

SDC 300 MODEL SELECTION GUIDE

| | | | | |
|--------|---|----|-----|----|
| SDC300 | I | II | III | IV |
|--------|---|----|-----|----|

| | | | | |
|-----|-----|-------------------------------------|---------------------------------|---|
| I | O D | CONTROL OPERATION OUTPUT | | Time Proportioning PID, Relay Output |
| | 2 G | CONTROL OPERATION OUTPUT | | Position Proportioning PID, Relay Output for Modutrol Motor |
| | 5 G | CONTROL OPERATION OUTPUT | | Current Output PID, 4-20mA DC Output |
| | 6 D | CONTROL OPERATION OUTPUT | | Time Proportioning PID, 8V DC Pulse Voltage |
| II | T | 46 | INPUT RANGE | T (CC) -100 to 200°C |
| | J | 04 | | J (IC) 0 to 400°C |
| | E | 08 | | E (CRC) 0 to 800°C |
| | K | 04 | | K (CA) 0 to 400°C |
| | K | 08 | | K (CA) 0 to 800°C |
| | K | 09 | | K (CA) 0 to 1200°C |
| | S | 16 | | S (PR 10) 0 to 1600°C |
| | R | 16 | | R (PR 13) 0 to 1600°C |
| | B | 18 | | B (PR 6-30) 0 to 1800°C |
| | W | 20 | | W (W5WRe 26) 0 to 2000°C |
| | P | 45 | | P (JIS Pt 100Ω) -100.0 to 100.0°C |
| | P | 02 | | P (JIS Pt 100Ω) 0 to 200.0°C |
| | P | 03 | | P (JIS Pt 100Ω) 0 to 300°C |
| | P | 05 | | P (JIS Pt 100Ω) 0 to 500°C |
| | N | 35 | | Ni (Ni 508Ω) -50.0 to 150.0°C |
| | C | 01 | | Linear 4-20mA DC Programmable Range |
| V | 01 | Linear 1-5V DC Programmable Range | | |
| M | 01 | Linear 0-10mV DC Programmable Range | | |
| III | 0 | POWER SUPPLY VOLTAGE | AC 100/110V, 50-60 Hz | |
| | 4 | | AC 200/220V, 50-60 Hz | |
| IV | 00 | ADDED FUNCTION | None | |
| | Y0 | | With Event | |
| | PO | | With Programmable Range | |
| | Q0 | | With Programmable Range + Event | |

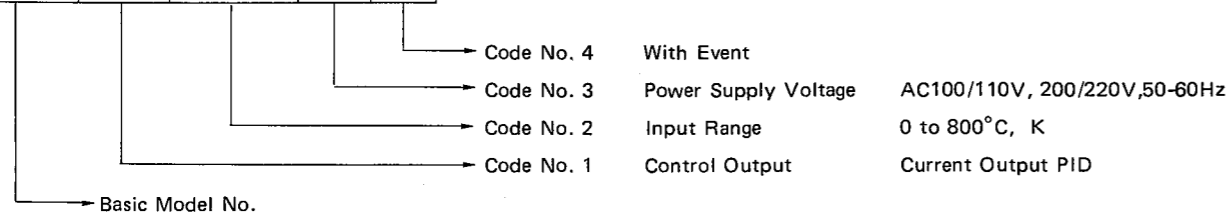
Note: 1. 4-20mA non-linear input with the above thermocouple or RTD range should be available as follows:

Ex. 4-20mA T/C type K09 → K59

2. PO and QO are applied only to C01, V01, and M01.

EXAMPLE:

| | | | | |
|--------|-----|------|-----|----|
| SDC300 | I | II | III | IV |
| | 5 G | K 08 | 0 | Y0 |



Specifications are subject to change without notice.

Yamatake-Honeywell

The SDC300 is a digital indicating controller which can accept a direct input from a thermocouple or a resistance thermometer or measure mV or mA direct.

The device is a microprocessor-based multi-function type digital indicating controller comprising a single-loop controller which controls process variables such as temperature, pressure, flow, or number of rotations.

A wide variety of relay contact output PID, current output PID, and trigger voltage output PID models are available. Each model is selected according to the application.

The main setting, control constant setting, and event setting can be made from the front keyboard. This instrument has, as a standard function, balanceless and bumpless Auto/Manual changeover.

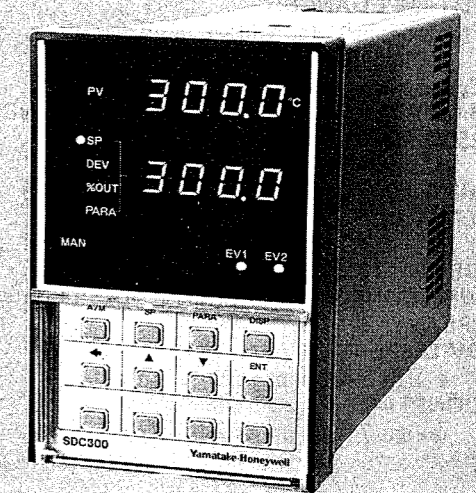
KEY FEATURES:

- All-digital indication
- Free scaling of temperature, pressure, or flow in a programmable range.
- High accuracy of ±0.25% F.S.
- Balanceless and bumpless type Auto/Manual changeover
- Overshoot protection algorithm
- Easy key manipulation
- Non-volatile memory
- Wide variety of event functions



DigitroniK Line

DIGITAL INDICATING CONTROLLER



SDC300 SERIES

*Trademark

Inquiries and orders direct to **Yamatake-Honeywell Co., Ltd.**
 2-12-19 Shibuya, Shibuya-ku, Tokyo, Japan
 Phone: (03) 486-2431 Telex: J22902 Cable: YAMATAKECO

Form number AI-2190E FEB., 1984

SPECIFICATIONS

COMMON SPECIFICATIONS

RATED POWER SUPPLY VOLTAGE:
100/110VAC or 200/220VAC 50/60Hz

ALLOWABLE POWER SUPPLY VOLTAGE:
90 to 121V at 100/110V rating
180 to 242V at 200/220V rating

INDICATION ACCURACY: $\pm 0.25\%F.S. \pm 1$ digit

SETTING ACCURACY: $\pm 0.25\%F.S.$

CONTROL CONSTANTS:

PROPORTIONAL BAND (P):
1 to 1000%F.S. (1% resolution)

RESET TIME (I):
1 to 3600 sec. (1 sec. resolution)

RATE TIME (D):
0 to 1200 sec. (1 sec. resolution)
"0" means OFF for derivative control action.

NORMAL OPERATION/REVERSE OPERATION:
Changeable by internal DIP switch.

TYPE OF INPUT: Thermocouple, resistance thermometer, DC voltage and DC current

INPUT IMPEDANCE:
Thermocouple and voltage inputs:
500K Ω MIN
Current input: less than 50 Ω

ALLOWABLE SIGNAL SOURCE RESISTANCE:
250 Ω MAX (Thermocouple, DC voltage)
4 Ω MAX (Resistance thermometer)

BURNOUT: Up-scale (Thermocouple input)

ALLOWABLE AMBIENT CONDITIONS:
0 to 50°C and lower than 90% RH at 40°C.

STORAGE TEMPERATURE: -20 to 60°C

POWER CONSUMPTION: 20VA MAX (at rated power)

DISPLAY:

PV DISPLAY:
4 digit 7 segment LED

CONSTANT VALUE DISPLAY:
4 digit 7 segment LED

EVENT:

NUMBER OF CHANNELS: 2 channels (Selectable from the following 3 types. Configurable by DIP switch.)

TYPE: 3 types
(PV event, DEV event, and |DEV| event)

SETTING RANGE:
PV event: 0 - 100% F.S.
DEV event: minus 50% of SPAN to plus 50% of SPAN (Settings at values lower than minus 999 can not be made for minus 50% of SPAN)
|DEV| event: 0 to 50% of SPAN

EVENT OUTPUT: SPDT relay
Rated 200VAC 1A (resistive load)

OUTPUT MODE: ON-OFF

DIFFERENTIAL:
0 to 200°C or 0 to 20.0°C or industrial unit.

SAMPLING CYCLE: 400 msec.

VIBRATION RESISTANCE: 0.5G MAX (10 to 60Hz)

SHOCK RESISTANCE: 50G MAX

INSULATION RESISTANCE: 50M Ω MIN
(DC500V megger) between case and each terminal.

WITHSTAND VOLTAGE: 1500VAC for 1 minute between case and each power supply terminal.

MOUNTING: Panel mounting

WEIGHT: About 1.8kg

COLOR: Moss-green

ACCESSORY KIT: Panel mounting brackets
Instruction Manual

INDIVIDUAL SPECIFICATIONS

| Model Number | Major Specifications |
|--------------|---|
| SDC3000D | Time proportioning PID/SPDT relay output Cycle time: 10 - 60 seconds (adjustable) Contact rating: 250VAC, 5A resistive load |
| SDC3002G | Position proportioning PID/Relay output for Modutrol Motor Differential: 0.6%OUT (fixed) Dead zone: 1 - 5%OUT (adjustable) |
| SDC3005G | Current output PID/4-20mA DC output Load resistance: 600 Ω MAX |
| SDC3006D | Time proportioning PID/Voltage output Output rating: 8.5VDC Cycle time: 1 - 6 seconds (adjustable) |

DIMENSIONS OF SDC300 & PANEL CUTOUT DIMENSIONS

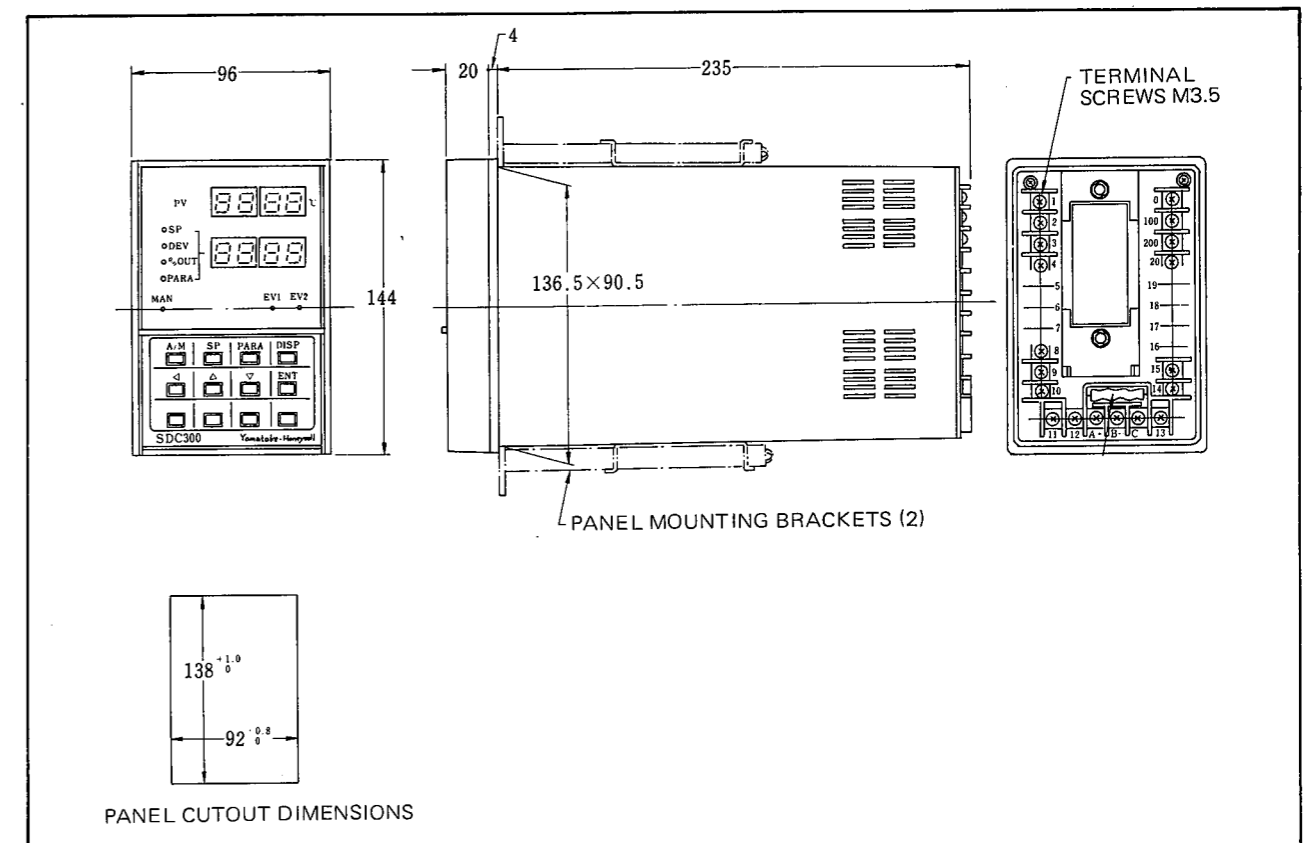


Fig. 1 External Dimensions & Panel Cutout Dimensions

INSTALLATION

(1) Environment

An extreme high temperature, high humidity, or dusty or corrosive atmosphere should be avoided. The ideal place is where the air is clean and dry and the temperature is stable. The allowable ambient temperature and humidity are 0 to 50°C and less than 90% RH at 40°C. The vibration resistance of instrument is more than 0.5 G (10 to 60 Hz).

(2) Installation Method (See Fig. 2)

The SDC300 is flush-mounted on a panel with panel mounting brackets at the top and bottom of the instrument housing. The customer terminals are located at the rear of the instrument.

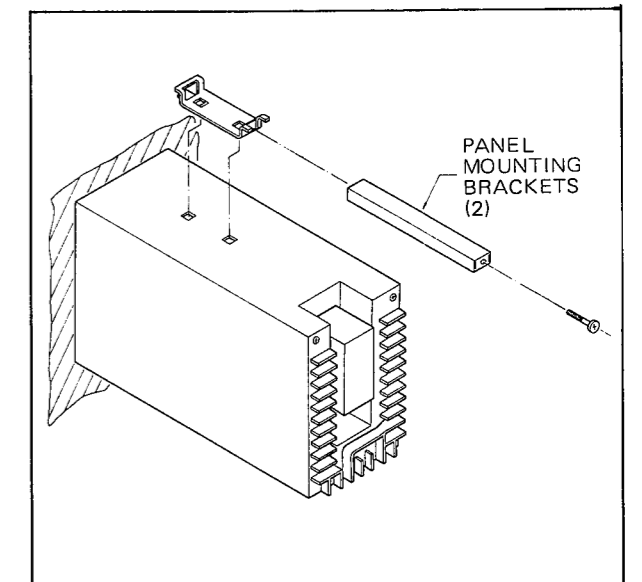


Fig. 2 Installation Method

WIRING

1. Wiring Precaution

- (1) All wiring must conform to local codes, and practices.
- (2) For the input signal wiring, use shielded cable as far as possible. (Recommend use of JIS 364 twisted pair polyethylene insulated and sheathed cable with shield)
Separate the input signal cable from the power line by more than 50 cm.
- (3) For the output signal wiring (4–20 mA DC, feedback resistance for Modutrol motor, and voltage pulse), the wiring must be the same as in (2).
For the relay output, use 600V grade polyvinyl chloride insulated wire.
- (4) For the power cable, use 600V grade polyvinyl chloride insulated wire. Use a line filter if the surge from the power cable is large. (Recommend use of ZAC2205-00 made by TDK.)
- (5) Install a CR suppressor or a surge absorber or noise sources like electromagnetic contactors, motors, etc. as necessary.
For a sharp surges, a CR suppressor is effective. For a pulse-type surge with a high peak value, a varistor is more effective.
- (6) Connect wires in accordance with the terminal symbols for external wiring. Use solderless terminals for connections.
- (7) Use compensation wires for the connections from the thermocouple to the ⊕ and ⊖ input terminals of the instrument. (See Table 2)
Use 3 leadwires of the same size for the connections from the resistance thermometer to the terminals A, B, and C.
- (8) Connect the power supply to terminals ⑩ and ⑪ for a 100 or 110V power source. Connect the power supply to terminals ⑩ and ⑫ for a 200 or 220V power source. The allowable range of supply voltage is 100/110V rating: 90 to 121 V
200/220V rating: 180 to 242V
- (9) No power supply switch or fuse is provided in the instruments. If required, they must be provided externally.

Table 2. Specifications for Compensation Wires

| Type | Thermocouple To be Used | Symbol | Use | Temp. Range (°C) | Surface Insulation Color |
|------------|-------------------------|---------|------------|------------------|--------------------------|
| Wire for R | R (PR) | RX - G | Regular | 0 - 90 | Black |
| | | RX - H | High temp. | 0 - 150 | |
| Wire for K | K (CA) | KX - G | Regular | -20 - 90 | Blue |
| | | KX - GS | | | |
| | | KX - H | High temp. | 0 - 150 | |
| Wire for E | E (CRC) | EX - G | Regular | -20 - 90 | Purple |
| | | EX - H | High temp. | 0 - 150 | |
| | | EX - HS | | | |
| Wire for J | J (IC) | JX - G | Regular | -20 - 90 | Yellow |
| | | JX - H | High temp. | 0 - 150 | |
| Wire for T | T (CC) | TX - G | Regular | -20 - 90 | Brown |
| | | TX - H | High temp. | 0 - 150 | |

2. Wiring Method

(1) SDC3000D

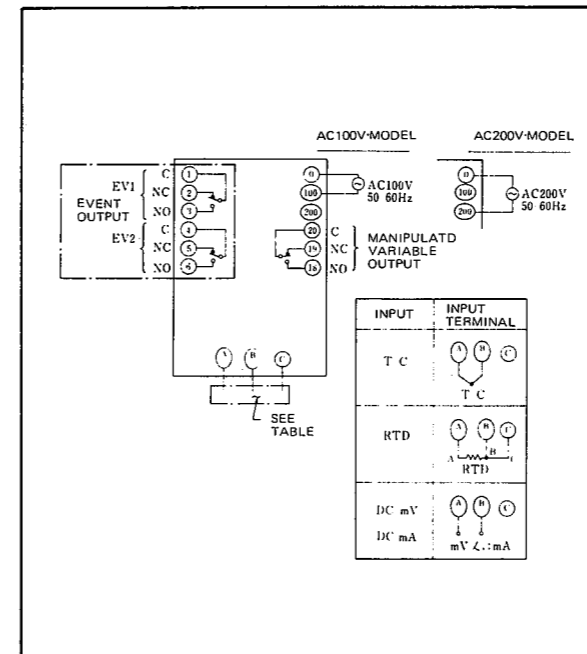


Fig. 3

(2) SDC3002G

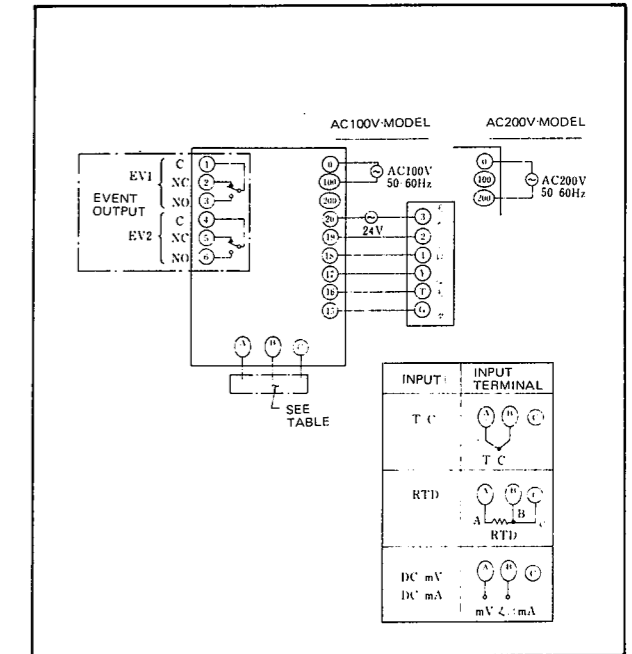


Fig. 4

(3) SDC3005G

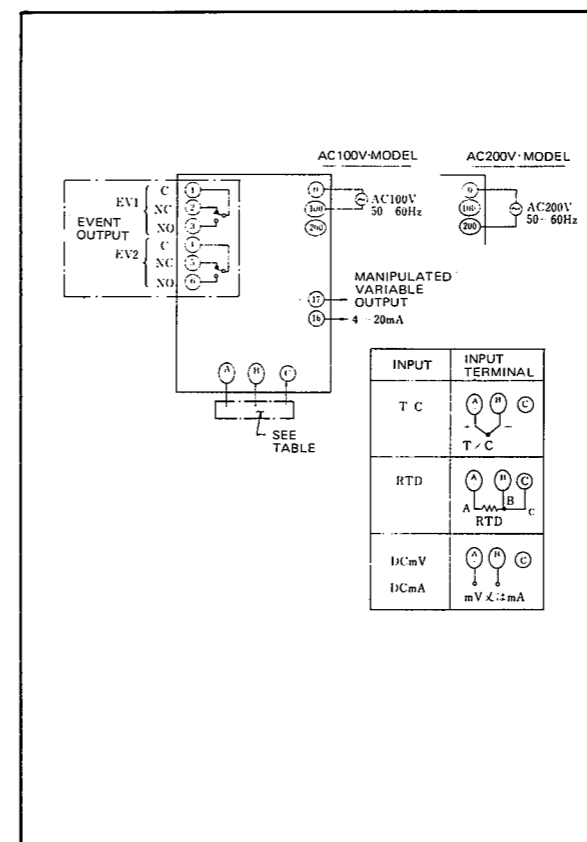


Fig. 5

(4) SDC3006D

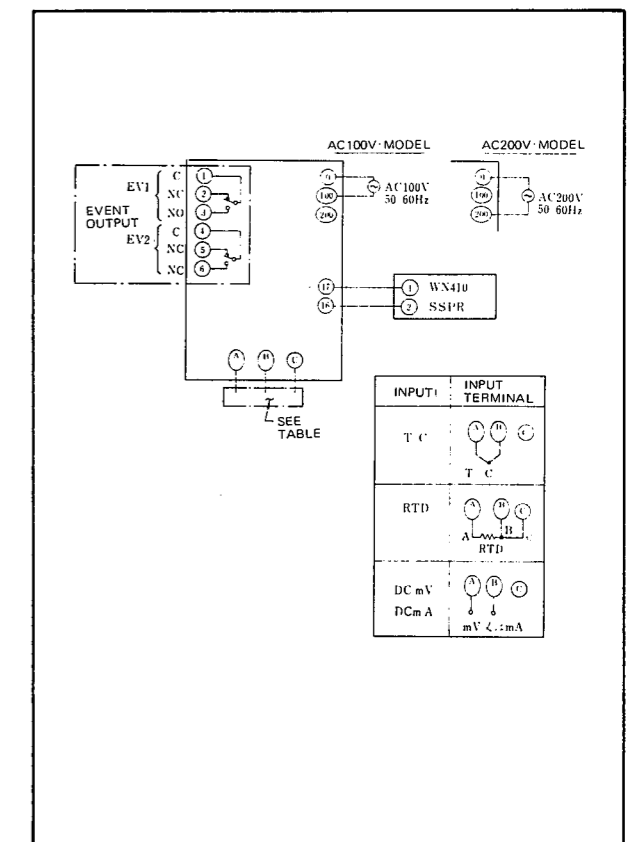


Fig. 6

START UP PROCEDURE

1. Checks Before Operation

- (1) Ensure that the AC line voltage is correct. Check that the connections to the terminals are correct.
- (2) Check that the thermocouple or converter leadwires (+, -) are connected to the correct terminals with the correct polarity. Check that the connections between the resistance thermometer and the instrument (A, B, and C) are correct.
- (3) After checking (1) and (2), turn ON the instrument power switch.
- (4) The instrument is set in automatic mode at shipment. Set to manual and then adjust the equipment settings. As setting values vary according to the load and equipment used, re-adjust the setting for new applications to achieve optimum control.

LAYOUT

1. Front Panel Layout

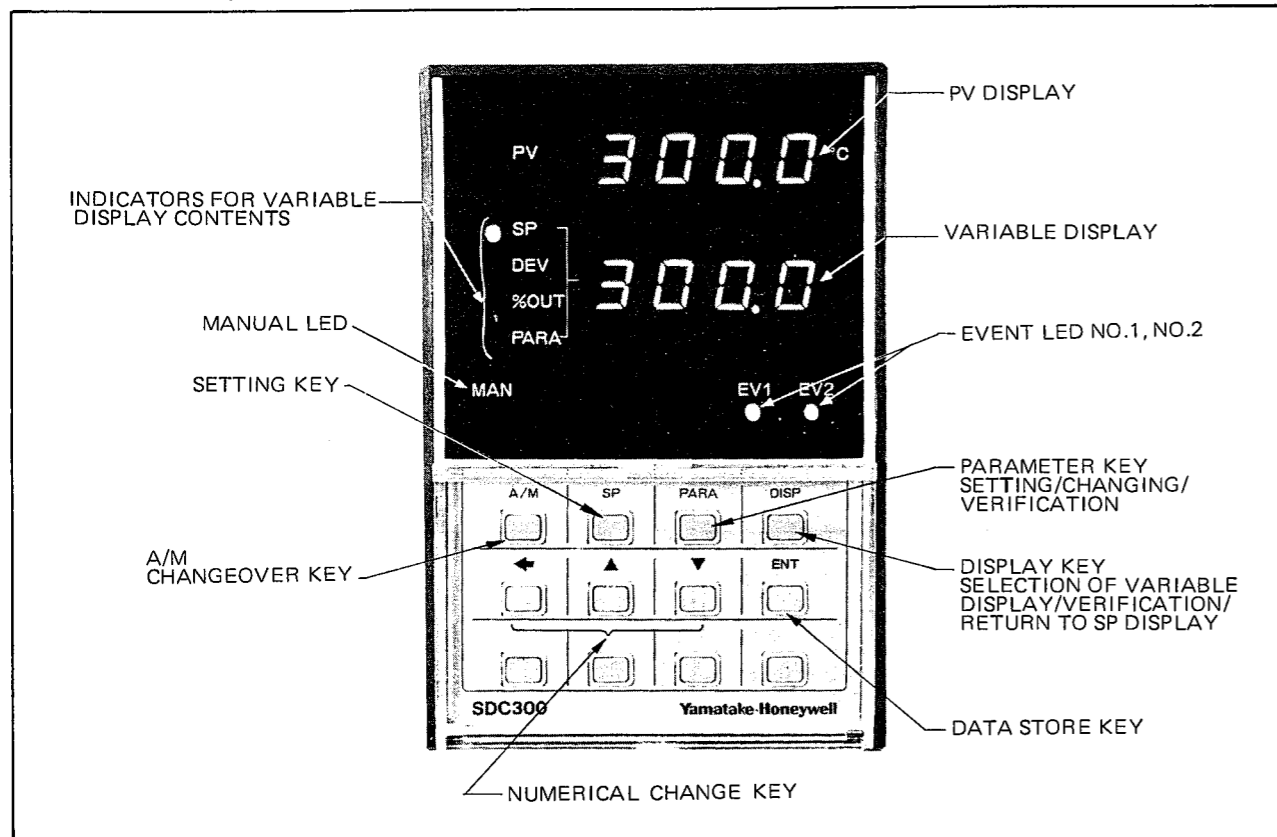


Photo. 1 SDC300 Front View Display (e.g. SDC3000D)

2. Keyboard Functions

- | | |
|-------------|--|
| A/M | Selects automatic (PID control) or manual operation. MAN LED lights when instrument is in manual mode. |
| S P | Used to adjust the settings or change the SP value (set point). |
| PARA | Used to adjust the settings or change the parameter values of PID, event, differential, etc. |
| DISP | Changes the display contents of the variable display in the order SP value, DEV value (PV minus SP), and %OUT value (output) in normal mode with each push of the key. (See Photo. 1) Used also when changing the SP value and when returning from parameter change mode to normal display mode. |
| ← | Used to change SP value or parameter value. The shift key shifts the blinking digit to the left (carry). However, the digit is returned from the 3rd digit position to the 1st digit position by an additional push of the shift key. The increment and decrement keys are used to change the value at the blinking digit. |
| ▲ | |
| ▼ | |
| ENT | When this key is depressed in the SP value change or parameter change mode, the value indicated in the variable display becomes effective. At the same time, the value is stored in the memory. Ensure that the digit blinking stops for a while at this time. This is not required for changing %OUT. |

3. Mode

The following 4 modes are available for the SDC300:

- ① Normal mode
- ② %OUT mode
- ③ SP value change mode
- ④ Parameter value change mode

For automatic operation, ①, ③, and ④ are selectable. For manual operation, ②, ③, and ④ are selectable.

(1) Normal Mode

With each push of the **DISP** key in the automatic mode, the variable display changes in the order indication → DEV indication → %OUT indication → SP indication. Although at this time a function display LED corresponding to each indication lights, the value of the display cannot be changed.

The value can be changed from automatic as follows:

- Push the **A/M** key to change to %OUT value change mode.
- Push the **SP** key to change to SP value change mode.
- Push the **PARA** key to change to parameter value change mode.

(2) %OUT Mode

In the manual operation mode, the %OUT value indicated on the constant value display can be changed by the 3 keys **←**, **▲**, and **▼**. At this time, the output is the manipulated variable identical to the displayed value.

The mode can be changed from manual as follows:

- Push the **A/M** key to change to automatic operation.
- Push the **SP** key to change to SP value change mode.
- Push the **PARA** key to change to parameter value change mode.

(3) SP Value Change Mode

In this mode, the SP value indicated on the variable display can be changed by the 3 keys of **←**, **▲**, and **▼**.

The values of the display become effective by a push of the **ENT** key. While pushing the **ENT** key, the blinking digits stop verifying the action of the **ENT** key.

By pushing the **DISP** key, this mode can be returned to automatic operation.

(4) Parameter Value Change Mode

In this mode, each parameter value indicated on the variable display can be changed by the 3 keys **←**, **▲**, and **▼**. While pushing the **ENT** key, the blinking digits stop verifying the action of the **ENT** key. By pushing the **DISP** key, this mode can be returned to normal mode.

With each push of the **PARA** key, the indication of the variable display changes in the order proportional band (P), integral control action (I), derivative control action (D), event No.1 (E1), event No.2 (E2), differential No.1 (F1), differential No.2 (F2), zero point (AO), span (A1), manual output value at power failure recovery (PO), and back to proportional band. At this time, the code corresponding to each parameter is indicated on the PV display. (Zero and span for models with optional specifications)

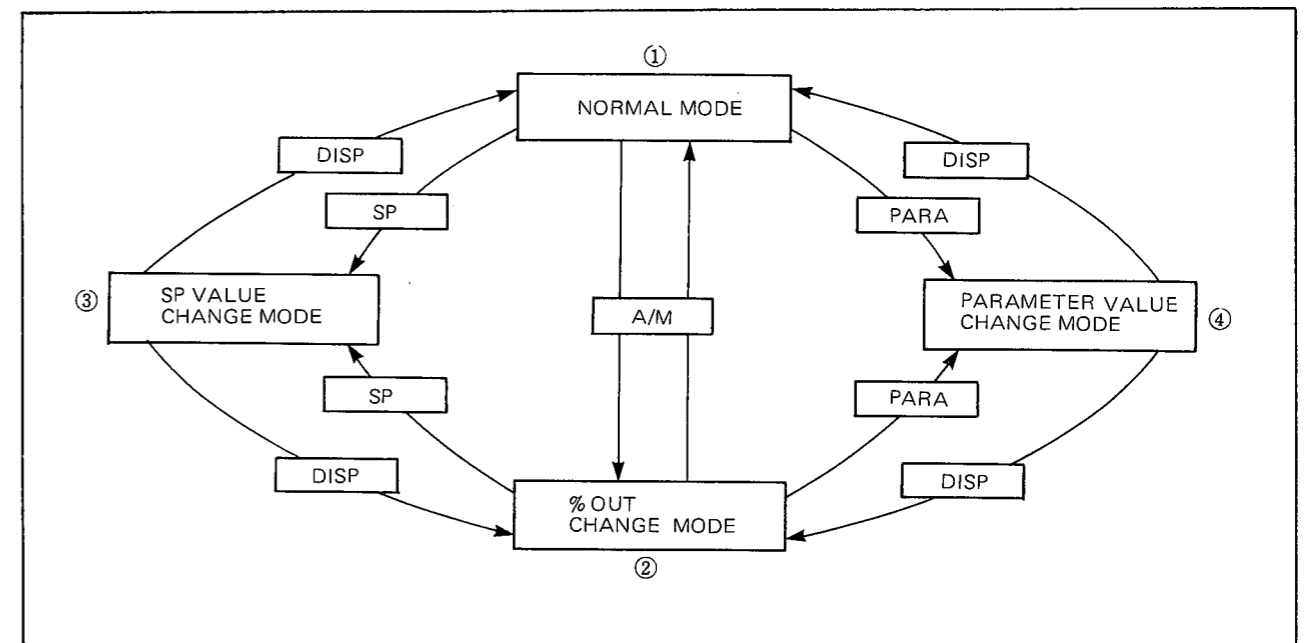


Fig. 7 Mode Change System

Parameters

| Indication of PV Display | Contents | Setting Range |
|--------------------------|---|---|
| | Proportional band (%) | 1 to 1000 % |
| | Reset time (Second) | 1 to 3600 Sec. |
| | Rate time (Second) | 0 to 1200 Sec. |
| | Event No. 1 | PV event: 0 to 100% F.S. DEV event: Minus 50% of Span to plus 50% of Span Settings at values lower than minus 999 not available for minus 50% of Span. DEV event: 0 to 50% of Span |
| | Event No. 2 | |
| | Differential No. 1 (corresponding to event No. 1) | |
| | Differential No. 2 (corresponding to event No. 2) | 0 to 200°C |
| | Manual output value at power failure recovery | -10 to 110 % |
| | Linear input zero point | (-999 to 9999) |
| | Linear input span | (-999 to 9999) |

Fig. 3

(4) DIP Switch

The DIP switch is mounted in the front area on the left board of the body when viewed from the front of the instrument.

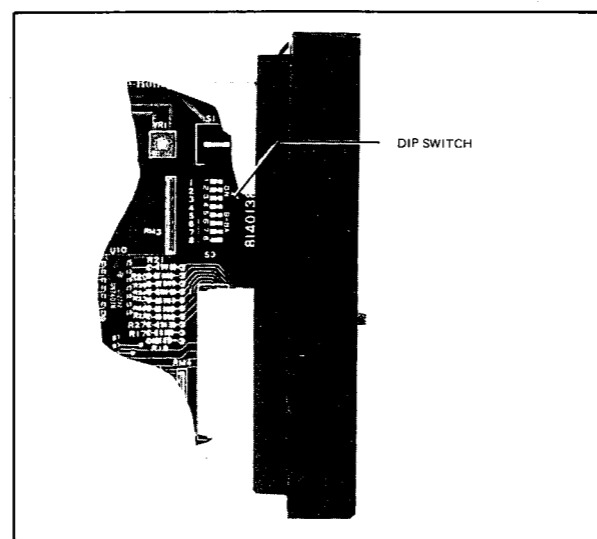


Photo. 2

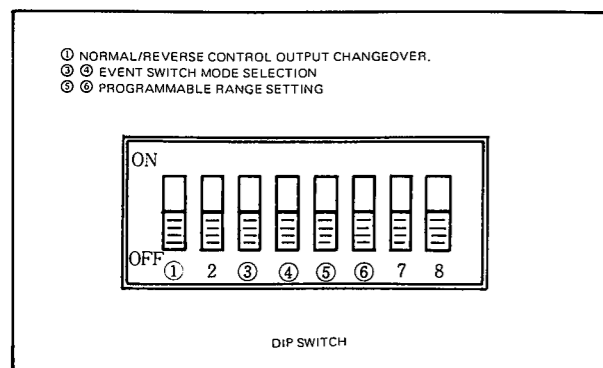


Fig. 8

SETTING

Set the switches in the following order after supplying power:

1. Main Setting

- ① Push the **SP** key. SP LED lights.
 - ② Set at the desired value using the **←**, **▲** and **▼** keys.
 - ③ Push the **ENT** key to store the set point.
 - ④ Push the **DISP** key when returning to normal mode.
- (This operation is also applicable to Items 2, 6, 7).

| KEY OPERATION | CONTENTS OF OPERATION | INDICATION |
|------------------------------------|---------------------------------------|-------------|
| ① SP | SHIFT SP INCREMENT SP DECREMENT | ○ SP LIGHT |
| ② ← ▲ ▼ | | S.P. |
| ③ ENT | | |
| ④ DISP | | |

2. Control Parameter Setting

(1) Proportional Band Setting

The proportional band can be set at any point between 1% and 1000% in each series of SDC 300. Normally, when the proportional band is set wider, the movement of the controller does not vary greatly, even if the process variables are altered, so the control stabilizes. However, too wide a proportional band causes off-set to occur. When the proportional band is set narrower, the controller movement is not stable, and hunting often results. Both the SDC 300 5G and 2G are set at reverse action 20-4mA, and the B1 of dip switch S3 is set OFF at the time of shipment from the factory. If 4-20mA normal action is desired, change the B1 of dip switch S3 to ON.

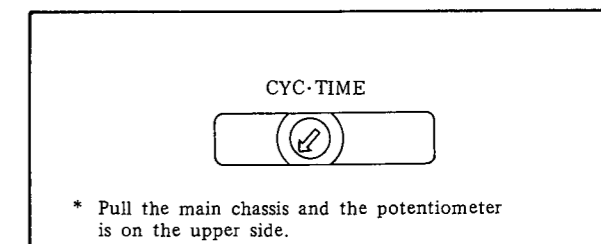
- ① Push the **PARA** key. **P** is indicated on the PV value indication display. PARA LED lights.
- ② Set at the desired proportional band (%) using the **←**, **▲** and **▼** keys.
- ③ Push the **ENT** key to store the set point.

| KEY OPERATION | CONTENTS OF OPERATION | INDICATION |
|------------------------------------|---------------------------------------|---------------|
| ○ PARA | SHIFT SP INCREMENT SP DECREMENT | P |
| ○ ← ▲ ▼ | | ○ PARA LIGHTS |
| ○ ENT | | S.P. |

(2) Cycle Time Setting

Model No. SDC 300 0D: 10-60 sec. (variable)
06: 1-6 sec. (variable)
The cycle time is set via the CYC-TIME potentiometer. When the cycle time is set longer, rotate

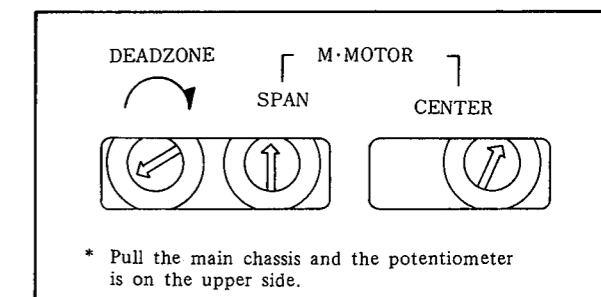
the potentiometer clockwise. When it is set shorter, rotate the potentiometer counterclockwise. At the time of shipment from the factory, the cycle time is set at the minimum level.



- (3) Calibration of Dead Zone, Center and Span for the SDC 300 2G
Dead Zone
Model No. SDC 300 2G: 1-5% OUT (variable)
The dead band calibration is made by the DEAD ZONE potentiometer. When the dead band is set wider, rotate the potentiometer clockwise; rotate counterclockwise when narrower.

- (4) Center Calibration
Model No. SDC 300 2G
This is the calibration for the center of the modutrol motor rotation angle. Switch the **A/M** key to MAN, set the OUTPUT at 50% and calibrate using the CENTER potentiometer so that the modutrol motor rotation angle reaches 50%.

- (5) Span Calibration
Model No. SDC 300 2G
Calibration of modutrol motor span can be made by switching the **A/M** key to MAN, setting the SPAN potentiometer so that the modutrol motor span becomes 100% (or 0%).



- (6) Reset Time Setting
The reset time can be set at any position between 1 and 3600 seconds for each SDC 300 model. The reset will automatically cancel any off-set if it is made during operation of the instrument. When the reset time is shorter, the reset action is intensely affected. Thus, if the reset time is too short, the control will become unstable. The reset time should be set longer at the beginning and then gradually adjusted downward after progress is made and noted.

- ① Push the **PARA** key. **I** is indicated on the PV value indication display. PARA LED lights.
- ② Set at the desired reset time (second) using the **←**, **▲** and **▼** keys.
- ③ Push the **ENT** key to store the set point.

| KEY OPERATION | CONTENTS OF OPERATION | INDICATION |
|---------------|-----------------------|---------------|
| ○ PARA | | i |
| ○ ← | SHIFT | ○ PARA LIGHTS |
| ○ ▲ | SP INCREMENT | |
| ○ ▼ | SP DECREMENT | S.P. |
| ○ ENT | | |

(7) Rate Time Setting

The rate time can be set at any position between 0 and 1200 seconds for each SDC 300 model. The longer the rate time, the more intense the rate action becomes. When the rate time is set longer, the controller moves more sharply, even when the deviation (PV-SP) is small. As a result, it causes cycling and hunting. The rate time should be set shorter at first and gradually adjusted upward after its progress is made and noted.

- Push the **PARA** key. **d** is indicated on the PV value indication display. PARA LED lights.
- Set at the desired rate time (second) using the **←**, **▲** and **▼** keys.
- Push the **ENT** key to store the rate time.

| KEY OPERATION | CONTENTS OF OPERATION | INDICATION |
|---------------|-----------------------|--------------|
| ① PARA | | d |
| ② ← | SHIFT | ○ PARA LIGHT |
| ③ ▲ | SP INCREMENT | |
| ④ ▼ | SP DECREMENT | S.P. |
| ⑤ ENT | | |

3. Event Setting

(1) Setting

In the SDC 300, Event 1 and Event 2 are selectable separately. Setting is made by selecting combinations from Table 4 for the inner dip switch and then setting to the desired value.

- PV event Setting Value: 0-100% F.S.
- DEV Event: $-SPN/2$ $SPN/2$
- Absolute Value DEC Event: $0-SPAN/2$

(Two out of the above three are selectable)

Following the diagram in Table 4, set the inner switch and select the desired event mode.

(2) Setting Method for Event

- Select the event to be set, and set the DIP switch in accordance with Table 4.
- Push the **PARA** key to indicate EV1 and EV2 on the PV display.
- Set at the desired value using the **←**, **▲**, and **▼** keys.
- Push the **ENT** key to store the set point.

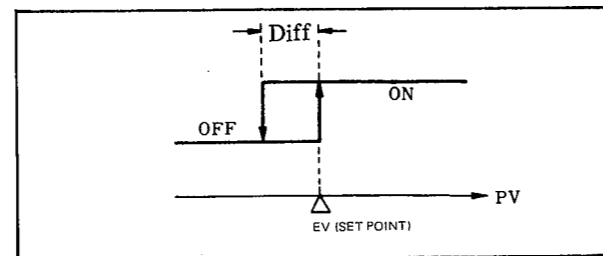
Table 4. Event Switch Combination

| DIP SWITCH | | EVENT 1 (EV1) | EVENT 2 (EV2) |
|------------|-----|---------------|---------------|
| ③ | ④ | | |
| OFF | OFF | PV EVENT | PV EVENT |
| ON | OFF | PV EVENT | DEV EVENT |
| OFF | ON | PV EVENT | DEV EVENT |
| ON | ON | DEV EVENT | DEV EVENT |

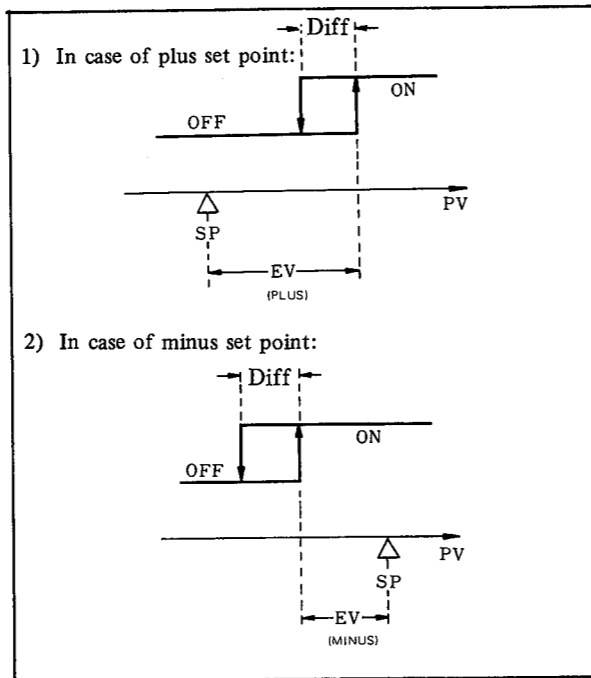
3. (2) Event Setting

| KEY OPERATION | CONTENTS OF OPERATION | INDICATION |
|---------------|-----------------------|----------------------------|
| ① PARA | | EV 1 OR EV 2 |
| ② ← | SHIFTS | ○ PARA LIGHTS |
| ③ ▲ | SP INCREMENT | |
| ④ ▼ | SP DECREMENT | S.P. |
| ⑤ ENT | | |

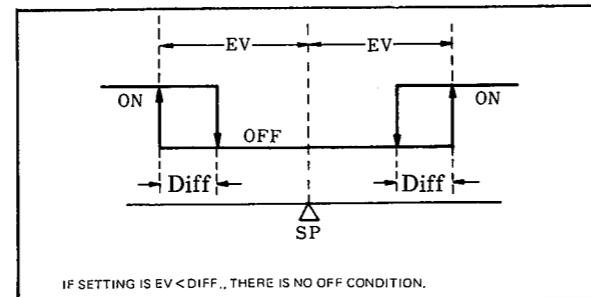
① PV EVENT



② DEV EVENT



③ DEVI EVENT

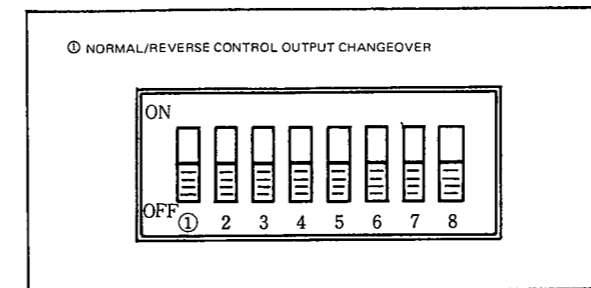


IF SETTING IS EV < DIFF., THERE IS NO OFF CONDITION.

4. Normal/Reverse Changeover of Control Output

For type SDC3005G, changeover from 4-20mA (normal operation) to 20-4mA (reverse operation) can be made for the control output.

Set switch ① on DIP switch S3 mounted on the internal body of the instrument as follows:
 ON: Normal operation
 OFF: Reverse operation



5. Programmable Range Function

The SDC300 where the No.4 code in the model number is PO or QO has a capability enabling the PV display corresponding to 4 to 20mA, 1 to 5V or 0 to 10mV linear input to be set in the following range:

- Zero point: minus 999 to 9999
- Span range: 0 to 9999

The location of the decimal point for the SP value or PV value can be changed by the DIP switch.

| DIP SWITCH | | |
|------------|-----|--------|
| ⑤ | ⑥ | |
| OFF | OFF | X. XXX |
| ON | OFF | XX. XX |
| OFF | ON | XXX. X |
| ON | ON | XXXX |

(Example-1)

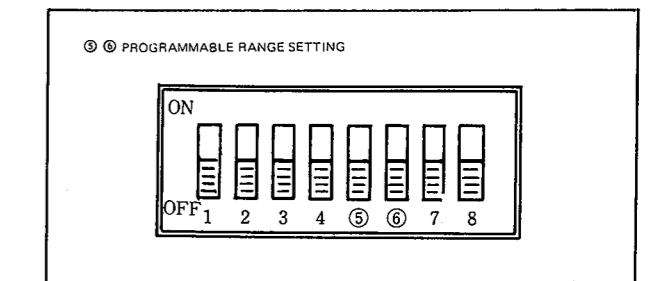
When the PV display is set at minus 50.0 to plus 50.0 to the input of 0 to 100%, the setting is made as follows:

- DIP switch ⑤ is OFF, ⑥ is ON.
- Set the zero point (AO) and span (A1) as follows:
 AO: minus 50 (Zero-point setting)
 A1: 100.0 (Span setting of minus 50.0 to plus 50.0)

Next set the SP value, EV1 and EV2 in accordance with the SETTING Section.

Note:

The location of the decimal point for each value (SP value, PV value, event value, or differential value) is selected by the DIP switch.



(Example-2)

When the switches of ⑤ and ⑥ are both OFF, the setting range differential is 0.000 - 0.020.

Note:

For a programmable range, set the zero and span first, and then set EV1, EV2, and the SP value.

6. Manual Output Value at Power Failure Recovery

If the power fails during manual operation (MAN) and has been restored, manual operation starts at the values which were set by the parameter key. If the power fails during automatic operation (AUTO) and has been restored, the operation starts in automatic operation.