>DC (mV)</td>
<td>-5.000 to 5.000V</td>
<td>±500.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>08</td>
<td>DC (mV)</td>
<td>-10.000 to 10.000V</td>
<td>±1000.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>09</td>
<td>DC (mV)</td>
<td>-20.000 to 20.000V</td>
<td>±2000.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
<tr>
<td>10</td>
<td>DC (mV)</td>
<td>-50.000 to 50.000V</td>
<td>±5000.0mV</td>
<td>±0.1% ± 1 d</td>
</tr>
</tbody>
</table>

### Exceptions to accuracy rating

<table>
<thead>
<tr>
<th>Input type</th>
<th>Measuring range</th>
<th>Accuracy rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>K, E, J, T, L</td>
<td>-200 to 0°C</td>
<td>±0.2% ± 1 d</td>
</tr>
<tr>
<td>R, S</td>
<td>0 to 400°C</td>
<td>±0.2% ± 1 d</td>
</tr>
<tr>
<td>B</td>
<td>0 to 400°C</td>
<td>±0.15% ± 1 d</td>
</tr>
<tr>
<td>N, U</td>
<td>0 to 100°C</td>
<td>±0.3% ± 1 d</td>
</tr>
<tr>
<td>W-WRe26</td>
<td>100 to 300°C</td>
<td>±0.5% ± 1 d</td>
</tr>
<tr>
<td>PtRh40-PtRh20</td>
<td>0 to 300°C</td>
<td>±1.5% ± 1 d</td>
</tr>
<tr>
<td>CR-AuFe</td>
<td>0 to 50K</td>
<td>±0.5% ± 1 d</td>
</tr>
<tr>
<td>Pt100 (97)</td>
<td>700 to 850°C</td>
<td>±0.15% ± 1 d</td>
</tr>
</tbody>
</table>

Note) Thermocouple input is converted into the reference range.
10 Option

1) Alarm outputs

Output types:
- Alarm point output
- FAIL output
- Chart paper end (C.End) output

Numbers of outputs:
- AL3000 ... 6 points
- AH3000 ... 6 or 12 points

Contact capacity (with resistive load):
- MOS relay output ... 240 V (AC, DC), 50 mA (AC, DC)
- Mechanical relay (Common for “a” and “c” contacts) ... 100VAC 0.5 A, 240VAC 0.2 A, 100VDC 0.3 A

Output wiring:
AND/OR output selection is available for each alarm points (including FAIL and C.End)

Relay coil phase:
Energize/Not energize selectable*

Relay output latch:
Hold/Not hold selectable*

Alarm display latch:
Hold/Not hold selectable*

*Common to all relays

Dimension:
The following length will be added for the depth.
- AL3000 ... 14 mm (MOS relay, Mechanical “c” contact)
- 25 mm (Mechanical “a” contact)
- AH3000 ... 16 mm (MOS relay, Mechanical “c” contact)
- 27 mm (Mechanical “a” contact)

2) Remote contacts

Input terminals:
- 4 points (Common terminals: 2 points)

Input signal:
Contact (Open/Shorted)

Voltage when the contact is open:
Approx. 5 V

Current when the contact is shorted:
Approx. 2 mA

Operations:
Up to 4 input terminals can be selectable in the following table.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Printing ON/OFF, 3 chart speeds</td>
<td>2</td>
</tr>
<tr>
<td>② Message (No.1 to No.5) printing</td>
<td>4</td>
</tr>
<tr>
<td>③ Message (No.1 and No.2) printing</td>
<td>2</td>
</tr>
<tr>
<td>④ Digital data printing</td>
<td>1</td>
</tr>
<tr>
<td>⑤ List 1 printing</td>
<td>1</td>
</tr>
<tr>
<td>⑥ List 2 printing</td>
<td>1</td>
</tr>
<tr>
<td>⑦ List 3 printing</td>
<td>1</td>
</tr>
<tr>
<td>⑧ Operation record A</td>
<td>1</td>
</tr>
<tr>
<td>⑨ Operation record B</td>
<td>1</td>
</tr>
<tr>
<td>⑩ Operation record C</td>
<td>1</td>
</tr>
<tr>
<td>⑪ Operation record D</td>
<td>1</td>
</tr>
<tr>
<td>⑫ Reset of totalization*</td>
<td>1</td>
</tr>
</tbody>
</table>

*This operation is only available for the “totalization” (option).

3) Printing format

Trace printing format:
- Automatic range shift
- Compressed/Expanded

Compressed/Expanded or Zone scale, is selectable for each channel. The format ③ is common to all channels.

<table>
<thead>
<tr>
<th>Automatic range-shift</th>
<th>Printing area can be divided up to 5 ranges. It switches the range according to the measured values automatically for printing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed/Expanded</td>
<td>Specific printing range is compressed or expanded for printing.</td>
</tr>
<tr>
<td>Zone scale</td>
<td>Printing area is divided into 2 to 4 zones*. Data of each channel is printed in the relevant zone.</td>
</tr>
</tbody>
</table>

*AL3000 ... 2, AH3000 ... 2 to 4

4) Others

Options: Detail

Communications interface*
Specify one of the following modes.
- RS-232C, RS-422A, RS-485

Input resistance for current input*
Capable up to ±50mA DC by connecting an input resistance to the measuring input terminal.
- 100Ω: Applicable current ±50mA
- 250Ω: Applicable current ±20mA

Math expression*
One of following math expressions is selectable for each channel.
Addition, subtraction, multiplication, division, natural logarithm, logarithm, exponential, square root, temperature/humidity, maximum, minimum, average value, absolute value, data communications input*, flow rate compensation.
*This function is only available for the “communications interface” (option).

Totalizing*
Totalizing measured values and calculation results. Reset function is executed with programmed intervals or remote contacts signals*.
*This function is only available for the “remote contacts” (option).

Transmitter power supply*
Power supply unit for the transmitter generating input signal to the recorder

16 m chart paper
AL3000 only .... Total chart paper length of 15.6 m
* Exclusive instruction manual is provided.
CHINO CORPORATION
32-8, KUMANO-CHO, ITABASHI-KU, TOKYO 173-8632

Telephone: 81-3-3956-2171
Facsimile: 81-3-3956-0915

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