社会開発調査部報告書

THE STUDY ON
MANAGEMENT OF GROUNDWATER AND
LAND SUBSIDENCE
IN
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TOKYO, JAPAN

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF MINERAL RESOURCES
MINISTRY OF INDUSTRY
AND
PUBLIC WORKS DEPARTMENT
MINISTRY OF INTERIOR
THE KINGDOM OF THAILAND

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

OPERATION MANUAL FOR MONITORING STATION

MARCH 1995

KOKUSAI KOGYO CO., LTD.
TOKYO, JAPAN

Table of Contents

1.0 Outline

1.1 Preface

This monitor was granted to the Department of Mineral Resources of the Ministry of Industry, Public Works Department of the Ministry of Interior, in the Kingdom of Thailand, through the Japan International Cooperation Agency for the "Bangkok Metropolitan Area Subsidence and Ground Water Monitoring Plan Survey."

After examining the various reports of this survey and the requirements of the department which ordered the equipment, a monitor was manufactured to special specifications based on our land subsidence observation instrument and ground water level observation instrument, which were researched and developed over a lengthy period of time. This monitor also has an automatic measuring system corresponding to computer analysis.

1.2 Monitor Specifications

A Land subsidence and ground water level integrated measuring
panel NS-LIII 16, Nissaku Co., Ltd. 1 unit
Control box indoor dust-proof steel rack
(equipped with a panel heat exchanger and dehumidifier)
Dimensions (630W X 2,000H X 580D mm)

Measuring items	16 channels
1. Land subsidence measurement	: 8 channels
Measurement range (fluctuating range)	: 000.0 ~ 100.0 mm
Resolution	: 0.1 mm
Overall accuracy	: ±1.0% FS
2. Water level measurement	: 8 channels
Measurement range	: 00.00 ~ 20.00 m
Resolution	: 10 mm
Overall accuracy	: ±1.0% FS

Machinery

a) Digital display section 1 unit
Display of the subsidence and water levels of each well digitally in 4 digits by the change-over switch.

b) Interrupted power supply 1 unit
FULLBACK SC 501 SANKEN ELECTRIC CO., LTD.

AC input voltage	single phase 2 lines	100V ±10%
	frequency	50Hz/60Hz ±5%
	capacity	maximum 600VA

AC output	capacity	500VA (400W)
	single phase 2 lines	100V ±3%
	frequency	50Hz/60Hz ±1%
	current (peak value)	maximum 5A (maximum 14A peak)
Battery	type	small sealed lead storage battery
	back-up time	10 minutes or greater (+25°C 400W output)
	recharging time	within 24 hours

c) Logic unit (Print circuit board) 1 unit
Land subsidence 8 pcs
Ground water level 8 pcs

d) Recorder 2 units
Intelligent hybrid recorder DPR 500 Yamatake-Honeywell
Number of channels : 12 channels
Input range : 0 ~ 5V
Input scanning period : 15 sec
Chart feed speed : 12.5/25 mm/h
Recording chart paper : W180 mm

e) Datalogger 2 units
LAND SCALE MDL - 1,000 KARTER ART LANDSCAPING INC.
Recording method : analogue input 8 channels
Recording medium : IC card 256 KB 3pcs
Observation interval : 7 types 1, 2, 3, 4, 6, 12, 24 hours, between 1 to 24 hours
Analogue input : 0 ~ 5V

f) DC power supply
Control box main body
Breaker NFB
Power supply transformer : PRI. 0-200-220-240-V
SCE. 0-100-115V
1 KVA
Noise filter is equipped with 100V for each type DC power supply is installed to the print circuit board and to each datalogger.

B Land subsidence and underground water level integrated measuring panel 2 units
NS-LIII 10, Nissaku Co., Ltd.
Control box indoor dust-proof steel rack
(equipped with a panel heat exchanger and dehumidifier)
Dimensions (630W X 2,000H X 580D mm)

Measuring items 10 channels

1. Land subsidence measurement : 5 channels
   Measurement range (fluctuation range) : 000.0 ~ 100.0 mm
   Resolution : 0.1 mm
   Overall accuracy : ±1.0% FS

2. Water level measurement : 5 channels
   Measurement range : 00.00 ~ 20.00 m
   Resolution : 10 mm
   Overall accuracy : ±1.0% FS

Machinery

a) Digital display section 1 unit

Display of the subsidence and water levels of each well digitally in 4 digits by the change-over switch.

b) Interrupted power supply 1 unit

FULLBACK SC 501 SANKEN ELECTRIC CO., LTD.

AC input	single phase 2 lines	100V ±10%
	frequency	50Hz/60Hz ±5%
	capacity	maximum 600VA
AC output	capacity	500VA (400W)
	single phase 2 lines	100V ±3%
	frequency	50Hz/60Hz ±1%
	current (peak value)	maximum 5A (maximum 14A peak)
Battery	type	small sealed lead storage battery
	back-up time	10 minutes or greater (+25°C 400W output)
	recharging time	within 24 hours

c) Logic unit (Print circuit board) 1 unit

Land subsidence 5 pcs

Ground water level 5 pcs

Spare 1 piece

d) Recorder

Intelligent hybrid recorder DPR 500 Yamatake-Honeywell

Number of channels : 6 channels

Input range : 0 ~ 5V

Input scanning period : 7.5 sec

Chart feed speed : 12.5/25 mm/h

Recording chart paper : W180 mm

e) Datalogger 2 units

LAND SCALE MDL-1,000 KARTER ART LANDSCAPING INC.

Recording method : analogue input 8 channels

Recording medium : IC card 256 KB 3pcs

Observation interval : 7 types 1, 2, 3, 4, 6, 12, 24 hours, between 1 to 24 hours

Analogue input : 0 ~ 5V

f) DC power supply

Control box main body

Breaker NFB

Power supply transformer : PRI 0-200-220-240-V
SCE 0-100-115V
1 KVA

Noise filter is equipped with 100V for each type

DC power supply is installed to the print circuit board and to each datalogger.

C Land Subsidence Sensor 20 pcs

NL-III NISSAKU CO.,LTD

Measuring method : precision potentiometer

Measuring range : 0 ~ 100.0mm

Resolution : 0.1 m

Accuracy : ±0.5% FS

Machinery

a) Precision potentiometer 1 piece

(dust-proof, drip-proof structure)

Outer diameter 20±1 mm, total length	approx. 410 mm
Mechanical stroke	approx. 103 mm
Electrical stroke	100 ±/mm
Total resistance	10 $^{k\Omega}$ ±10%
Rated power	1.5W

b) Dial gauge 1 piece

c) Exclusive bracket 2 sets

d) Sensor board 2 sets

D Groundwater Level Sensor 20 pcs

NS-III Nissaku Co., Ltd.

Measuring method	: semiconductor piezo resistance-type pressure sensoring method
Water level measurement range	: 00.00 ~ 20.00 m
Output voltage	: 5,000 ~ 0,000V
Measurement accuracy	: ±0.3% FS
Output load resistance	: 5 $^{k\Omega}$ space and greater
Withstanding water pressure	: 2.5 kgf/cm^2
Cable	: 4C PE tube 100 m

Equipped with cable fittings

E Power Supply Switch Box

Control box indoor dust-proof steel box

Dimensions (300W X 250H X 120D)

Machinery

a) Breaker
   200V 15A trip

b) Power arrester
   AC 200V, impulse voltage 3,000V, 10μs

F Data Analysis Software

Time series display corresponding to Toshiba J-3100 GT201VT

Graph

Distribution

a) Analysis software
b) IC card reader

G Consumable Products

Recording paper 72pcs X 3 years = 216pcs

Recorder pen

2.0 Machine Configuration

Chart 1.1 shows the machine configuration for each site.

Equipment \ Area	A area	B area	C area
Land subsidence and ground water integrated panel	1	1	1
Land subsidence sensor	8	5	5
Ground water level sensor	8	5	5
Power supply switch box	1	1	1
Dial gauge	8	5	5
Land subsidence exclusive bracket	8	5	5
Bracket to attach dial gauge	8	5	5
Land subsidence sensor board	16	10	10
C-clamp	16	10	10
Metal fitting for the ground water level meter	8	5	5
Spare land subsidence meter	2		
Spare ground water level meter	2		
IC card reader	1		

2.1 Equipment Flow

Figures 1 and 2 show the flow of each piece of equipment.

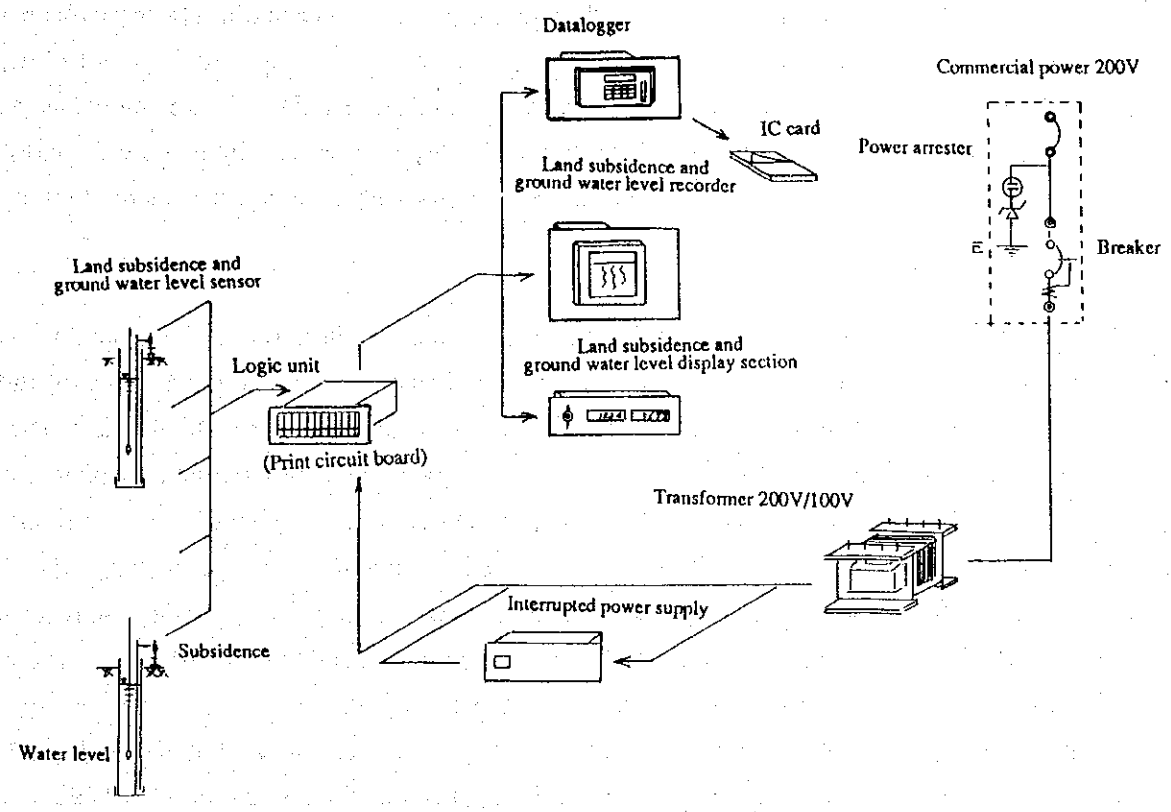


Figure 1 Equipment Flow at each Observation Site

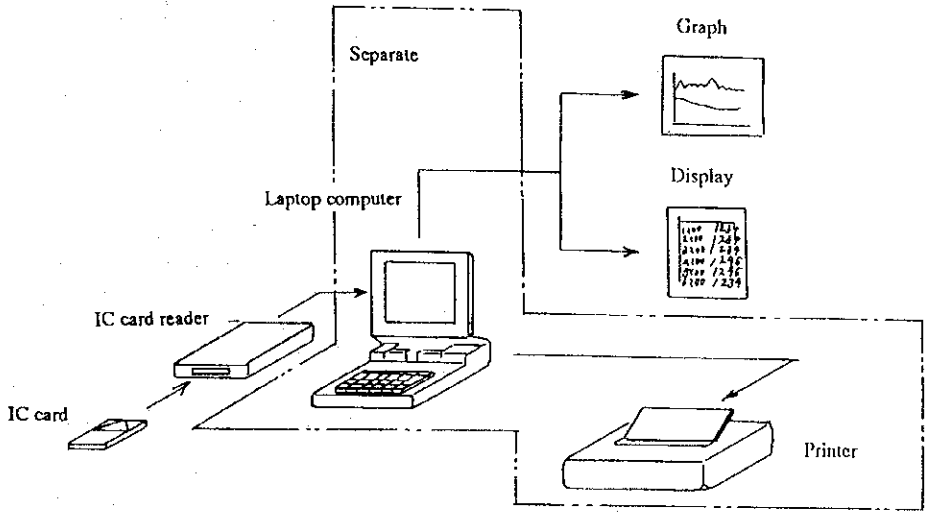


Figure 2 Information output entered on the IC card

The measurement flow of the equipment at the observation site, as shown in Figure 1, is described as follows. The land subsidence sensor and the ground water level sensor are installed at the land subsidence observatory wells. The land subsidence value and ground water level at each observatory well are output to the operational circuit of the print circuit board. Output to the operational circuit is as follows: output subsidence 0 m as 0V; 100 mm as 5V; 0 m water level as 0V; and 20 m as 5V, and are entered at each digital display section, recorder, and data logger. The digital display section simultaneously displays the land subsidence value and the ground water level of the observatory wells, which are selected by the selection switch.

The ground water level can be measured within 0 to 20 meters, therefore, if the ground water level is greater than 20 meters or deeper than the standard surface, the sensor must be moved to a location where measurement is possible. The difference between the value measured by the manual water meter and the digital display section becomes the added value of the ground water level of the digital display section. It is necessary to record this value as it is essential for computer processing. The intermittent recorder measures at intervals of 15 seconds for 12 channels, and 7.5 seconds for 6 channels. A chart feed speed of 12.5 mm/h allows approximately 2 months of recording, while a speed of 25mm/h allows 1 month of recording. The datalogger generally records data once every 12 hours. The motor circuit and recorder stop if commercial power is cut; however, data continues to be recorded by the datalogger until the battery of the uninterrupted power supply is exhausted. Observation data is recorded on the IC card every 12 hours. As Figure 2 shows, the data recorded on the IC card is read by the IC card reader through a laptop computer and recorded on a floppy or hard disc.

3.0 Equipment Installation Wiring

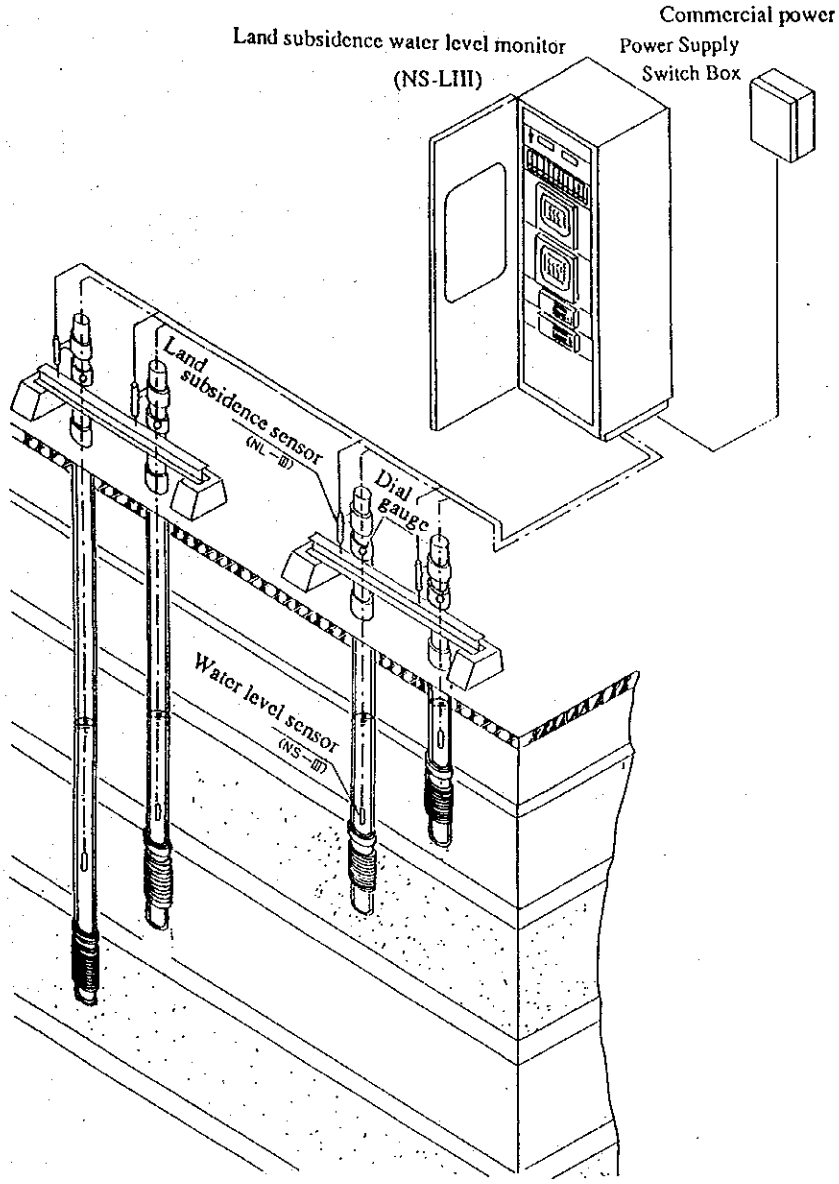


Figure 3 Equipment Installation Wiring

Equipment is installed in each observatory shelter. Wiring of the equipment should follow the wiring diagram attached to the material integrated measuring panel.

3.1 Installation of the Land Subsidence Meter

Assemble the land subsidence meter as shown in Figure 5, and fix the meter to the inner pipe with the bracket.

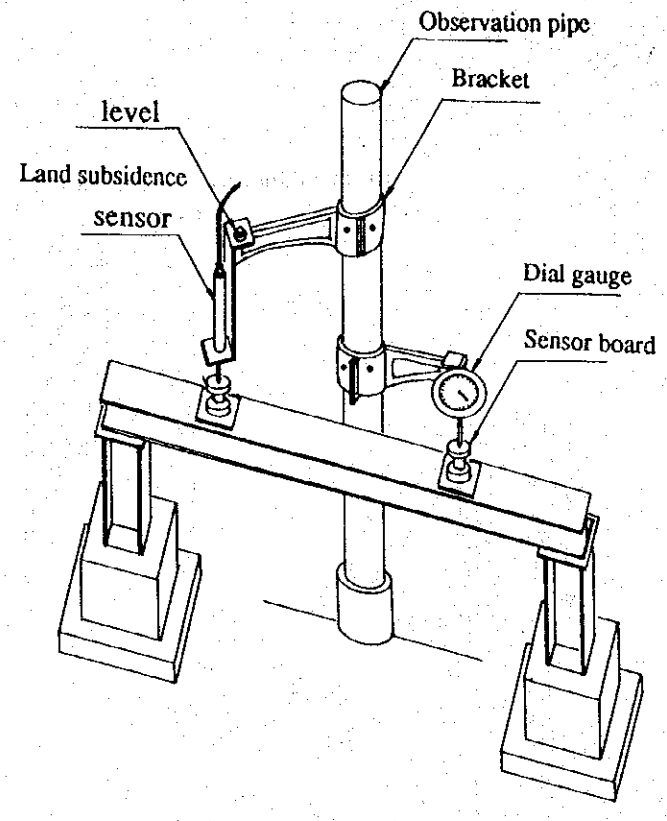


Figure 4 Installation Figure for the Subsidence Meter

3.2 Installation of the Ground Water Meter

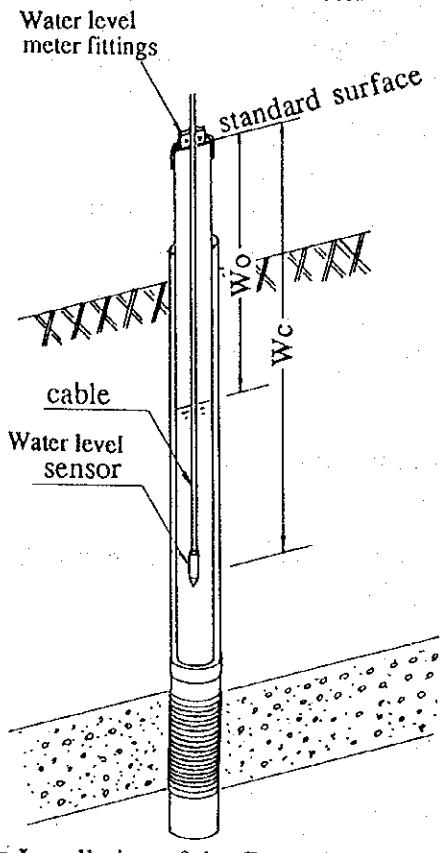


Figure 5 Installation of the Ground Water Meter

The ground water level meter measures the ground water level by a submersion water pressure sensor method. Measure the present ground water level from the standard surface using a manual water level meter. The water level sensor is fixed approximately 10 m in the water. (The maximum water is 20 meters.)

From Figure 6, if the measured water depth is W_1,

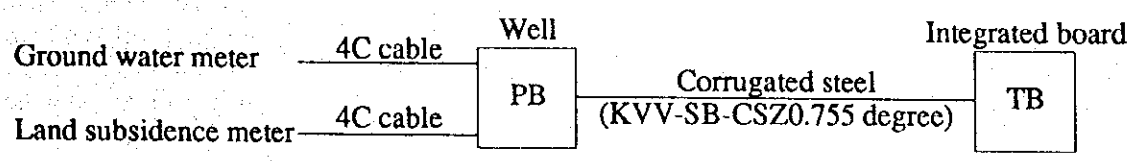
$W_1 = Wc - Wo$

W_1 output is 0(V) when Lx = 0 m

5V when W_1 = 20 m

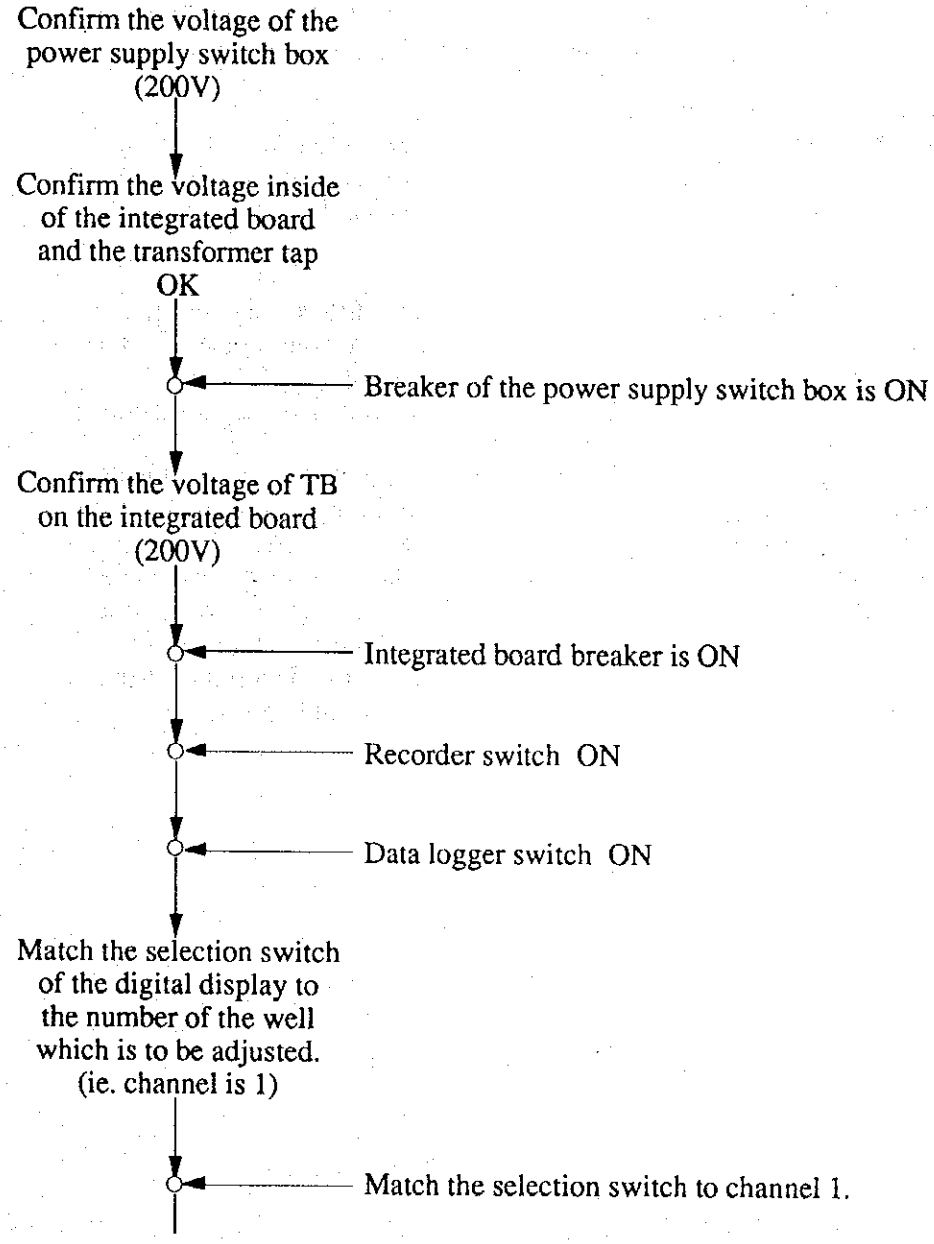
3.3 Wiring between Equipment

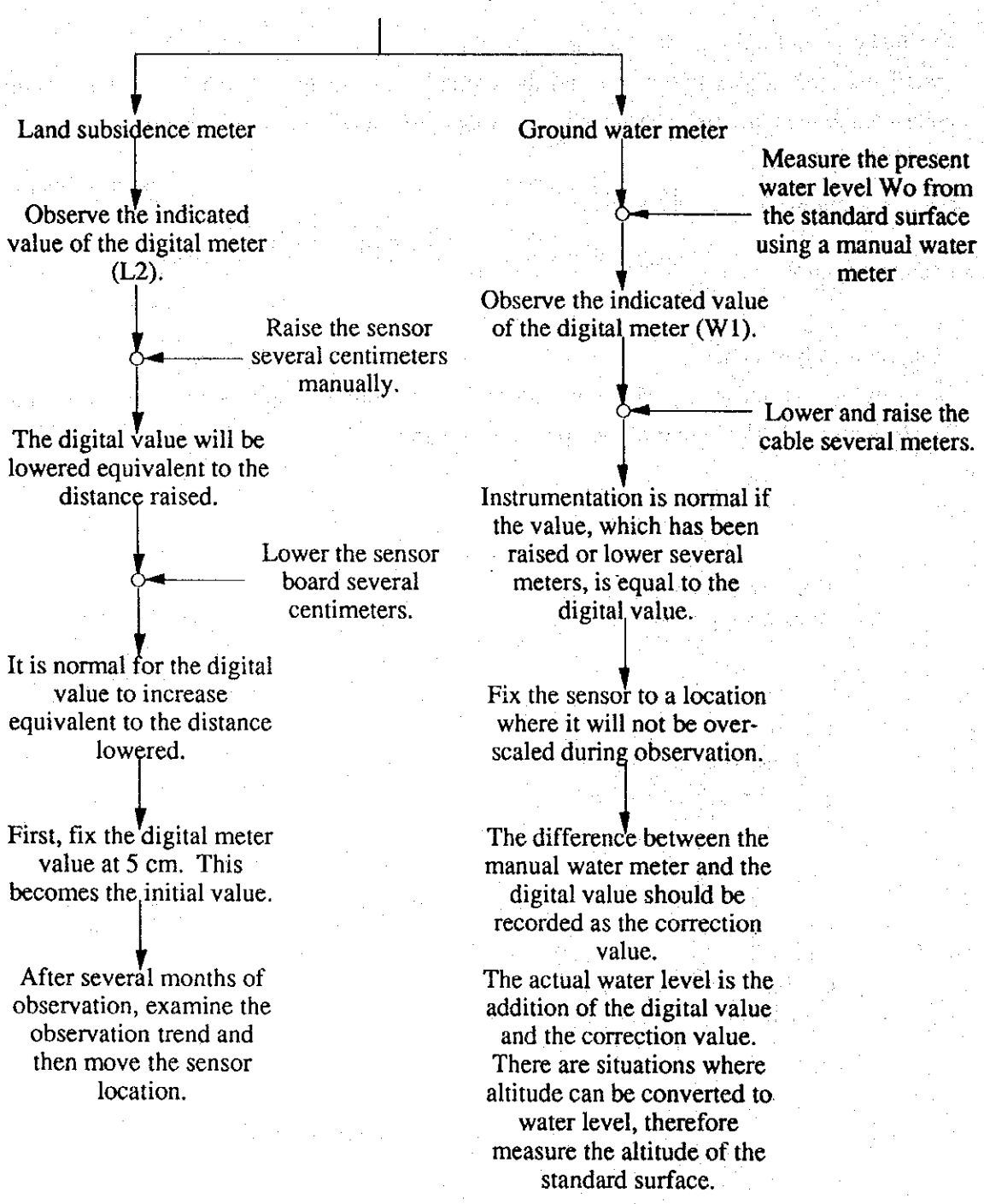
Install the land subsidence meter and the ground water meter to each well. The equipment is connected to the pull box at each well and wired to the integrated board terminal.



3.4 Equipment Adjustment

Confirm the continuity of each circuit after wiring is complete, and begin equipment adjustment. The following is a flow chart of the operation preparation.




Land subsidence meter
Observe the indicated value of the digital meter (L2).
Raise the sensor several centimeters manually.
The digital value will be lowered equivalent to the distance raised.
Lower the sensor board several centimeters.
It is normal for the digital value to increase equivalent to the distance lowered.
First, fix the digital meter value at 5 cm. This becomes the initial value.
After several months of observation, examine the observation trend and then move the sensor location.
Ground water meter
Measure the present water level Wo from the standard surface using a manual water meter
Observe the indicated value of the digital meter (W1).
Lower and raise the cable several meters.
Instrumentation is normal if the value, which has been raised or lower several meters, is equal to the digital value.
Fix the sensor to a location where it will not be over-scaled during observation.
The difference between the manual water meter and the digital value should be recorded as the correction value.
The actual water level is the addition of the digital value and the correction value.
There are situations where altitude can be converted to water level, therefore measure the altitude of the standard surface.

3.4.1 Example of Land Subsidence Meter Usage

The suffixes attached to L in this explanation are not related to the previous pages.

For the initial setting, the initial measurement indicated value [Lo] is set through the installation of the sensor arm and fine adjustment of the probe stand. Usually, subsidence is 0 mm during the initial installation, therefore set the initial correction value at [Lc] = -50.0 mm. (Subsidence has not occurred during the initial setting.)

Initial correction value [Lc] = [Lo]=[-50.0]

Subsidence amount[L] = [L_1] + [Lc] = [50.0] + [-50.0] = 0 mm

Through continuous measurement, the measurement indicated value [L_2] showed 91.4 mm.

Subsidence amount [L] = [L_2] + [Lc] = [91.4] + [-50.0]
= 41.4 mm

Immediately after the above measurement, change the installation location of the sensor arm and set the measurement indicated value [L_3] at 31.4 mm through fine adjustment of the probe stand.

Corrected value [Lc] = [L_2] - [L_3] + corrected value immediately before [Lc]
= [91.4] - [31.4] + [-50.0]
= 10.0 mm

Subsidence amount [L] = [L_3] + [Lc] = [31.4] + [10.0]
= 41.4 mm (This is equivalent to the value before the changes.)

Continue further measurements. The measurement indicated value [L2] showed 68.3 mm.

Correction value [Lc] = 10.0 mm

Subsidence amount [L] = [L_4] + [Lc] = [68.3] + [10.0]
= 78.3 mm

Immediately after the above measurement, change the installation location of the sensor arm and set the measurement indicated value [L_5] at 28.3 mm through fine adjustment of the probe stand.

Correction value [Lo] = [L_4] - [L_5] + previous correction value [Lc]
= [68.3] - [28.3] + 10.0 = 50 mm

Subsidence amount [L] = [L_5] + [Lc] = [28.3] + [50.0]
= 78.3 mm

Continue measuring in the same way. Record new correction values after changing the sensor arm location, and use the new correction values for personal computer data processing.

Personal computer data processing also follows the above example. If you would like to process land subsidence data as an altitude change, measure the altitude of the field during the initial measurements and calculate by subtracting the subsidence amount.

3.4.2 Example of Ground Water Meter Usage

The water level measurement taken immediately before the initial installation was 31.2 m.

Initial measured value [Wo]= 31.2 m

The operating sensor was gently lowered into the observation pipe and fixed with a cable band and it showed a measurement indicated value [W1] at 11.2 m.

Initial correction value[Wo] = [Wo] - [W1] = [31.2] - [11.2]
= 20.0 mm

Measured water level [W] = [W1] + [Wo] = [11.2] + [20.0]
= 31.2 m

Continue observation in this manner. The measured indicated value [W2] showed 18.6 m through the lower water level.

Measured water level [W] = [W2] + [Wc] = [18.6] + [20.0]
= 38.6 m

Change the sensor installation location to a deeper location and fix when the indication value [W3] is 3.6 m.

Sensor relocation distance [W_D] = [W2] - [W3] = [18.6] - [3.6]
= 15 m

Correction value [Wc] = correction value before changing [Wc] + [W_D] = 20.0 + 15.0
= 35.0 m

Measured water level [W] = [W4] + [Wc] = [3.6] + [35.0]
= 38.6 m

Continue further measurements. Measurement indicated value [W4] showed 17.2 m.

Measured water level [W] = [W4] + [Wc] = [17.2] + [35.0]
= 52.2 m

Continue measuring in the same way. Record the new correction value after changing the sensor location. For personal computer data processing, enter the new correction value and execute the data processing command.

Personal computer data processing also follows the above example. If you would like to process the measured water level data as an altitude water level, measure the altitude of the field during the initial measurements. Enter the data into the personal computer and execute using the altitude processing data command.

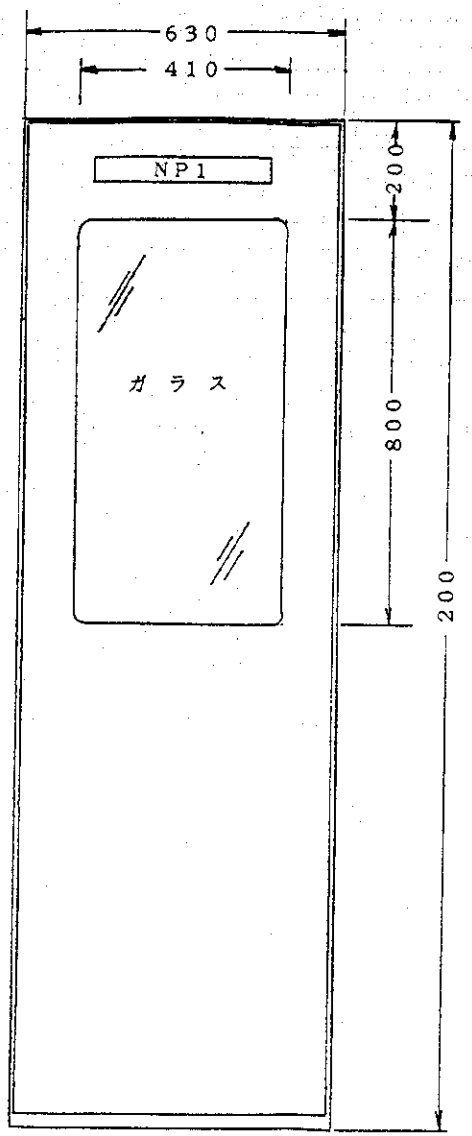
3.5 Integrated Board Adjustment

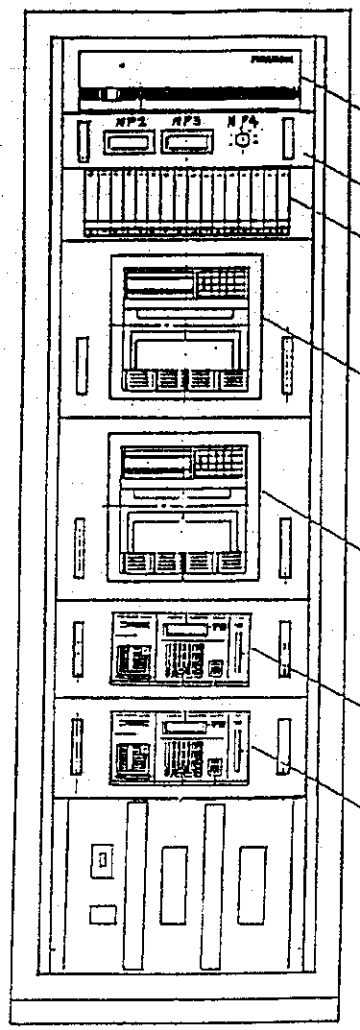
Read the attached operation manual before using the recorder and data logger installed on the integrated board.

3.6 Data Software

Read the attached operation manual before using the Data Analysis Software.

4.0 Integrated Measurement Board Figure





Interrupted power supply A1 B1 C1

Digital display section A2 B2 C2

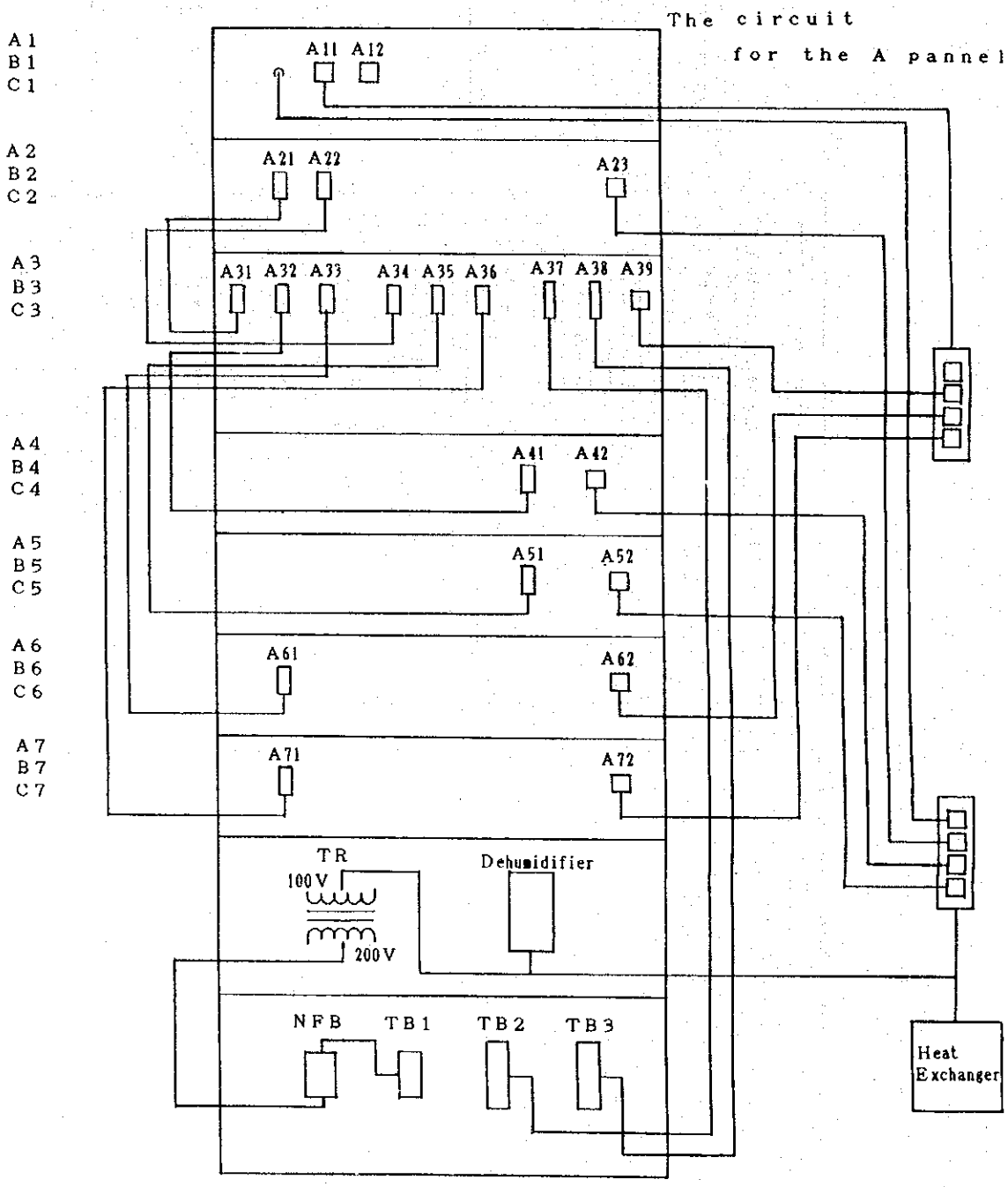
Logic unit (Print circuit board) A3 B3 C3

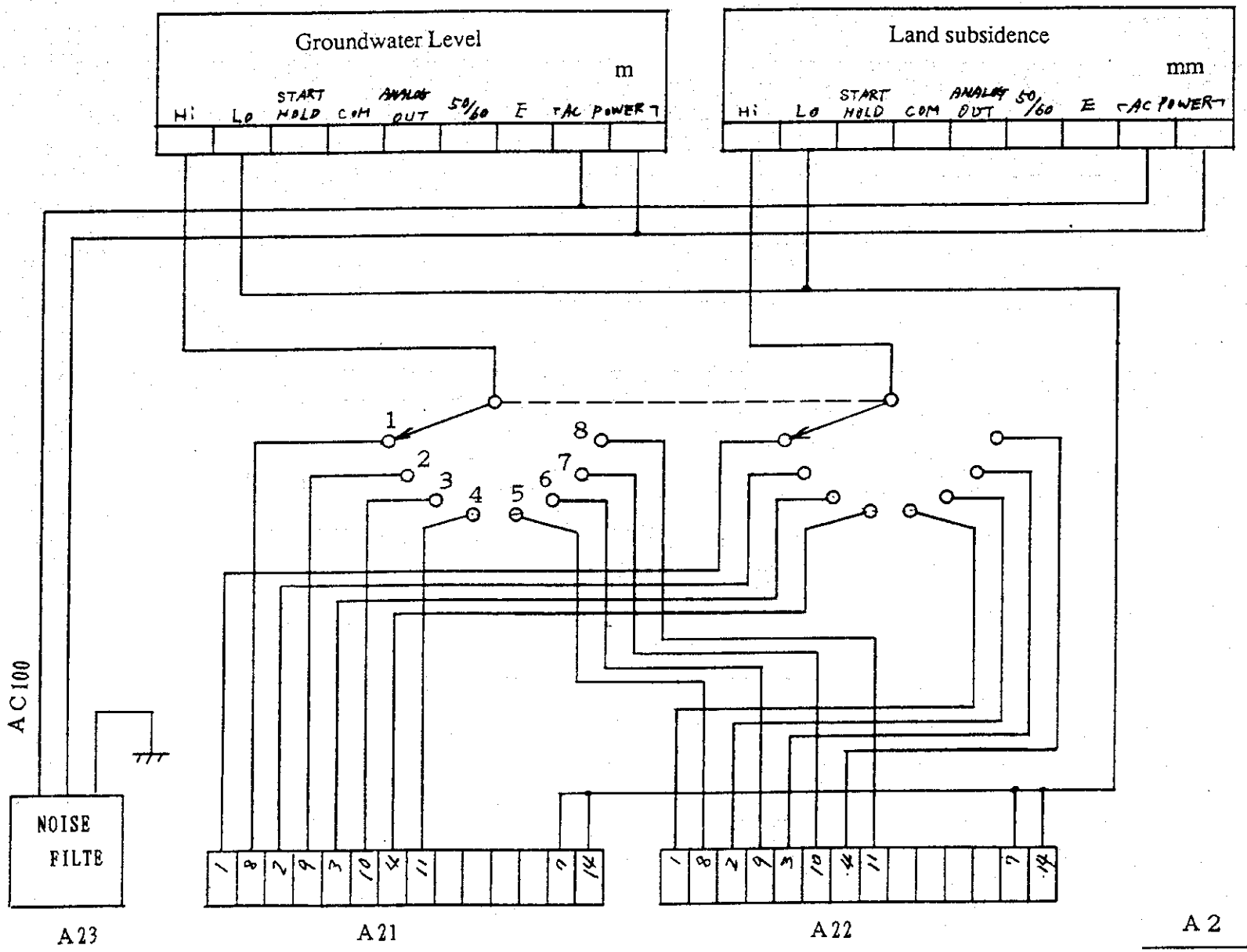
Recorder A4 B4 C4

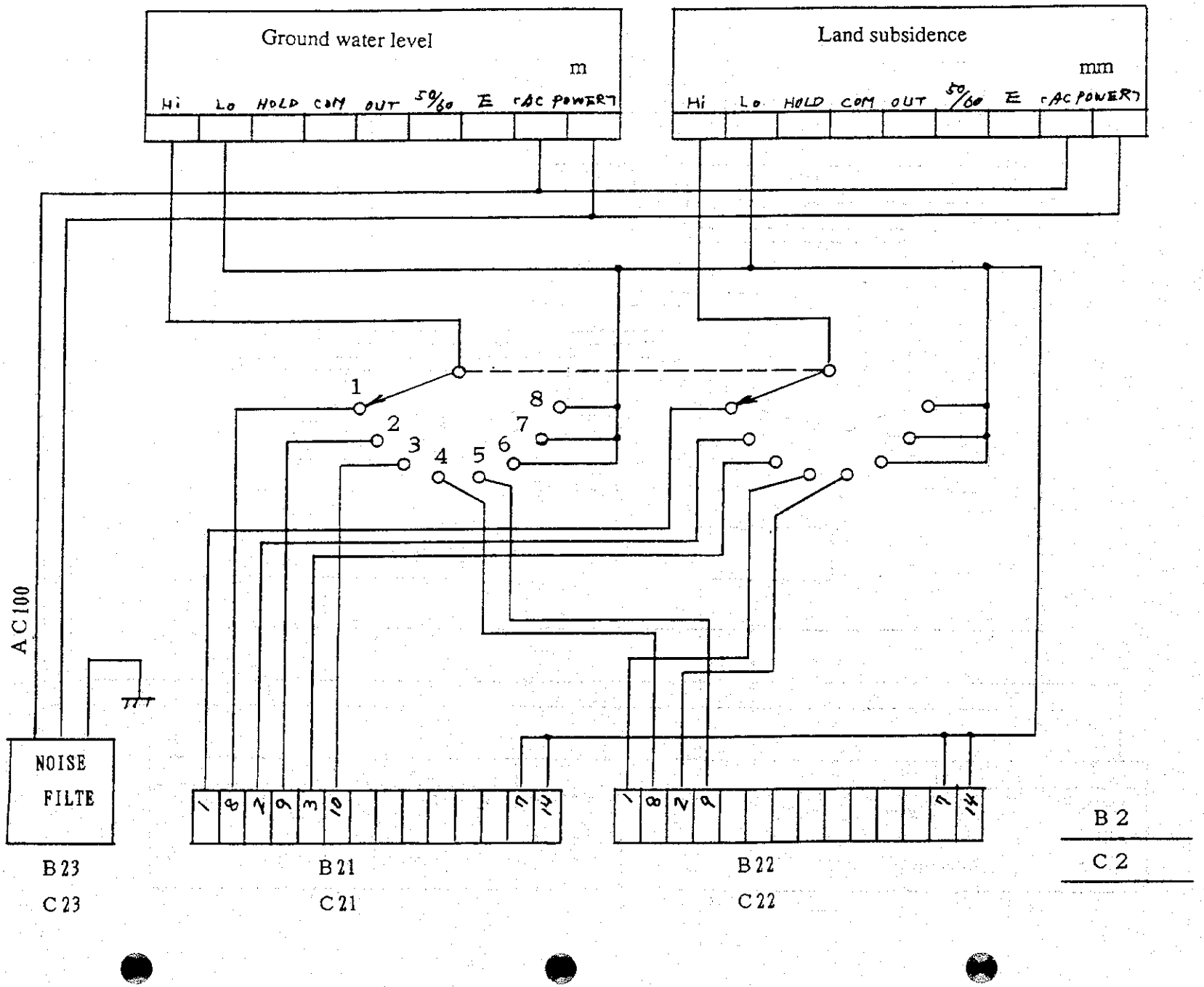
Recorder A5 B5 C5

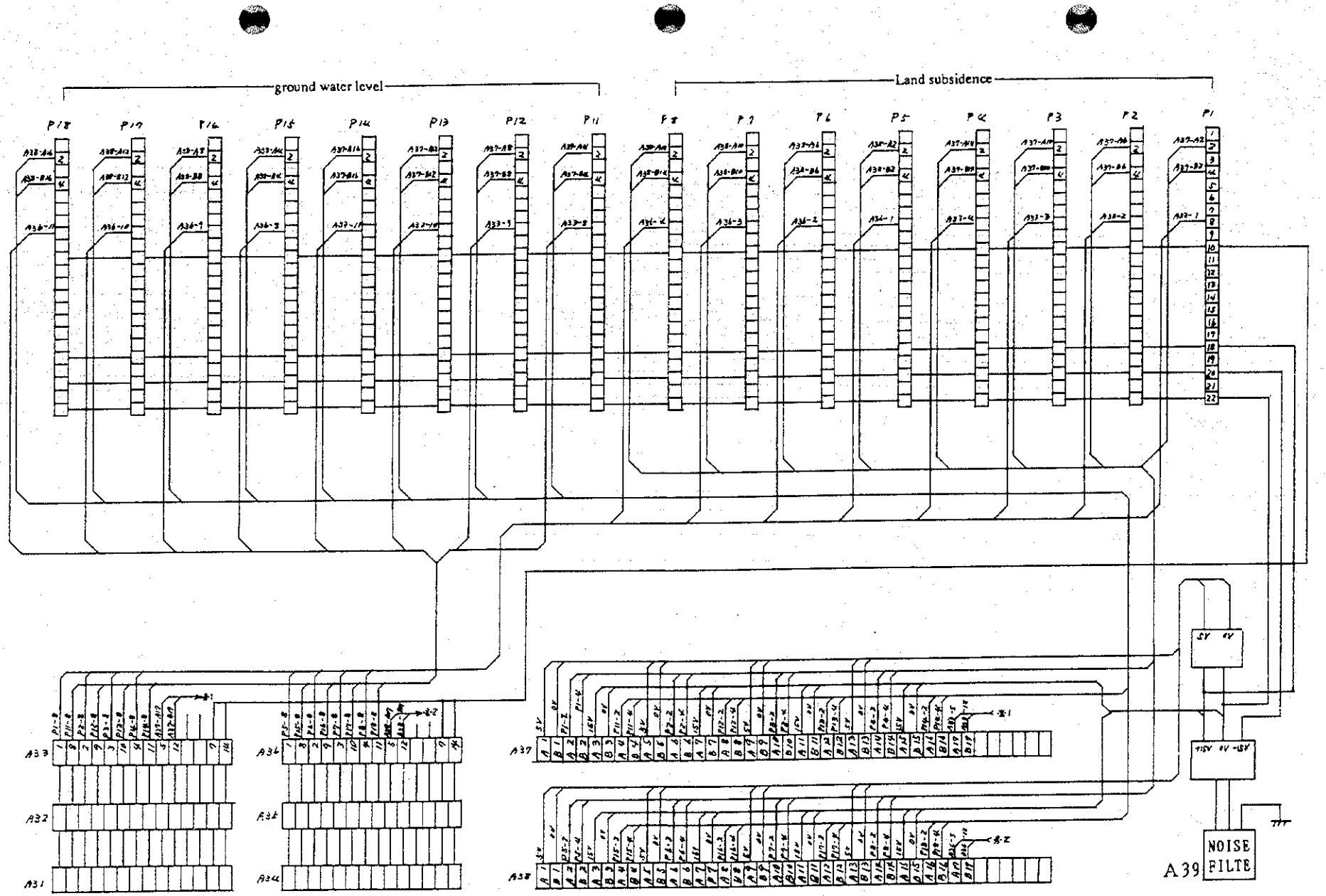
Datalogger A6 B6 C6

Datalogger A7 B7 C7

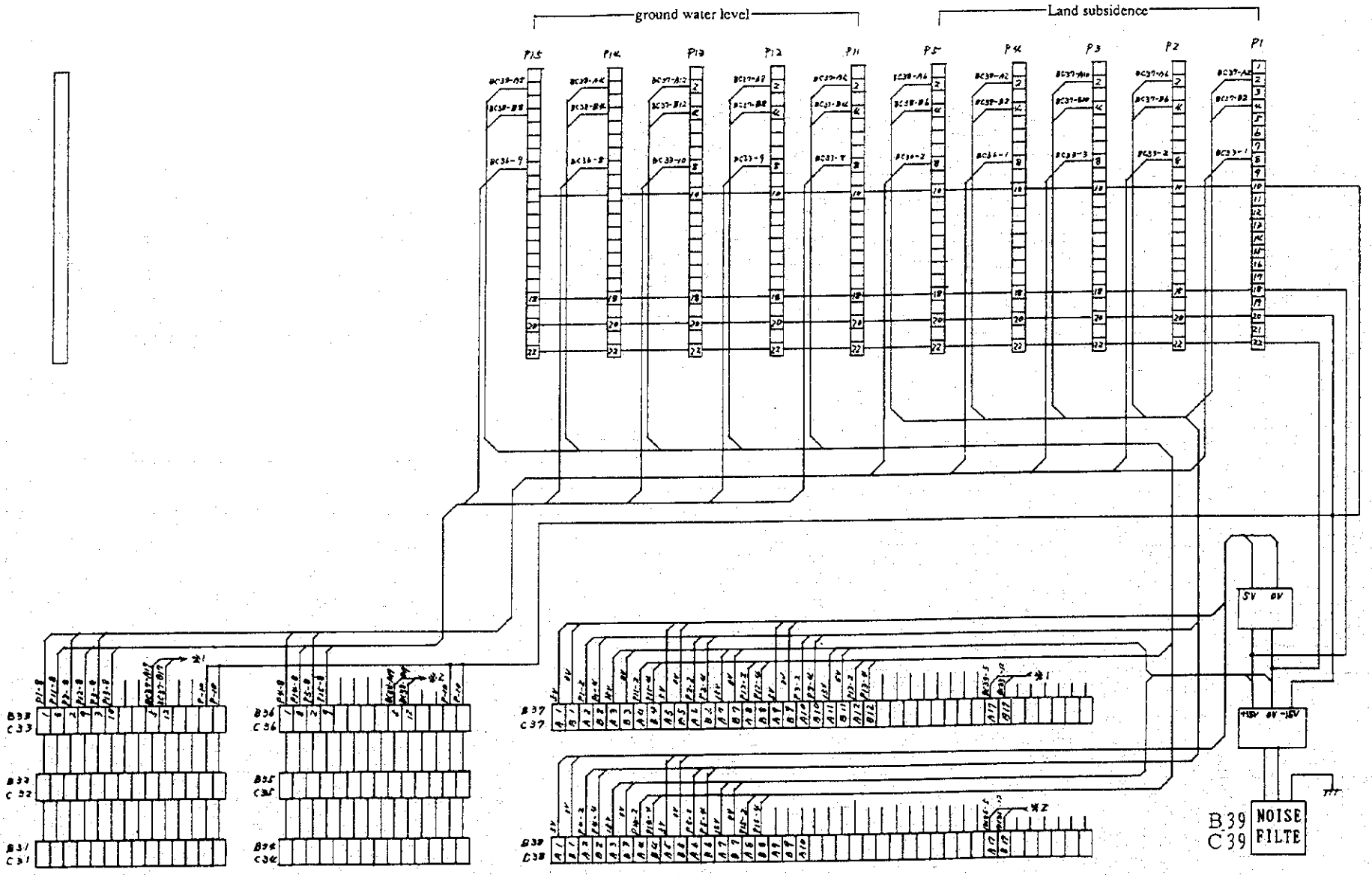

The circuit
for the A pannel
A1
B1
C1
A11 A12
A2
B2
C2
A21 A22
A23
A3
B3
C3
A31 A32 A33 A34 A35 A36 A37 A38 A39
A4
B4
C4
A41 A42
A5
B5
C5
A51 A52
A6
B6
C6
A61
A62
A7
B7
C7
A71
A72
TR
100V
200V
Dehumidifier
NFB
TB1
TB2
TB3
Heat
Exchanger


Groundwater Level
m
Hi
Lo
START HOLD
COM
ANALOG OUT
50/60
E
AC POWER
Land subsidence
mm
Hi
Lo
START HOLD
COM
ANALOG OUT
50/60
E
AC POWER
1
2
3
4
5
6
7
8
AC100
NOISE FILTE
A23
A21
A22
A 2

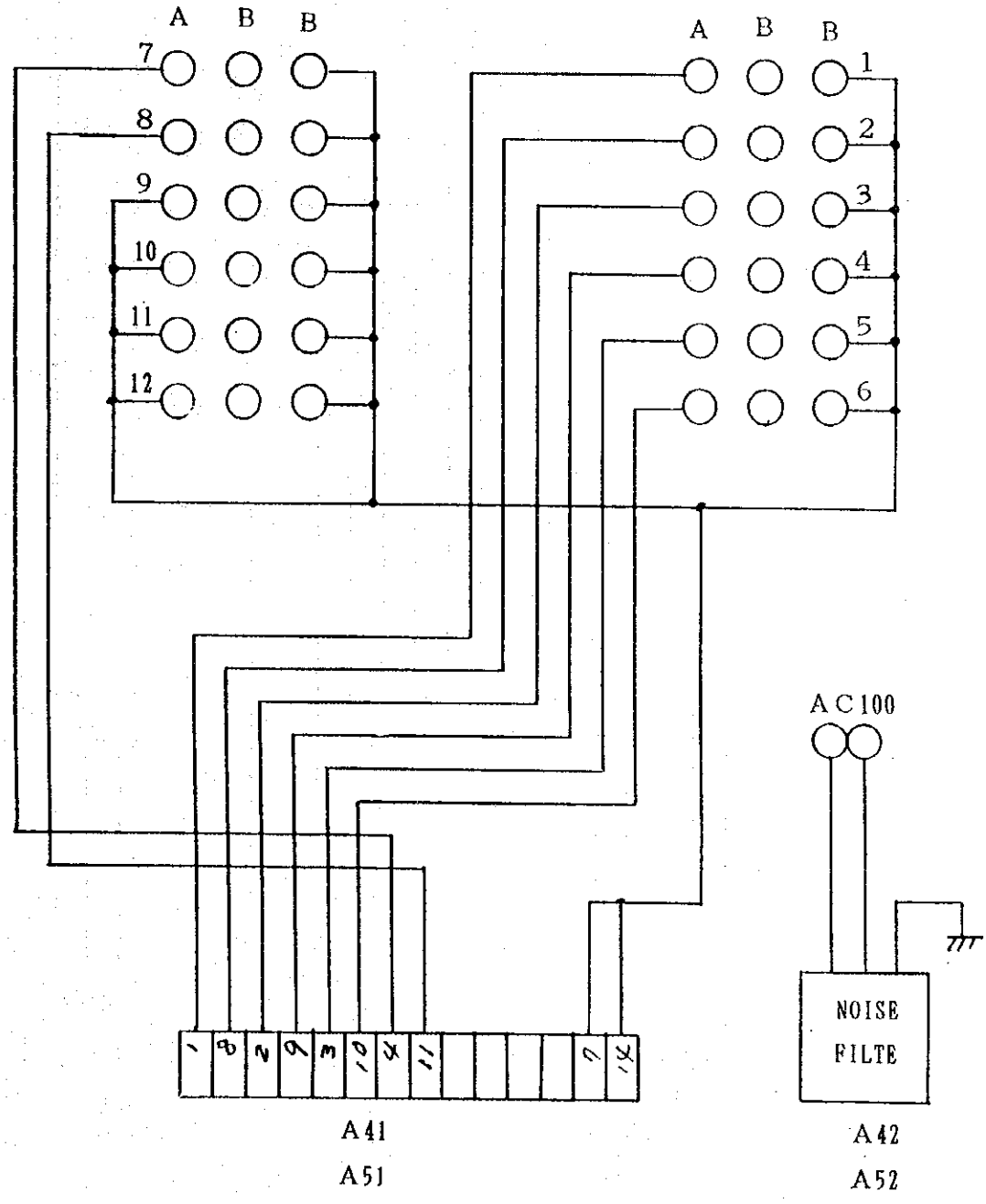

Ground water level
m
Hi Lo HOLD COM OUT 50/60 E AC POWER
Land subsidence
mm
Hi Lo HOLD COM OUT 50/60 E AC POWER
1
2
3
4
5
6
7
8
AC100
NOISE
FILTE
B23
C23
B21
C21
B22
C22
B 2
C 2



A3

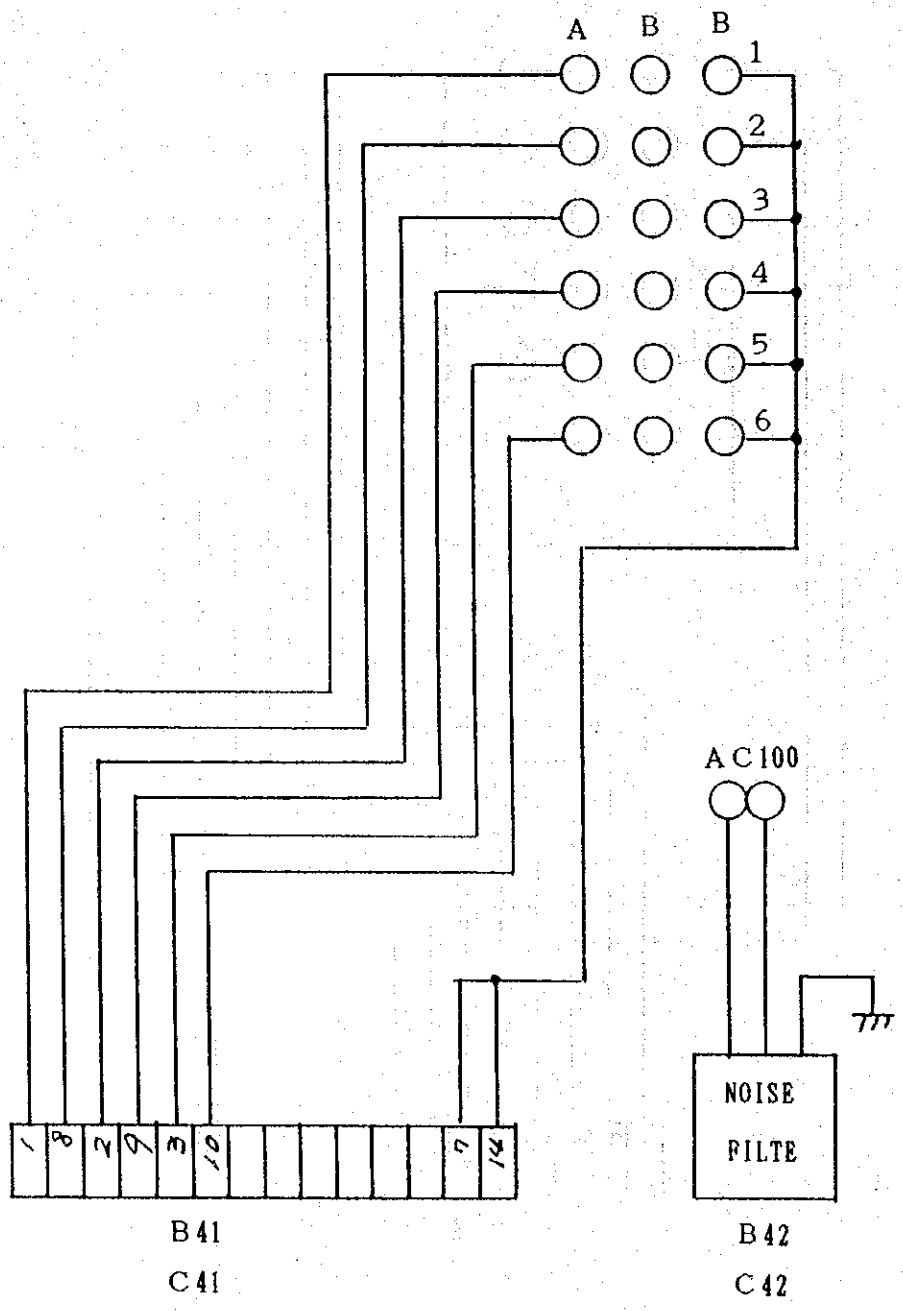

ground water level
Land subsidence
P15
P14
P13
P12
P11
P5
P4
P3
P2
P1
5V 0V
+15V 0V -15V
B39
C39
NOISE
FILTE

B3
C3



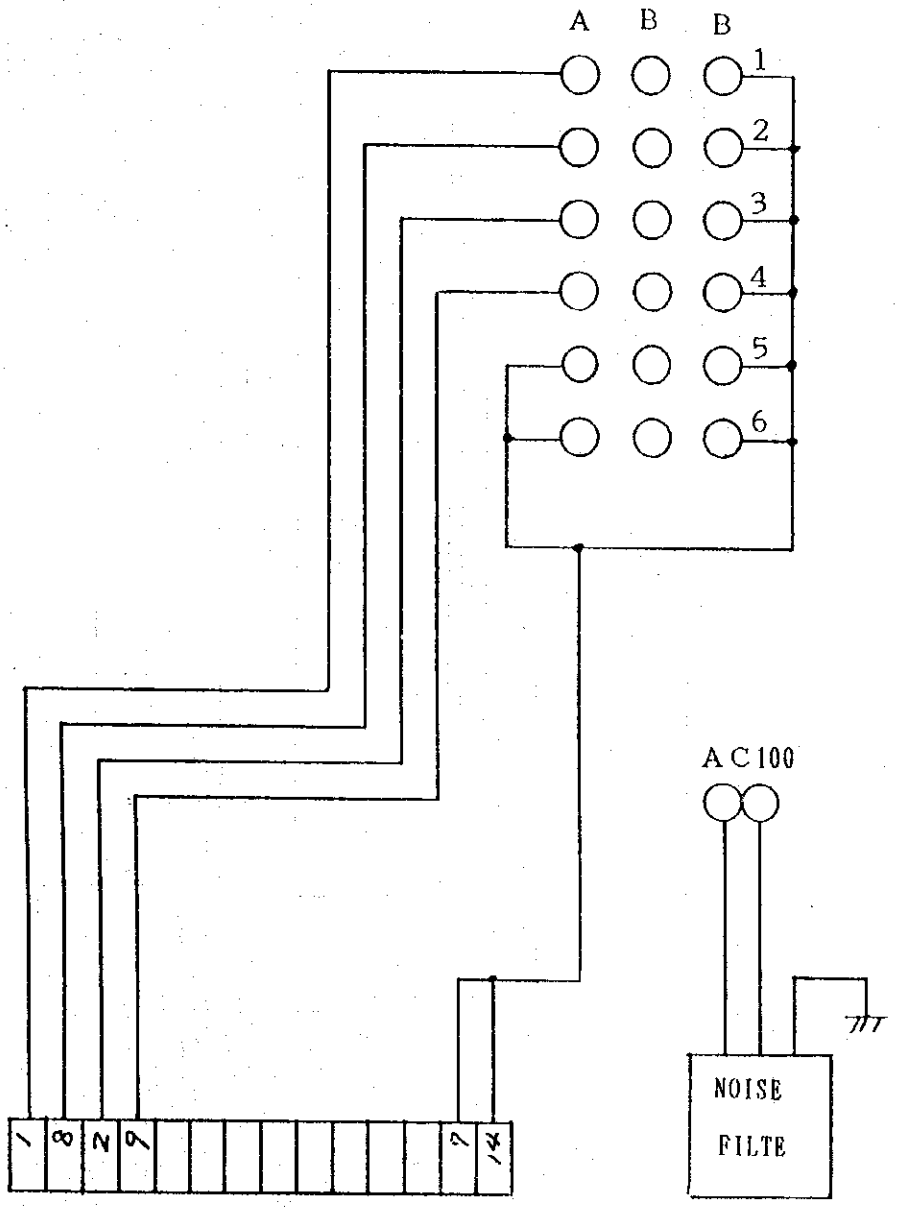
A 4

A 5



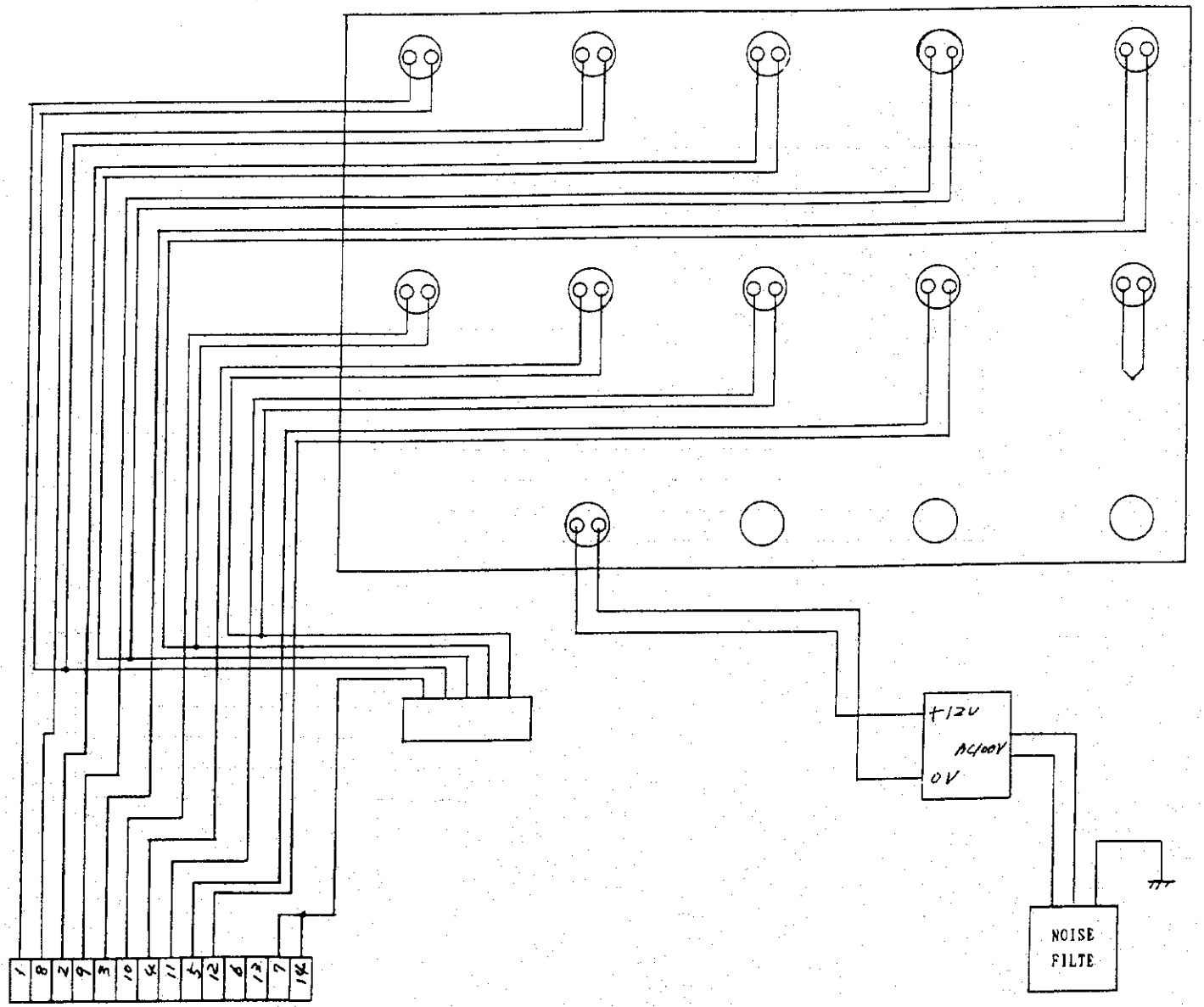
B 4

C 4



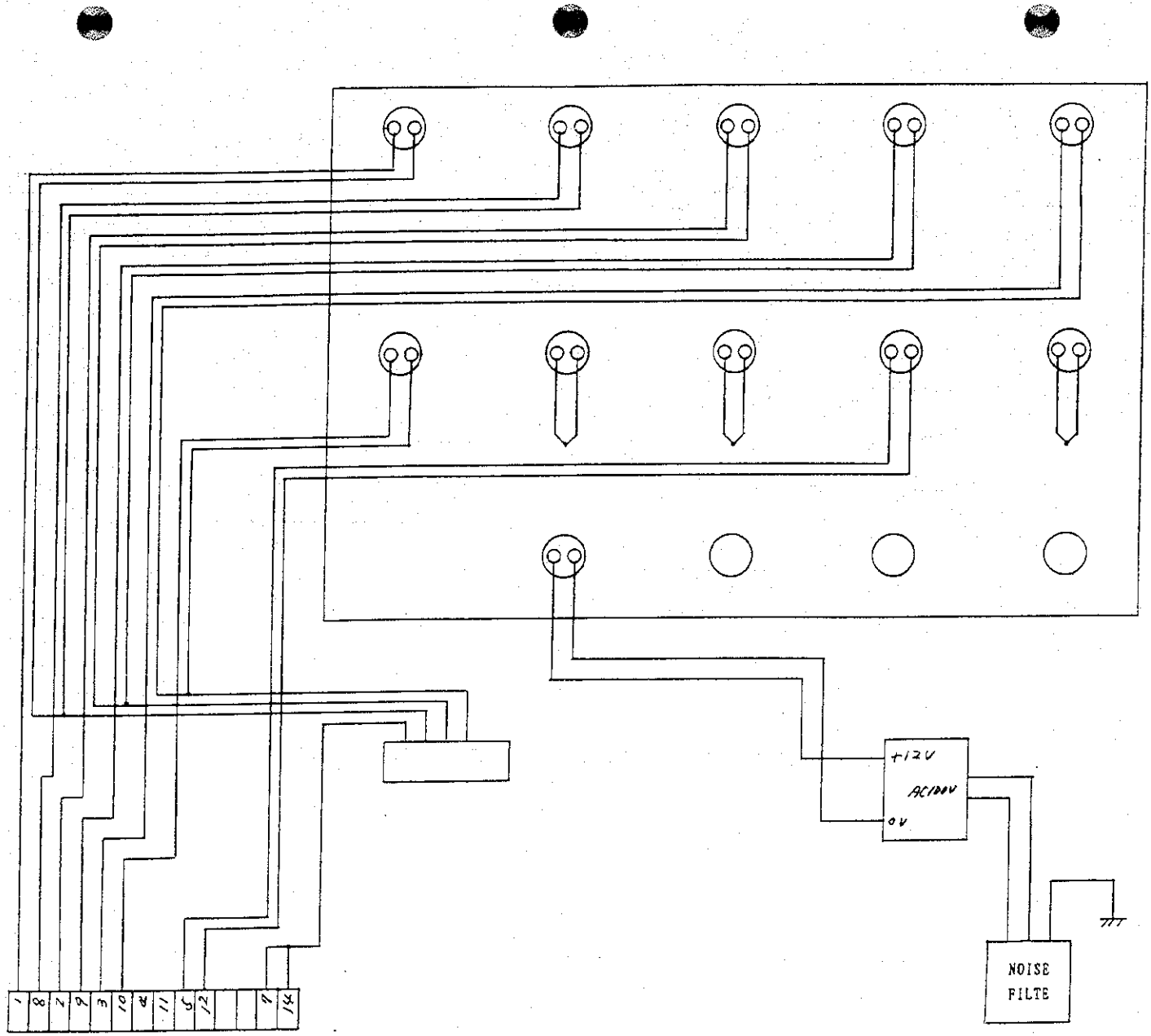
B 5

C 5



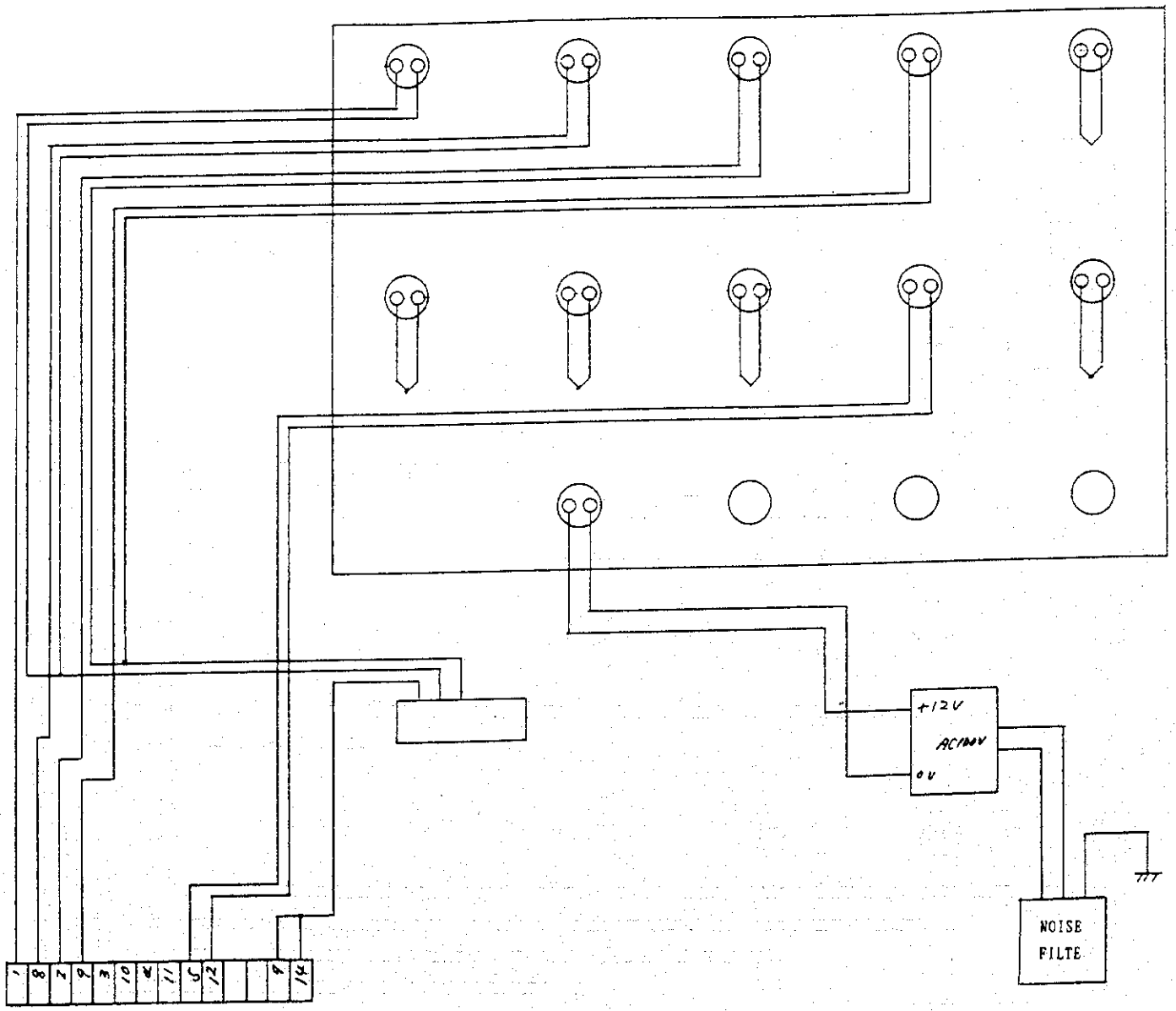
A 6

A 7



B 6

C 6



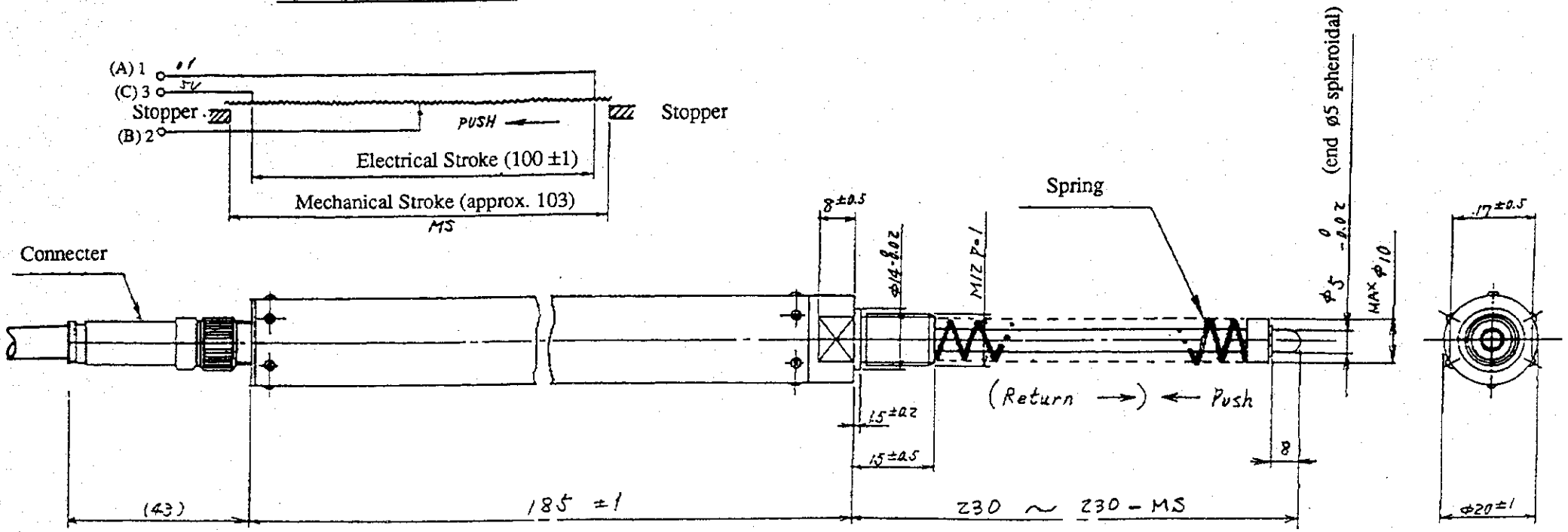
B 7

C 7

4.1 Land Subsidence Meter Sensor Figure

Subsidence Sensor

Terminal Connection Figure within ( ) is the connector terminal character.



Note) Includes an internal washer and hexagon nut (MIZ P=1) as a metal fitting.

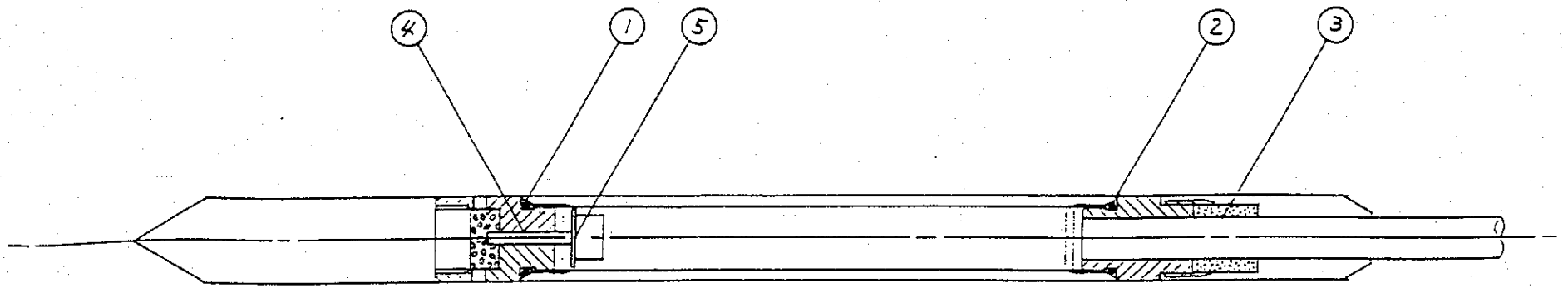
General Characteristics

- Total resistance and tolerance — $10^{k\Omega}$ ±10% (desired value of our company)
- Single linearity — ±0.3% (precision type)
- Rated current — 1.5W
- Friction — Approx. 3.0^{kgf} (When pushing the shaft to the end)
- Weight — Approx. 150g

Connector Specifications

[Performance]	Withstand voltage	: AC900V
	Insulation resistance	: DC500V $1{,}000^{M\Omega}$ or greater
	Waterproof	
	Number of poles	: 6 poles
	Connecting electric wire diameter	: ø6.3 max

4.2 Ground Water Meter Sensor Figure



1	O-ring p-14 grease
2	O-ring p-14 grease
3	Rubber bushing grease
4	Adhere
5	Adhere (in water level sensor [semi conductor type])

Waterproof structure

Drawing for the semiconductor water level meter structure

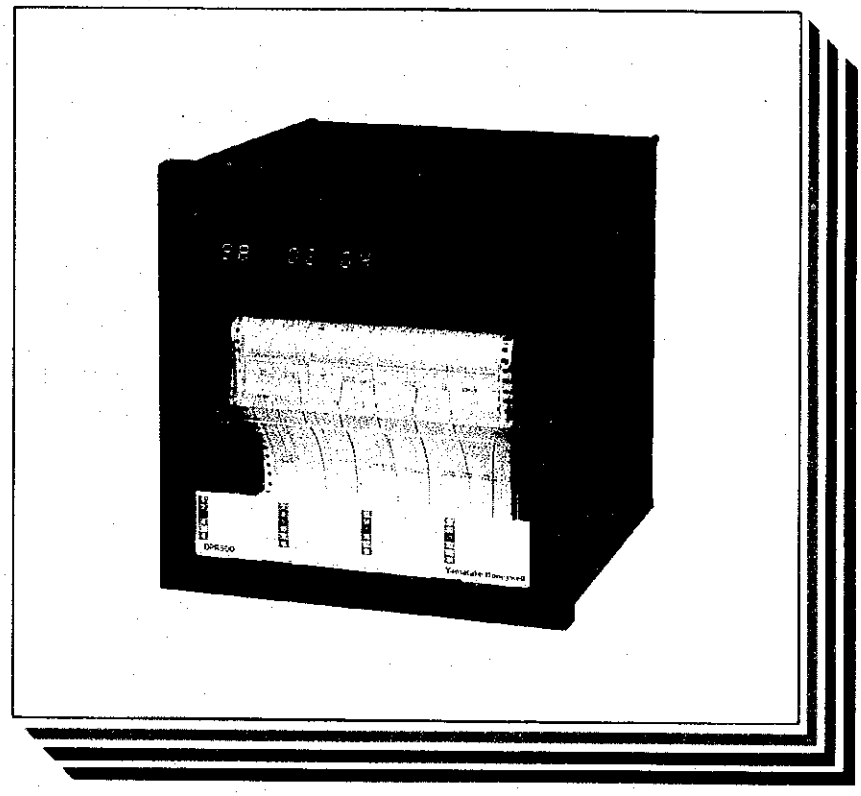
5.0 Equipment Operating Manual

5.1 Recorder

Yamatake-Honeywell

Digital Process Reporter
Intelligent Hybrid Recorder
DPR500

Product Manual



No. CP-UM-1220E
Dec, 1989 ISSUE 4 (H)

TABLE OF CONTENTS

1. GENERAL

1.1 Description

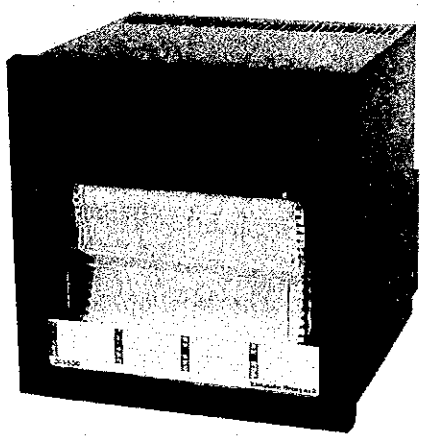
The DPR500 is a microprocessor-based intelligent hybrid recorder with various efficient recording functions.

The DPR500 is available in a 6-, 12- or 24-channel type. It allows three recording formats, namely, trend recording, trend + log recording, and log recording. The recording chart paper is 180 mm wide, folded type. The printing speed is fast and the dot printed images are clear.

The DPR500 accepts a multiple number of different types of inputs, namely, thermocouple inputs, resistance temperature sensor inputs, and DC voltage or current inputs. It, as a standard model of instrument, is incorporated with functions for three types of different measuring modes. Thus, the DPR500 can be used as an ideal process analyzer or reporter.

The DPR500 can be incorporated with the various optional functions, such as remote control input, event output, and communication functions.

To make the correct and efficient use of the DPR500, be sure to read this manual before starting operating the DPR500.



An External View of DPR500

1.2 Features

(A) Standard Functions

The DPR500 is incorporated with the following functions as standard features.

- The DPR500 accepts directly a multiple number of different types of inputs. The recording scale for each of the inputs can be set as required.

- Three types of recording formats as follows are selectable.

  - o Trend (waveform) recording

    The trends of process variables are recorded as signal waveforms. Time, recording scales, and events are printed digitally.

  - o Trend recording + logging

    Both trend recording and logging are done simultaneously.

  - o Logging

    Process variables are digitally printed out sequentially at certain time intervals, thereby automatically providing accurate and detailed process reports.

- Three types of measuring modes are selectable for each of the input channels.

  - o Regular measurement (regular PV value)

  - o Differential value between two channels

  - o Differential value of a channel with respect to a fixed value

- Burnout protection for thermocouple input is selectable for each of the input channels.

  - o Off

  - o Upscale

  - o Downscale

- The configuration data for setting the DPR500 is protected in E^2PROM even when power of the DPR500 is turned off. The configuration data can be modified readily.

- The powerful recording capability of the DPR500 allows efficient analysis of process data.

- The DPR500 is able of record and print out the measured process data, channel numbers, tag names, engineering units of measure, high and low limit values of recording scales, chart feed speed, events (time of occurrence/reset, channel number, and status of each event), markers, and date and time.

- The DPR500 is able to record also the events of configuration data change.

(B) Optional Functions

The DPR500 can be optionally incorporated with the following functions.

- The remote control signal input circuit allows the DPR500 to be remote-controlled with three contact signals for the following items.

  (1) Start/stop of recording

  (2) Switching of chart drive speed and interval timer

  (3) Switching of recording scale

- The event output circuit, with relays for 6 or 12 output channels, allows to deliver the sum signals of logical OR of four event setpoints of individual channel.

- The communication function will allow the DPR500 to cope with future FA and LA.

1.3 Specifications

■ Input Section

No. of channels	6, 12, or 24 channels
Types of inputs	Thermocouple, resistance temperature sensor, and DC voltage or current* types of inputs. (See Table 1.1)
Input scan period	7.5 sec/6 channels, 15 sec/12 channels, or 30 sec/ 24 channels
Input ranges	Can be set as required, from front panel, employing range codes. (See Table 1.1).
Resolution	See Table 1.1.
Reference junction compensation	± 0.5°C
Scaling	Can be displayed and recorded in engineering units of measure (for DC voltage or current inputs)
PV bias	Can be set for each input channel, within a range of -19999 to +29999
Allowable wiring resistances	Thermocouple, DC voltage or current inputs: Up to 2 kΩ Resistance temperature sensor inputs: Up to 10 Ω (The resistances of the three wires must be identical.)
Input resistances	> 10 MΩ

* For each of the DC current inputs, provide a precision resistor in order to convert it into a DC voltage signal. (Type number of 250 Ω Precision Resistor: J-ARR50)

Table 1.1. Types of Inputs and Indicating Accuracies

Type of input		Range code	Measuring range	Indicating accuracy	Resolution
DC voltage	± 20 mV	00	± 20.00	± (0.2% of rdg + 3 digits)	10 µV
	± 200 mV	01	± 200.0	± (0.2% of rdg + 2 digits)	100 µV
	± 2 V	03	± 2.000	± (0.2% of rdg + 2 digits)	1 mV
	± 6 V	04	± 6.000	± (0.2% of rdg + 2 digits)	1 mV
Thermocouple (°C)	R	10	0.0 to 1760.0	± (0.15% of rdg + 1°C) Except ± 3.7°C for 0 to 100°C, and ± 1.5°C for 100 to 300°C	0.2°C
	S	11			
	B	12	400.0 to 1820.0	± (0.15% of rdg + 1°C) Except ± 2°C for 400 to 600°C	0.2°C
	K	13	-200.0 to 1370.0	± (0.15% of rdg + 0.7°C) Except ± (0.15% of rdg + 1°C) for -200 to 100°C	0.1°C
	E	14	-200.0 to 800.0	± (0.15% of rdg + 0.5°C)	0.1°C
	J	15	-200.0 to 1100.0	± (0.15% of rdg + 0.5°C) Except ± (0.15% of rdg + 0.7°C) for -200 to 100°C	0.1°C
	T	16	-200.0 to 400.0	± (0.15% of rdg + 0.5°C)	0.1°C
	W5Re-26	17	0.0 to 2315.0	± (0.15% of rdg + 1°C)	0.2°C
	Ni-Ni•MO	18	0.0 to 1200.0	± (0.15% of rdg + 0.5°C)	0.1°C
	Semi-standard	See the Note	See Table 1.2.		
Resistance temperature sensor (°C)	Pt100 Ω (JIS)	30	-200.0 to 550.0	± (0.2% of rdg + 0.5°C)	0.1°C
	Pt50 Ω (JIS)	31	-200.0 to 550.0	± (0.2% of rdg +1°C)	0.2°C
	Ni508.4 Ω	32	-50.0 to 150.0	± (0.2% of rdg + 0.5°C)	0.1°C

Note: When a semi-standard input is involved, the type of input specified with a code number replaces the Ni-NiMo type (Range Code 18).
That is, for a semi-standard type of input, configuration should be made by means of Range Code = 18.

Table 1.2. Semi-standard Input Types and Indication Accuracies

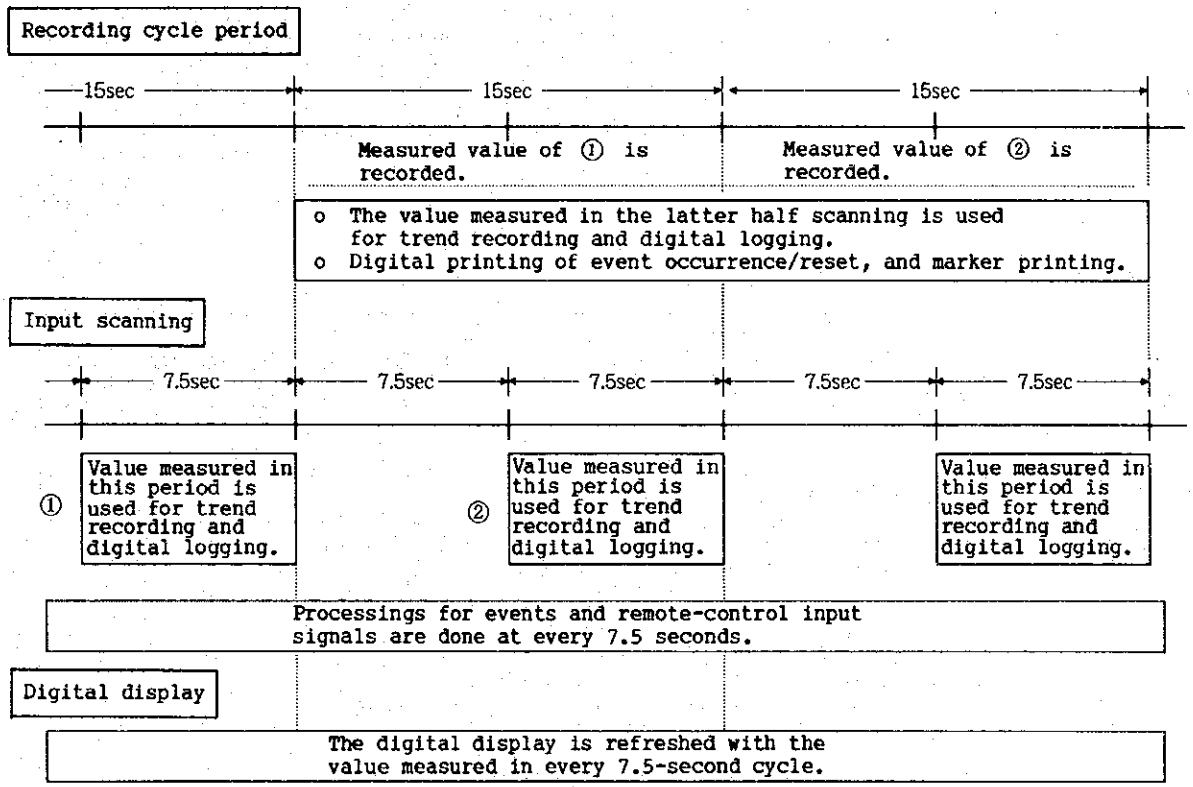
Type of input		Measuring range (°C)	Indication accuracy	Resolution
Thermocouple (°C)	Nicrosil-Nisil	0 to 1300	± (0.15% of rdg + 1.0°C)	0.1°C
	PR40-20	0 to 500	± 40.0	4.0°C
		500 to 900	± 12.0	2.0°C
		900 to 1500	± (0.3% of rdg + 6.0°C)	1.0°C
		1500 to 1880	± (0.3% of rdg + 3.5°C)	0.5°C
	Gold + 0.07% Iron-chromel	-272 to -250	± (0.3% of rdg + 0.7°C)	0.2°C
		-250 to 26	± (0.15% of rdg + 0.7°C)	0.2°C
	DIN L	-200 to 900	± (0.15% of reg + 0.5°C)	0.1°C
	DIN U	-200 to 600	± (0.15% of rdg + 0.5°C)	0.1°C
Radiation Pyrometer (°C)	RH	400 to 700	± 52.0	4.0°C
		700 to 900	± (0.3% of rdg + 5.0°C)	0.5°C
		900 to 1200	± (0.3% of rdg + 2.0°C)	0.2°C
		1200 to 1800	± (0.15% of rdg + 0.8°C)	0.1°C
	RI	400 to 700	± 13.0	1.0°C
		700 to 1400	± (0.3% of rdg + 3.0°C)	0.2°C
		1400 to 1780	± (0.15% of rdg + 1.0°C)	0.1°C

■ Recorder Section

Recording system	Dot printing 6, 12 or 24 printing points, with six different colors Purple: Channels 1, 7, 13, 19 Red: Channels 2, 8, 14, 20 Black: Channels 3, 9, 15, 21 Green: Channels 4, 10, 16, 22 Blue: Channels 5, 11, 17, 23 (also for printing of date, time, and chart feed speed) Brown: Channels 6, 12, 18, 24
Recording period	15 sec for 6 or 12 channels*; 30 sec for 24 channels
Recording chart paper	Recording width 180 mm, 20 meters long, folded paper. Chart end warning mark at 1.5 m before the end of chart.
Chart drive system	Sprocket type
Chart feed speed	12.5, 25, 50, 70, or 150 mm/hr (selectable)
Printing of numerals, characters and symbols	With vertical 7 dots and horizontal 5 dots
Recording formats	(1) Trend recording, (2) Trend recording + logging, or (3) Logging. (selectable)

*: o When the chart feed speed is low and the input signal value remains almost unchanged, printing may not be repeated at every 15 seconds due to the double-printing prevention function (overlapping dot print prevention function).

o The 6-channel DPR500 scans twice the input channels per one recording cycle period (15 seconds). The values measured in the latter half cycle are used for trend recording and digital logging. (See the timing chart given below.)


Recording cycle period
15sec
15sec
15sec
Measured value of ① is recorded.
Measured value of ② is recorded.
o The value measured in the latter half scanning is used for trend recording and digital logging.
o Digital printing of event occurrence/reset, and marker printing.
Input scanning
7.5sec
7.5sec
7.5sec
7.5sec
7.5sec
①
Value measured in this period is used for trend recording and digital logging.
②
Value measured in this period is used for trend recording and digital logging.
Value measured in this period is used for trend recording and digital logging.
Processings for events and remote-control input signals are done at every 7.5 seconds.
Digital display
The digital display is refreshed with the value measured in every 7.5-second cycle.

■ Display Section

Digital readout	Display elements: LED's Display cycle period: 4 sec. (when in AUTO display mode) Displayed items: Channel number, measured value, alarm, date and time, chart speed, and other configuration data items
Indicator lamps	Indicated items: Recording mode and event occurrence mode. Individual types of configuration mode and operation mode

■ Overall Instrument Specifications

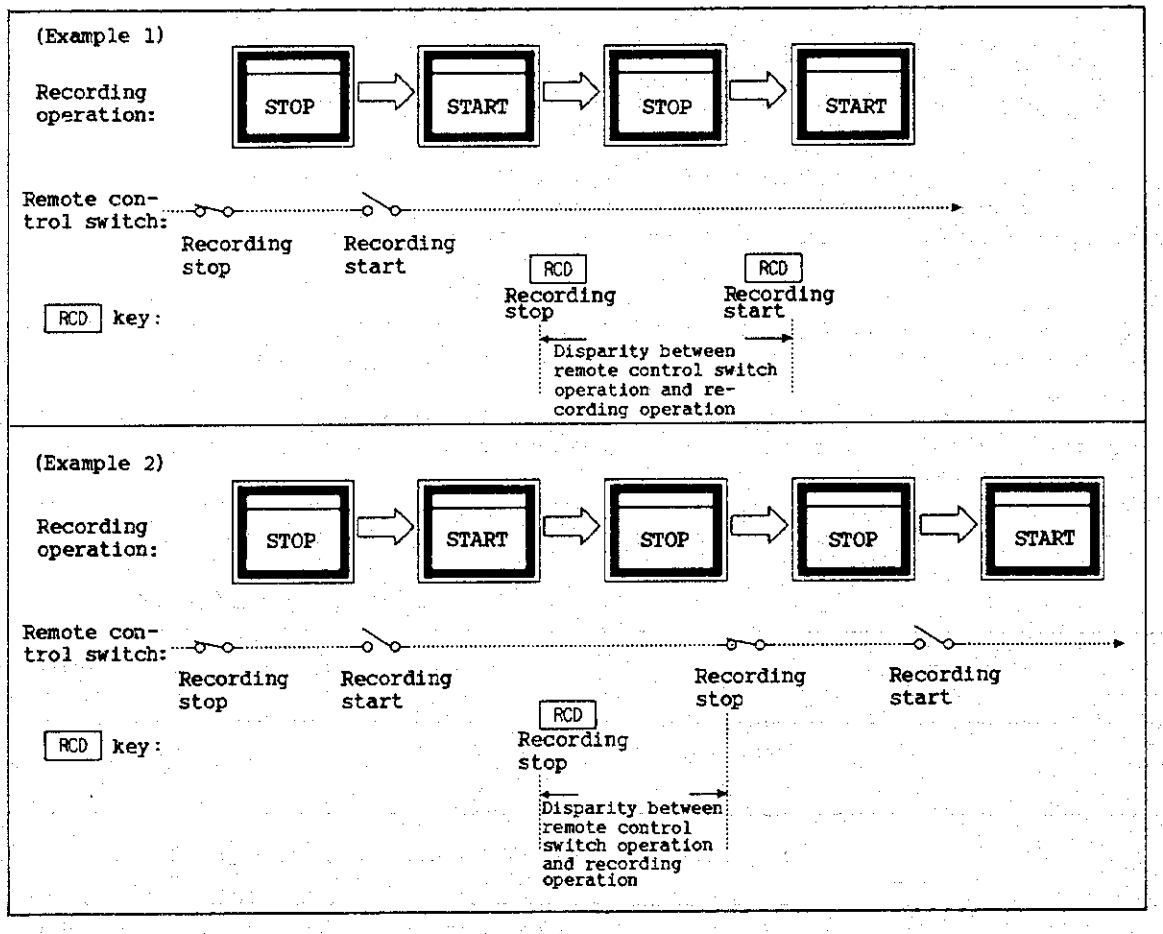
Memory protection	Configuration data: Stored in E^2PROM Clock backup: With three battery Type SUM-3 dry battery cells. (To be replaced at every 12 months or thereabout)
Mechanical vibration	0.2 g (0 - 100 Hg)
Mechanical shock	Up to 30 G
Insulation resistances	More than 20 MΩ (Between each terminal and chassis, as measured with 500 V DC megohm tester)
Withstand voltages	Between signal input terminal and chassis: 1000 V (50/60 Hz AC), for 1 minute Between signal input terminals: 140 V (50/60 Hz AC), for 1 minute Except resistance temperature sensor inputs Between power input terminal and chassis: 1000 V (50/60 Hz AC), for 1 minute Between output terminal and chassis: 1000 V (50/60 Hz AC), for 1 minute
Induction rejection	Common mode rejection ratio: 120 dB Normal mode rejection ratio: 40 dB
Operating ambient temperature	0 to 50°C
Storage ambient temperature	-40 to 70°C (Except -20 to 50°C for printing cartridges)
Operating ambient humidity	30 to 90% RH (There must not dew condensation.)
Storage ambient humidity	5 to 95% RH (There must not dew condensation.)
AC line voltage (Nominal)	100 V, 115 V, 200 V, 230 V; 50 Hz or 60 Hz
AC line voltage allowance	± 10% of nominal voltage
Power Consumption	DPR500 without options: 25 VA DPR500 with options: 30 VA
Materials	Casing: Steel plates Door: Glass fiber reinforced polyester resin
Weight	DPR500 without options: 13 kg DPR500 with options: 14 kg
Finish	Casing and door: Black
Installation	Panel flush mount
Mounting angle	From level to 30-degree downward toward rear

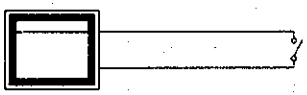
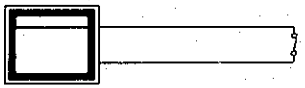
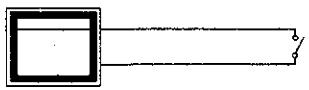
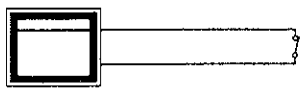
■ Remote Control Signal Input Circuit (optional)

No. of control signals	3 signals. (For (1) record start/stop, (2) chart drive speed or interval timer change, and (3) recording scale change)
Type of control signals	Contact signals. Alternate type switches (See Note 1.)
Input terminal open voltage	Approx. 6 V
Input terminal shorted current	Approx. 5 mA
Functions	(1) Record Start/Stop Control Recording operation can be start/stop-controlled either locally with the RCD key on the front panel or remotely with an external contact signal. When in the local mode, recording starts as you press the RCD key and the RECORD lamp illuminates or it stops as the lamp goes off. When in the remote mode, recording starts as the external control contact signal (switch signal) is changed from "made" to "broken" or it stops as the signal is changed from "broken" to "made". Notes: (1) Start/stop control of recording is done by employing the rise up or fall down edge of the contact signal waveform. Therefore, the contact (switch) must not be of a momentary type. (2) To start recording again after it was stopped by pressing the RCD key after it had been started with an external switch signal, turn the external switch to the state for stop and then start recording again. (3) To disable the RCD key in order to prevent local intervention, use the key lock function (set to key lock level 1). For the key lock function, refer to Section 8.4.8.

Functions

Examples of Relationship Between Remote Control Switch and Local RCD Key



Functions	(2) Chart Speed or Interval Timer Change As the remote control contact is changed from "made" to "broken", the chart feed speed for trend recording or the interval timer setting for digital logging is changed to that of No. 1. As the contact is changed from "broken" to "made", the speed or timer is changed to that of No. 2.  "Broken": For chart feed speed or interval timer of No. 2  "Made": For chart feed speed or interval timer of No. 2
	(3) Recording Scale Change This function is enabled only when the remote control mode is specified for the recording scale change system by configuration setting for the measuring scale. As the remote control contact is changed from "made" to "broken", the recording scale of No. 1 is selected. As the contact is changed from "broken" to "made", the recording scale of No. 2 is selected. For setting of recording scale, refer to Section 8.4.2.  "Broken": For recording scale No. 1  "Made": For recording scale No. 2

■ Event Output Circuit (optional)

No. of output channels	6 or 12 channels
Type of outputs	Relay contact outputs (transfer contact outputs)
Relay operation	On logical OR of alarm event outputs of channel assigned to output relay
Contact ratings	Non-inductive load: 240 V AC, 1 A Inductive load: 30 V DC, 1 A
Type of relay drive operation	Direct operation (Relay is energized when event is on.)
Type of trip operation	For high alarm: Trips when PV value or differential value has exceeded the preset limit value. For low alarm: Trips when PV value or differential value has falled below the preset limit value.
Preset items	No. of preset points: Up to 4 points per channel Preset range: -19999 to 29999 (Position of decimal point differs by the range.) Differential gap: 0 to 29999 (Position of decimal point differs by the range.)

■ Communications (Optional)

		RS-232C	RS-485
Specification	Standard	Comparable to EIA RS-232C	Comparable to EIA RS-485
	No. of Signal Lines	8 (including FG)	5
	Transmission Distance	15m or less	300m or less
Protocol	Network	1 to 1	Multidrop (max. 31 slaves)
	Function	Slave	Slave
	Master Station	Not specified	Not specified
Transmission	Communication Mode	Synchronization	Synchronization
	Communication Manner	Half-duplex	Half-duplex
	Transmission Rate	1200, 2400, 4800, 9600BPS	1200, 2400, 4800, 9600BPS
	Start Bit	1	1
	Data Length	7, 8	7, 8
	Parity	Even no. or No.	Even no. or No.
	Stop Bit	1, 2	1, 2
	Error Check	LRC, Sum check	LRC, Sum check

1.4 Model Number Table

	Basic model No.	Selections	Options I	Options II
Description:	DPR5 □□	A□	□□□□	□

Basic model No.	Selections I	Selections II	Options I I	Options I II	Options I III	Options I IV	Options II		Description
DPR506									6-channel recorder
DPR512									12-channel recorder
DPR524									24-channel recorder
	-A								JIS °C display
		1							AC 100 V (Common for 50 Hz and 60 Hz)
		2							AC 115 V
		3							AC 200 V
		4							AC 230 V
			0						Without remote control input circuit
			1						With remote control input circuit (for 3 channels)
				0					Without alarm event output circuit
				1					With event output circuit (6 channels)
				2					With event output circuit (12 channels)
					0				Without recording chart illumination lamp
					1				With recording chart illumination lamp
						0			Without communication function
						1			With communication function (RS-232C)
						2			With communication function (RS-485)
						3			Communication (RS-422) (Use with CMC300 or MA500)
							X		Without Options II
							D		With inspection and test data sheet
							T		With tropicalization
							S		With inspection and test data sheet plus tropicalization
								R01	Nicrosil-Nisil
								R02	PR40-20
								R03	Gold Iron-Chromel
								R04	DIN L (Fe-CuNi)
								R05	DIN U (Cu-CuNi)
								R06	Radiation pyrometer RH
								R07	Radiation pyrometer RI

1.5 Recording formats

The DPR500 is able to print out data in three different formats, namely (1) trend recording (analog waveform recording), (2) trend recording plus digital logging, and (3) digital logging. Examples of records in these formats are introduced in the following.

(1) Trend Recording

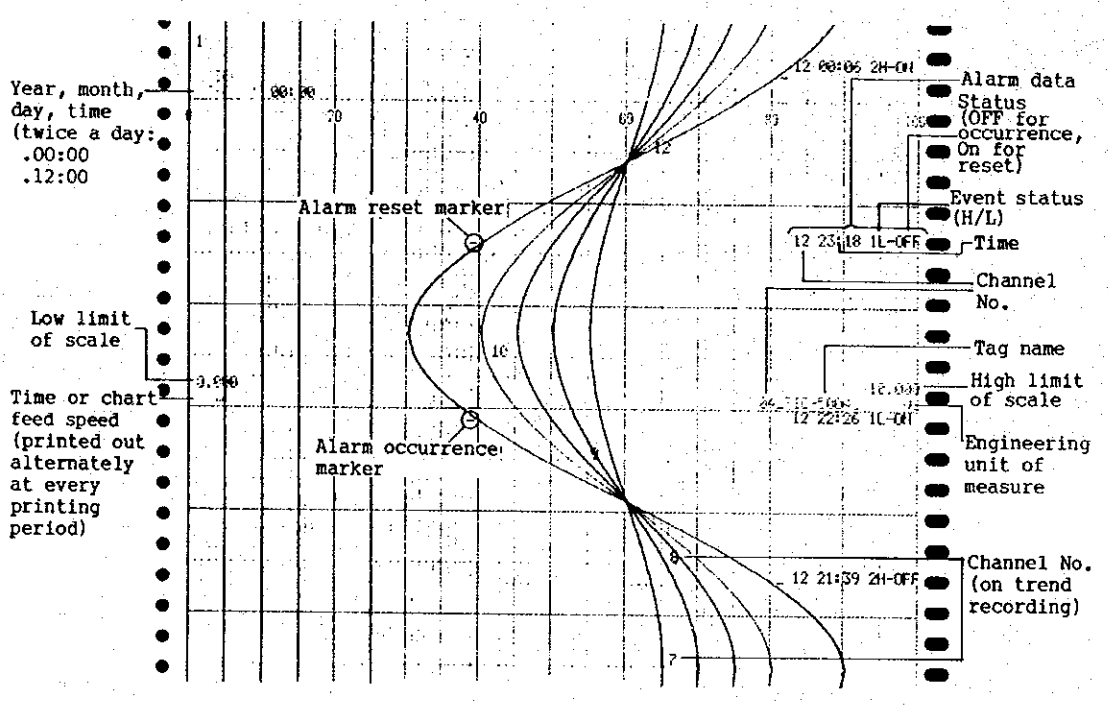


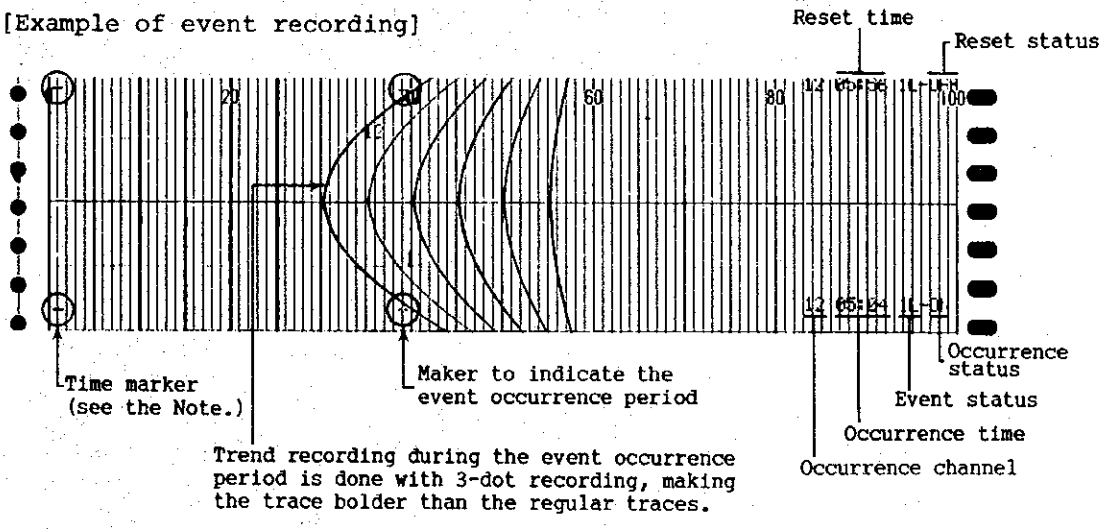
Fig. 1.1. An Example of Trend Recording

- When in the trend recording format mode of operation, the analog input signals are trend-recorded and their channel numbers are printed out.

  - o For each channel, one of the three measuring modes can be specified. (The three measuring modes are (1) PV measurement, (2) measurement of differential value between two channels, and (3) measurement of differential value of PV with respect to a fixed reference value.)

- When an event has occurred, its channel number, occurrence/reset time and status, and even level are printed out and the period of event occurrence is marked on the trend recording.

[Example of event recording]



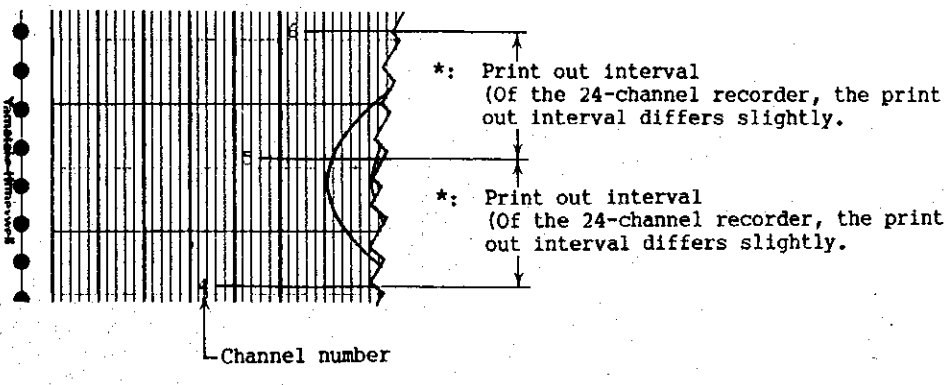
Note: Of the 24-channel recorder, time markers are printed only when the chart drive speed is 150 mm/hr. In this case, time markers and event occurrence period markers alone are printed out and no digital data is printed out.

- Intervals of channel number print out on trend recording (Channel numbers are printed out sequentially, one by one.)

  When chart feed speed is 75 mm/hr or slower: At every 25 mm*

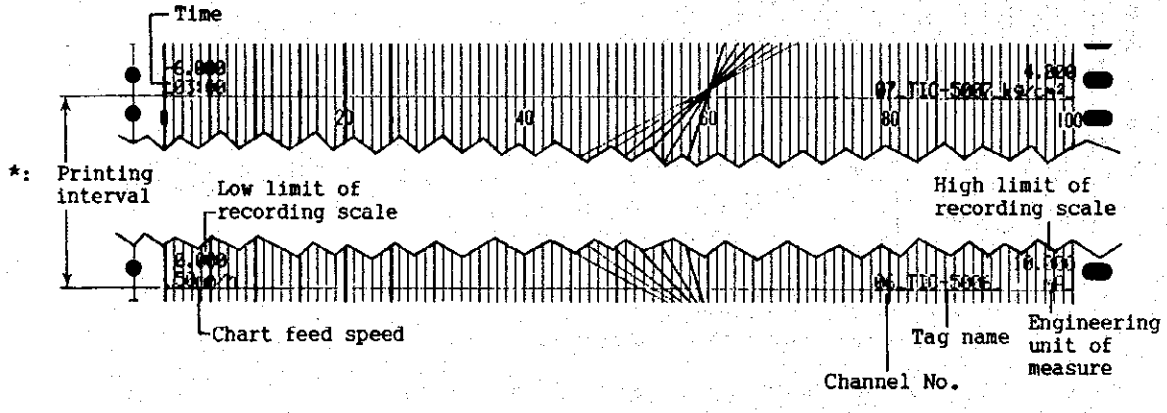
  When chart feed speed is 150 mm/hr: At every 75 mm*
  (Of the 24-channel recorder, no channel numbers are printed out.)

[Example of channel number print out]



- Intervals of print out of recording scale high/low limits time, chart speed (Note 1), channel number, tag name, and engineering unit of measure
  When chart feed speed is 12.5 mm/hr: At every 6 hours 75 mm
  When chart feed speed is 25 mm/hr : At every 3 hours 75 mm
  When chart feed speed is 50 mm/hr : At every 1.5 hours 75 mm
  When chart feed speed is 75 mm/hr : At every 1 hours 75 mm
  When chart feed speed is 150 mm/hr : At every 1 hours 100 mm
  Note 1: Time and chart feed speed are printed out alternately at every recording period.
  Note 2: Of the 24-channel recorder, these items are not printed out when the chart feed speed is 150 mm/hr.

[Example of print out]

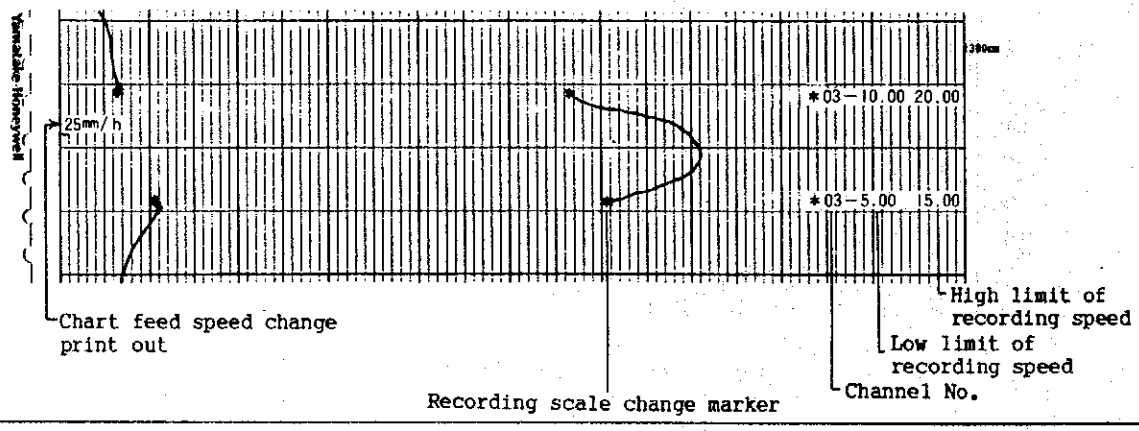


- When the DPR500 is incorporated with the remote control signal input circuit (optional), two different recording scales can be preset for each of the channels in order to expand or contract the trend-recorded waveforms.
- Items printed out when scales are changed are as follows:
  - o Chart feed speed and high/low limits of newly selected ones are printed out together with marker (Note 1)
  - o Chart feed speed change marker: "-" (bar)
  - o Recording scale change markers: Markers as shown below are printed out on trend recording.

Channel No.	Marker
1 to 6	*
7 to 12	+
13 to 18	▨
19 to 24	◺

Note 1. When the instrument is operating as a 24-point recorder with a chart feed speed of 150 mm/hr, no alterations of recording conditions are printed out.

[Example of marker print out]



(2) Trend Recording + Logging

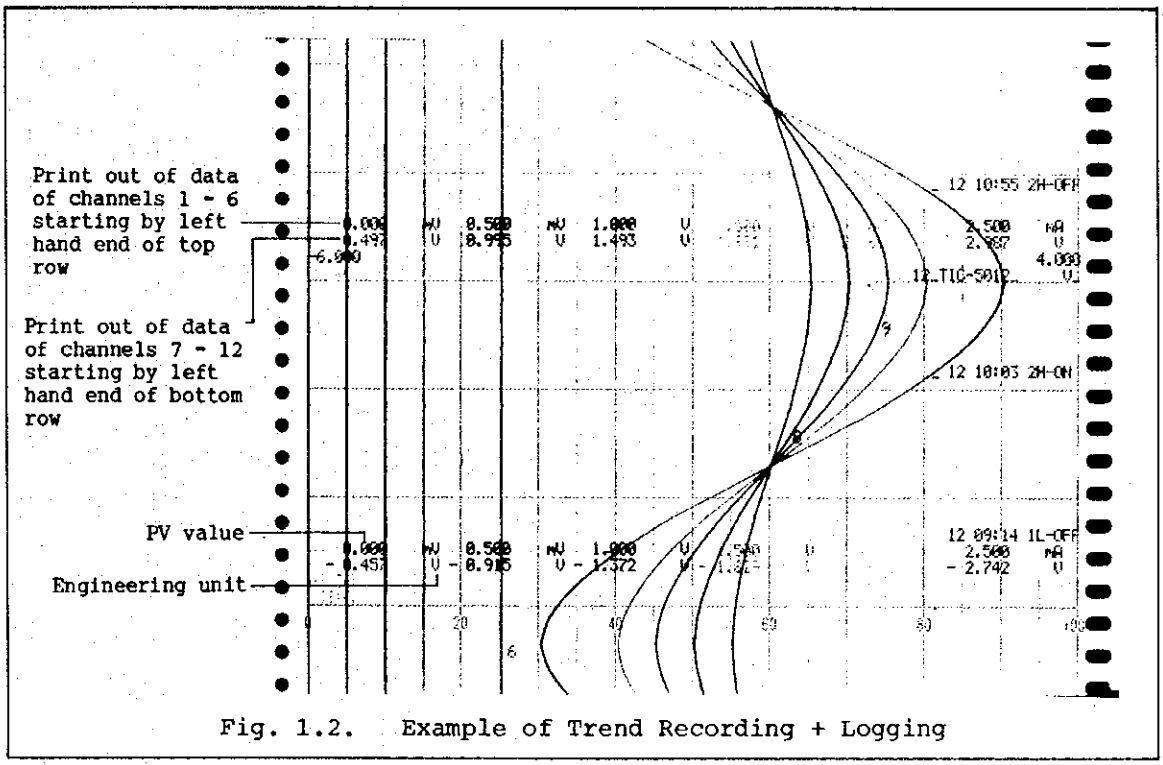
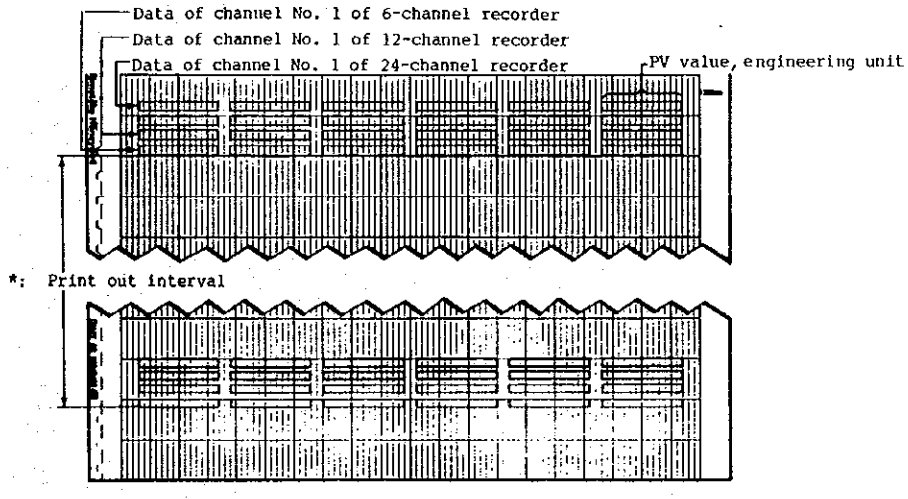


Fig. 1.2. Example of Trend Recording + Logging

- The measured digital values are collectively printed out following the recording scale print out, overlapping on the trend recording. The digital PV values and engineering unit of measure are printed out in the same color as that of the trend recording. Other items printed out are identical with those printed out when in the trend recording mode.
- Intervals of print out of digital values are as follows:

  When chart feed speed is 12.5 mm/hr: At every 6 hours 75 mm
  When chart feed speed is 25 mm/hr : At every 3 hours 75 mm
  When chart feed speed is 50 mm/hr : At every 1.5 hours 75 mm
  When chart feed speed is 75 mm/hr : At every 1 hours 75 mm
  When chart feed speed is 150 mm/hr : At every 1 hours 100 mm

  Note 1: Of the 24-channel recorder, these items are not printed out when the chart feed speed is 150 mm/hr.



(3) Logging

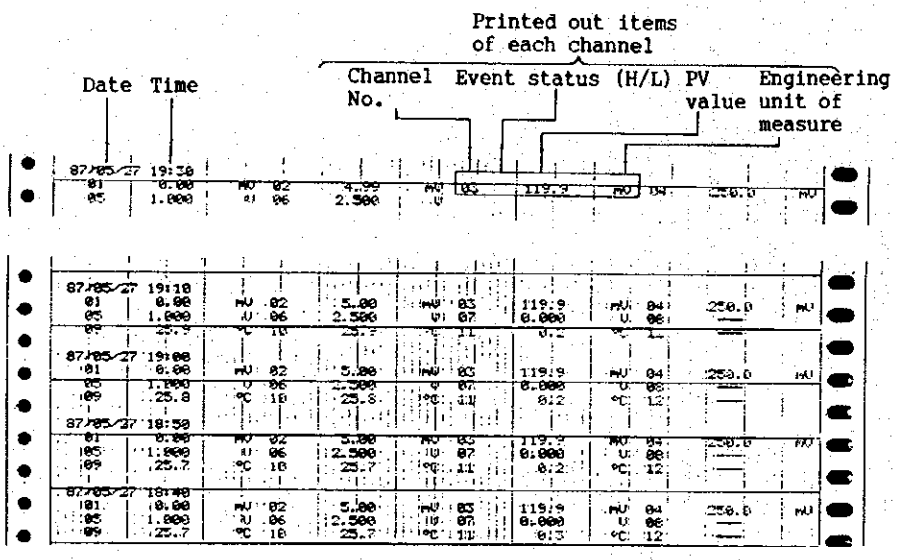


Fig. 1.3. Example of Logging

- The below-mentioned items ar collectively printed out at preset intervals or as demanded by pressing the DMD key.

(4) Demand Print Out

As you press the DMD key while in the recording mode, data is printed out in the logging mode. This can be done overlappingly even when in the trend recording mode or in the trend recording + logging mode.

2. GENERAL NOTES

2.1 Removing the Transportation Bolt

The DPR500 will be delivered to you with its chassis clamped by a transportation bolt to the casing in order to prevent damage when in transportation. Before using the DPR500, remove the transportation bolt. Keep the removed transportation bolt as it should be used when transporting the DPR500 again.

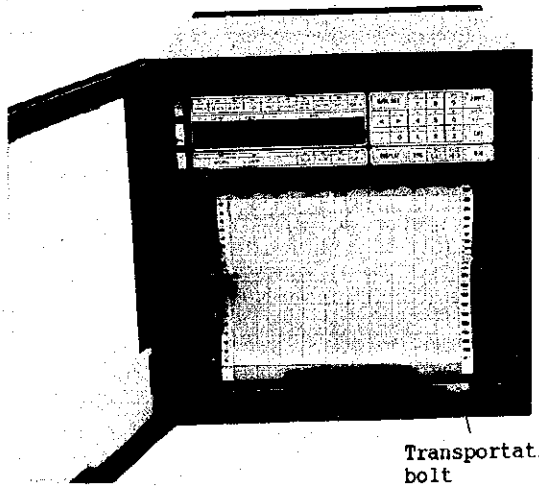


Fig. 2.1 Location of Transportation Bolt

2.2 Checking the Nameplate

The nameplate is posted at the right hand side on the chassis. Check the items indicated on the nameplate referring to the model number table to make the correct use of the DPR500. (For the pull out procedure of the chassis, refer to Section 6.3 "Preparation for Recording."

2.3 Accessories

The standard accessories of the DPR500 are as shown in Table 2.1. When the DPR500 is delivered to you, check that these accessories accompany the DPR500.

Table 2.1 Accessories

Accessory	Q'ty	Remarks
Mounting brackets	2	
Mounting bolts	2	
Recording chart paper	1	Folded type
Printing cartridge (purple)	1	
Printing cartridge (red)	1	
Printing cartridge (black)	1	
Printing cartridge (green)	1	
Printing cartridge (blue)	1	
Printing cartridge (brown)	1	
Fuse	1	1 A (for nominal 100 V) or 0.5 A (for nominal 200 V)
Dry batteries	3	Type SUM-3 (regular dry cells available on the market)
Measuring-unit seal	1	

3. NOMENCLATURE AND LAYOUT OF COMPONENTS

The nomenclature and layout of the major components of DPR500 are shown in Fig. 3.1.

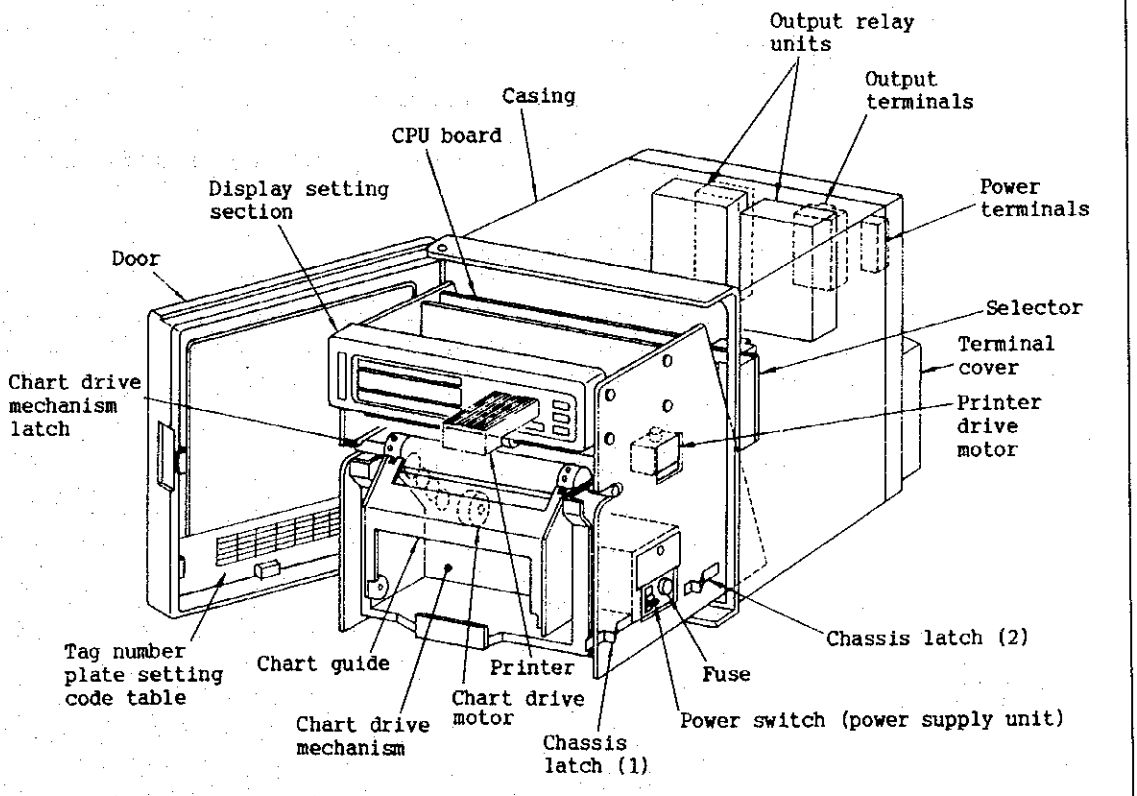


Fig. 3.1. Nomenclature and Layout of Components of DPR500

Notes: 1. Exercise care when pulling out the chassis from the casing by pressing the chassis latch (2). Note that the chassis is not held by the casing and can fall down when it is pulled out beyond the chassis latch (2) position.

2. Be sue to put back the chassis into the original casing. Note that chassis and casing of different DPR500 instruments must not be interchanged.

4. INSTALLATION

4.1 Environmental Requirements

The place of installation of the DPR500 should meet the following requirements:

(1) Clean atmosphere (not dusty and free of corrosive gas)

(2) Reasonably free from mechanical vibration

(3) Favorable ambient temperature and humidity (without sharp change in temperature or humidity)

(4) Reasonably free from electromagnetic fields

Note: When transporting the DPR500, be sure to clamp its chassis to the casing employing the transportation bolt. (See Section 2 "GENERAL NOTES.")

4.2 Instrument Dimensions and Panel Cutout Dimensions

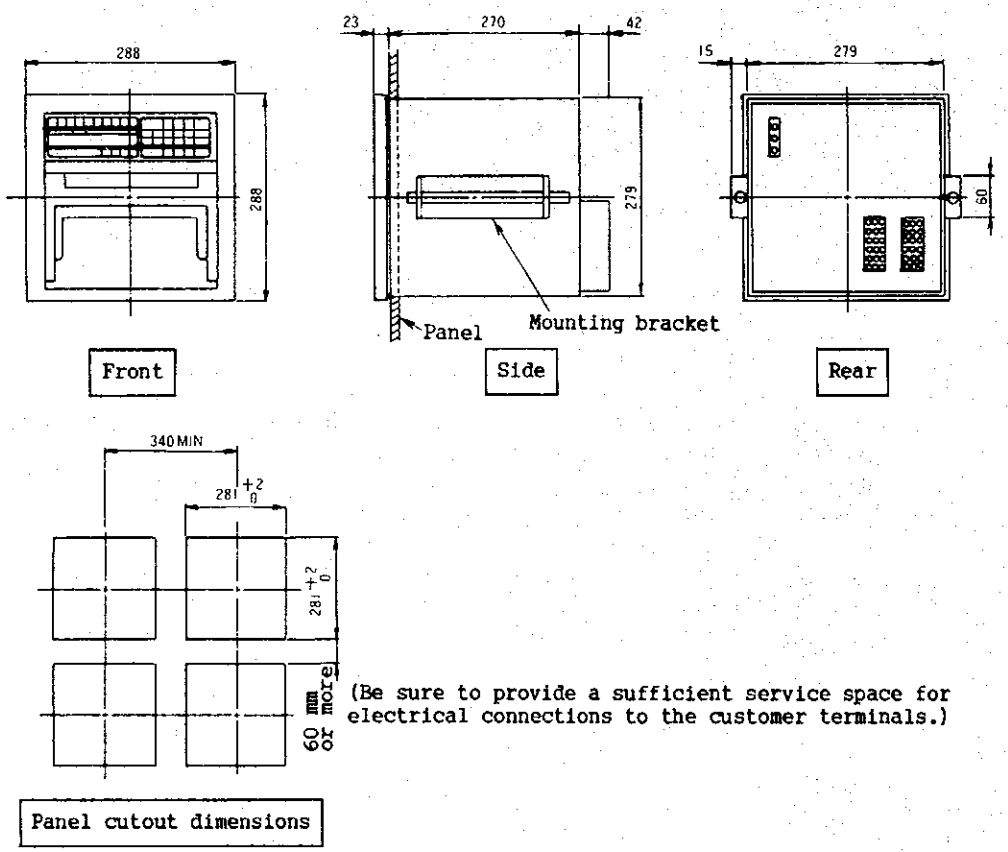


Fig. 4.1. Instrument Dimensions and Panel Cutout Dimensions

4.3 Installation Method

Insert the DPR500 into the panel cutout from the front side of an instrumentation panel and tighten the DPR500 from both sides employing the mounting brackets.

Note: The instrumentation panel must be made of a 3 mm or more thick steel plate.

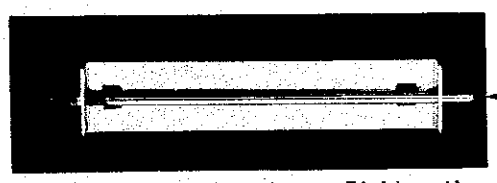


Fig. 4.2. Installation Method

5. ELECTRICAL WIRING

5.1 General Precautions for Electrical Wiring

(1) Note that digital instruments are much more susceptible to electrical noise that analog instruments are, resulting in operation errors and failures. When making electrical wiring for the DPR500, be sure to pay attention to noise observing the instructions given in this manual.

(2) For the solderless terminals, use one which meet M4 screws.

(3) When making electrical wiring for the DPR500, check its model number and correctly connect the wires referring to the input terminal drawing. After the wiring is over, check the wiring again to make it double sure that the wiring is correct.

(4) Lay the input and output signal lines as apart as possible from the 100 V or higher power lines. Do not lay the former together with the latter in the same conduit or duct.

(5) Do not attempt to make use of the unemployed terminals (such as terminals B when inputs are thermocouples) for other purposes (such as for junction terminals).

Table 5.1. Specifications of Thermocouple Leadwires

	Old symbol (for reference)	Symbol	Classification by heat resistance and accuracy	Accuracy	Ambient temperature (°C)	Sheath color
JIS C1610-1981						
B	—	BX-G	Regular type, regular class	—	0 to 100	Grey
R S	—	RX-G SX-G	Regular type, regular class	+3 -7	0 to 150	Black
		RX-H SX-H	Heat resistant type, regular class			
K	CA	KX-G	Regular type, regular class	± 2.5	-20 to 150	Blue
		KX-GS	Regular type, regular class	± 1.5		
		KX-H	Heat resistant type, regular class	± 2.5		
		KX-HS	Regular type, regular class	± 1.5		
		WX-G	Regular type, regular class	± 3.0		
		WX-H	Heat resistant type, regular class			
		VX-G	Regular type, regular class	± 2.5	-20 to 100	
E	CRC	EX-G	Regular type, regular class		-20 to 150	Purple
		FX-H	Heat resistant type, regular class			
J	IC	JX-G	Regular type, regular class			Yellow
		JX-H	Heat resistant type, regular class			
T	CC	TX-G	Regular type, regular class	± 2.0		Brown
		TX-GS	Regular type, precision class	± 1.0		
		TX-H	Heat resistant type, regular class	± 2.0		
		TX-HS	Heat resistant type, precision class	± 1.0		
Other than JIS						
WRe5-26		No dedicated types of thermocouple leadwires are specified. RX and SX leadwires can be used if larger errors are tolerable.				
Ni-Ni-Mo		—				

5.2 Input/Output Signal Wiring

5.2.1 Wiring for Thermocouple Input Signals

For wiring for input signals from thermocouples, connect the element wires of the thermocouples directly to the input terminals. When the distances from thermocouples to the input terminals are long or when the thermocouples are with junction terminals, use thermocouple leadwires. Shielded type of thermocouple leadwires are most recommendable.

5.2.2 Wiring for Analog Input Signals (Other Than Those from Thermocouples) and Digital Input/Output Signals

For wiring for these types of signals, use insulated and vinyl-sheathed cables (CVV or CVS JIS-C-3401 equivalent).

5.3 AC Line Power Wiring

For wiring for AC line input power, 600 V vinyl-sheathed cable (JIS C3307) is most recommendable.

5.4 Signal Source Resistances and Wiring Resistances

The signal source resistances and wiring resistances of input circuits must not be greater than the values given in the below table. Note that measuring errors will increase if the resistances are large.

Type of input	Signal source resistance or wiring resistance
Thermocouple input or voltage input	Signal source resistance: < 2 kΩ Of thermocouple with burnout, measuring accuracy degradation per 100 Ω resistance change is ± 100 μV.
Resistance temperature sensor input	Wiring resistance per wire: < 10 Ω Wiring is in a 3-wire system. The resistances of the three wires must be as uniform as possible.

5.5 Wiring Procedure

(1) Turn off the power switch of the instrument and remove the rear terminal cover.

(2) The terminal cover is held by means of hooks and can be readily removed by pushing it upward (as shown by arrowhead ① in Fig. 5.1) and pulling it rearward (as shown by arrowhead ② in Fig. 5.1).

(3) For allocations of channels to input terminals, see Fig. 5.2.

(4) Connect the AC input power between terminal H and terminal N (neutral line).

(5) Be sure to connect terminal G to ground line of JIS Class 3 grounding work or an equivalent one.

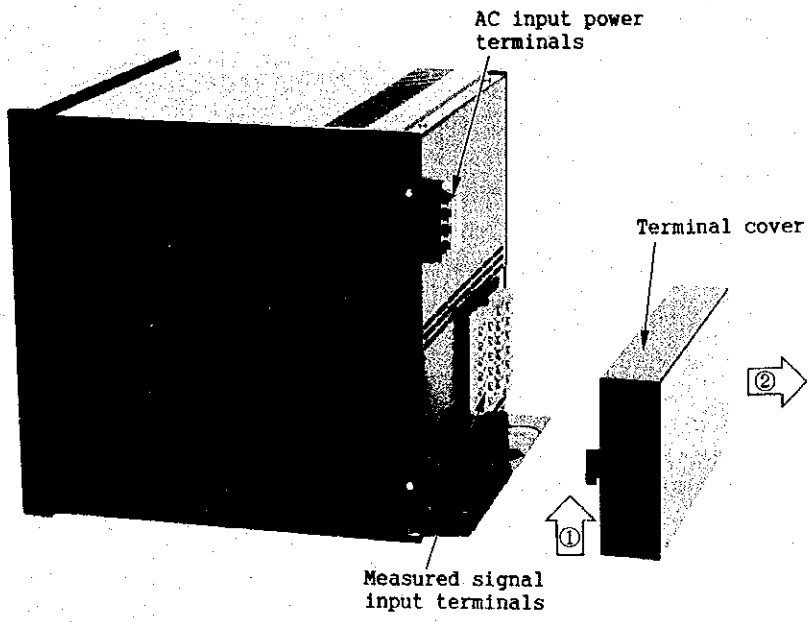
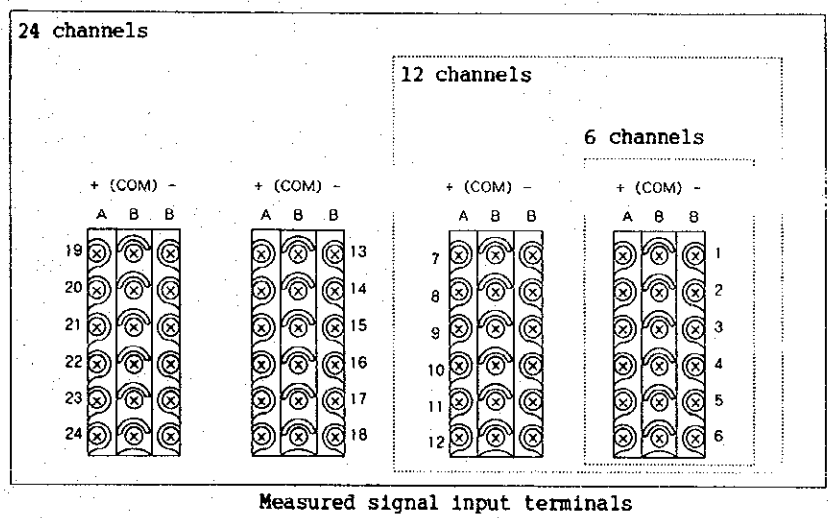


Fig. 5.1

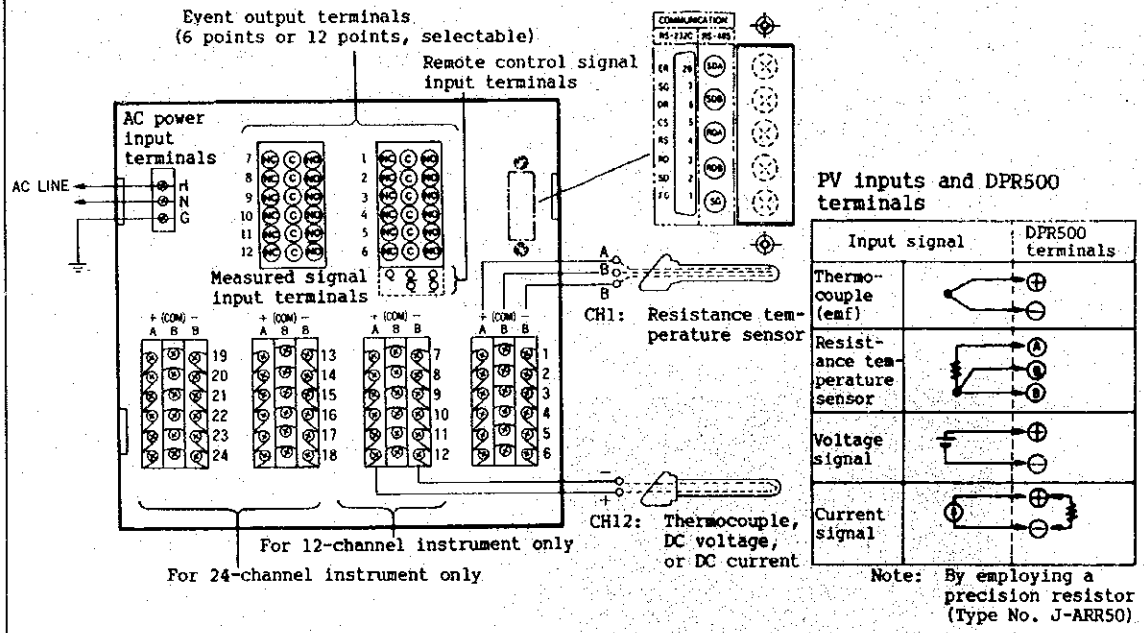


Note: The number of measured signal input terminals differs by the number of input channels of the instrument.

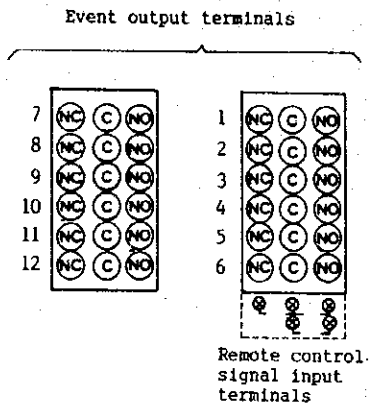
Fig. 5.2

5.6 Customer Terminal connections

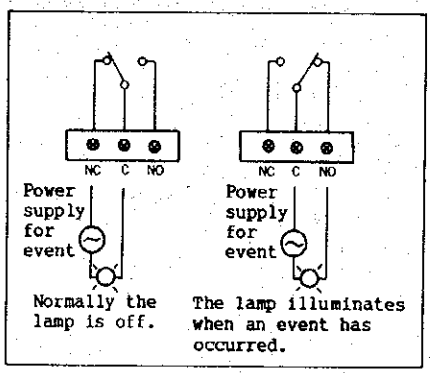
■ Examples of connections to measured signal input terminals



■ Examples of connections to event output terminals and remote control signal input terminals



o Examples of connections to Event output terminals



Examples of connections to remote control signal input terminals

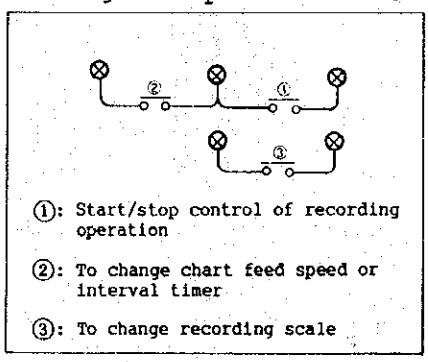


Fig. 5.3 (a). Examples of Customer Terminal Connections

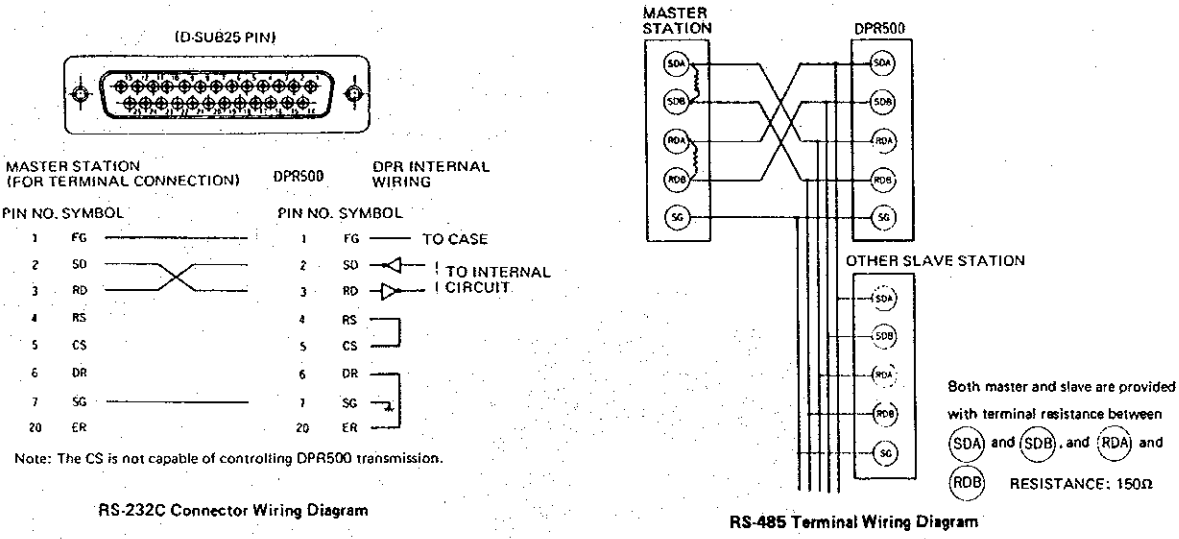


Fig. 5.3 (b). External Communication Wiring Diagram

5.7 Parallel Operation

The term "parallel operation" as used here means that one input signal (the low level voltage signal of a thermocouple) is applied in parallel to another instrument also as well as to the DPR500. When in this mode of operation and the input wiring resistance has become several kilo-ohms, interferences between instruments may occur. To prevent such interferences, observe the following instruction.

(1) Channel Allocation

Allocate high voltage level input signals (± 6 V, ± 2 V) to channels of elder numbers.

(2) Burnout Protection

When in "parallel operation," the burnout protection circuit of DPR500 is disabled. Turn off the burnout protection circuit of DPR500 and let the other instrument provide a burnout protection function of the other instrument is brought into effect, the DPR500 also acts for the same function. (Of the DPR500, burnout protection for a thermocouple input can be set for each of the channels.)

6. PREPARATION FOR OPERATION

6.1 Stopping the Recorder Operation

Check that the RECORD lamp is off and the recorder is not in the recording operation. If it is in the recording operation, press the RCD key to stop it.

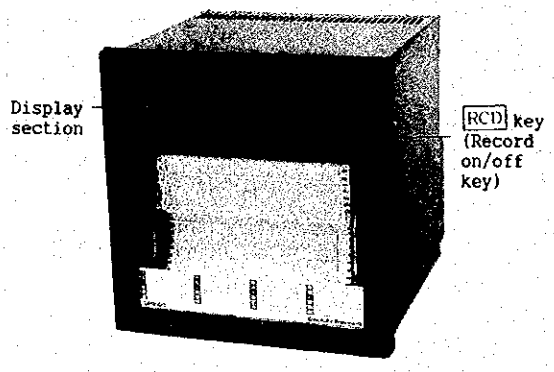


Fig. 6.1

6.2 Logging the Recorder with Chart Paper

(1) Unbind a book of recording chart paper (folded type) by shaking it.

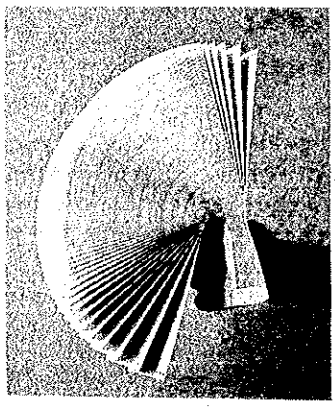


Fig. 6.2

(2) Holding the brim of the chart cassette with your hands, pull it down frontward.

(3) Pull down the chart guide also frontward.

(4) Open the chart retainer upward while pushing it rearward.

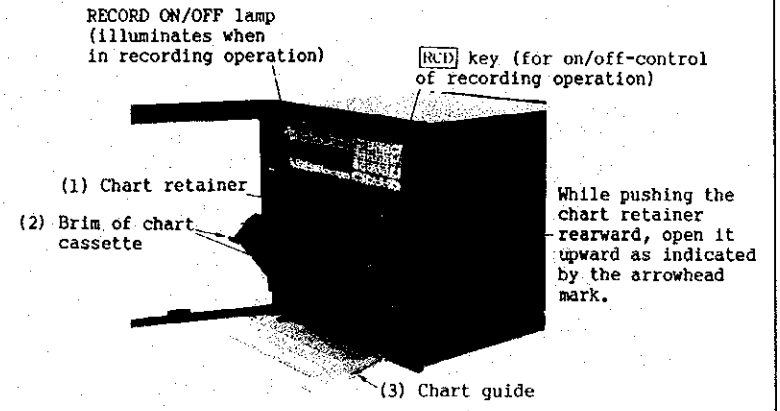


Fig. 6.3

(5) Put the chart paper into the chart holder from the front and lead the chart end frontward.

Note: Be sure to put the chart paper fully and correctly into the chart holder. Note that the chart paper may not be smoothly fed for recording unless it is correctly placed.

(6) Unhold the chart paper end by approximately four folds and let its drive holes engaged with the sprocket teeth. Return the chart retainer to the original position.

Note: Make sure that the horizontal lines (time lines) of chart paper are level.

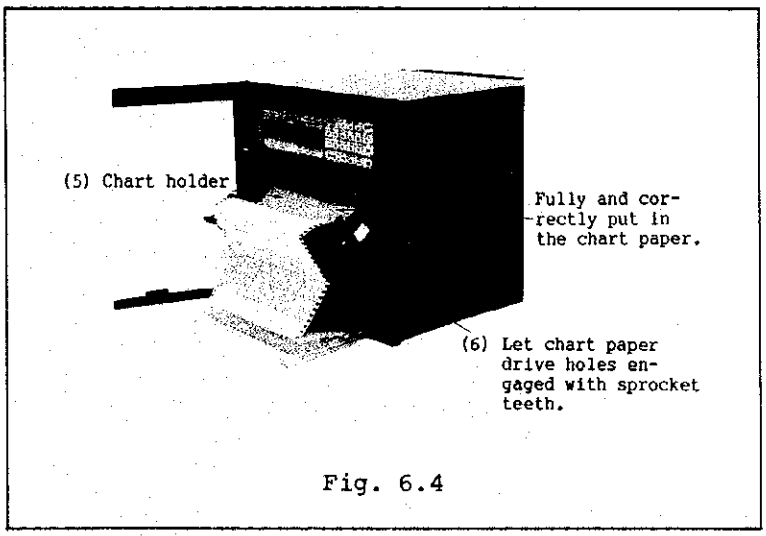


Fig. 6.4

(7) Holding the brim of the chart cassette with both hands, return the chart cassette into the chassis.

(8) Fold the unfolded end of the chart paper, put it on the tray, and return it to the original position by pressing it until the chart guide latch is engaged.

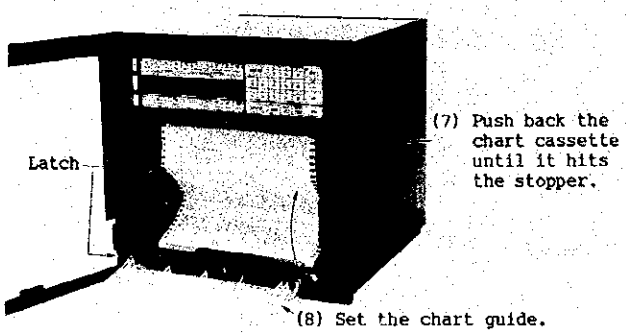
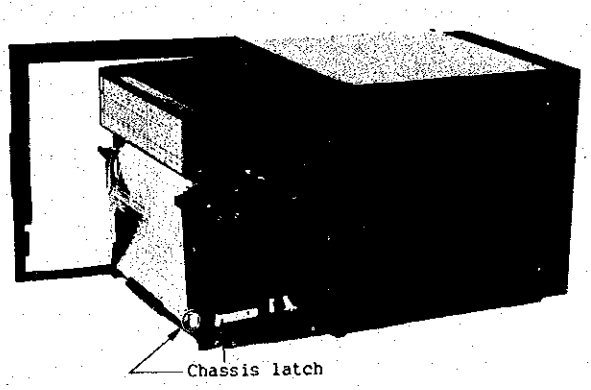


Fig. 6.5

6.3 Preparation for Recording

To install or remove the printing cartridges, pull out the chassis by pressing leftward the chassis latch which is located on the right hand side of the chassis as viewed from the instrument front (see Fig. 6.6).



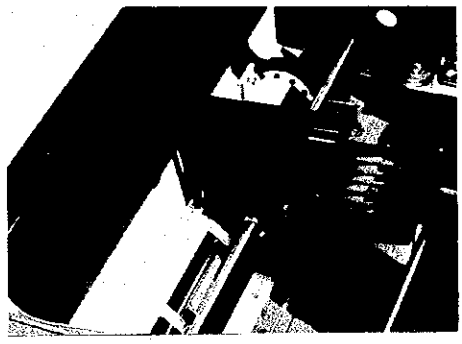


Fig. 6.6

(1) Installing the Printing Cartridges

Align the pen and guide of the printing cartridge with the slit of the guide plate, align the hook with the hole of the printing arm, and press the cartridge in the direction indicated with the arrowhead mark in Fig. 6.7.

Install the printing cartridges in the order of (1) purple, (2) red, (3) black, (4) green, (5) blue, and (6) brown, from left to right as viewed from the instrument front.

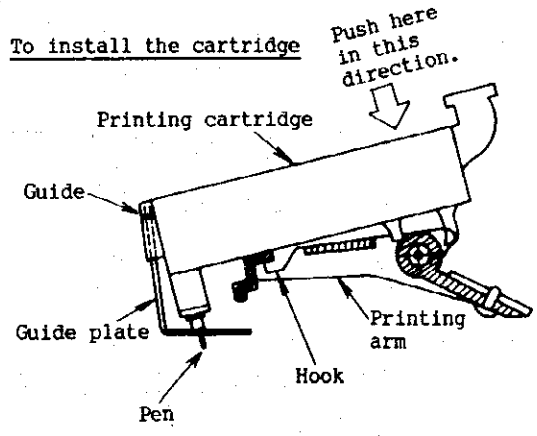


Fig. 6.7

(2) Removing the Printing Cartridges

To remove the printing cartridge, hold the extrusion of the cartridge with your fingers and pull it in the direction indicated with the arrowhead mark in Fig. 6.8.

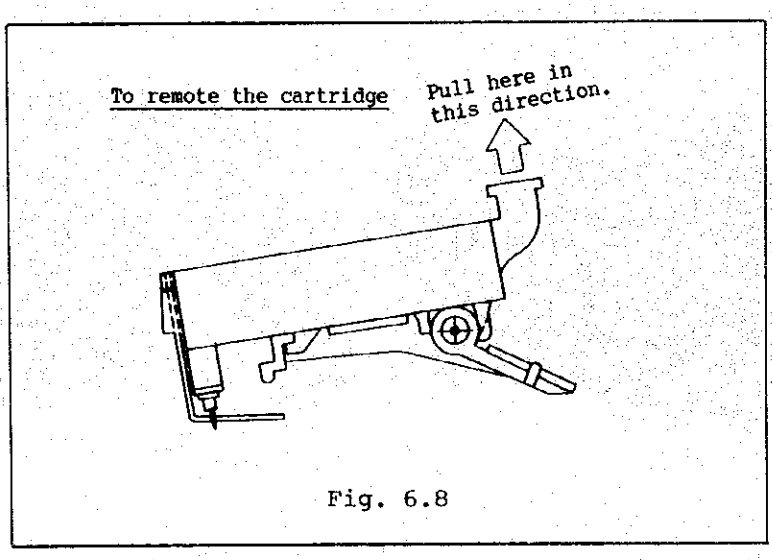


Fig. 6.8

6.4 Clock Backup Battery

The DPR500 employs a battery power source (three type SUM-3 dry batteries) to back up the clock. To replace the dry batteries, refer to Fig. 6.9 and proceed as follows:

(1) To gain access to the battery compartment which is located above the POWER switch, pull out the chassis from the casing by pressing the chassis latch.

(2) Remove the cover of the battery compartment by removing its screw.

(3) Remove the old batteries and install fresh ones in the correct polarity.

(4) Put back the compartment cover and the chassis to their original positions.

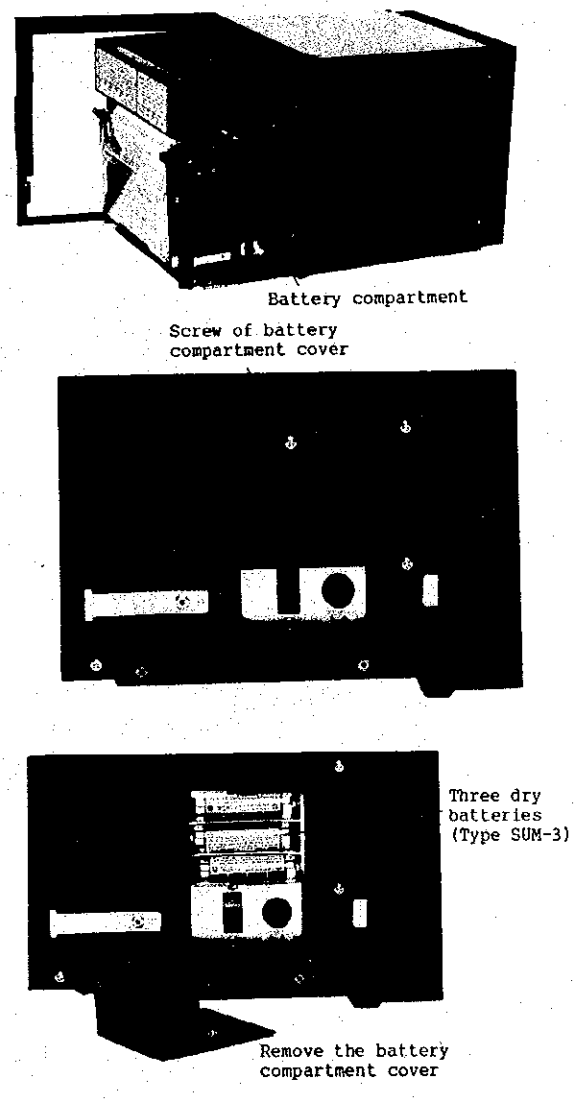

Battery compartment
Screw of battery compartment cover
Three dry batteries (Type SUM-3)
Remove the battery compartment cover

Fig. 6.9

6.5 POWER Switch and RCD key

(1) Turning on the POWER switch

After electrical wiring, chart paper loading, printing cartridge installation and backup battery installation are complete, turn on the POWER switch. To gain access to the POWER switch (Refer to Fig. 3.1), pull out the chassis while pressing the chassis latch.

As you turn on the POWER switch, the DPR500 starts operating and allows configuration setting. Set the configuration data items as you may require, referring to Section 8 "CONFIGURATION DATA ENTRY."

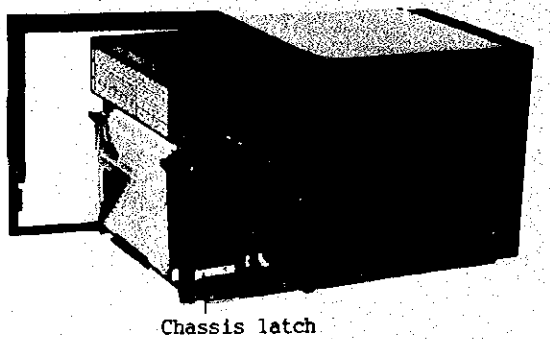


Fig. 6.10

(2) Pressing the RCD key

When the entry of configuration data is complete, the readout will display sequentially the measured values of input channels at 4-second intervals.

As you press the RCD key, the recorder will start printing out the measurement data in the recording format specified by the configuration data. As you press again the RCD key, the recorder will stop printing out the data.

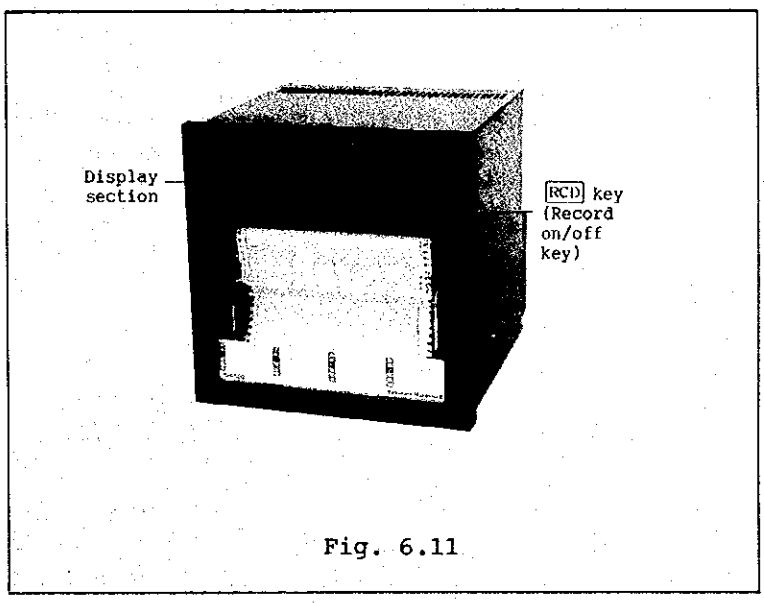


Fig. 6.11

7. DISPLAY PANEL AND KEYS

The display panel is comprised of three display sections (a readout section, a configuration data entry status indicator section, and an operation status indicator section) and two key sections (a configuration data entry key section and an operation key section).

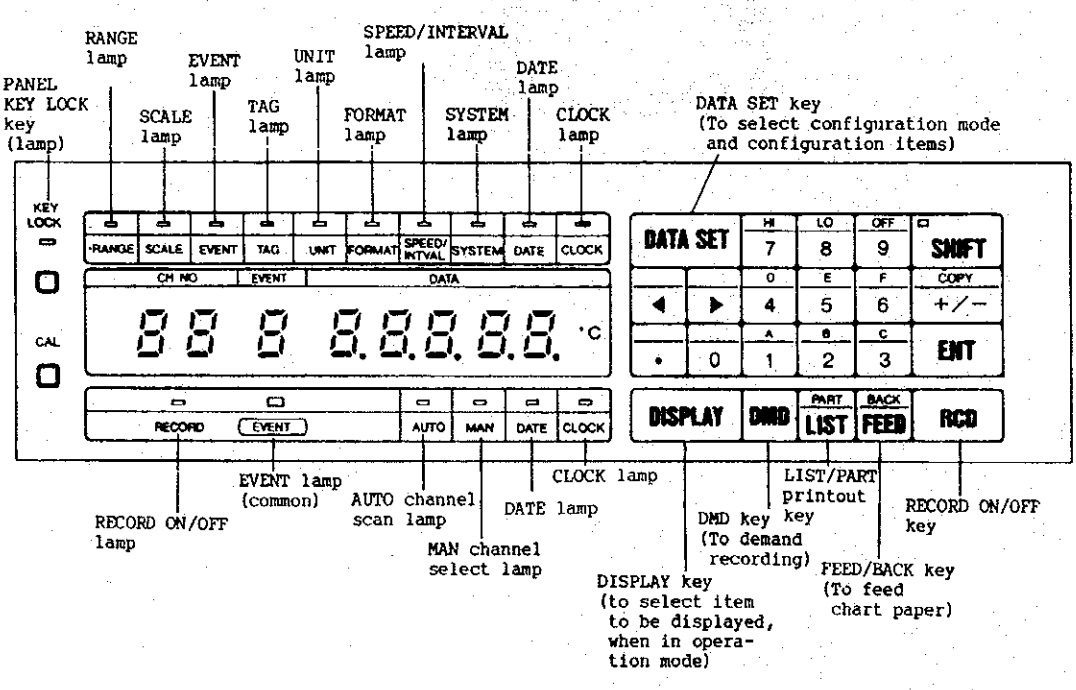


Fig. 7.1. Nomenclature of Display Panel

Table 7.1. Functions of Keys

	Key	Function
Configuration mode	Data setting key DATA SET	Each time as your press the key, the configuration items are sequentially selected as shown below. The status indicator lamp of the selected configuration item illuminates. RANGE: Range data setting status SCALE: Recording scale data setting status EVENT: Event (alarm) data setting status TAG: Tag name setting status UNIT: Status for setting of engineering unit of measure FORMAT: Recording format setting status SPEED/INTVAL: Chart feed speed or interval timer setting status SYSTEM: Status for setting of key lock level or other optional item DATE: Status for setting of data (year, month, day) CLOCK: Status for setting the time of clock
	Tenkeys HI 7 LO 8 OFF 9 D 4 E 5 F 6 copy +/- . 0 A 1 B 2 C 3	The tenkeys are used to enter numerical data or character data and to set the types of events. The uppercase characters are selectable with the SHIFT key. The copy +/- (sign) key is used for setting of measuring ranges and recording scales.
	Cursor keys ◁ (leftward) ▷ (rightward)	o When in the data modification mode, the cursor keys are used to move the cursor. o When in the "MAN" select digital display mode, the cursor keys are used to select a fixed channel (to advance or retrogress channel numbers).
	Shift key SHIFT	The shift key is used to select the uppercase characters or functions of keys.
	Enter key ENT	The data you have with keys is entered as you press this key.
	Copy key SHIFT COPY +/- COPY +/- (Total copy) SHIFT copy +/- (partial copy)	The copy key is used to copy the configuration data of a channel onto another channel. Total copy: Total configuration data of a channel is copied onto another channel. Partial copy: Part of configuration data of a channel is copied onto another channel.

Operation mode

Key	Function
Display key DISPLY	The display key selects the item to be digitally displayed. Each time as you press the key, the displayed items are sequentially selected as shown below. The selected item is indicated by the corresponding one of the status lamps. AUTO: To display the measured values of channels automatically scanned. ↓ MAN: To display the measured value of the manually selected channel ↓ DATE: To display the date ↓ CLOCK: To display the time of clock ↓ (back to AUTO)
Record demand key DMD	As you demand recording operation by pressing the DMD key, the measured data is digitally printed out. The print out format is identical with that for logging.
List print key PART LIST (Total list print out) SHIFT + PART LIST (Partial list print out)	The key is used to print out the configuration data entered. Total list print out: Total configuration data is printed out. Partial list print out: Part of the configuration data is printed out. (May be used to print out the frequently used items only, such as alarm event setting data.)
Chart feed key BACK FEED (Forward) SHIFT + BACK FEED (Backward)	During the period you keep the key pressed, recording chart paper is fed forward/backward. Note: Backward feeding of chart paper by pressing the chart feed key must be limited to a short distance.
Record on/off key RCD	As you press the key, recording operation starts or stops and the RECORD operation status indicator lamp illuminates or goes off.
Key-lock key KEY LOCK	As you press the key, keys are locked in order to be protected against inadvertent pressing. The range of applicable keys depends on the key-lock level. The key-lock lamp illuminates when the key-lock function is effected.
Calibration mode key CAL	This key is used for span calibration. Note: Span calibration is done before shipment of the instrument. Normally, no span calibration by the user is necessary.

8. CONFIGURATION MODE OR OPERATION

8.1 Display Formats

Configuration data can be entered with the configuration data entry key. Data to be entered are displayed on the readout. The display format differs by the item of configuration as shown in Table 8.1.

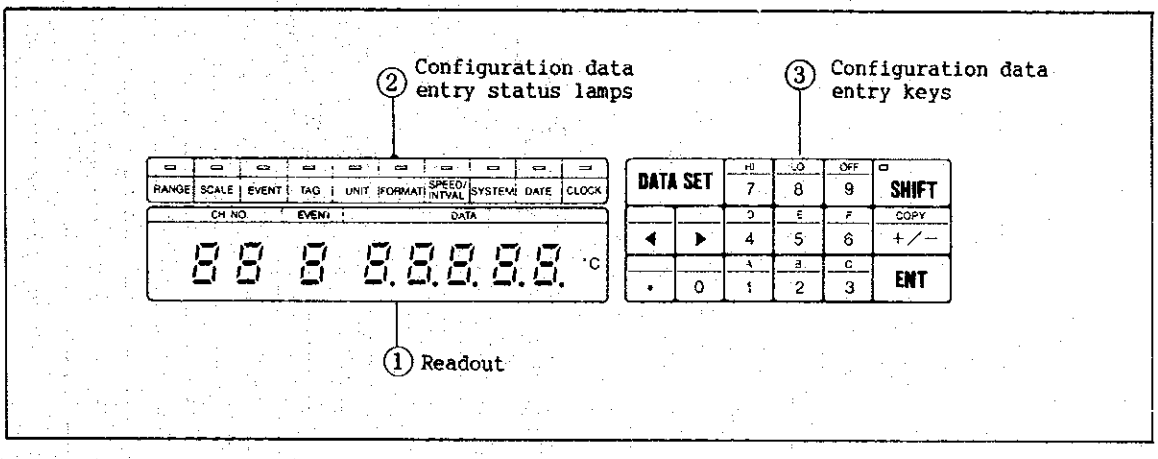


Table 8.1. Data Display Formats (When in Configuration Mode or Operation Mode)

Item \ Readout			CH NO.	EVENT		DATA				
			8 8	8		8	8	8	8	8
Configuration mode	DATA SET	RANGE	CH No.	Entry procedure *	1	Record mode		Range code		Unit of measure
					2	Input calculation type	Reference channel			Burnout
					3	Measuring range				0% value
					4					100% value
					5	Engineering range				0% value
					6					100% value
					7	Fixed Value for difference calculation				
					8	PV bias value				
		SCALE	CH No.	Entry procedure *	1	Scale #1				0% value
					2					100% value
					3	Scale #2				0% value
					4					100% value
					5	Scale print out requirement		Switching system		
					6	Value for automatic switchover				
					7	Differential value for automatic switchover				
		EVENT	CH No.	Entry procedure 1, 2, 3, 4 / 5, 6, 7, 8 / 9, A, B, C		Type of event		Relay No.		
						Value for event				
						Differential value for event				
		TAG / UNIT	CH No.	Code No. = Character No.		Character code (hexadecimal)				
		FORMAT				Recording format				
		SPEED/ INTVL		Entry procedure * 1, 2		Chart speed		Chart speed (typical value)		
				3, 4		Interval timer		Interval timer (typical value)		
		SYSTEM		Entry procedure 1		Key-lock level				
		DATE	Year			Month	—	Day		
		CLOCK				Hour	—	Minute		
Operation mode	DISPLAY	AUTO	CH No.	Event		PV value				
		MAN	CH No.	Event		PV value				
		DATE	Year			Month	—	Day		
		CLOCK				Hour	>—<	Minute		

* Note: Some of the entry procedures may be skipped depending on the type of item and depending on whether the instrument is incorporated with optional provisions or not.

8.2 Configuration Data Entry Flowchart

A flowchart of configuration data entry is shown in Fig. 8.1

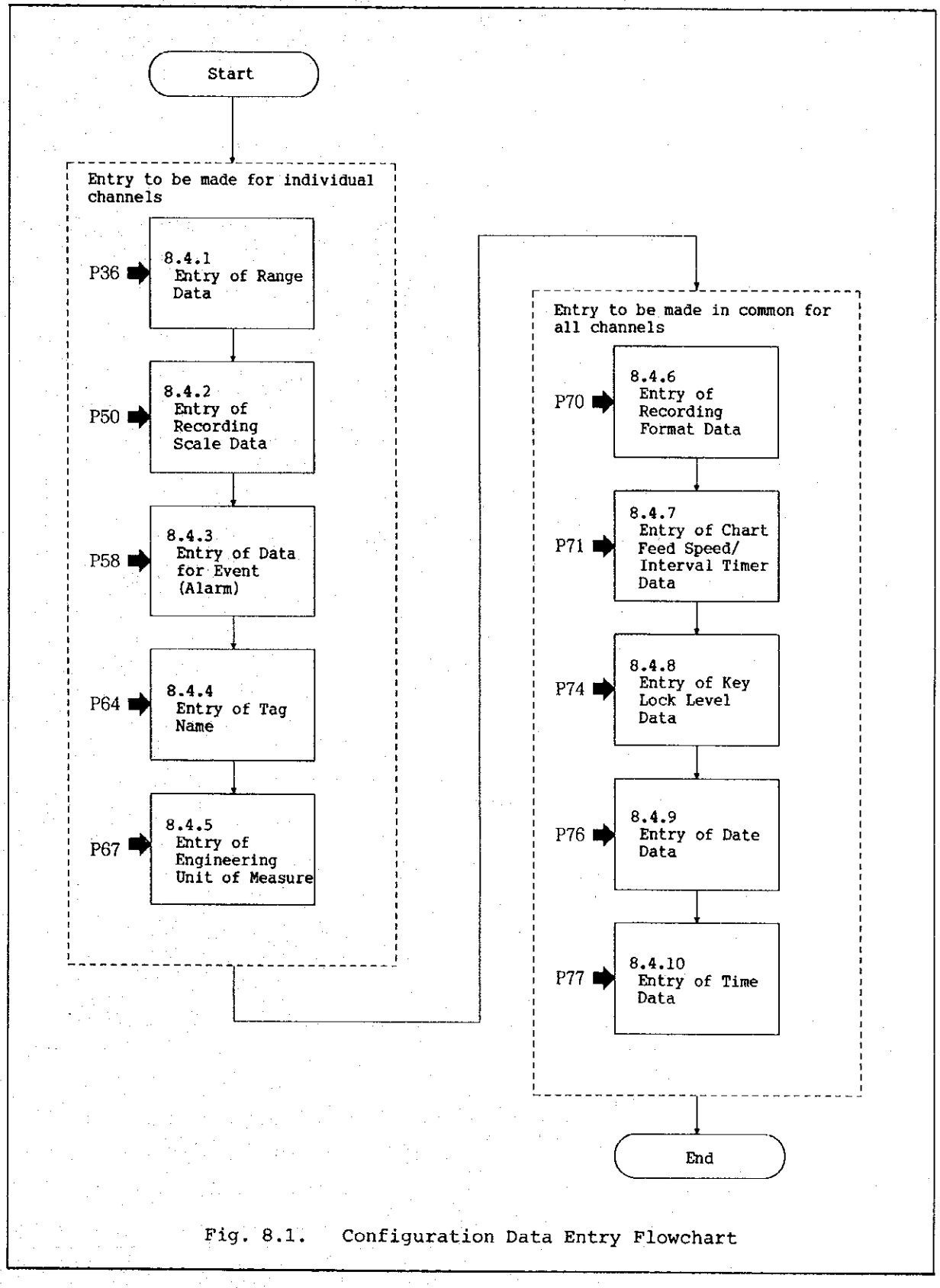


Fig. 8.1. Configuration Data Entry Flowchart

8.3 Common Entry Procedures

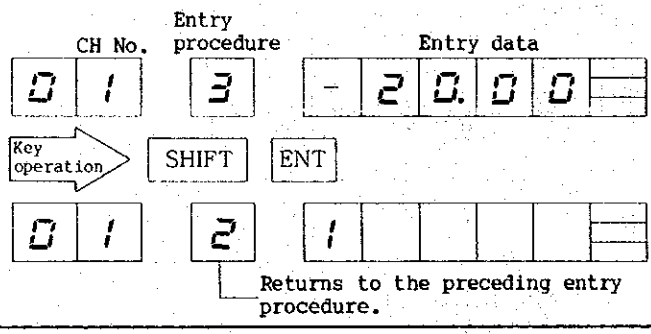
To enter configuration data, you should follow the entry procedures for which you are prompted by the indication at the EVENT section of the readout. When entering data in this manner, the below-mentioned procedures are applicable in common to entry of the various items of configuration data.

Common Entry Procedures

1) To return to the preceding entry procedure

Key operation → SHIFT ENT

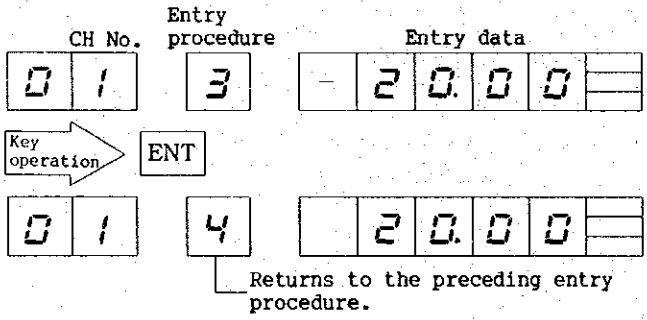
(Example)



2) To advance to the next entry procedure (To enter the set data)

Key operation → ENT

(Example)

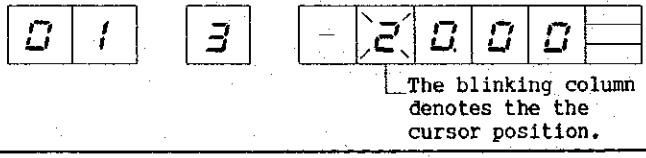


3) To modify data to be entered

Key operation → Move the cursor with the ◀ and ▶ keys to the column to be modified and then modify it.

(Example)

Move the cursor with ◀ and ▶ keys.



4) To correct an invalid data entry

Key operation → ENT

When an invalid data is entered by press the ENT key, overall readout will blink. Press the ENT key again and then enter a valid data.

8.4 Configuration Data Entry Procedures

8.4.1 Entry of Range Data

To enter range data, follow the entry procedures 1 - 8 for each of the channels. The entry procedures (code numbers) are automatically displayed at the EVENT section of the readout, prompting you to enter configuration data. Data items which are not required from the view-point of the type of input are skipped, allowing you to enter data for the required items only.

Readout / Item	CH NO.	EVENT		DATA				
	8 8	8		8	8	8	8	8
RANGE	CH NO.	Entry procedure (Appears automatically)	1	Record mode	Range code			Unit of measure
			2	Input calculation type	Reference channel			Burnout
			3		Measuring range *1	0% value		
			4			100% value		
			5		Engineering range *1	0% value		
			6			100% value		
			7		Fixed value for difference calculation *2			
			8		PV bias value			

*1: Data for this item is required to be entered only for DC voltage input of range code 00 - 04. When the input is of a thermocouple or a resistance temperature sensor, this item is automatically skipped.

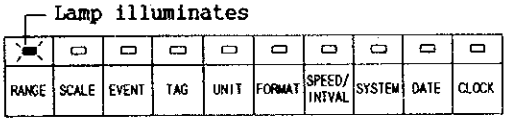
*2: Data for this item is required to be entered only when the input is of a differential value calculation type. When the input is a PV value, this item is automatically skipped.

Key Operation Before Starting Data Entry Procedures

(1) Selecting the "RANGE" Mode

Key operation → Press the DATA SET key to select the "RANGE" mode.

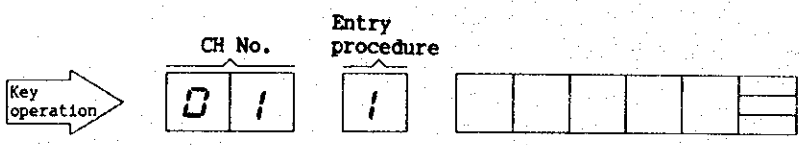
The corresponding data entry status lamp (RANGE lamp) will illuminate.



(2) Selecting the Channel

Select the channel number you may require. (It is assumed here that data is required to be entered starting by channel No. 01.)

- If the readout indicates "CH No. = 01, advance to Entry Procedure 1 which follows.
- If the readout indicates "CH No. ≠ 01", modify it to "CH No. = 01" with the following procedure.



Move the cursor (blinking column) to the channel number columns with the ◀ key. Press tenkeys [0] and [1].

As the state of "CH No. = 01" is attained, the cursor moves automatically to the next column for entry of recording mode data.

Entry Procedure 1

This procedure is to enter data for recording mode, input range, and unit of measure.

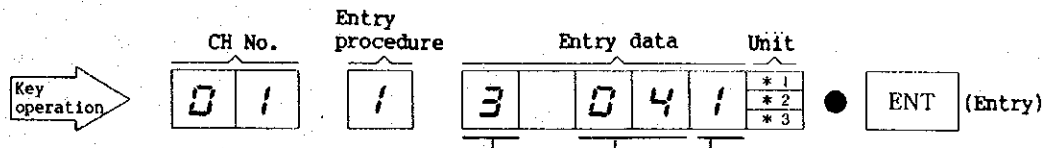
(1) Recording mode: For each channel, one of the three recording modes can be specified.

You may set the unused channels to the OFF mode so that both display and recording for them are skipped.

(2) Input range: Specify an appropriate range by means of the range code.

(3) Unit of measure: Specify the unit of measure (represented by the position of the UNIT lamp on the readout). This data is not required if the input is of a thermocouple or a resistance temperature sensor.

Note: As data for recording mode or input range is entered, the cursor moves automatically to the position for entry of the next data item.



Specify a recording mode (1 - 3)

Tenkeys

1 : OFF (Off mode)
2 : DISP (Display mode)
3 : RCD (Display and record mode)

Specify a lamp position (1 - 4). The lamp will illuminate when its position is specified.

Tenkeys

1 : Top (*1)
2 : Center (*2)
3 : Bottom (*3)
4 : No indication

Note: When a range code for thermocouple or resistance temperature sensor input is selected, this item is not required to be specified since "°C" (the lamp at the center position) is automatically specified.

Specify a range code. Tenkeys

Type of input		Range code	Measuring range
DC voltage (Linear scaling)	mV	00	± 20.00
		01	± 200.00
	V	03	± 2.000
		04	± 6.000
Thermocouple (°C)	R	10	0.0 to 1760.0
	S	11	0.0 to 1760.0
	B	12	400.0 to 1820.0
	K	13	-200.0 to 1370.0
	E	14	-200.0 to 800.0
	J	15	-200.0 to 1100.0
	T	16	-200.0 to 400.0
	W5Re26	17	0.0 to 2315.0
	Ni-Ni-MO	18	0.0 to 1200.0
	(Note 2) Semi-standard input		See the Table in the right
Resistance temperature sensor (°C)	Pt100Ω	30	-200.0 to 550.0
	Pt50Ω	31	-200.0 to 550.0
	Ni508.4Ω	32	-50.0 to 150.0

Type of Semi-standard Input		Measuring range (°C)
Thermo-couple	Nicrosil-Nisil	0 to 1300
	PR40-20	0 to 1880
	Gold + 0.07% Iron-chromel	-272 to 26
	DIN L	-200 to 900
	DIN U	-200 to 900
Radiation Pyro-meter	RH	400 to 1800
	RI	400 to 1780

Note 1: If you specify range code 03 or 04, a default value is set for the measuring range.

Note 2: When a semi-standard input is involved, the type of input specified with a code number replaces the Ni-NiMo type (Range Code 18).
That is, for a semi-standard type of input, configuration should be made by means of Range Code = 18.

- As you press the [ENT] key, a prompter for proceeding to Entry Procedure 2 will appear on the readout.

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the [◀] and [▶] keys and then modify the data.

(2) To modify the data which has been entered by pressing the [ENT] key, return to Entry Procedure 1 by pressing the [SHIFT] and [ENT] keys, and then modify the data with the procedure of (1).

Entry Procedure 2

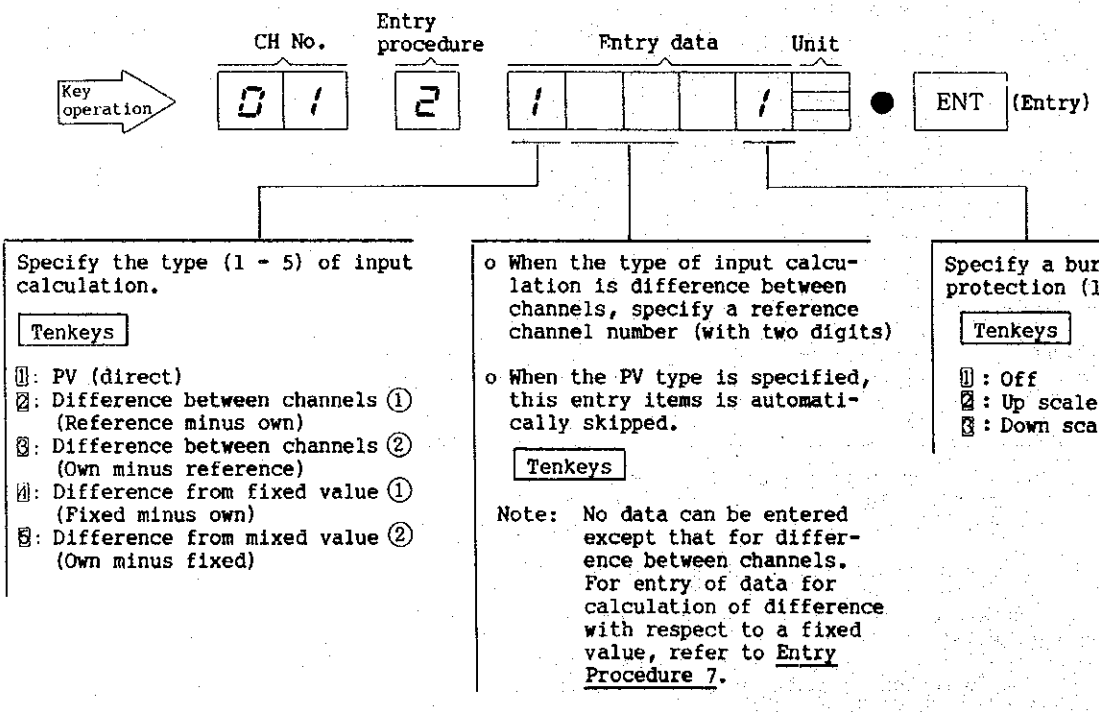
This procedure is to enter data for (1) the type of input calculation, (2) reference channel number, and (3) burnout protection.

(1) To specify either the input is to be subjected to calculation before measurement or not.

(2) To specify the channel number of the reference channel which is used for calculation for a differential-value input.

(3) Burnout protection can be specified for each channel, for thermocouple input only.

> Note: As you enter data for the type of input calculation or reference channel number, the cursor moves automatically to the next data entry position.



- As you press the [ENT] key, a prompter for proceeding to Entry Procedure 3 will appear on the readout.

Note: Entry Procedure 3 - 6 are for voltage or current inputs. For thermocouple or resistance temperature sensor inputs, you will be prompted to skip the above procedures and to be Entry Procedure 7 and 8.

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the [◀] and [▶] keys and then modify the data.

(2) To modify th data which has been entered by pressing the [ENT] key, return to Entry Procedure 2 by pressing the [SHIFT] and [ENT] keys, and then modify the data with the procedure of (1).

Entry Procedure 3

This procedure is to enter data for the low limit value of measuring range (linear scaling).

(1) The purpose this entry is to let the low limit values of measuring range and input signal conform, when the input code is 00 - 04.

(2) For thermocouple or resistance temperature sensor inputs, Entry Procedures 3 - 6 are skipped.

Note: Each time as you change range codes, the low limit values are automatically changed to the default values as shown in Table 8.2. Due to this, you should enter a range code before entering a low limit value.

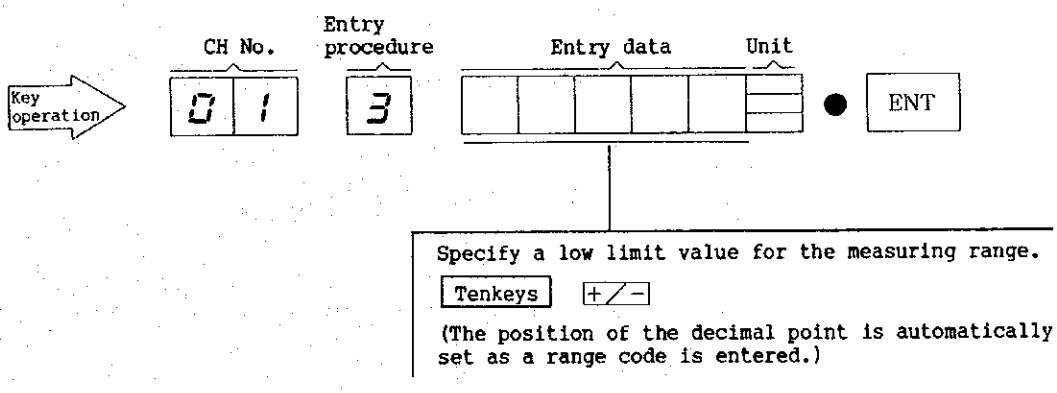


Table 8.2. Default Values

Code	00	01	03	04
Low limit value	-20.00 mV	-200.0 mV	-2.000 V	-6.000 V

- As you press the ENT key, a prompter for proceeding to Entry Procedure 4 will appear on the readout.

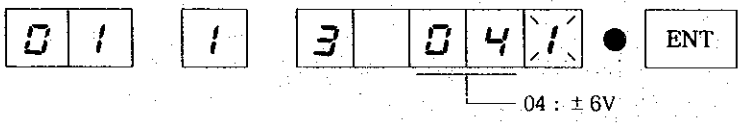
Key operation Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

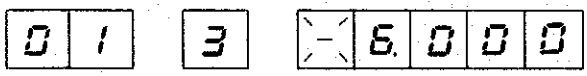
(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 2 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

Entry Example 1: Entry of low limit value of measuring range for 1 - 5 V input signal

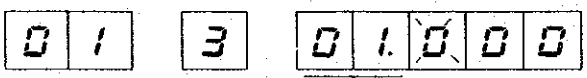
1) Enter ± 6 V range code with Entry Procedure 1.



2) In Entry Procedure 3, the readout will display the following (default value).



Enter the low limit value (1 V) of measuring range as follows:

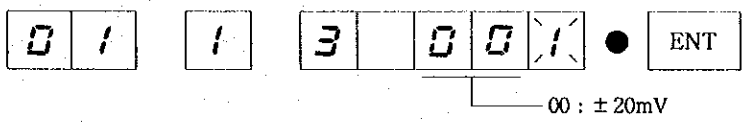


Enter data by pressing these keys in this order.

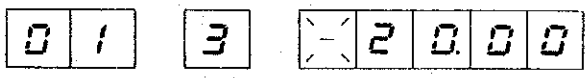
+/− · 0 · 1 · ENT

Entry Example 2: Entry of low limit value of measuring range of 0 - 10 mV input signal

1) Enter ± 20 mV range code with Entry Procedure 1.



2) In Entry Procedure 3, the readout will display the following (default value).



Enter the low limit value (0 mV) of measuring range as follows:

Enter data by pressing these keys in this order.

+/− · 0 · 0 · ENT

Entry Procedure 4

This procedure is to enter data for the high limit value of measuring range (linear scaling).

(1) The purpose of this entry is to let the high limit values of measuring range and input signal conform, when the input code is 00 - 04.

> Note: Each time as you change range codes, the high limit values are automatically changed to the default values as shown in Table 8.3. Due to this, you should enter a range code before entering a high limit value.

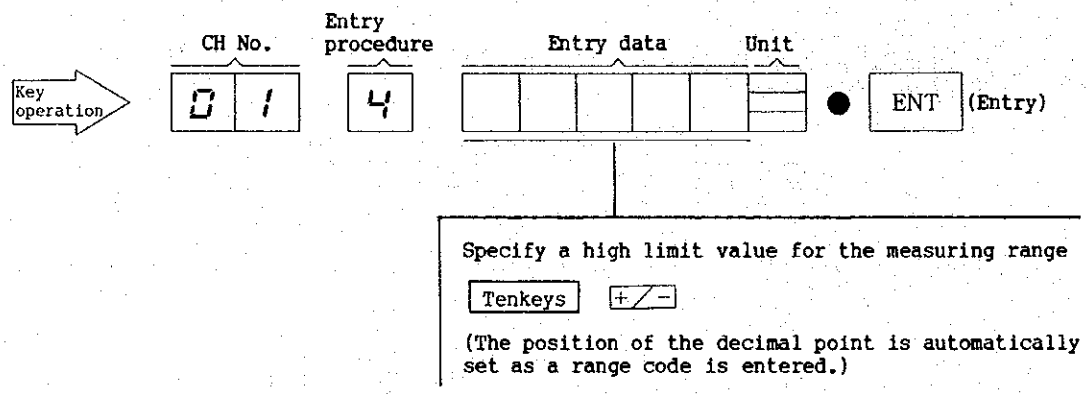


Fig. 8.3. Default Values

Code	00	01	03	04
High limit value	-20.00 mV	-200.0 mV	-2.000 V	-6.000 V

- As you press the ENT key, a prompter for proceeding to Entry Procedure 5 will appear on the readout.

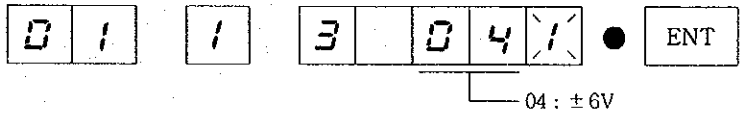
Key operation Re-enter Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

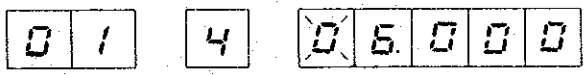
(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 4 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

Entry Example 1: Entry of high limit value of measuring range for 1 - 5 V input signal

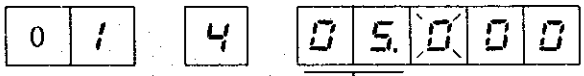
1) Entry ± 6 V range code with Entry Procedure 1.



2) In Entry Procedure 4, the readout will display the following (default value).



Enter the high limit value (5 V) of measuring range as follows:

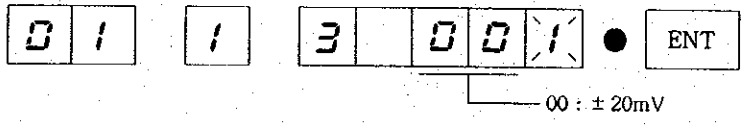


Enter data by pressing these keys in this order.

0 · 5 · ENT

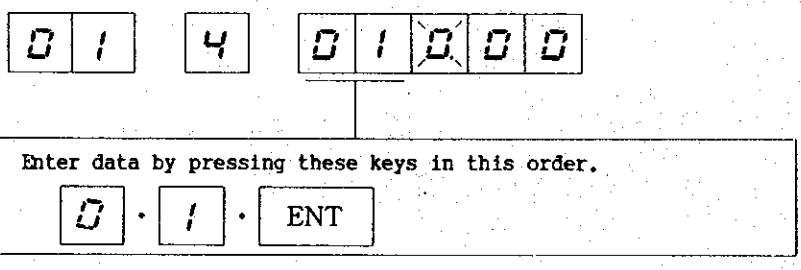
Entry Example 2: Entry of high limit value of measuring range for 0 - 10 mV input signal

1) Enter ± 20 mV range code with Entry Procedure 1.



2) In Entry Procedure 4, the readout will display the following (default value).

Enter the high limit value (10 mV) of measuring range as follows:

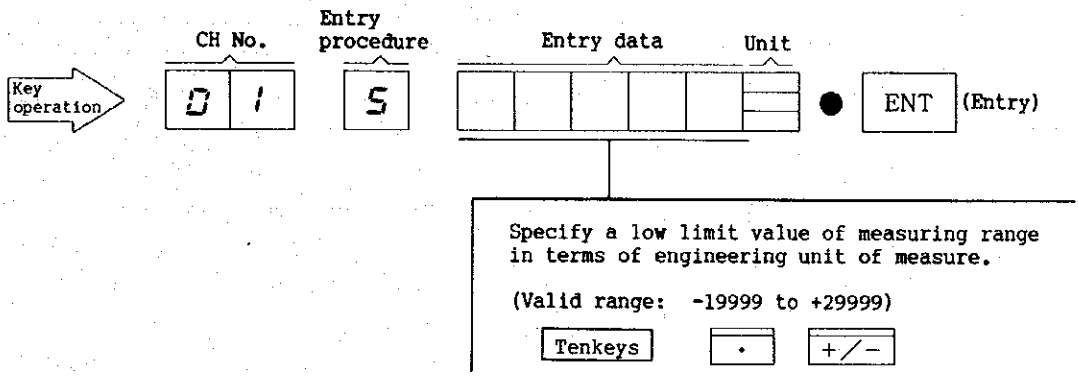


Entry Procedure 5

This procedure is to enter data for the low limit value of engineering range (linear scaling).

(1) The purpose of this entry is to specify the low limit value of measuring range in terms of engineering unit of measure.

> Note: The place of the decimal point also must be specified at this stage of the procedure. Note that change of place of the decimal point affects other entry items. Refer to the "Notes for Change of Place of Decimal Point" given in the next page.



Key operation to change place of decimal point

Key operation → Select a place for the decimal point with the ◀ and ▶ keys (the column will blink) and then press the · key.

- As you press the ENT key, a prompter to advance to Entry Procedure 6 will appear on the readout.

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 5 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

o Notes for Change of Place of Decimal Point

If the place of the decimal point is changed when entering data for the low limit value of engineering range, that of the entered data items mentioned below also is changed and, therefore, data for these items should be re-entered.

Re-entry items			
RANGE	o High limit of engineering range o Fixed value for difference calculation o PV bias data	SCALE	o Automatic switchover point setting o Differential gap for automatic scale switchover
SCALE	o Low limit of recording scale o High limit of recording scale	EVENT	o Data for event o Data for differential gap of event

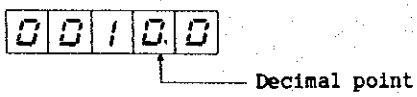
Example: When the place of decimal point of an engineering range low limit value is changed, the contents of change of recording scale are as follows:

① Displayed values

	Low limit value	High limit value
Engineering range	00010	00300
Recording scale	00010	00300

② Setting of decimal point at the initial digit

If decimal point is placed as shown in ②, the value is changed as shown in ③.



③ Setting after change of place of decimal point

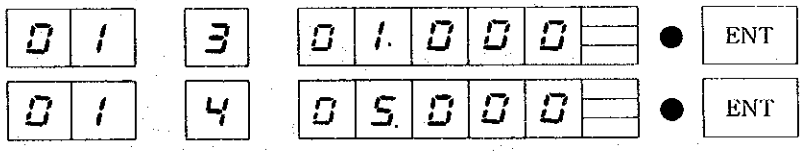
	Low limit value	High limit value
Engineering range	001.00	003.00
Recording scale	0001.0	0030.0

Re-enter. (Also refer to aforementioned re-entry procedures.)

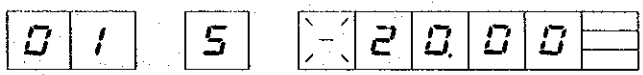
Entry Example 1: Entry of low limit value of engineering range (To display or record the 1 - 5 V input signal directly)

1) Enter the ± 6 V range code with Entry Procedure 1.

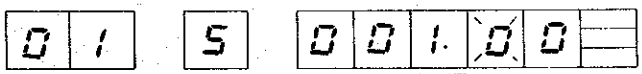
2) Enter 1 - 5 V measuring range data with Entry Procedures 3 and 4.



3) When in Entry Procedure 5 (entry of low limit value of engineering range), a default value is displayed as follows:



Enter the low limit value (1 V) of engineering range as follows:

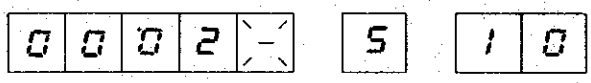


Enter data by pressing these keys in this order.

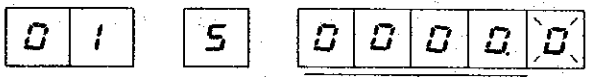
Entry Example 2: Entry of low limit value of engineering range (To display or record the 1 - 5 V input signal in terms of 0 ~ 100%)

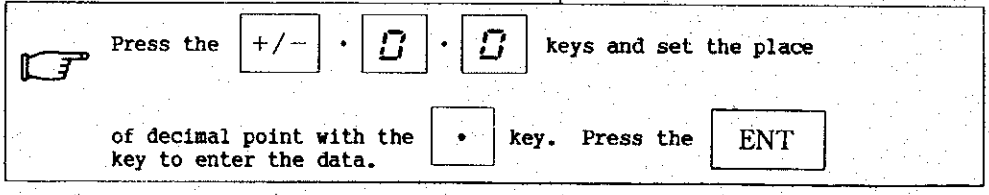
1) Enter data for the 1 - 5 V measuring range in the same manner as in Entry Example 1.

2) When in Entry Procedure 5 (entry of low limit value of engineering range), a default value is displayed as follows:



Enter the low limit value (0%) of engineering range as follows:

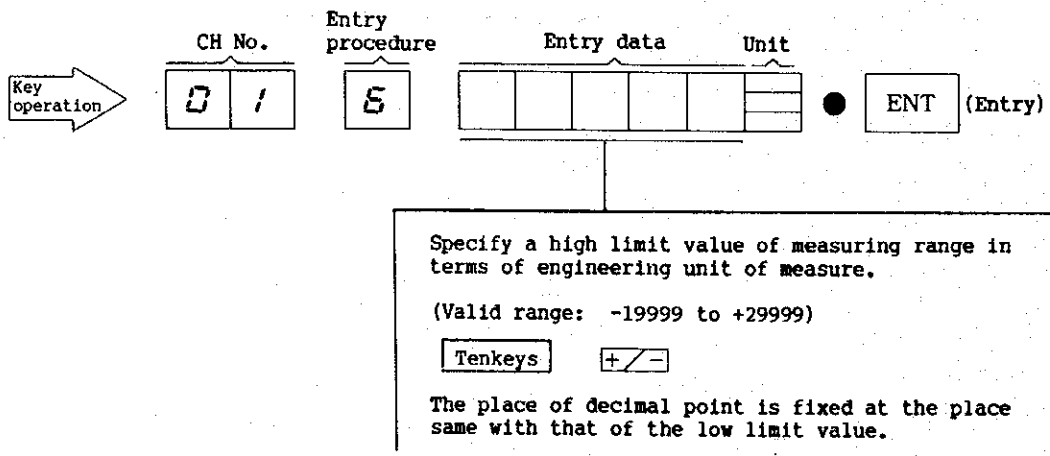




Entry Procedure 6

This procedure is to enter data for the high limit value of engineering range (linear scaling).

(1) The purpose of this entry is to specify the high limit value of measuring range in terms of engineering unit of measure.



- As you press the [ENT] key, a prompter for proceeding to Entry Procedure 7 will appear on the readout if the input is of a calculated type (as entered with Entry Procedure 1) or that for proceeding to Entry Procedure 8 will appear if the input is of a PV type (direct input type).

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the [◀] and [▶] keys and then modify the data.

(2) To modify the data which has been entered by pressing the [ENT] key, return to Entry Procedure 6 by pressing the [SHIFT] and [ENT] keys, and then modify the data with the procedure of (1).

Entry Example 1: Entry of high limit value of engineering range (To display or record 1 - 5 V input signal directly)

1) When in Entry Procedure 6 (entry of high limit value of engineering range), a default value is displayed as follows:

Enter the high limit value (5 V) of engineering range as follows:

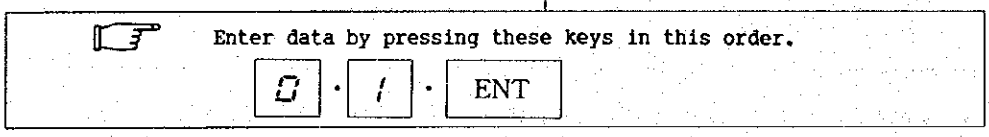
Enter data by pressing these keys in this order.

0 · 0 · 5 · ENT

Entry Example 2: Entry of high limit value of engineering range (To display or record the 1 - 5 V input signal in terms of 0 - 100%)

1) When in Entry Procedure 5 (entry of high limit value of engineering range), a default value is displayed as follows:

Enter the high limit value (100%) of engineering range as follows:

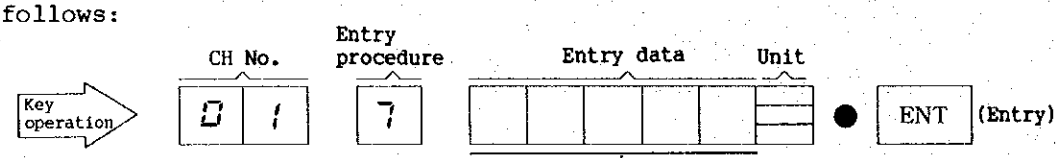


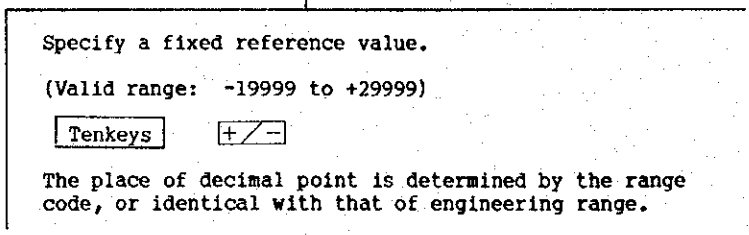
Entry Procedure 7

This procedure is to enter data for the fixed reference value for differential input value calculation.

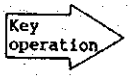
(1) The entry is only for recording of differential value with respect to a fixed value as set in Entry Procedure 2. For others, procedure jumps to Entry Procedure 8.

(2) To enter a reference value for difference calculation, proceed as follows:





- As you press the ENT key, a prompter for proceeding to Entry Procedure 8 will appear on the readout.



Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 7 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

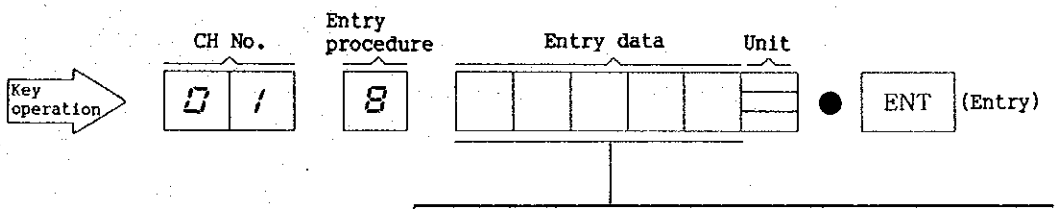
Entry Procedure 8

This procedure is for entry of PV bias data.

(1) The purpose of this entry is to bias the PV input signal by a certain value.

(2) A typical example of use of this function is to compensate for shift to thermocouple or other sensor signal due to aging.

> Note: When measurement of differential value between channels is specified, the PV bias value provided by the reference channel is ignored and that provided by own channel is added.



Specify a PV bias value.

(Valid range: -19999 to +29999)

Tenkeys +/−

The place of decimal point is determined by the range code, or identical with that of engineering range.

Note: Normally, specify 0.

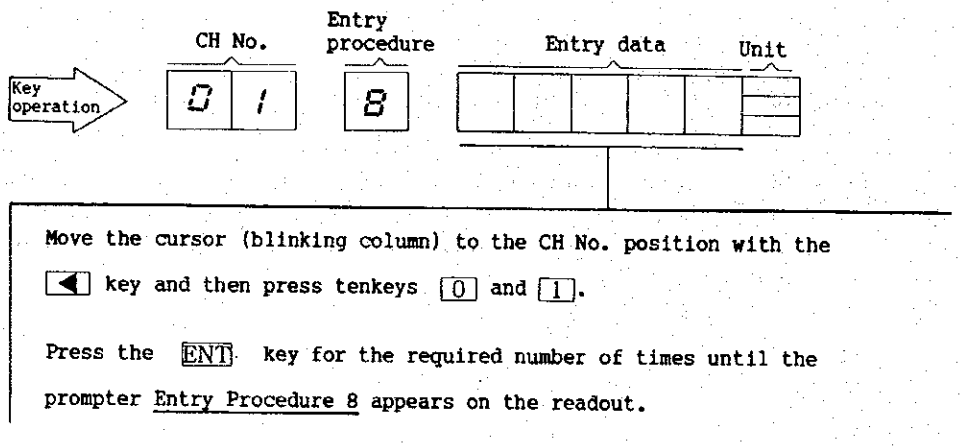
- As you press the [ENT] key, range data entry for channel 1 is complete and a prompter for proceeding Entry Procedure 1 for range data of channel 2 appears on the readout. For channel 2 and subsequent channels, repeat Entry Procedures 1 - 8 for range data entry.

> Note: Configuration data entered for a certain channel can be copied onto other channels to rapidly accomplish configuration data entry. (Refer to Section 8.4.11 "Copying of Configuration Data."

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the [◀] and [▶] keys and then modify the data.

(2) To modify the data which has been entered by pressing the [ENT] key, return to Entry Procedure 8 by pressing the following keys and then modify the data with the procedure of (1).



8.4.2 Entry of Recording Scale Data

Recording scale data can be entered for each channel by following Entry Procedures 1 - 7. The entry procedure number, as a prompter, is indicated at the EVEN column of the readout. Data must be entered following the prompter numbers as shown in the below table. For the standard model of DPR500 which has no remote control signal input circuit, the data entry items related to remote control are automatically skipped.

Item \ Readout	CH NO.	EVENT		DATA
	8 8	8		8 8 8 8 8
SCALE	CH NO.	Entry procedure (Prompter)	1	Scale #1 — 0% value
			2	Scale #1 — 100% value
			3	Scale #2 (optional)*1 — 0% value
			4	Scale #2 (optional)*1 — 100% value
			5	Scale print out — Switching system
			6	Auto scale (optional)*1
			7	Differential gap for auto scale (optional)*1

*1: Can be entered only for instrument incorporated with remote control signal input circuit (optional). For instrument which is not incorporated with this optional function, this item is automatically skipped.

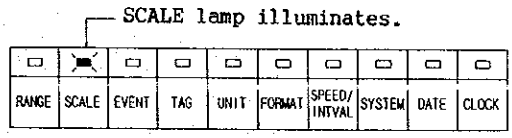
Key Operation Before Starting Data Entry Procedures

(1) Selecting the "SCALE" Mode

Key operation

Press the DATA SET key to select the "SCALE" mode.

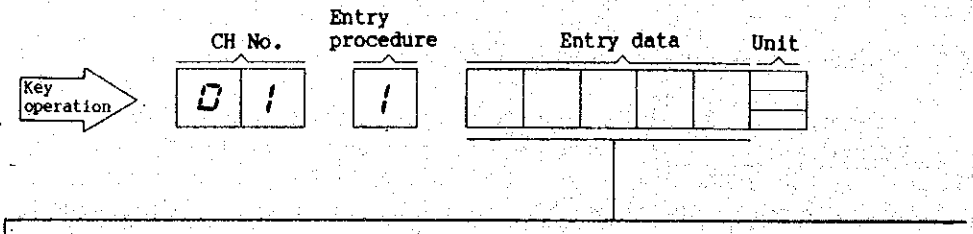
The corresponding data entry status lamp (SCALE lamp) will illuminate.



(2) Selecting a Channel

Select a channel number for data entry. (Channel No. 01 is assumed here.)

- If the channel number displayed on the readout is 01, go to Entry Procedure 1 which follows:
- If the channel number displayed on the readout is not 01, modify it to 01 with the following procedure:



Move the cursor (blinking column) to the CH No. column with the ◀ key and press tenkeys [0] and [1].

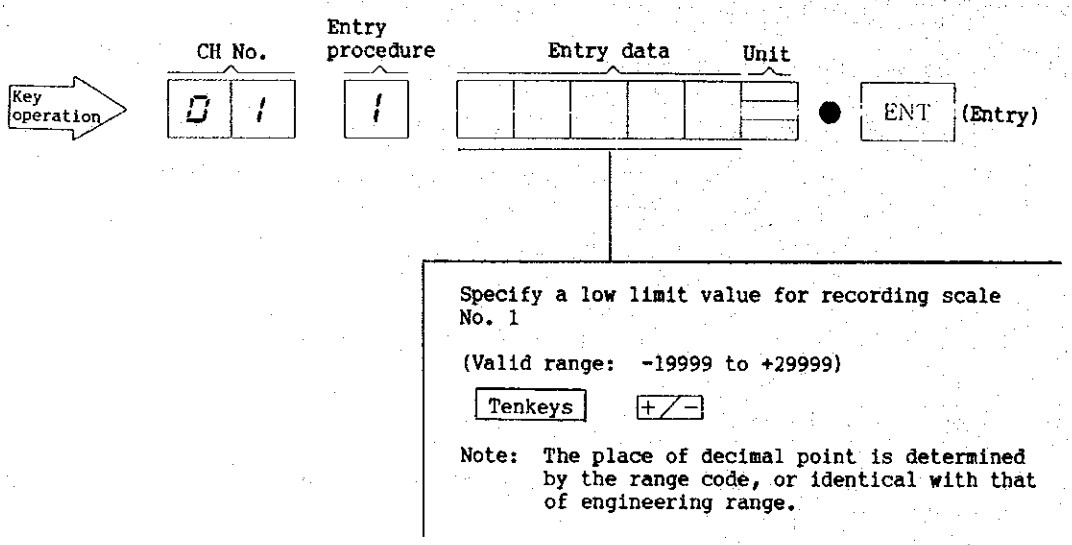
* As the state of "CH No. = 01" is attained, the cursor moves automatically to the position for next data entry (entry of low limit value of recording scale #1).

Entry Procedure 1

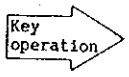
This procedure is to enter the low limit value of recording scale No. 1.

(1) The purpose of this entry is to specify the low limit value of scale No. 1 for trend recording.

(2) The low limit value can be specified irrespective of the input measuring range.



- As you press the [ENT] key, a prompter for proceeding to Entry Procedure 2 will appear on the readout.



Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

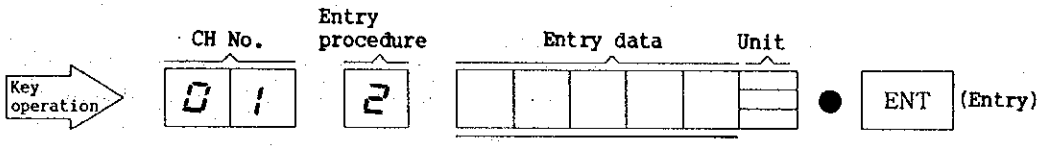
(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 1 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

Entry Procedure 2

This procedure is to enter the high limit value of recording scale No. 1

(1) The purpose of this entry is to specify the high limit value of scale No. 1 for trend recording.

(2) The low limit value can be specified irrespective of the input measuring range.



Specify a high limit value for recording scale No. 1.

(Valid range: -19999 to +29999)

Tenkeys +/-

Note: The place of decimal point is determined by the range code, or identical with that of engineering range.

- As you press the ENT key, a prompter for proceeding to Entry Procedure 3 will appear on the readout if the instrument is incorporated with the remote control signal input circuit (optional) or a prompter for skipping to Entry Procedure 5 will appear if the instrument is without the optional circuit.

Key operation Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

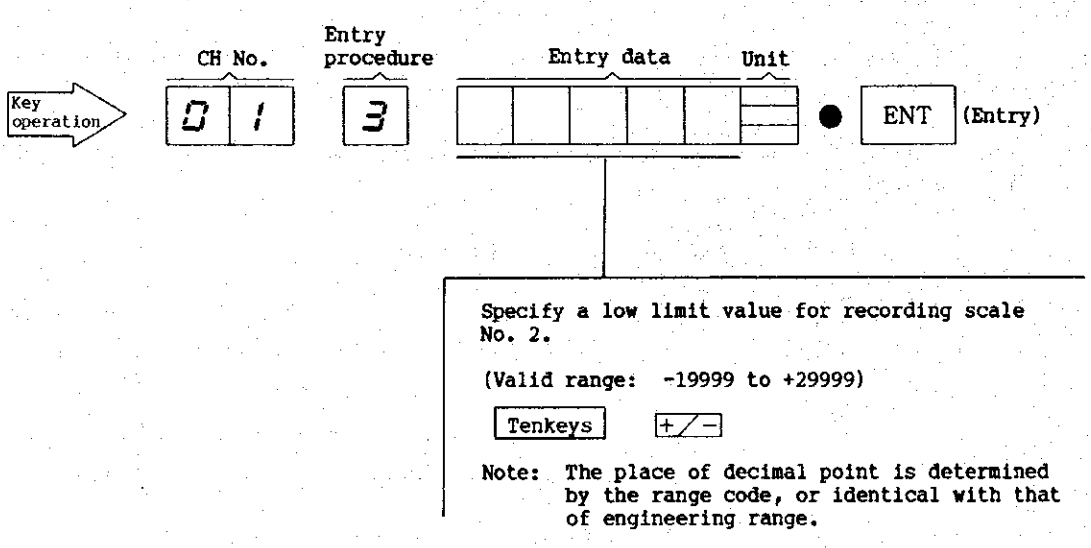
(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 2 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

Entry Procedure 3

This procedure is to enter the low limit value of recording scale No. 2 (optional).

(1) The purpose of this entry is to specify the low limit value of scale No. 2.

(2) If the instrument is not incorporated with the remote control signal input circuit (optional), procedure skips to Entry Procedure 5.



- As you press the ENT key, a prompter for proceeding to Entry Procedure 4 will appear on the readout.

Key operation → Re-entry Procedure

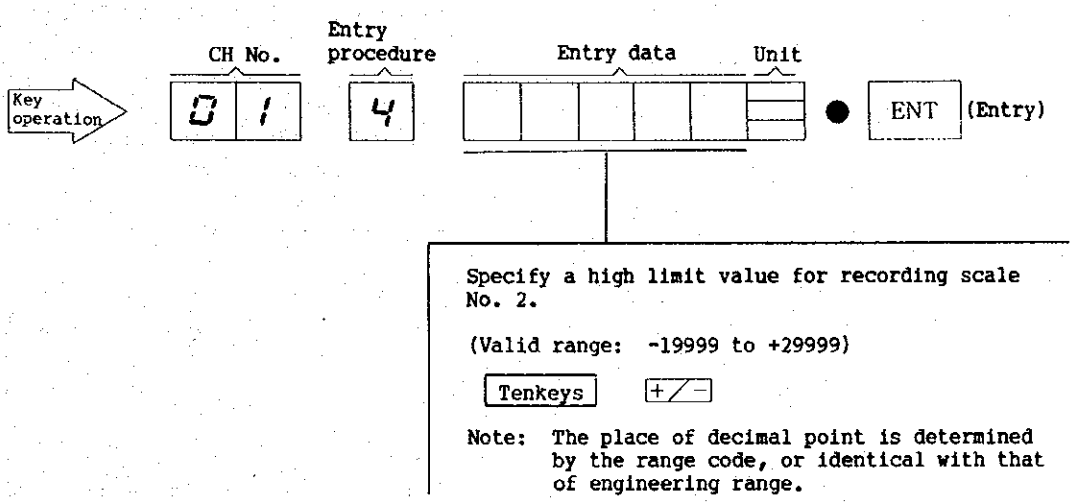
(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 3 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

Entry Procedure 4

This procedure is to enter the high limit value of recording scale No. 2 (optional).

(1) The purpose of this entry is to specify the high limit value of scale No. 2.



- As you press the ENT key, a prompter for proceeding to Entry Procedure 5 will appear on the readout.

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

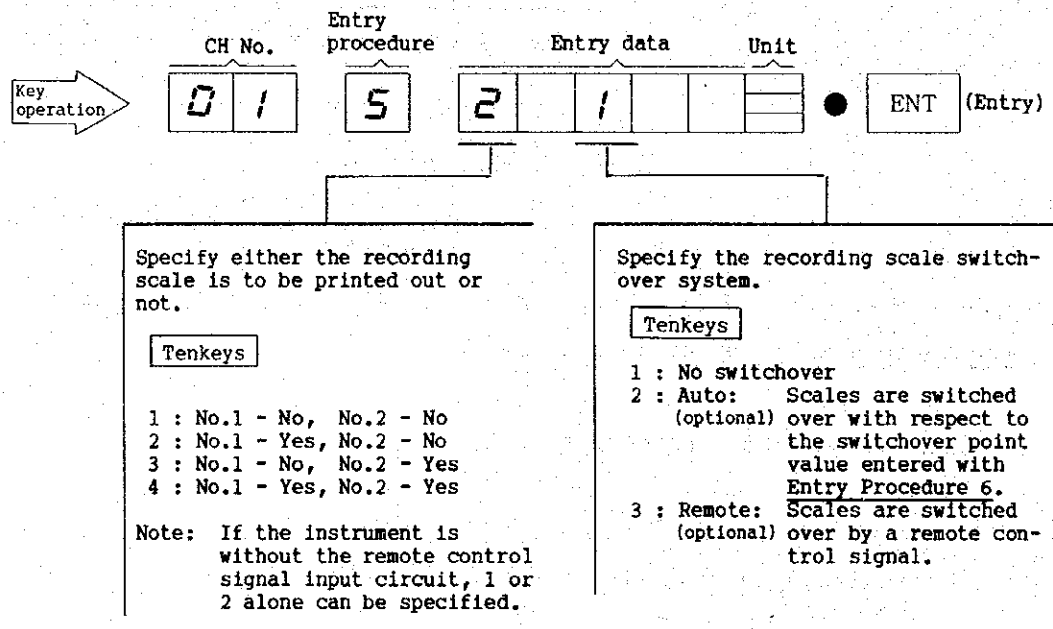
(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 4 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

Entry Procedure 5

This procedure is to enter data for recording scale print out and recording scale switchover system (optional).

(1) The purpose of this entry is to specify either the recording scale is to be printed out or not and to specify the type* of switching over the scales between No. 1 and No. 2, for which data has been entered with Entry Procedures 1 - 4.

*: The type of auto/remote switching over the scales between No. 1 and No. 2 can be specified only when the instrument is incorporated with the remote control signal input circuit (optional).



- As you press the ENT key, a prompter for proceeding to Entry Procedure 6 will appear on the readout if the instrument is with the remote control signal input circuit (optional) or that for skipping Entry Procedure 6 and 7 will appear if the instrument is without the optional circuit.

Key operation Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 5 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

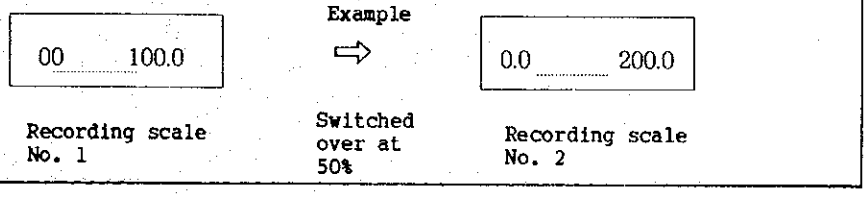
Entry Procedure 6

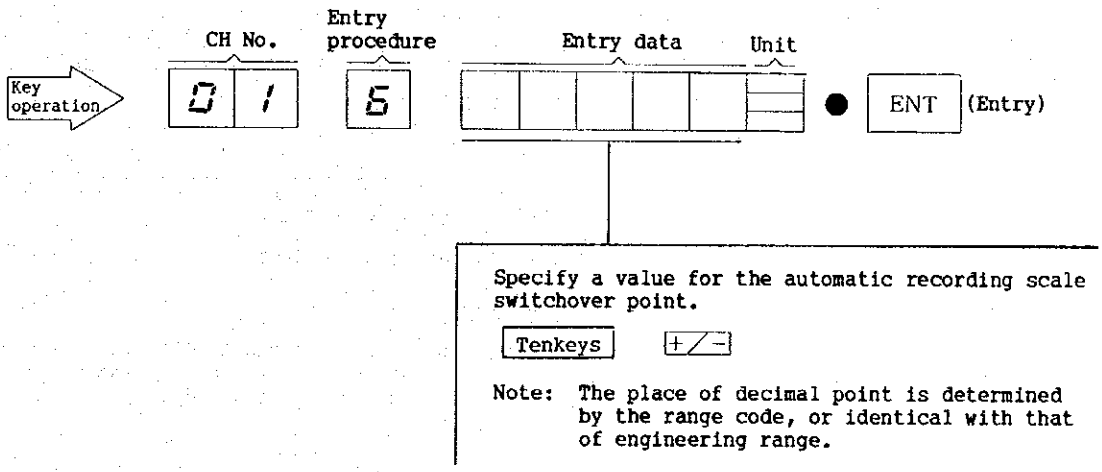
This procedure is to enter a value for the switchover point of recording scales.

(1) This procedure is skipped unless the automatic type of switchover is specified with Entry Procedure 5.

(2) The purpose of this entry is to specify the value at which the scales are to be automatically switched over (between recording scale No. 1 which has been specified with Entry Procedures 1 and 2 and recording scale No. 2 which has been specified with Entry Procedures 3 and 4.

Note: The automatic switchover function is enabled only when the AUTO system is specified with Entry Procedure 5.





- As you press the ENT key, a prompter for proceeding to Entry Procedure 7 will appear on the readout.

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

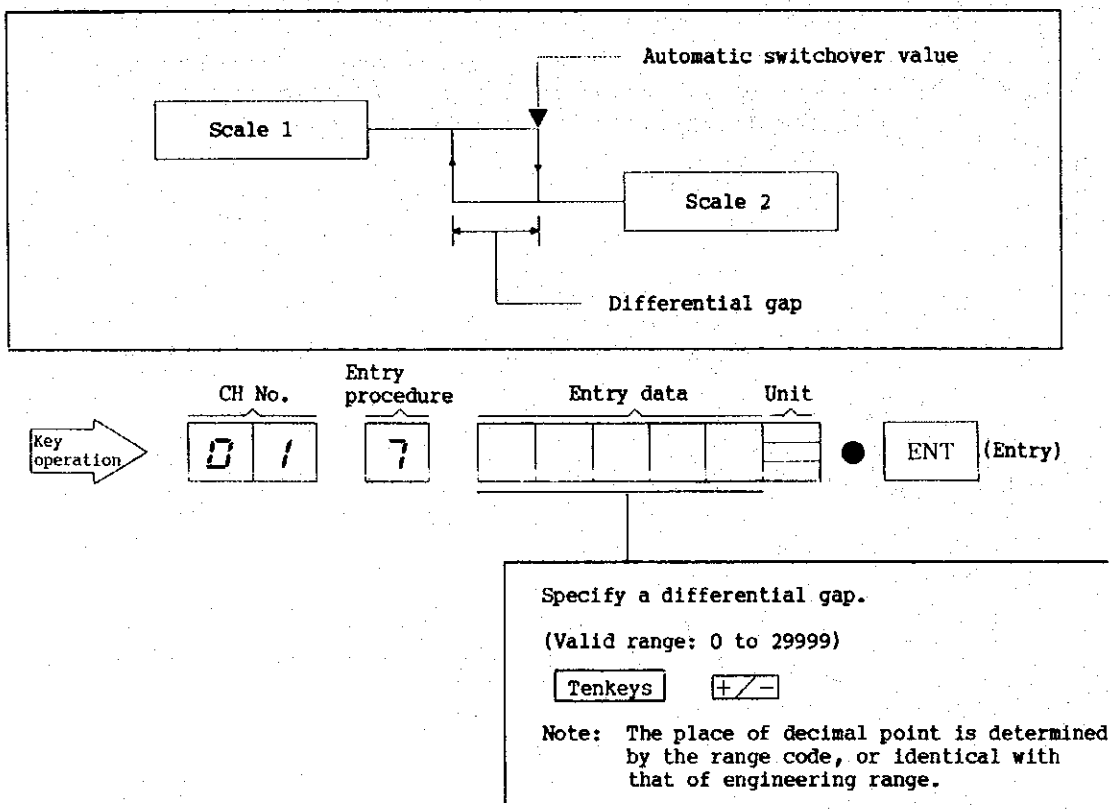
(2) To modify the data which has been entered by pressing the ENT key, return to Entry Procedure 6 by pressing the SHIFT and ENT keys, and then modify the data with the procedure of (1).

Entry Procedure 7

This procedure is to enter a differential gap for automatic scale switchover (optional).

(1) This procedure is skipped unless the automatic type of switchover is selected with Entry Procedure 5.

(2) The purpose of the differential gap is to prevent unnecessarily rapid automatic switchover between the two scales.



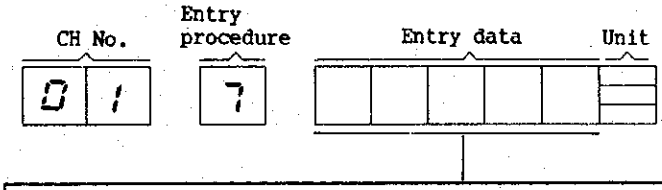
- As you press the ENT key, recording scale data entry for channel 1 is complete and a prompter for proceeding to Entry Procedure 1 for scale data of channel 2 will appear on the readout. For channel 2 and subsequent channels, repeat Entry Procedures 1 - 7 for recording scale data entry.

Note: Configuration data entered for a certain channel can be copied onto other channels to rapidly accomplish configuration data entry. (Refer to Section 8.4.11 "Copying of Configuration Data.")

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the [◀] and [▶] keys and then modify the data.

(2) To modify the data which has been entered by pressing the [ENT] key, return to Entry Procedure 8 by pressing the following keys and then modify the data with the procedure of (1).



- o Move the cursor (blinking column) to the CH No. position with the [◀] key and then press tenkeys [0] and [1].
- o Press the [ENT] key for the required number of times until the prompter Entry Procedure 7 appears on the readout.

8.4.3 Entry of Data for Event (Alarm)

Data for event can be entered by following Entry Procedures 1 - C for each channel. (Data for event is comprised of type of event, relay to be used, high and low alarm limit values, and differential value for event.) The Entry Procedure numbers are automatically displayed as prompter numbers at the EVENT column of the readout. The prompter numbers for data items which are not required to be entered are automatically skipped, allowing you to accomplish efficiently the data entry by following the procedures indicated by the prompters.

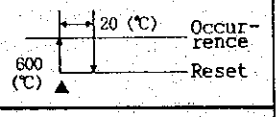
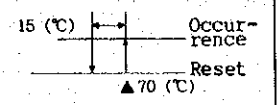
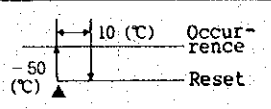
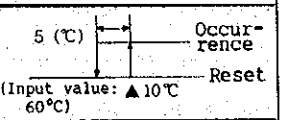
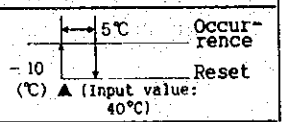
Readout / Item	CH NO.	EVENT		DATA
	8 8	8		8 8 8 8 8
EVENT	CH NO.	Entry procedure (Prompter number)	1, 2, 3, 4	Type of event — Relay No.
			5, 6, 7, 8	Limit value for event *1
			9, A, B, C	Differential value for event *1

*1: Entry Procedure numbers (prompter numbers) are automatically skipped depending on the type (H/L) of events. See Table 8.4.

Table 8.4. Example of Relationships Between Type of Event Data and Entry/Non-entry

Event point No.	Type of event: Entry Procedure No. (Prompter No.)		Limit value for event: Entry Procedure No. (Prompter No.)		Differential value for event: Entry Procedure No. (Prompter No.)	
Point 1	1	H type	(Corresponding) 5	Enter	(Corresponding) 9	Enter
Point 2	2	L type	(Corresponding) 6	Enter	(Corresponding) A	Enter
Point 3	3	OFF type	7	(Skip)	B	(Skip)
Point 4	4	OFF type	8	(Skip)	C	(Skip)

Table 8.5. Examples of Event Occurrences by Combinations of Type of Input Calculation and Type of Event

Type of input calculation	Example of fixed-value entry	Example of event limit value entry (▲)	Example of event differential value entry	Type of event, and occurrence/reset	Reading
1. Regular Measurement (Direct measurement of input)	Irrelevant	800 (°C)	30 (°C)	High limit	
		600 (°C)	20 (°C)	Low limit	
2. Differential Measurement Between Channels (Measurement of between measured channel and reference channel)	Irrelevant	70 (°C)	15 (°C)	High limit	
		-50 (°C)	10 (°C)	Low limit	
3. Differential Measurement with Fixed Value (Measurement of differential value between measured channel and fixed value)	(50°C)	10 (°C)	5 (°C)	High limit	
		-10 (°C)	5 (°C)	Low limit	

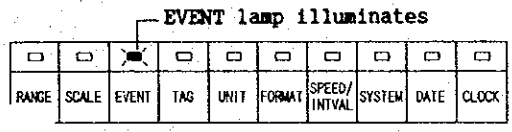
Key Operation Before Starting Data Entry Procedures

(1) Selecting the "EVENT" Mode

Key operation

Press the DATA SET key to select the "EVENT" mode.

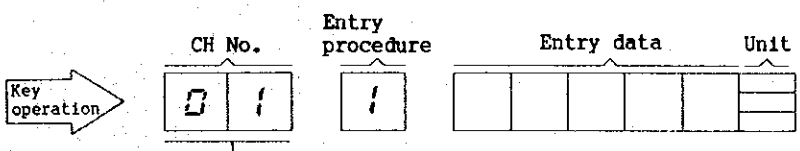
The corresponding data entry status lamp (EVENT lamp) will illuminate.



(2) Selecting a Channel

Select a channel number for data entry. (Channel No. 01 is assumed here.)

- If the channel number displayed on the readout is 01, go to Entry Procedure 1 which follows.
- If the channel number displayed on the readout is not 01, modify it to 01 with the following procedure.



Move the cursor (blinking column) to the EVENT column with the ◀ key and press tenkeys 0 and 1.

As the state of "CH No. = 01" is attained, the cursor will automatically move to the position for the next data entry (enter of data for event).

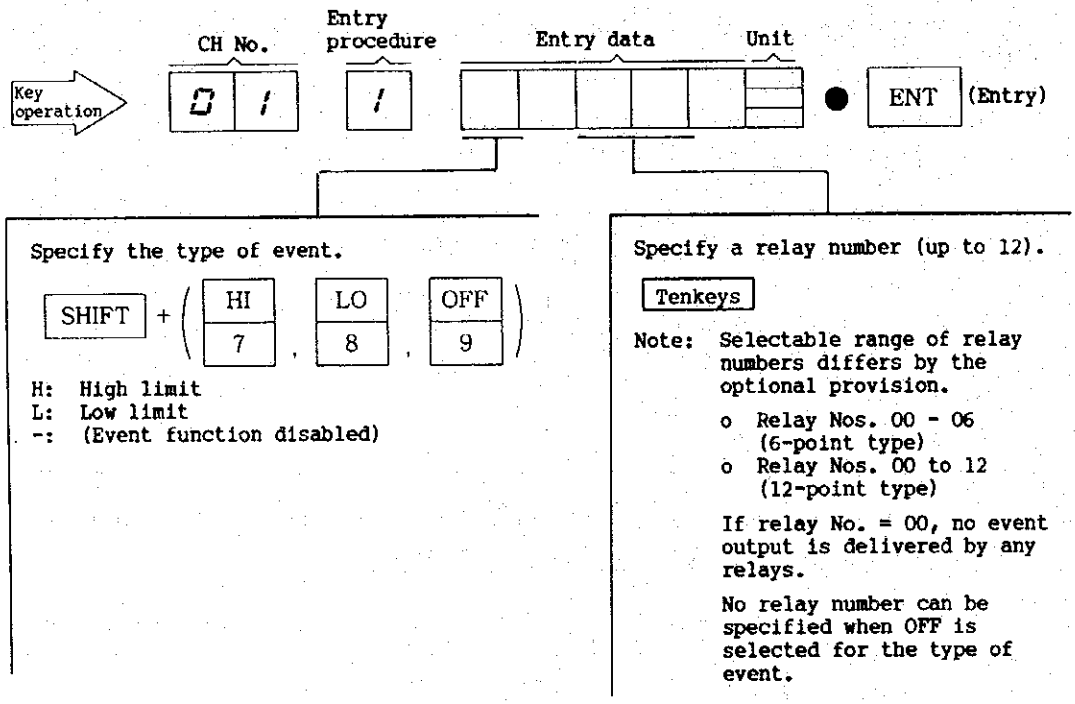
Entry Procedures 1 - 4

These procedures are for entry of data for the type of event and relay number.

(1) Type of event is selectable for 4 points for each channel.

(2) If the instrument is not provided with the event output circuit, relay number cannot be specified. If the same relay number is specified for two or more channels, an output is delivered on an OR logic.

> Note: As you enter the data for the type of event, the cursor automatically moves to the relay number entry position.



- As you press the ENT key, a prompter for proceeding to Entry Procedure 2 will appear on the readout. For Entry Procedures 2 - 4 also, enter data in the same manner as above.

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the ◀ and ▶ keys and then modify the data.

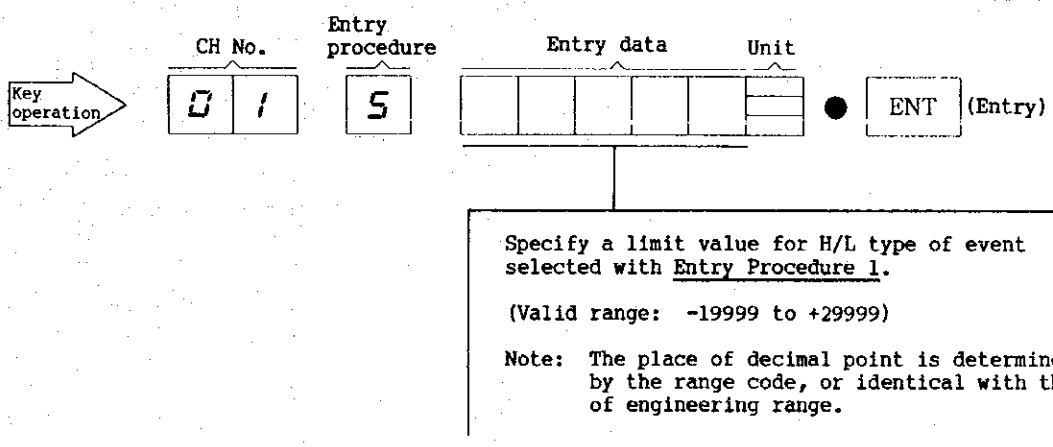
(2) To modify the data which has been entered by pressing the ENT key, return to the preceding Entry Procedure by pressing the SHIFT and ENT key and then modify the data with the procedure of (1).

Entry Procedures 5 - 8

These procedures are for entry of event point data.

(1) These procedures are for entry of limit values (trip point values) for the H or L type of event selected with Entry Procedures 1 - 4. When the OFF type is selected, these procedures are skipped and the prompter jumps to the subsequent entry procedure.

Note:	Entry Procedure 5:	To specify a limit value for H/L type of event selected with Entry Procedure 1.
	Entry Procedure 6:	To specify a limit value for H/L type of event selected with Entry Procedure 2.
	Entry Procedure 7:	To specify a limit value for H/L type of event selected with Entry Procedure 3.
	Entry Procedure 8:	To specify a limit value for H/L type of event selected with Entry Procedure 4.



- As you press the [ENT] key, a prompter for proceeding to Entry Procedure 6 will appear on the readout. For Entry Procedures 6 - 8 also, enter data in the same manner as above.

Key operation → Re-entry Procedure

(1) To modify the data to be entered, move the cursor to the required position with the [◀] and [▶] keys and then modify the data.

(2) To modify the data which has been entered by pressing the [ENT] key, return to the preceding Entry Procedure by pressing the [SHIFT] and [ENT] key and then modify the data with the procedure of (1).