
INSTRUCTION MANUAL
for
U N I C O R D E R
U - 1 6 4 1

Read this instruction manual thoroughly before use.

PANTOS CO., LTD.
Kyoto, JAPAN

Thank you for purchasing this product.

Please read this manual carefully to ensure safe operation and a long service life.

Safety Precautions

To prevent malfunctions, personal injury, or potentially fatal accidents, be sure to observe all cautions indicated in this page, because they are important for Safety.

We cannot accept responsibility for any damage or accidents that may occur if the Safety Precautions are not heeded.

Safety Symbols

The following safety symbols are used in the manuals for this unit.

Symbol	Meaning	Explanation
	General caution	Indicates an unspecified, general caution, warning, or danger
	Electric shock	Indicates the potential for electric shock
	Fire	Indicates the potential for fire
	Explosion	Indicates the potential for explosion
	Pinch	Indicates the potential for finger injury from pinching

CAUTIONS Danger of injury and property damage may be caused.

<p> Be sure to ground the unit. Grounding prevents electric shock and noise.</p> <p> Use only the specified fuse. Use of incorrect fuse may cause a fire or malfunction.</p> <p> Supply only the specified voltage. Supplying incorrect voltage may cause a fire or malfunction.</p> <p> Do not overload an electrical outlet. Overloaded circuits may cause a fire.</p> <p> Do not expose to chemicals, moisture, or gas. A leak or spark may cause a fire, electric shock, or malfunction.</p>	<p> Do not allow metal or foreign objects to infiltrate. A fire or malfunction may result.</p> <p> Do not supply power when disassembled or broken. Electric shock or malfunction may result.</p> <p> Do not cover the unit while the power is on. Heat will accumulate, causing the unit to deform. Fire may result.</p> <p> Never carelessly put your hands in the pen moving area. Personal injury or mechanical breakdown may result.</p> <p> Never touch the metal of the input terminals. Electric shock may result.</p>
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CAUTIONS

When the UNICORDER is brought out from Japan:

The UNICORDER is designed and manufactured to be used only in Japan.

The UNICORDER is subjected to the Foreign Exchange Control Order and Foreign Trade Control Act and is considered as one of strategic goods under control. Therefore, it is recommended that necessary application such as export permit be made to Japanese Government before the UNICORDER is brought out from Japan.

PANTOS reserves the right to change the specification of the UNICORDER without prior notice.

No part of this manual may be reproduced in any form or any means, without permission in writing from PANTOS.

This manual has been prepared carefully to cover every aspect of the UNICORDER. Whenever you find any mistake or insufficient explanation, please contact to your local agent.

PANTOS is not responsible at all for any effect caused or resulted from usage of the UNICORDER.

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1. INTRODUCTION

1.1 Precautions

Contents of this manual	<p>It is forbidden to reproduce any part of this manual without permission.</p> <p>The contents of this manual may change without notice. Although this manual has been prepared carefully, if you find any mistakes or difficult to understand explanations, please contact your local distributor.</p>
Operating the UNICORDER	<p>The UNICORDER is designed as a general-use instrument (test,experiment, etc) . It is a high-quality, reliable instrument. The UNICORDER cannot be used in situations in which breakdowns or operational errors may direct harm the human body (device for medical care, various safety devices etc.) or measurements related to money transactions.</p> <p>PANTOS takes no responsibility for any injuries or damage caused by or resulting from usage of the UNICORDER.</p>
Taking the UNICORDER abroad	<p>The UNICORDER is manufactured and sold on the conditions it will be used in Japan. Some countries prohibit use of the UNICORDER by law or regulations. PANTOS takes no responsibility for any damage caused by use of the UNICORDER in such countries. Repair and maintenance service are limited to the Japanese domestic market.</p> <p>The UNICORDER falls under the "Foreign Exchange and Trading Control Law " which regulates strategic goods.</p> <p>Therefore, to bring the UNICORDER to outside of Japan, export permission from the Japanese government is necessary.</p>
Operation	<p>The operation switch and EL display unit attached to the operation assembly have a movable structure. Be careful not to catch your finger between them during operation.</p> <p>The recording pen may be driven in high-speed by the input signal or switch operation. When placing your hands within the movement range of the recording pen to replace the pen, the operation must be correct. Be careful not to place any parts of your body within the movement range to the recording pen.</p>
Ground connection	<p>Be sure to connect the case ground to a proper ground connection. If the connection is not complete, electric shock may occur.</p>

1.2 Organization of This Manual

Introduction	<p>Explains precautions for the use of this manual and the UNICORDER as well as an explanation of the warranty.</p>
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1. INTRODUCTION

Name and functions	Describes connections and operations together with figures. By reading this chapter an outline of the operating method can be grasped and the user can start to use the UNICORDER .
How to handle the equipment	Explains the accessories and how to install the chart paper, ink ribbon and input unit.
Operation panel	Describes the switches on the panel and how to operate the EL display.
Operation	This chapter explains the operations in more detail, such as troubleshooting, interpreting recording result etc. Also explains various functions for more convenient use as well as options.
Specifications	Specifications of the UNICORDER.

Note; Detailed explanations of the options are described in the instruction manual for options.

1.3 Warranty

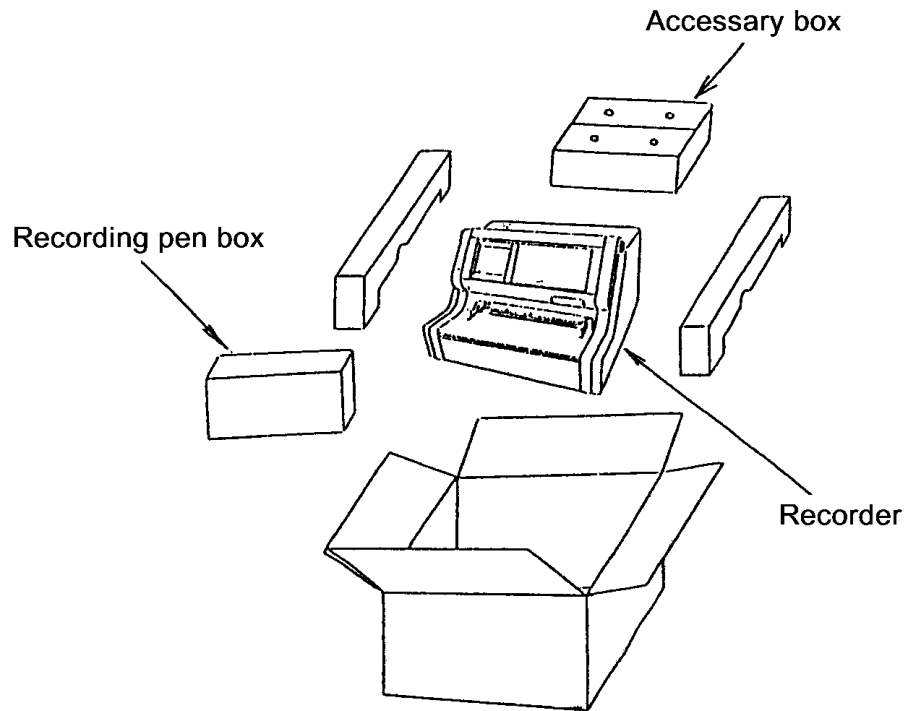
Warranty	The recorder is warranted for one year from the date of purchase. Should the recorder breakdown due to a defect in manufacturing within the said period, PANTOS shall repair it at no charge to the customer. In principle, the customer shall bring the recorder to an PANTOS's dealer and pick it up upon completion of repair. In the case the customer requires the repair to be done by a serviceman at the customer's site, a porting of the repair fee, i.e., transportation fee, shall be borne by the customer. Costs for any breakdowns caused by the customer such as ones due to operation mistakes that are not due to manufacturing defects shall be borne by the customer even if they occur within the warranty period for one year from the date of repair. Cost for repair or replacement of any consumables shall be borne by the customer. This warranty is valid only in Japan.
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Note; The details of this warranty will not limit the rights of purchaser.

Repair	PANTOS will repair instruments that has been used long periods. Although PANTOS maintains stocks of replacement parts as much as possible, there may be some cases in which the problem cannot be repaired due to discontinued part. When a repair is required, we recommend to providing detailed information of the condition of the problem.
Periodical inspection	Periodical inspections are necessary to maintain accuracy of the measured values. Carry out periodic inspections every six months.

1.4 Unpacking

Unpacking



Accessories

Confirm that the following accessories are in the carton.
If a part is missing, contact the dealer in your city or our sales department.

Parts name	Model	Q'nty
Power cable		1
Chart paper (20m)	2501P50	1
IC memory card		1
Pen	NDL-**	1 each
Dust cover		1
Fuse (built-in)	5A	1
Input cover		1
Input cover stay		4
Instruction manual		1
Dropping pipet		1
Grounding adapter		1
External remote connector		1

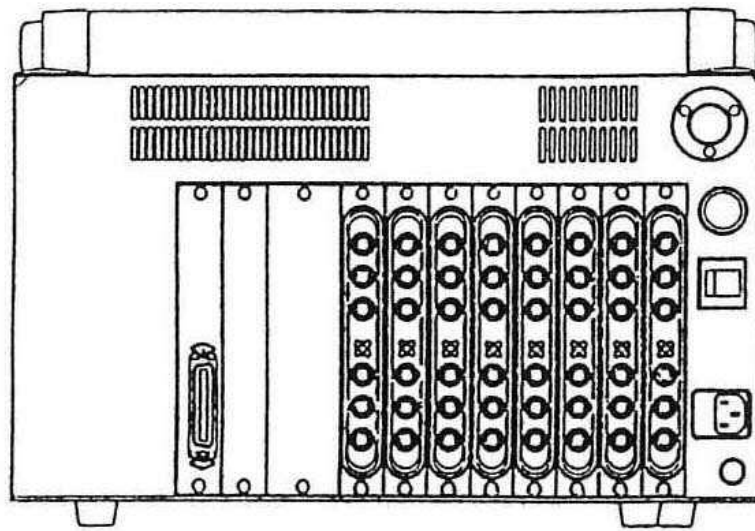
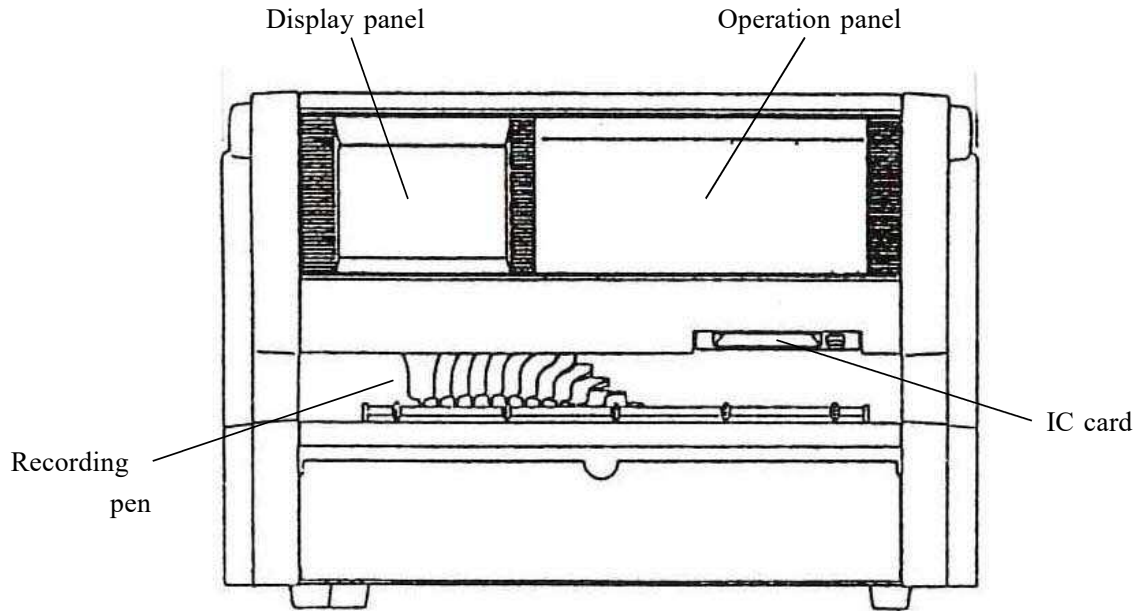
1. INTRODUCTION

1.5 Preparing for Recording

We recommend you to read the sections in the following order before operation.

- (1) Put water into the automatic pen cap. (3.3)
- (2) Install the printing ribbon cassette. (3.8)
- (3) Set and confirm the power and voltage. (2.2.1)
- (4) Connect the power connector and turn on the power switch. (2.2.2)
- (5) Load the chart paper. (3.1)
- (6) Install the recording pen. (3.2)
- (7) Connect the input cable. (3.6)
- (8) Install the input cover. (3.9.1)

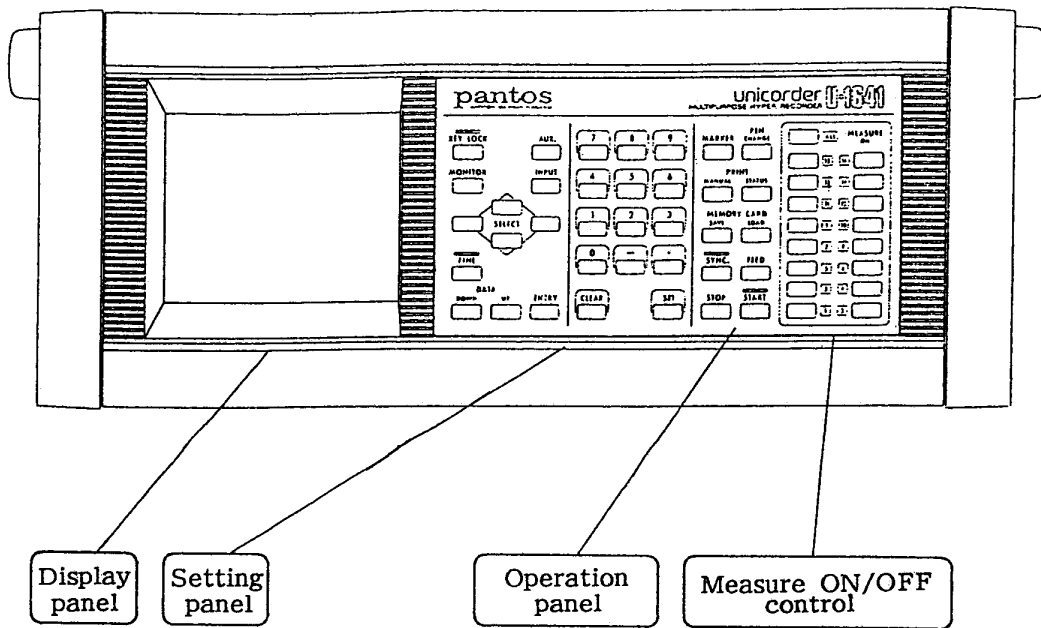
2. NAME AND FUNCTION



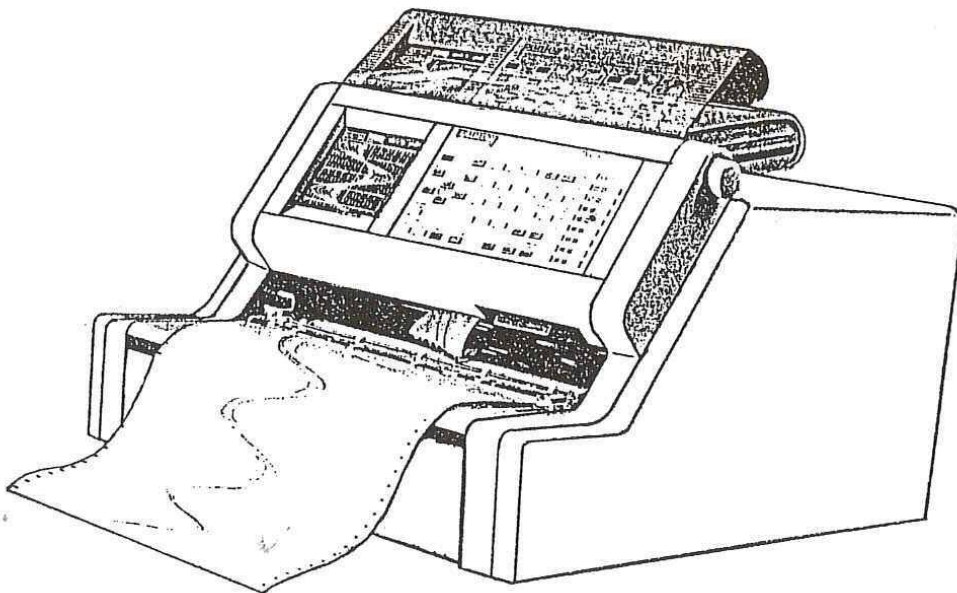
Rear panel

2. NAME AND FUNCTION

2.1 Operating Unit



The operating unit can be moved and used at any position.



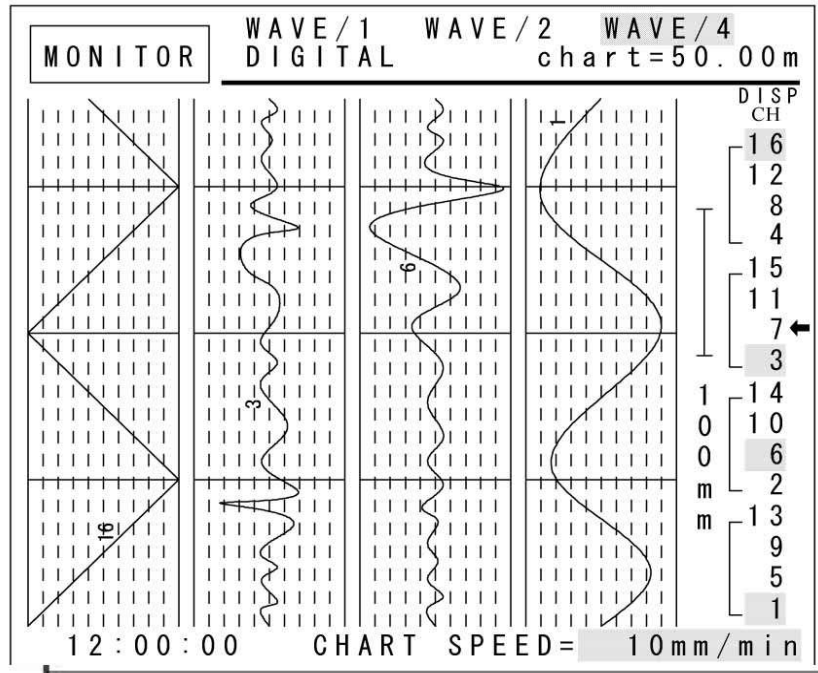
**Caution: Be careful not to catch your fingers.
Keep your body away from the pen operating area.**

2. NAME AND FUNCTION

2.1.1 Display unit

Display unit shows the analog waveform, digital display, and setting screen. All settings for the input amplifier and auxiliary functions are done in this display unit. Switch the display using the switch on the setting unit. Analog waveform scrolls in synchronization with the chart paper feed. Digital display can be directly read physical amounts by setting of the scale function of the auxiliary function.

Analog waveform



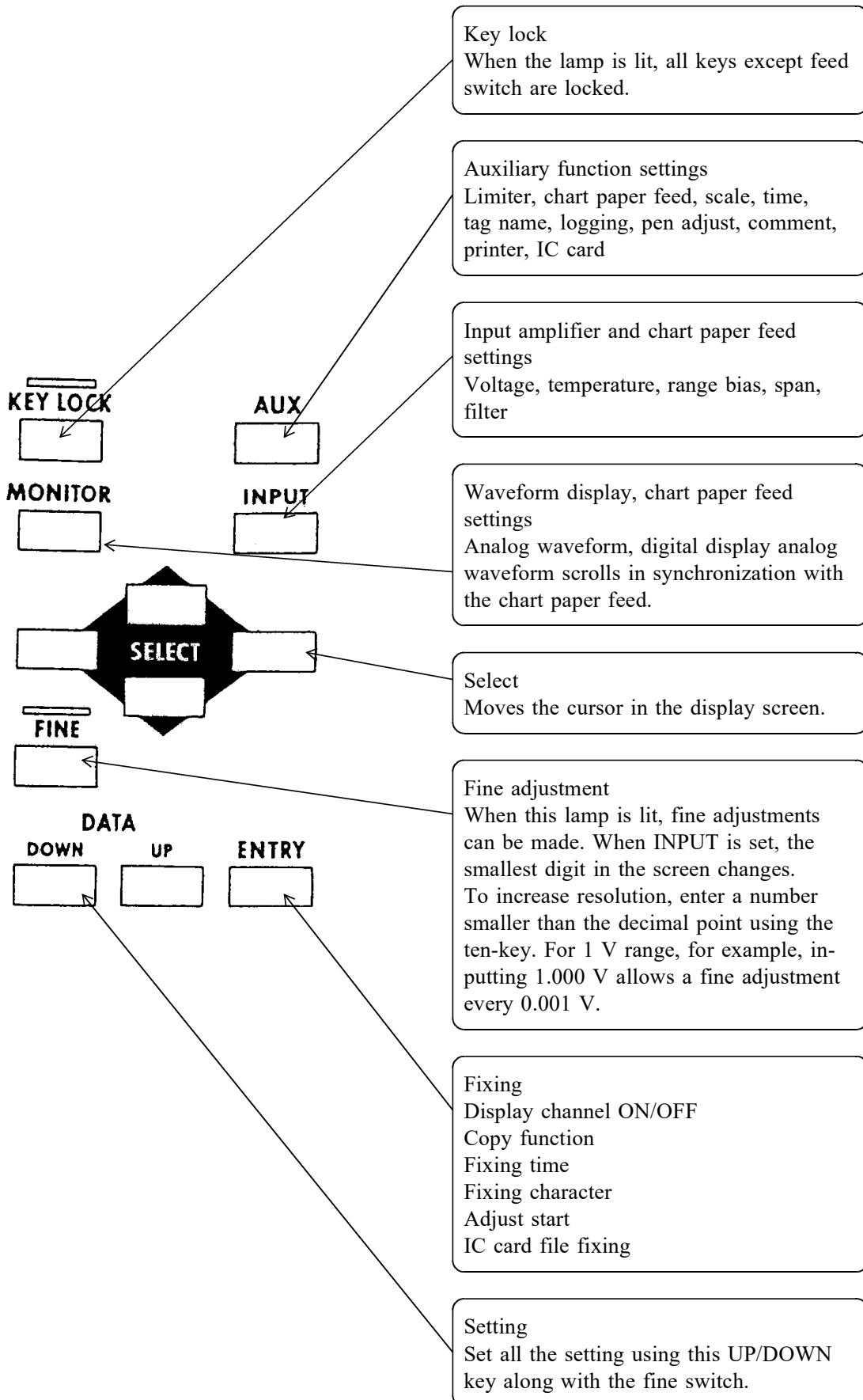
Digital waveform

MONITOR		WAVE/1	WAVE/2	WAVE/4
CH	DIGITAL		CH	DIGITAL
15	***		16	***
13	13.84	V	14	12.76 mV
11	8.56	V	12	6.32 V
9	7.87	V	10	10.56 V
7	230.5	°C	8	2560 rpm
5			6	1.562 V
3	4.872	mV	4	783mmHg
1	10.45	V	2	-2.564 mV

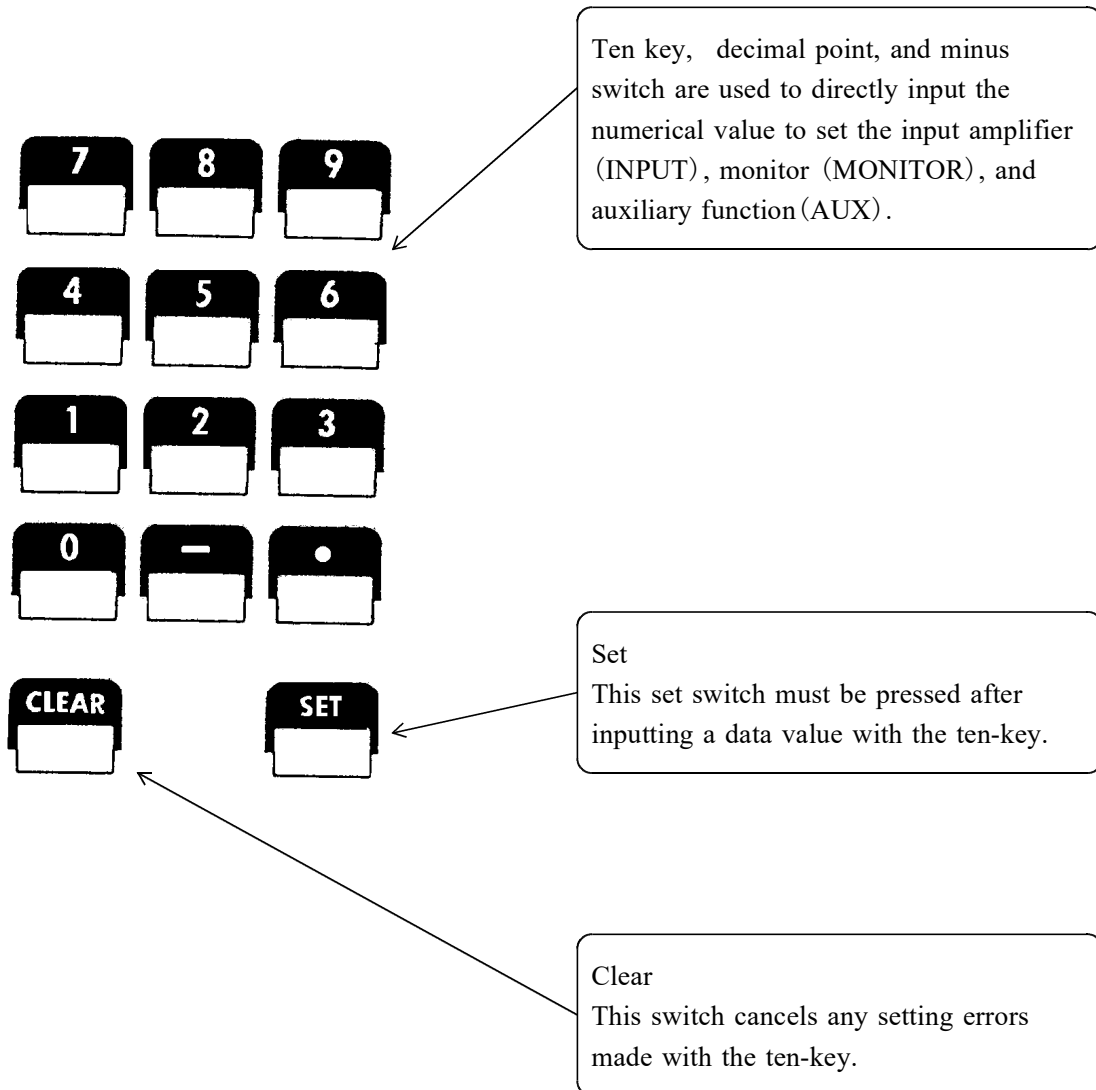
12:00:00 CHART SPEED = 10mm/min

2. NAME AND FUNCTION

2.1.2 Setting unit



2. NAME AND FUNCTION



2. NAME AND FUNCTION

(1) Input amplifier/chart paper feed (INPUT)

Settings the amplifier and chart paper feed settings.

Input condition setting screen

MONITOR and AUX. keys: switches to other functions.

Displays INPUT setting mode. (COPY MODE, TIME BASE separately)

INPUT (SET MODE)					
CH	TY PE	FIL TER	RAN. SPAN	RANGE SPAN-L	BIAS SPAN-R
16	*	*	**	**	**
15	*	*	**	**	**
14	V	OFF	SPAN	8.3 V	4 V
13	V	OFF	RAN.	10.33 V	20 %
12	Pt	ON	SPAN	200 °C	0 °C
11	R	ON	SPAN	1800 °C	100 °C
10	B	ON	SPAN	200 °C	-50 °C
9	S	OFF	SPAN	0 °C	300 °C
8	T	OFF	SPAN	100 °C	150 °C
7	E	OFF	RAN.	500 °C	20.0 %
6	K	OFF	SPAN	1200 °C	-100 °C
5	J	ON	SPAN	100 °C	0 °C
4	mV	ON	RAN.	10.0 mV	10 %
3	mV	OFF	SPAN	50.0 mV	0.0 mV
2	V	ON	RAN.	5.50 V	30.5 %
1	V	OFF	RAN.	10.0 V	50.0 %

15:45:56 CHART SPEED= 10mm/min

No input unit is provided

Setting channel

Press the cursor [←] to set COPY MODE and press the ENTRY key. ← displays Data at the ← position can be copied by moving the cursor on CH and key.

E (error) displays in this line when the setting value is not correct.

SPAN-L and SPAN-R for 8CH

At present, the SPAN-R value can be set. Value can be changed with the DATA UP or DOWN key. Fine numerical value is set with the FINE key ON. (Ten-key and the SET key can be used for the setting. Pressing the ENTRY key is not required)

Display of time

When the cursor is positioned at CHART SPEED numerical values can be changed with the DATA UP or DOWN key and the ten-key. Pressing the ENTRY key is not required.

Input amplifier

1. Selecting the Channel: Move the cursor with the SELECT keys.
2. Selecting the item: Move the cursor with the SELECT keys.
3. Setting the item: Use the DATA UP or DOWN key.

TYPE: 16TCV1:
Voltage (mV, V)
Temperature (Thermocouples: J, K, E, T, S, R, and B)
Thermo resistance bulb (Pt 100 ohm:Pt) is added for 16RTD1.

FILTER: ON (1 Hz), OFF (10 Hz)

RANGE/SPAN: Selects sensitivity setting method
 RANGE: Sets sensitivity and zero point
 Example: Full scale 1 mV (RANGE)
 Zero point 50% (BIAS)
 SPAN: Sets measuring range
 Example: 1mV (SPAN-R) - 2mV (SPAN-L)

2. NAME AND FUNCTION

RANGE: Determined by selection of RANGE/SPAN as described above.
BIAS% Use the DATA UP or DOWN key or ten key. When input are done
SPAN-L/SPAN-R by the ten key, be sure to press the SET key. Can set in the range of 100 μ V to 50 V/FS. Accuracy is poor between 100 μ V and 900 μ V for measurements of fine voltage. BIAS indicates the position of the zero point.

4. Copying the setting:
- Example: To copy settings of channel 1 to channel 2 and 3
- 1) Select channel 1 with the SELECT keys.
 - 2) Move the cursor to the left end with the SELECT key.
 - 3) Press the ENTRY key. " \blacktriangleleft " displays at left of the table.
 - 4) Select channel 2 with the SELECT key, and press the ENTRY key. (Copy of channel 2 is completed.)
 - 5) Select channel 3 with the SELECT key, and press the ENTRY key. (Copy of channel 3 is completed.)

Chart paper feed

1. Move the cursor to CHART SPEED = .
Set with the DATA UP or DOWN key or the ten key.

2. NAME AND FUNCTION

(2) Waveform display/chart paper feed (MONITOR)

Set the setting for waveform monitor and chart paper feed.

Waveform recording screen

Pressing the MONITOR key the screen through WAVE / 1 → WAVE / 2 → WAVE / 4 → DIGITAL → WAVE / 1 → . . .
Pressing the INPUT or AUX key to other functions.

4-split display

MONITOR WAVE/1 WAVE/2 WAVE/4
DIGITAL chart=50.00m

DISP CH
16
12
8
4
15
11
7
3
14
10
6
2
13
9
5
1

12:00:00 CHART SPEED=10mm/min

Display of time

Channel No.

In this mode, CHART SPEED is variable in every hour. Numerical value can be changed with the DATA UP or DOWN key, and ten-key. Pressing the ENTRY key is not required.

Move the cursor up and down with the SELECT keys. Pressing the ENTRY key repeatedly turns the channel specified with the cursor ON/OFF.
(This example shows that channel 1, 3, 6, and 16 are ON.)

Press the MONITOR key. The monitor screen (waveform display or digital value) will display. The upper portion of the screen displays the menu. Pressing the MONITOR key again moves the cursor on the menu. The screen changes according to this movement of cursor.

Waveform display

Waveform scrolls synchronously with speed of the chart paper feed.

1. WAVE / 1 : Screen is not split and all channels set are displayed on one screen.
2. WAVE / 2 : Screen is split into two screens.
3. WAVE / 4 : Screen is split into four screens.

Waveform display ON/OFF

Turn on/off with DISP.CH at the right end of the screen.

1. With the SELECT keys, move the cursor to the target channel.
2. Put the mark in the channel display by turning on, the ENTRY key.

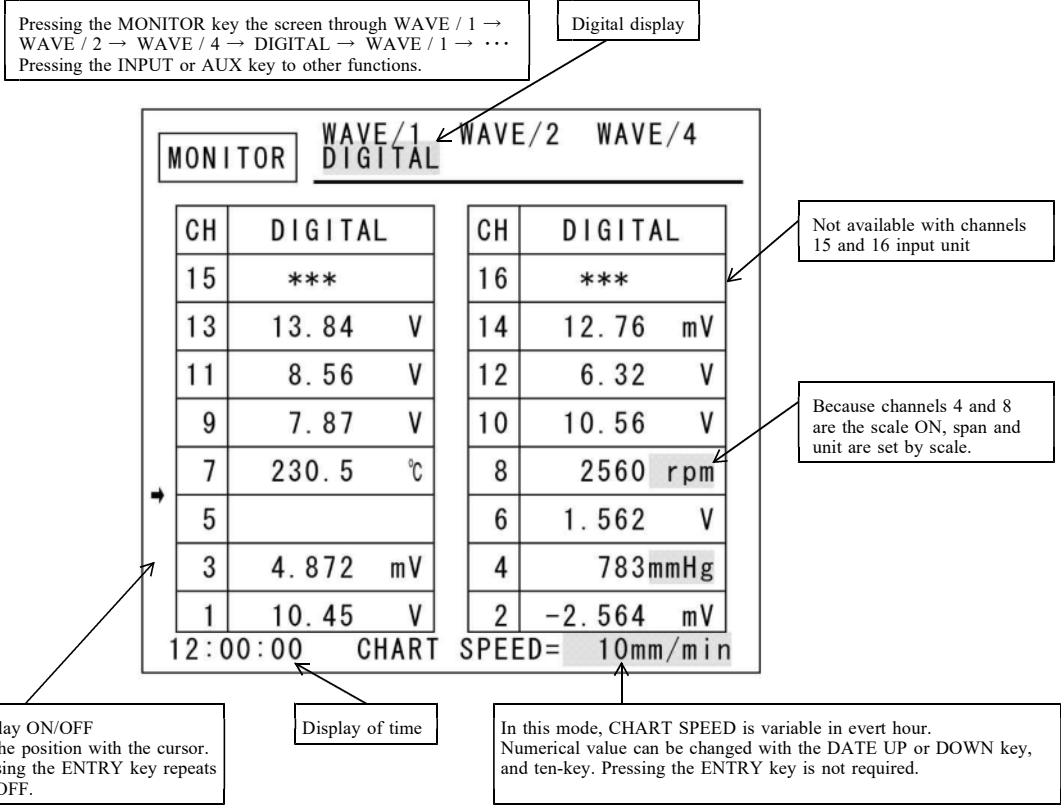
Waveform display is activated. To turn off the waveform display, press the ENTRY key to delete the mark.

Chart paper feed

Pressing the DATA UP or DOWN key changes CHART SPEED. Ten key can also be used to do setting.

(3) Digital value display/chart paper feed (MONITOR)
 Digital display value and chart paper feed setting.

Digital value display screen



Digital value display

Press the MONITOR key. The monitor screen (waveform display or digital value) will display. The upper portion of the screen displays the menu. Pressing the MONITOR key again moves the cursor to the menu. The screen changes according to this movement of cursor. Press the MONITOR key until the above screen is displayed.

Displays the measurement absolute value, conversion value specified by the scaling function, and unit.

A ■ mark of the unit indicates scaling.

ON/OFF of display

Using the SELECT key, move the cursor to the left of the channel display and select the channel. Every time the ENTRY key is pressed, the display is repeatedly turned ON/OFF.

Chart paper feed

Pressing the DATA UP or DOWN key changes CHART SPEED. Ten key can also be used for the setting.

2. NAME AND FUNCTION

(4) Limiter (AUX. → LIM)

Sets alarm output setting.

Limiter setting screen

Switch to other function with the MONITOR and INPUT keys, then press the AUX.key. AUX. is selected sequentially as CHART → SCALE → ...

Limiter value setting

Input numerical value with the DATA UP or DOWN keys, and the ten-key in the range of from 0% to 100%.

Move the cursor with the SELECT keys.

CH	USE	OUT	UPPER	LOWER	BUZZER
16	*	*	**	**	**
15	*	*	**	**	**
14	OFF				
13	OFF				
12	OFF				
11	OFF				
10	OFF				
9	OFF				
8	OFF				
7	ON	3	85.0%	15.5%	ON
6	ON	2	90.5%	23.7%	ON
5	ON	1	75.0%	10.5%	ON
4	OFF				
3	OFF				
2	ON	1	80.0%	5.5%	OFF
1	ON	1	90.0%		ON

No input unit is provided

Input channel

Output ON/OFF

At present three output terminals are being set. Same number makes OR.

E (error) displays in this line when the setting value is not correct.

Output cell (option)

Upper limit setting (%)

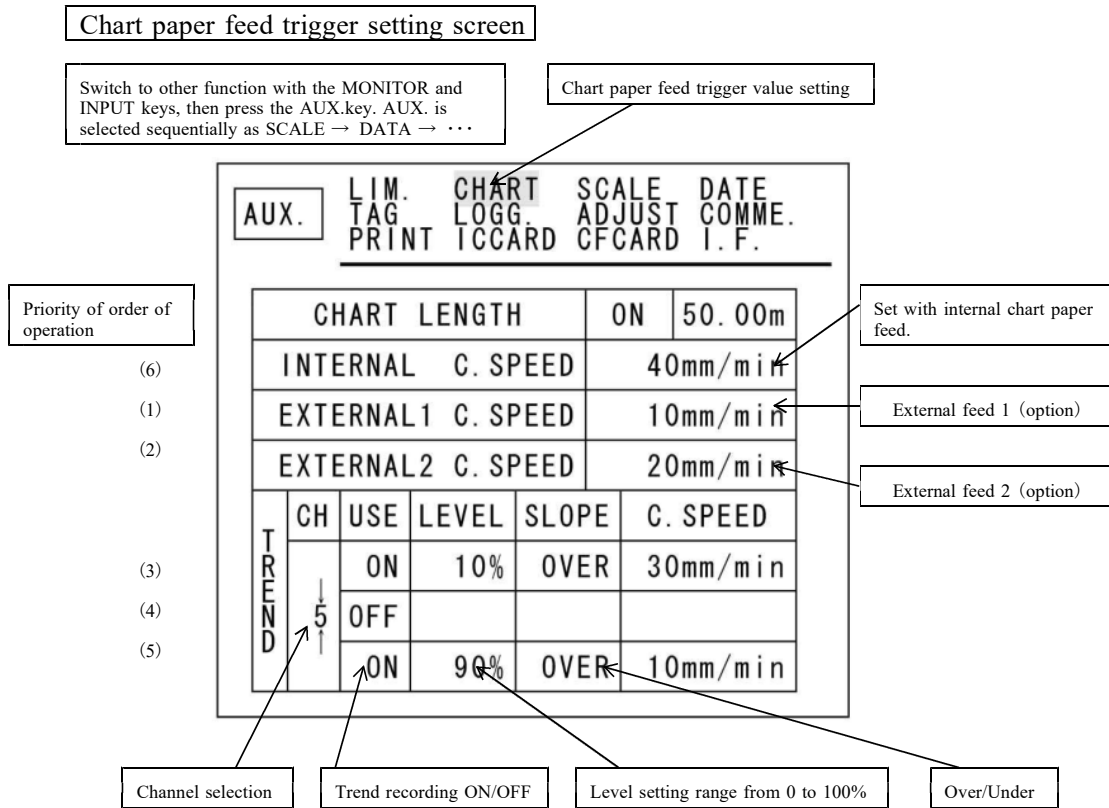
Lower limit setting (%)

Buzzer ON/OFF

Press the AUX.key until the cursor in the menu indicates LIM.

1. Select the channel: Move the cursor using the SELECT keys.
2. Output ON/OFF: Move the cursor to the block USE with the SELECT keys and select ON or OFF with the DATA UP or DOWN key.
3. Selecting an output cell: Output is an option. Cell is from 1 to 8. Channel and output can be set individually. Can be used even if multiple numbers of the same cell are set using the DATA UP or DOWN key or the ten key.
4. Setting the upper limit: Setting range is from 0 to 100%. If the signal exceeds this value, output is shorted dircuted.
5. Setting the lower limit: Setting range is from 0 to 100%. If the signal is smaller than this value, output will be shorted dircuted. Upper value and lower value can be set even if they are reversed.
6. Alarm buzzer ON/OFF: Selects whether to activate the warning buzzer that when the signal exceeds the upper value or lower value. The buzzer sounds for brief instant.

- (5) Chart paper feed trigger (AUX. → CHART)
 Setting for trigger function and external feed remote.



Press the AUX.key until the cursor in the menu displays CHART. Select the item with the SELECT keys and set with the DATA UP or DOWN key, or the ten key.

INTERNAL: Values set in the INPUT or MONITOR screen will display. This screen can also be used for settings. If settings are made with this screen, the setting value in the INPUT or MONITOR screen will change. When the external remote is turned off, items can be selected.

EXTERNAL 1: Selectable when external remote 1 is turned on.

EXTERNAL 2: Selectable when external remote 2 is turned on.

TREND: Chart paper feed can be changed according to signal level.

Setting condition

CH: 1-16CH

USE: Operation ON/OFF

LEVEL: 0 - 100%

SLOPE: OVER, UNDER

C.SPEED: 10mm/h - 40mm/sec

If triggers are applied simultaneously, order of operation is as follows:

EXTERNAL 1, EXTERNAL 2, TREND, and INTERNAL

2. NAME AND FUNCTION

(6) Scaling (AUX. → SCALE)

Set an arbitrary full scale value and unit.

Scaling setting screen

Switch to other function with the MONITOR and INPUT keys, then press the AUX.key. AUX. is selected sequentially as DATA → TAG → ...

Scaling value setting

AUX.		LIM. TAG	CHART LOGG	SCALE ADJUST	DATE COMME.
		PRINT ICCARD	CFCARD	I. F.	
CH	USE	100%	0%	UNIT	UNITTABLE
16	*	**	**	**	15 mg
15	*	**	**	**	14 g
14	ON	1000.0	0.0	cm	13 rpm
13	ON	6000	600	rpm	12 km/h
12	OFF				11 m/s
11	ON	200	0	km/h	10 kHz
10	OFF				9 Hz
9	OFF				8 °C
8	ON	2000	780	mmHg	7 °C
7	OFF				6 A
6	OFF				5 mA
5	ON	100.00	-20.00	mA	4 A
4	OFF				3 A
3	ON	200.0	-20.00	μS/c	2 V
2	ON	-10.0	0.0	Kcal	1 mV
1	ON	-10000	11000	kg/c	0
E					

Selecting OFF will not display the setting value.

Selecting ON turns on the digital display.

Current setting channel. COPY mode is available.

E (error) displays in this line when the setting value is not correct.

There are 64 types of units for 5 screens

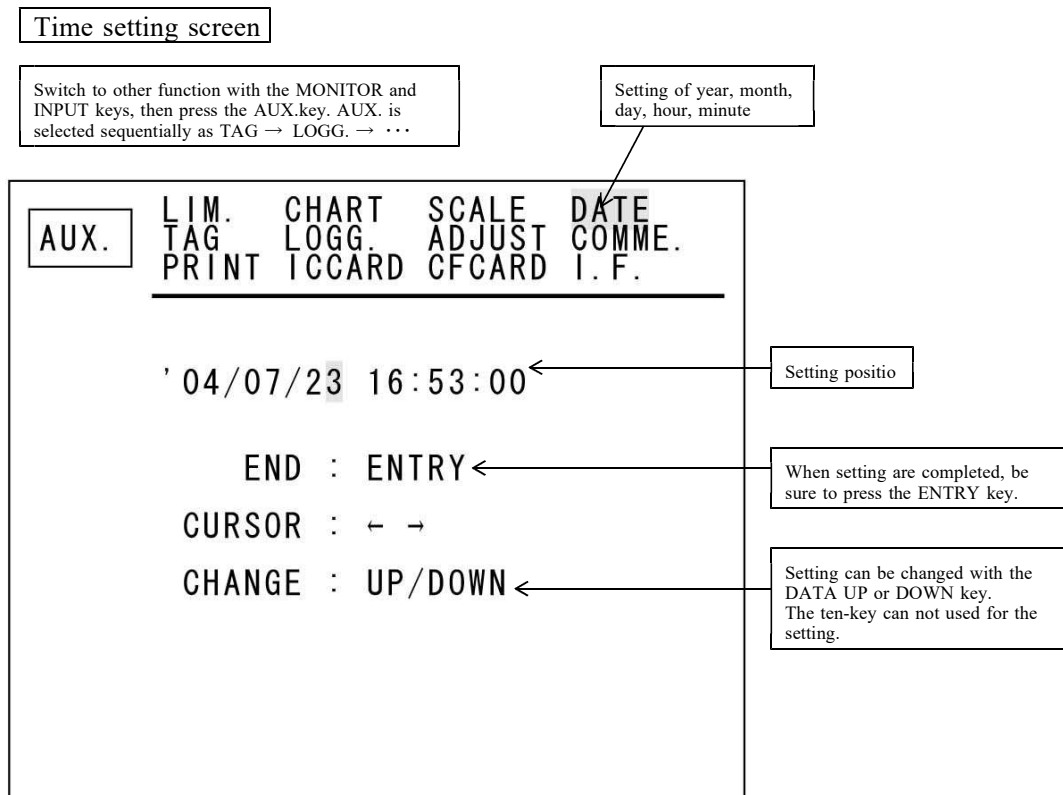
Shows current unit. Input with the DATA UP or DOWN key, and the ten-key. For mA, input "5" (range 0 to 63). Setting USE key is on.

Input 100% value and 0% value with the DATA UP or DOWN key (FINE), and the ten-key. If setting range (-10000 to 10000) is exceeded, "E" will display.

Press the AUX. key until the cursor in the menu displays CHART. Select the item with the SELECT keys and set with the DATA UP or DOWN key, or the ten-key.

1. Selecting the channel: Move the cursor using the SELECT keys.
2. Scaling ON/OFF: Move the cursor to the column USE with the SELECT keys and select ON or OFF using the DATA UP or DOWN key.
3. Full scale setting: Move the cursor to the column 100% with the SELECT keys and set an appropriate numerical value (range between -10,000 to 10,000) using the DATA UP or DOWN key, or the ten key.
4. Zero setting: Move the cursor to the column 0% to set an appropriate numerical value (range between -10,000 to 10,000) with the SELECT keys.
5. Unit setting: Move the cursor to the column UNIT using the SELECT keys and select an appropriate unit using the DATA UP or DOWN key, or the ten key.
Selection can be done only when ON is selected at USE.
6. Copy: Same as copy of the INPUT screen. Refer to 2.1,(1).

- (7) Time (AUX. → DATE)
Adjust the time in this screen.



Press the AUX. key until the cursor in the menu displays DATA.
Using the SELECT keys, select the setting item. Set value is changed with the DATA UP or DOWN key. Press the ENTRY key when complete.
When the ENTRY key is pressed, 00 is displayed for a second.

2. NAME AND FUNCTION

- (8) Tag name (AUX. → TAG.)
Adds a name to the signal.

Tag name setting screen

Switch to other function with the MONITOR and INPUT keys, then press the AUX.key. AUX. is selected sequentially as LOGG. → ADJUST → ...

Tag name setting

The screenshot shows the 'Tag name setting' screen. At the top, a menu bar includes 'AUX.', 'LIM. TAG', 'CHART LOGG.', 'SCALE ADJUST', and 'DATE COMME.'. Below this is a table with two columns for 'TAG NAME' and 'TAG NEME'. The 'TAG NAME' column has entries for channels 15, 13, 11 (PANTOS), 9, 7, 5 (ENGINE), 3 (SPEED), and 1. The 'TAG NEME' column has entries for channels 16, 14, 12, 10, 8 (ABCDEFGH), 6, 4, and 2. To the right is a character selection grid with letters A-Z, digits 0-9, and symbols #, %, (,), *, +, -, ., /, :. Below the grid are the labels '(SW) SELECT DATA ENTRY'. Callouts explain: '8 characters can be input.' (pointing to the 'SPEED' entry), 'Cursor at character position moves with the SELECT keys.' (pointing to the 'SPEED' entry), and 'Character selection UP: Moves cursor right, DOWN: Moves cursor left, ENTRY: Selects the character' (pointing to the character selection grid).

CH	TAG NAME	CH	TAG NEME
15	*****	16	*****
13		14	
11	PANTOS	12	
9		10	
7		8	ABCDEFGH
5	ENGINE	6	
3	SPEED	4	
1		2	

Character selection
UP: Moves cursor right
DOWN: Moves cursor left
ENTRY: Selects the character

(SW)
SELECT
DATA
ENTRY

8 characters can be input.

Cursor at character position moves with the SELECT keys.

Press the AUX. key until the cursor in the menu displays TAG.

Set the channel and character position with the SELECT keys, select character from the character selection column using the DATA UP or DOWN key, and press the ENTRY key every time one character is selected. Up to eight characters can be input for every channel.

To print the tag name that was input, specify ON/OFF by setting the PRINT condition in AUX.

(10) Pen Adjust (AUX. → ADJUST)

Adjust the pen variation compensation, pen zero point, and chart paper width.

Adjust setting screen

Switch to other function with the MONITOR and INPUT keys, then press the AUX.key. AUX. is selected sequentially as COMME. → PRINT → ...

Adjust setting

The numerical value of all channels changes at the same time when the cursor is in this position.

AUX.	LIM. TAG	CHART LOGG.	SCALE ADJUST	DATE COMME.
	PRINT	ICCARD	CFCARD	I. F.
	CH	PEN	LEFT	RIGHT
	16	0	0	5
	15	0	0	0
	14	1	-10	7
	13	0	20	0
	12	2	15	-3
	11	0	7	0
	10	-1	8	0
	9	-2	-2	0
	8	0	0	0
	7	0	0	10
	6	0	-3	0
	5	0	5	0
	4	3	2	9
	3	-2	1	0
	2	0	0	4
	1	—	0	0

ADJUST PEN DIFFERENCE

LEFT CORRECT PEN TO CHART LEFT

RIGHT CORRECT PEN TO CHART RIGHT

(SW) SELECT, DATA ENTRY START, STOP

C. S. = 10mm/min

① PEN: Setting of pen difference compensation value.
Range: -20 to 20

② RIGHT: Adjust the pen to the chart paper zero point.
Range: -400 to 400

③ LEFT: Adjust to the full scale point of the chart paper.
Range: -800 to 800

To set above ①, ②, and ③, use the DATA UP or DOWN key, or the T1ENkey and the SET key.

1 point is 16 μm.

At present, 9CH is being set.

Selecting LEFT of channel 9.

Standard pen

Check function
PEN: Records the Square waveform for checking pen difference compensation by pressing the ENTRY key.
RIGHT: All pens move to zero point by pressing the ENTRY key.
LEFT: All pens move to full scale point by pressing the ENTRY key.

In this mode, CHART SPEED is variable in every hour. Numerical value can be changed with the DATA UP or DOWN key, and TEN-key. Pressing the ENTRY key is not required.

Press the AUX. key until the cursor in the menu displays ADJUST.

To set the chart paper feed speed to 5 mm/sec, press the SELECT keys to move the cursor to the chart speed setting column at the lower right. Set 5 mm/sec with the DATA UP or DOWN key.

Pen variation compensation

To use the UNICORDER with setting the pen variation compensation (SYNC.) set to on, an adjustment is necessary, if the gap at the pen tip deviates from 4 mm. Move the cursor to PEN indication and press the ENTRY key.

Turn on the MEASURE ON key for channel 1 (standard channel) and only the channel to compensate. For example, assuming the channel to compensate is 9CH, move the cursor to 9CH with the SELECT keys and turn on the MEASURE ON "9" key.

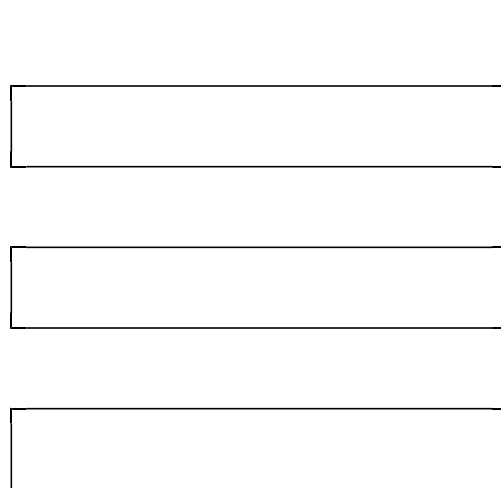
(Refer to 2.1.4 Mea-sure ON/OFF.)

Feed the chart paper. (START)

Adjust the standard channel overlap with record of 9CH by pressing the DATA UP or DOWN key. Do the same adjustment for the other channels.

Waveforms shown below are recorded.

2. NAME AND FUNCTION



Recording waveform in pen variation compensation

The right end reference point of a pen, and the left end reference point of a pen

The pen might be a little away from the reference point. This state is caused by expansion and contraction of the recording paper, and twist of the pen.

Set up each pen independently.

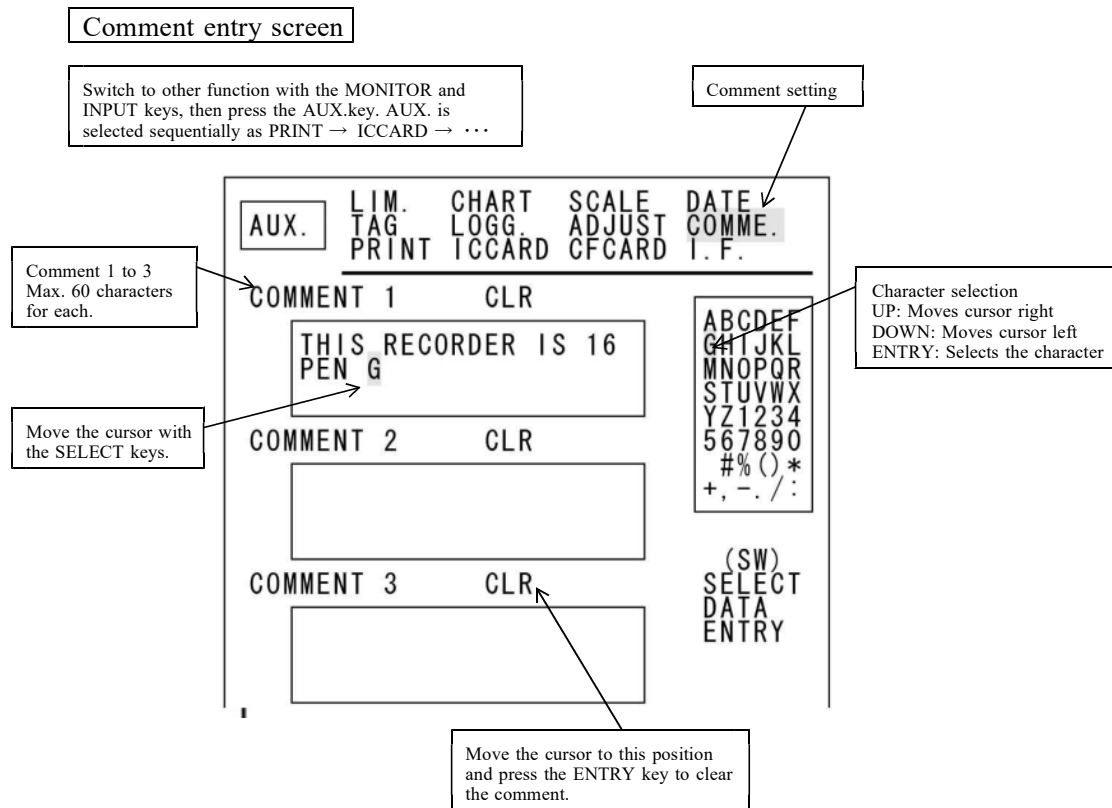
Move a cursor to the “RIGHT” , LEFT” display ($\leftarrow \cdot \rightarrow$) , and press the “ENTRY” key. Move a cursor to the channel to adjust ($\uparrow \cdot \downarrow$) , and make the channel major-on. Feed a recording paper (START) , Push and set the “UP” , “DOWN” , or the “TENKEY” and “SET” switch so that a pen point may ride on the reference point of a recording paper.

Set up all the pens at the same time.

Move the cursor of a channel position to the “LEFT” or “RIGHT” character, and push the “UP” , “DOWN” , or “TENKEY” and “SET” switch.

(11) Comment (AUX. → COMME.)

Maximum three comments can be set.



Press the AUX. key until the cursor in the menu indicates COMME.

Using the SELECT keys, move the cursor to the position to set and select the character with the DATA UP or DOWN key.

Set the comment by pressing the ENTRY key for each character.

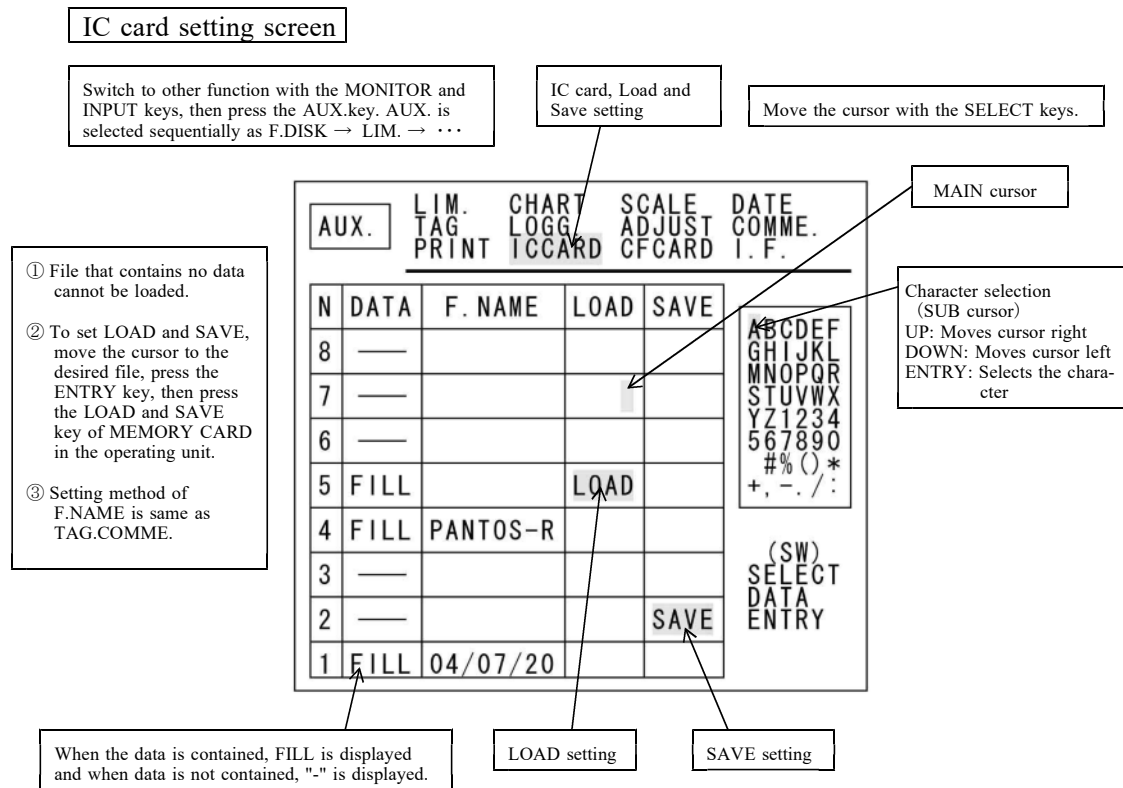
Maximum 60 characters can be set per one comment.

To clear all comments, move the cursor to CLR of the comment and press the ENTRY key.

2. NAME AND FUNCTION

(12) IC card (AUX. → ICCARD)

Saves and loads setting conditions.



Press the AUX. key until the cursor in the menu displays ICCARD. Insert IC card.
(section 3.7)

Save the setting condition

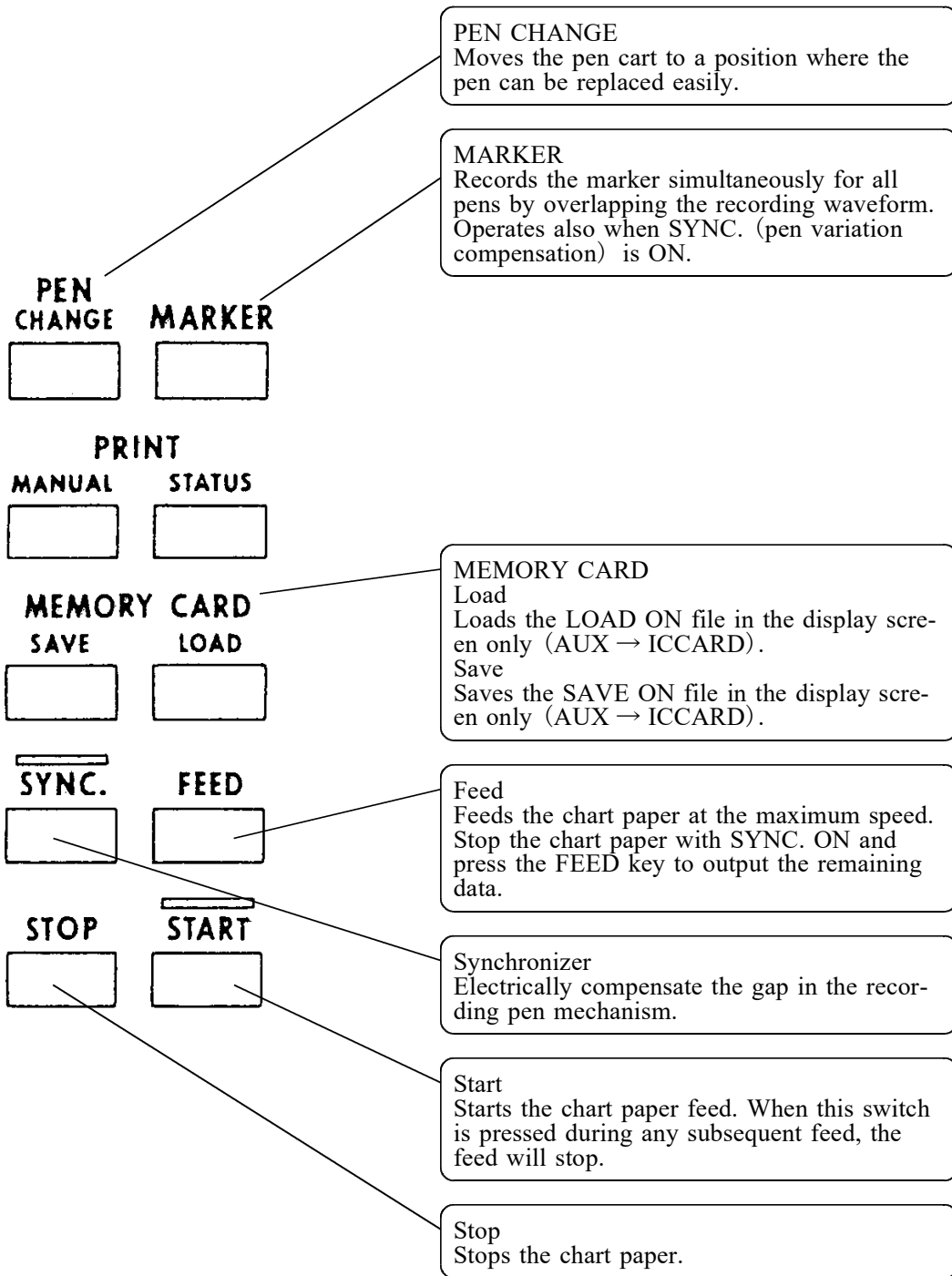
Move the cursor to the SAVE column using the SELECT keys, and select the block (1 to 8) you want to save in the IC card. Maximum 8 data can be saved. To specify the file name, move the cursor to the F.NAME column using the SELECT keys and select the characters with the DATA UP or DOWN key. Next, press the ENTRY key. Move the cursor to the SAVE column and press the ENTRY key. This determines the file number to save. Next, press the SAVE key. When SAVE is properly done, the screen displays the message "IC CARD SAVE OK!".

Load the setting conditions.

Move the cursor to the LOAD column using the SELECT keys, and select the file (block) loaded in the main unit. Pressing the ENTRY key determines the file number to load. The block that does not display FILL in the DATA column cannot be loaded. Next, press the LOAD key. When LOAD is done correctly, the screen displays the message "IC CARD LOAD OK!".

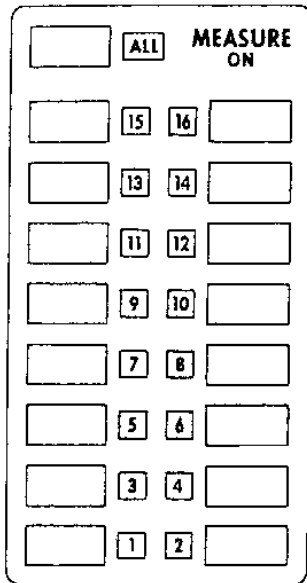
When IC card is replaced, the data of IC card is read immediately and displayed on the screen. Because of this, the IC card can be checked easily. When operation is complete, remove the IC card. This will prevent the battery in the IC card from discharging. When the power is turned off, the current setting conditions are not erased even if the IC card is not used.

2.1.3 Operation unit



2. NAME AND FUNCTION

2.1.4 MEASURE ON/OFF unit



When the ALL key is ON, the lamp lights and recording starts press keys 1 to 16.

Press the key again to turn off the lamp. The recording pen is housed in the pen cap holder.

When the ALL key is turned off, the MEASURE for the channel keys 1 to 16 specify (the LED lamp is lit) turned off and the recording pen is housed in the pen cap holder.

2.1.5 Error display and operation check display

"CHART EMPTY1"

Display when chart paper runs out.

"IC CARD LOAD ERROR1"

Display when IC memory card is not loaded correctly.

"IC CARD SAVE ERROR!"

Display when IC memory card is not been saved correctly.

"IC CARD LOAD OK!"

Display when IC memory card is loaded correctly.

"IC CARD SAVE OK!"

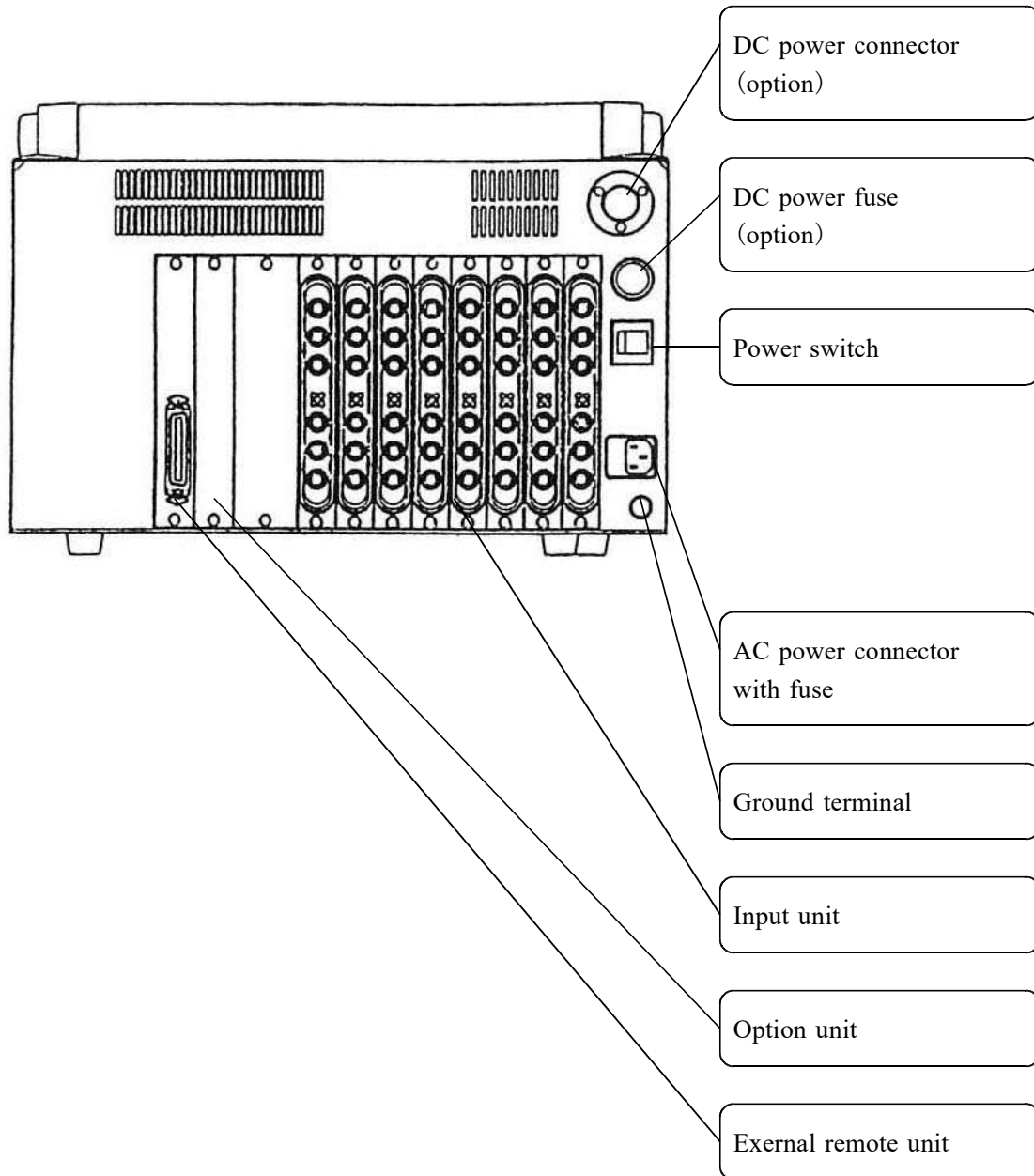
Display when IC memory card is saved correctly.

"IC CARD NO BATTERY"

Display when the battery for IC memory card runs down.

2. NAME AND FUNCTION

2.2 Rear Panel

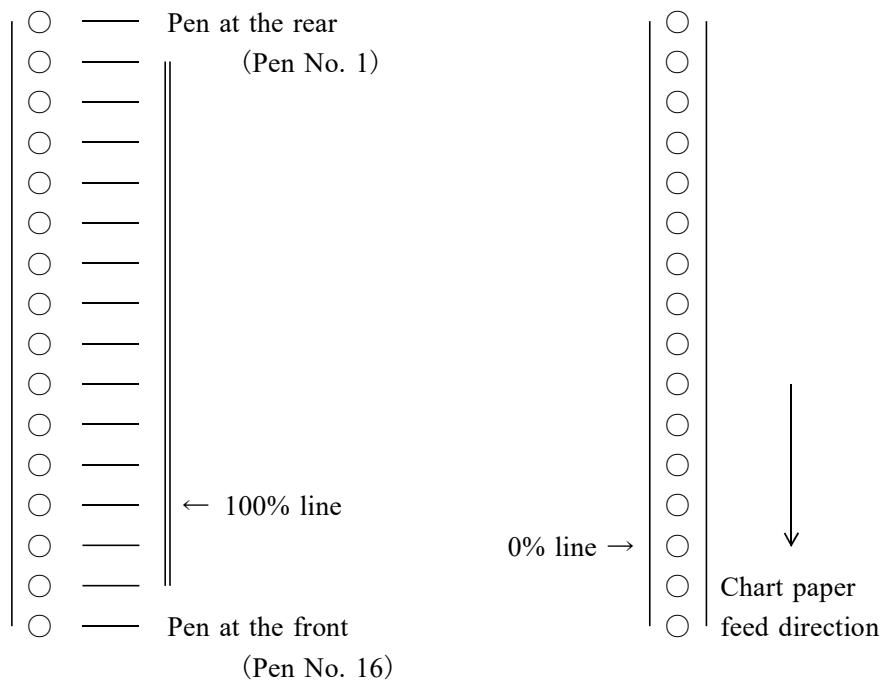


2.2.1 Setting the power voltage

It supports the power supply voltage (90-265V AC) of all the countries of the world.
There is no need of the setting.
Please use the power cable corresponding to current (5A) and the voltage.

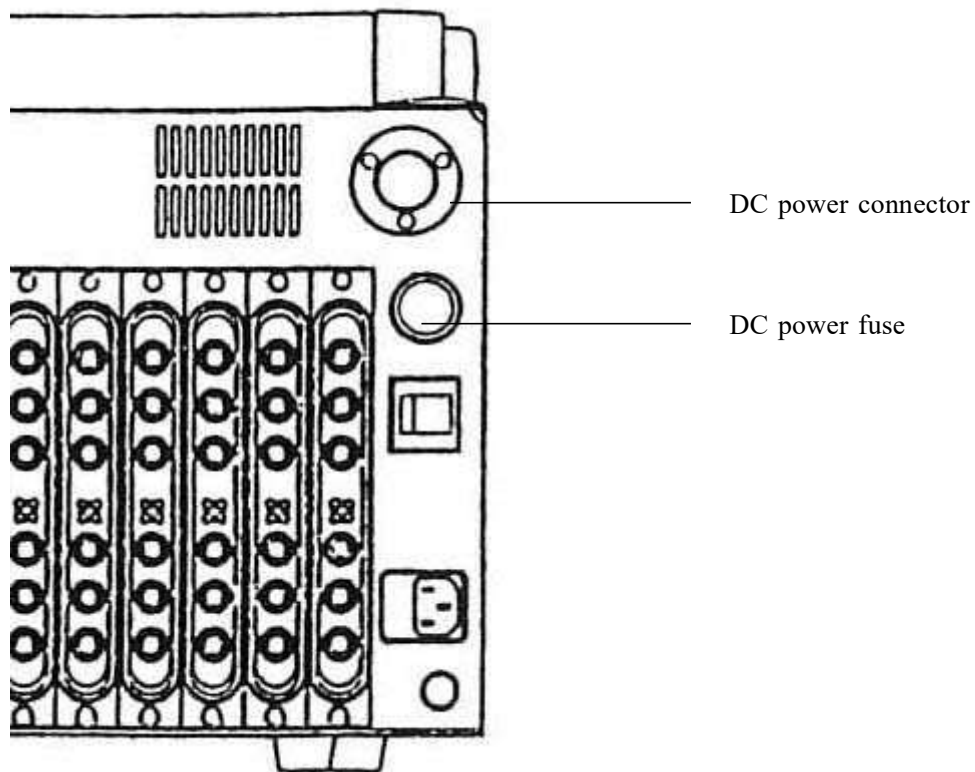
2.2.2 Power switch

When the power switch is turned on, the pen will slowly (several seconds) move to the right from the auto pen cap. When it hits the right end, it will start operation. The right end is zero point. After this operation, the pen will move to 100% side to record a color sample. This sample is used to discriminate the relationship of the color of the recording line and channel from the recorded result.



2. NAME AND FUNCTION

2.2.3 DC power connector (option)



DC power connector "DC SOURCE" 12 V DC

This is an input connector for supplying DC power. Connect the attached DC power cable to this connector. To connect the DC power cable to the battery, connect white line to 12 V side.

Fuse "FUSE" (30A)

This is a fuse to prevent accident by overcurrent etc.

How to use DC power source

- (1) Turn off the power switch of the recorder. Connect the attached power cable to DC-DC converter and battery. For the battery, connect white line to 12 V side.
- (2) Turning on the power switch to start recorder operation. If it dose not start, confirm that the voltage of the battery is in the normal range (9 V to 16 V DC).

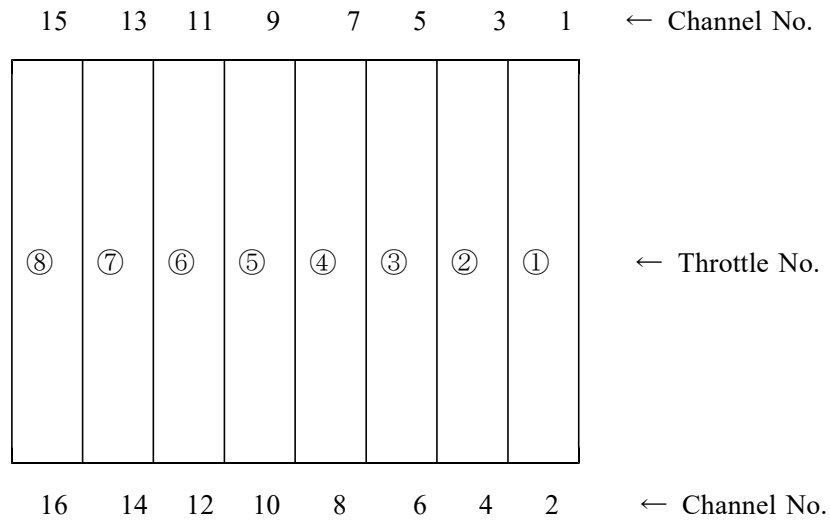
Specifications

Model name:	16DCP1 (-00 version) DC-DC converter
Circuit type:	Switching type
Input voltage:	12 V DC (9 V DC to 16 V DC)
Input protection:	Equipped with protection circuits for decreases and increases in input voltage and reverse connections. If the input voltage goes outside the normal range (9 V DC to 16 V DC), the unit will not operate.
Power consumption:	Maximum: 16 pens, 165 VA 14 pens, 160 VA 12 pens, 155 VA 10 pens, 145 VA 8 pens, 145 VA When balanced: 16 pens, 105 VA 14 pens, 101 VA 12 pens, 97 VA 10 pens, 93 VA 8 pens, 90 VA
Operating environment:	Corresponds to main unit
Insulation resistance:	Between power supply and chassis (GND): More than 50 Mohm (500 V DC mega)
Withstand voltage:	Between power supply and chassis (GND): 500 V DC for 1 minute
Shape:	Internal in main unit
Weight:	Approximately 800 g (Not including weight of main unit and power supply cord)
Accessory items:	Fuse 30 A: 1 DC power supply cord: 1

2. NAME AND FUNCTION

2.2.4 Input unit

Input unit: 2 channels in 1 throttle. Channel number is specified as the diagram.



Connection between the channels is electrically insulated.

Be sure to mount the input cover when performing temperature measurement and high sensitivity measurement.

2.2.5 External remote controller

Signal: TTL level
Transistor switch
Contact signal

Following functions can be operated from the external devices:
operation panel and OR.

Chart paper feed: Start-up and stop (L: stop)

Chart paper rapid feed: Start-up and stop (feed)
L: start-up
H: stop

Select of clock for chart-paper feed: Select the external clock or internal clock.
Chart paper can be fed in synchronization with the external clock.
L: external
H: stop

External clock input: 50 μ m/1 clock TTL
Max. frequency: 800 Hz
Min. pulse width: 10 μ s

Weight marker: Simultaneously for all channels
L: ON

Chart paper feed: Used when operating the units in parallel

Synchronous output: 1 clock/25 μ m TTL

U-1641 synchronous output

U-1641 external clock input (Select of clock: L)

Manual printing: Prints the setting items for printing ON.
L: print

Measurement ON/OFF: Simultaneously for all channels
L: OFF
H: ON

2. NAME AND FUNCTION

The following tables show connector pin numbers and details of operation.

Pin No.	Signal name	I/O	Pin No.	Signal name	I/O
1	External clock input	Input	19	GND	
2	Manual print	Input	20	GND	
3	Superimposed marker	Input	21	GND	
4	Chart paper feed	Input	22	GND	
5	Chart paper rapid feed	Input	23	GND	
6	Measure ON/OFF	Input	24	GND	
7	Selection of chart paper feed clock	Input	25	GND	
8	Synchronization of chart paper feed	Output	26	GND	
9	5V	Output	27	GND	
10	5V	Output	28	GND	
11			29	GND	
12			30	GND	
13			31	GND	
14			32	GND	
15			33	GND	
16			34	GND	
17			35	GND	
18			36	GND	

1	19
2	20
3	21
4	22
5	23
6	24
7	25
8	26
9	27
10	28
11	29
12	30
13	31
14	32
15	33
16	34
17	35
18	36

Pin Nos. 19 to 36 are digital ground.

Add a signal to the connection between these pins and the pins that correspond to respective operation.

The U-1641 can be operated by any of the following signals.

Type of signal: Voltage signal of TTL level
 Transistor switch
 Contact point signal

3. HANDLE PROCEDURE

3.1 Loading the Chart Paper

The U-1641 uses rolled chart paper or folding chart paper (factory option).
 The sprocket pin for the chart paper drum is a circular pin type and square pin type (option).
 Use chart paper that conforms to your recorder.

Table of applicable chart paper

Type of drum pin	Circular pin			Square pin	
Type of chart paper	Rolled		Folding	Rolled	Folding
Chart paper type No. (length)	2501P50 (20 m)	25020P50 (50 m)	2501Z150 (20 m)	2516P50 (20 m)	2516Z150 (20 m)

Special carriage is required for folding type paper.

3.1.1 Loading the rolled chart paper

- (1) Open the chart paper board upward
 (Refer to Fig. 3.1-1)
- (2) Place the long side of the chart paper with the perforations to the left and insert the top end of the chart paper into the lower side of the drum along the guide plate. Press the FEED key to rotate the drum and bring the chart paper to the surface of the drum.
 (Refer to Fig. 3.1-2)
- (3) When the chart paper comes out above the drum, set the light and left perforations into the sprocket of the drum and close the chart paper board.
 (Refer to Fig. 3.1-3)
- (4) Raise the chart paper holding arm. Pass the chart paper under the chart paper cutter and return the chart paper holding arm to the original position.
- (5) Press the FEED key to confirm that chart paper feeds correctly.

The above procedure completes the loading of the rolled chart paper.

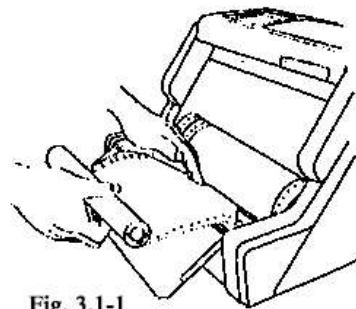


Fig. 3.1-1

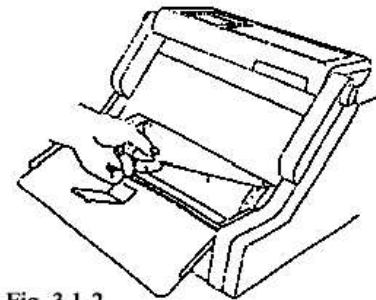


Fig. 3.1-2

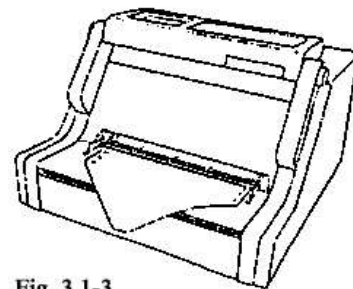


Fig. 3.1-3

3. HANDLE PROCEDURE

3.1.2 Loading the folding chart paper (option)

- (1) In order to prevent folded chart paper from falling out of the machine, loosen the chart paper as shown Fig. 3.1-4.
- (2) Open the chart paper board. Place the chart paper in the chart paper housing unit with the long side of chart paper perforation set at the left with the printing surface facing upward.

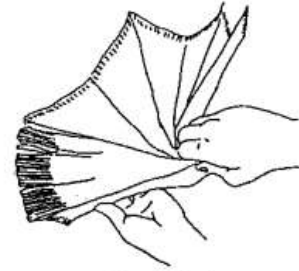


Fig. 3.1-4

At this step, lay the liner of the chart paper under the chart paper.

- (3) Pass the chart paper end under the drum along the guide plate and press the feed key to rotate the drum. Bring the chart paper up to the top of the drum. (Refer to Fig. 3.1-5)
- (4) When the chart paper comes out above the drum, set the right and left perforations into the sprocket of the drum and close the chart paper board. (Refer to Fig. 3.1-6)
- (5) Raise the chart paper holding arm. Pass the chart paper under the chart paper cutter and return the chart paper holding arm to the original position.
- (6) Press the FEED key to confirm that chart paper feeds correctly.

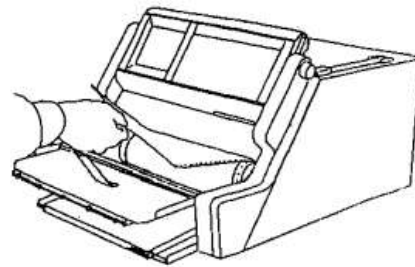


Fig. 3.1-5

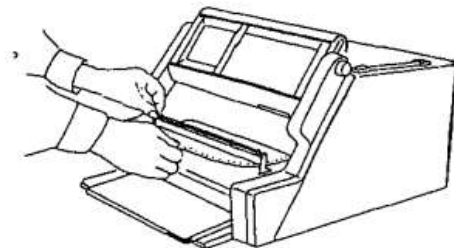


Fig. 3.1-6

The above procedure completes the loading of the folding chart paper.

3.2 Loading and Replacing the Recording Pen

Loading and replacing the recording pen when the power is turned on.

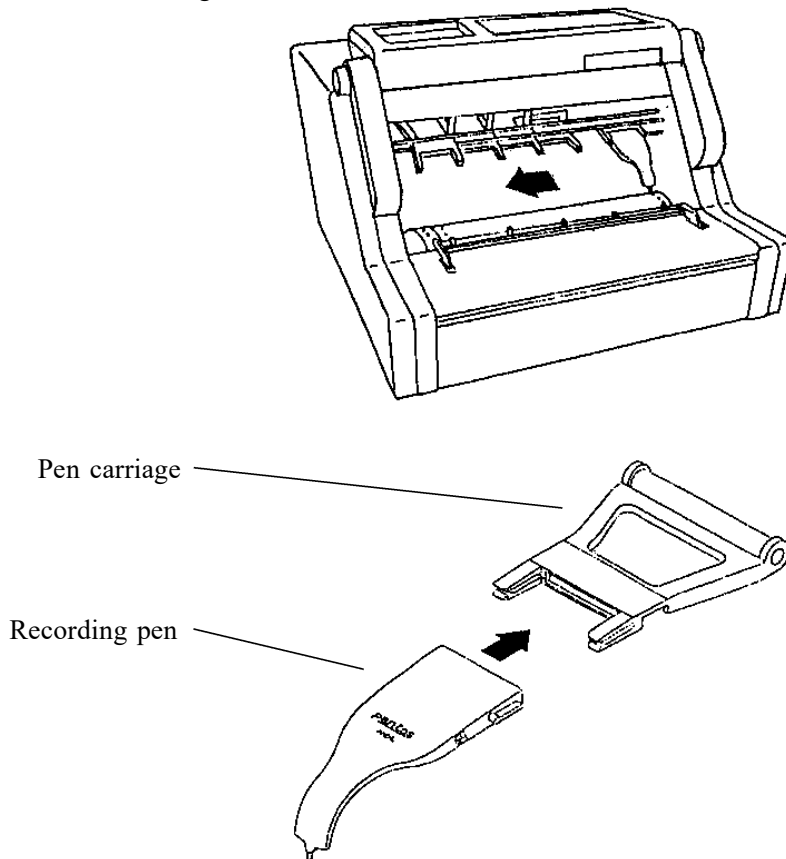
- (1) Press the power switch to turn on the power.
- (2) Press the PEN CHANGE key.

For the 16-channel U-1641, this is set to allow easy loading of the pen holder by doing channels 1 to 4 by first, channels 5 to 8 second, channels 9 to 12 third, and channels 13 to 16 forth.

- (3) Pen carriage at the rear is channel 1.
Load the pen carriage starting from the rear while adjusting the ink color of the recording pen.
- (4) Remove the pen cap. Holding the notched portion at both sides of the recording pen, insert the guide of the recording pen into the groove of the pen carriage until you feel light click. Be careful not to touch the pen tip to the drum.

The above procedure completes the loading of the recording pen.


To remove the recording pen, draw it out while raising the recording pen main unit identical to loading.



3. HANDLE PROCEDURE

Arrangement of channels and recording pens.

Channel No.	Model	Color	Holder position
1	NDL-01	Red	Rear
2	NDL-02	Dark green	
3	NDL-03	Brown	
4	NDL-04	Yellow green	
5	NDL-05	Dark blue	
6	NDL-06	Orange	
7	NDL-07	Blue	
8	NDL-08	Purple	
9	NDL-09	Yellow	
10	NDL-10	Violet	
11	NDL-11	Pink	
12	NDL-12	Black	
13	NDL-13	Green	
14	NDL-14	Dark brown	
15	NDL-15	Cool gray	
16	NDL-16	Olive brown	Front



Cautions

- (1) Do not apply unnecessary and excessive force when loading the recording pen. Pen shaft may bend.
- (2) When the pen change key is pressed, the pen moves at high speed. Be very careful not to allow the pen to come into contact with your hands or other parts of your body.

3.3 Auto Pen Cap

When the power is turned off, or when MEASURE is OFF, that cap will be placed over the pen automatically to prevent the pen tip from drying.

Replenish water to the auto cap mechanism.

- (1) Slowly replenish approximately 1cc of water from one of the pen cap holes in the 16 channels using the attached dropping pipet.
- (2) Replenish water every one month.

Auto pen cap mechanism

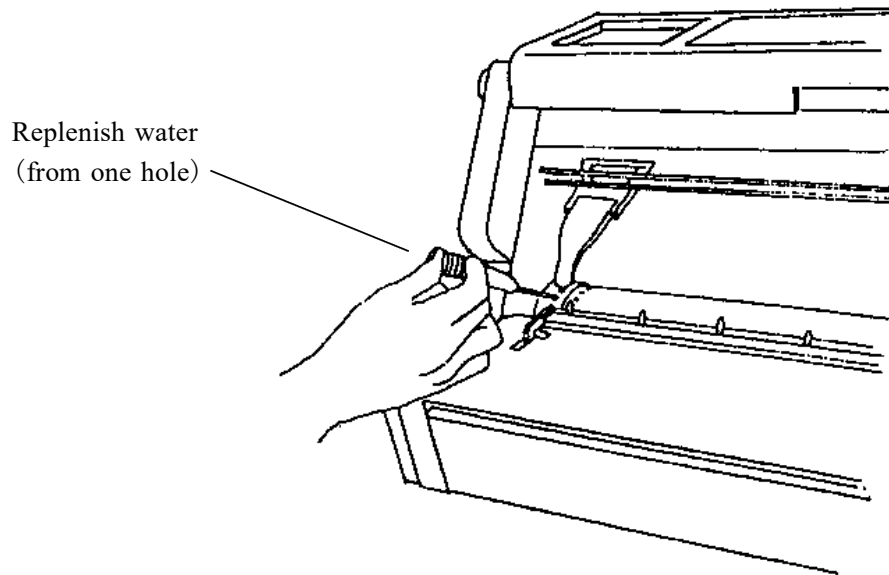


Fig. 3.3-1

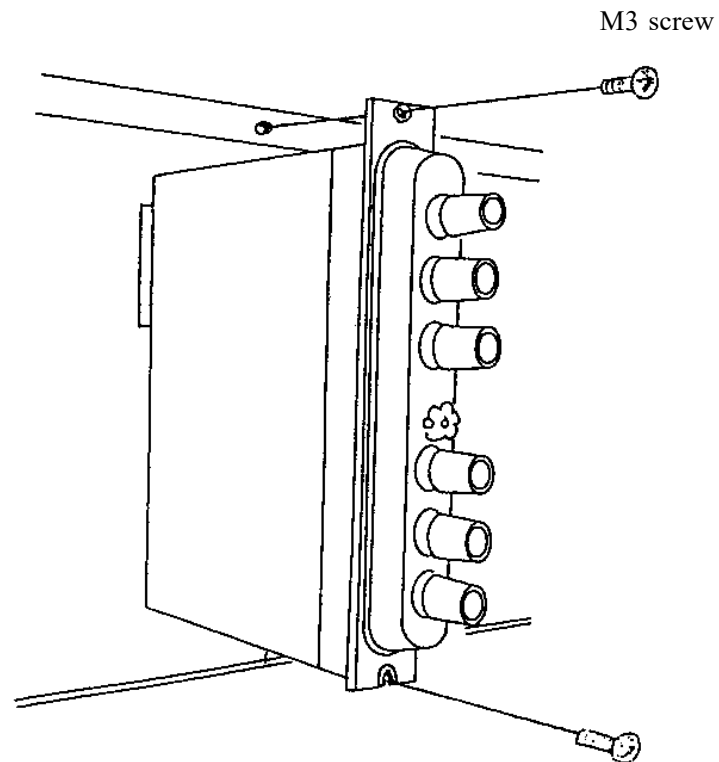
Cautions

- (1) **When the U-1641 is not used for short period (about 1 week), the auto pen cap mechanism functions eliminates the cap from being placed on the pen. When the power is turned off, all pens are automatically used in the cap mechanism unit.**
- (2) **When the U-1641 is not used for long period or during transportation, be sure to remove the recording pen and place the cap on the pen. Putting the recording pen in the package bag and firmly sealing the bag will extend the life of the pen.**

3. HANDLE PROCEDURE

3.4 Replace the Input Unit

Input amplifier is supplied in the system. Replace it depending on the type of measurement. Be sure to turn off the power switch when replacing the input amplifier. Remove the two fixing screws and pull out the input amplifier.



Insert the input amplifier slowly along the guide. Connect to the connector at the rear with the screws. For temperature measurement, be sure to install the attached cover. For safety, be sure to install the blank panel to slots not used.

3.5 Taking-up of the Chart Paper

Loading the chart paper in the following orders.

- (1) Open the front door forward as shown by the diagram.
(Refer to Fig. 3.5-1)
- (2) Load the chart paper, referring to 3.1 "Loading the rolled chart paper".
- (3) Insert the chart paper holder into both ends of the take-up accessory bobbin.
- (4) Set the movable shaft chart paper holder at the left and feed the chart paper from the drum. Wind up the top end of the chart paper about two rotations on the take-up bobbin with the print surface facing upward.
- (5) Insert the movable shaft chart paper holder into the left bearing. With pushing the take-up bobbin to the left, insert the fixed shaft recording paper holder into the right bearing.
- (6) Rotate the chart paper take-up bobbin to confirm that the concave portion of the top end of the fixed shaft chart paper holder firmly fits into the convex portion of the bearing and turn on the take-up switch.
- (7) Press the FEED key to confirm the chart paper is correctly taken up.

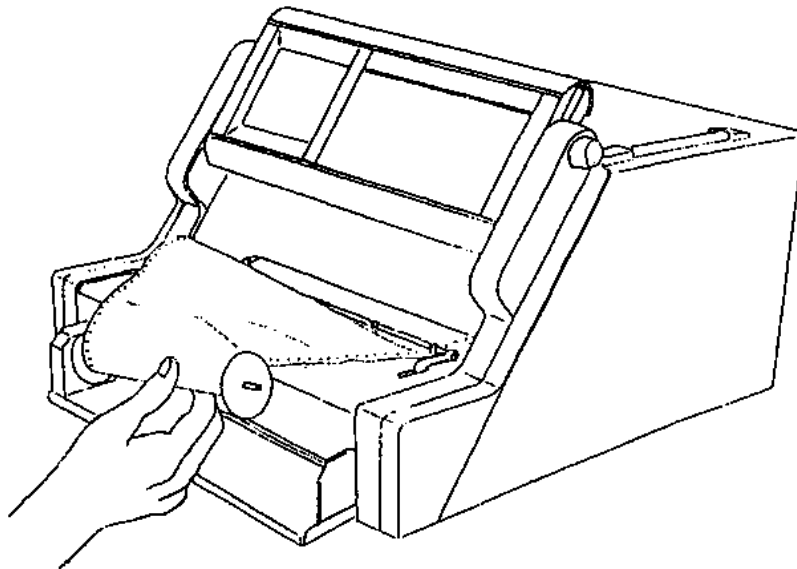


Fig. 3.5-1

3. HANDLE PROCEDURE

3.6 Connecting the Input Cable

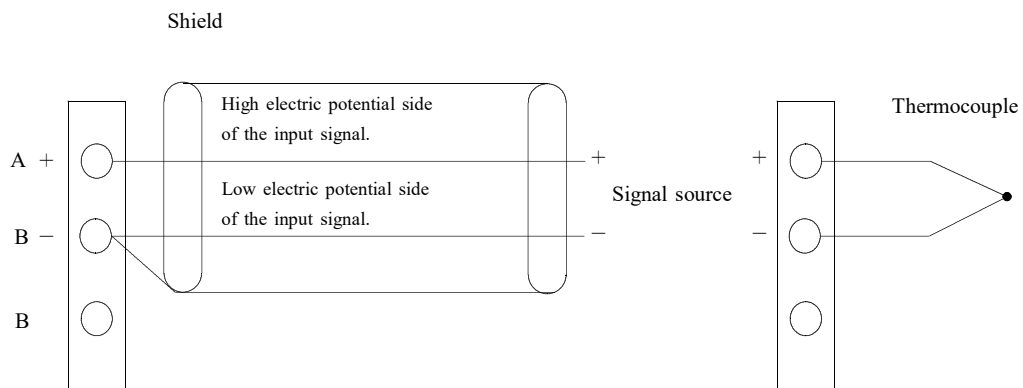
For measuring DC voltage, a special input cable (938CAB-XX) is provided as an option. Use good quality shield wire to avoid noise problems. To use for high sensitivity measurements such as 1 mV F.S, be careful the measurement are not affected by thermoelectromotive force.

3.6.1 DC voltage and thermocouple input

Three input terminals are provided: positive (+), negative (-), and for RTD (b). (RTD is an option.)

(1) To use the U-1641 in a normal environment or in high voltage range, make connections as follows.

1) Connect the input cable between (+), terminal and (-) terminal.



Precautions

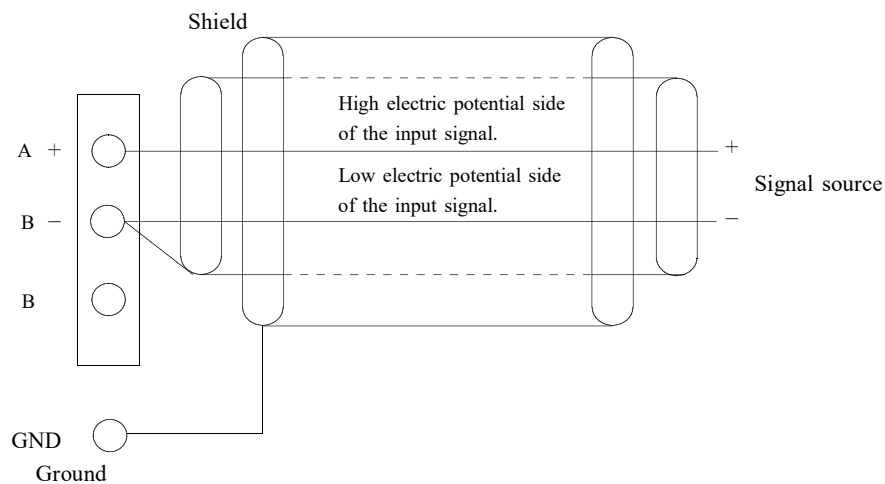
Precautions during temperature measurement and high sensitivity measurement

- (1) **Change in temperature difference between inside and outside of the U-1641 will cause zero drift. Pay attention to the following points when mounting the recorder.**
 - 1) **Do not use an air conditioner or the U-1641 in a location that is free from radical changes of temperature.**

(Since environmental temperature changes considerably when the air conditioner is activated or stopped, the U-1641 is affected by thermoelectromotive force.)
 - 2) **Avoid using the U-1641 in a windy location or where it is exposed to direct sunlight. Use the U-1641 in the place where temperature change between day and night is small.**
 - 3) **To maintain temperature of the terminal section at a stabilized level, be sure to use the attached terminal cover. Do not clog the ventilation hole in the case during use.**
- (2) **If the metal tip or wire materials other than copper are used for wiring of the input cable, a thermoelectromotive force of several μV may be generated. Therefore, be sure to use copper wire in high-sensitivity measurement. Make the input cable as short as possible.**

- (3) During thermocouple measurements, if the pressure connection terminal with a high thermal capacity is used, there is possibility temperature changes in the terminal section and standard contact compensation error may occur. Try to connect the thermocouple cable directly.

- (2) For high-sensitivity measurements or when noise is generated because the input signal line is long, make the connection as shown below.



Cautions

- (1) Maximum allowable input voltage is shown below. If the input voltage exceeds the range of allowable input voltage, the input circuit may be damaged. Be careful not to apply excessive input.

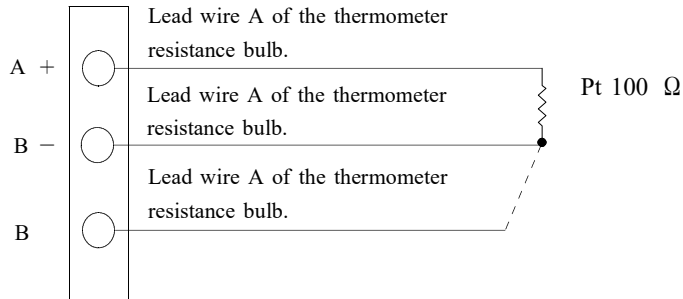
Measuring range	Range of allowable input voltage
0 - 500 mV	30 V or less
1 V - 50 V	200 V or less

- (2) Allowable signal source resistance is less than 1 K ohm for DC voltage thermocouple output. If the internal resistance of the signal source to measure is too large, it will cause errors in the recorded value.
- (3) Maximum common mode voltage is 250 Vrms. If it exceeds 250 Vrms, there may generation of errors and damage in the input circuit.

3. HANDLE PROCEDURE

3.6.2 Resistance thermometer bulb input (option)

Use a 3-wire resistance thermometer bulb.



Cautions

- (1) For the resistance thermometer bulb input, balance the three lead wire resistances. Following error will be generated by the lead wire resistance.
 $0.1\text{ }^{\circ}\text{C}$ at Pt 100 ohm : 10 ohm
- (2) Maximum common mode voltage is 250 Vrms. If it exceeds 250 Vrms, error may occur and damage the input circuit.

3.7 IC Memory Card

3.7.1 How to insert the card

With the surface printed \triangle mark facing upward, insert the IC memory card into the insertion port at the right of the U-1641 operation unit as shown in Fig. 3.7-1.

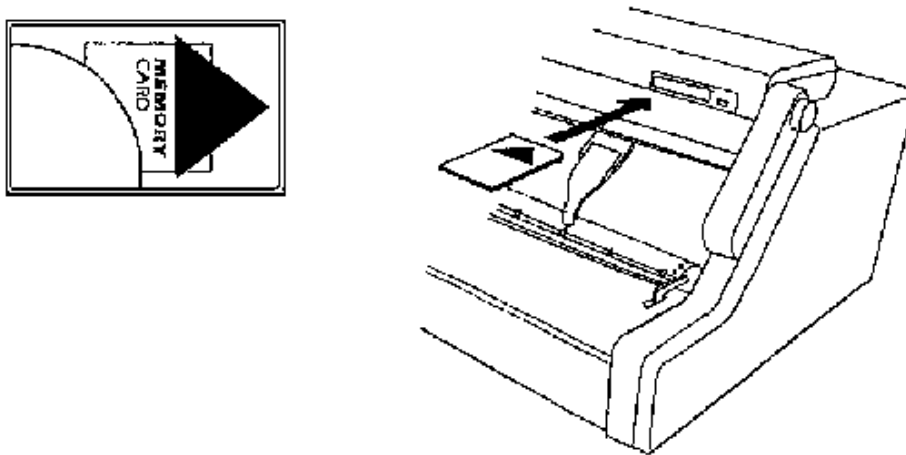


Fig. 3.7-1

Cautions

If the direction of the IC memory card is reversed and upside down, it cannot be completely inserted into the slot. If it is forcibly inserted, the IC memory card and connector of the U-1641 may be broken.

3. HANDLE PROCEDURE

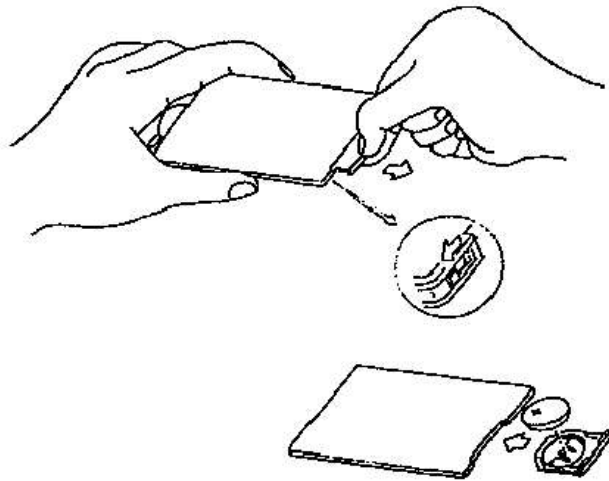
3.7.2 Loading and replacing the battery

Load the battery included with the U-1641.

(1) Loading

- 1) Face the \triangle mark print of IC memory card downward.
- 2) Release the lock of the battery holder unit. Pull the holder by hooking a nail in the slot of the battery holder and remove it.
- 3) Set a new battery in the battery holder.
- 4) Insert the battery holder into the IC memory card.

The above procedure completes the loading of the battery.



(2) Replacing

- 1) Select IC CARD in AUX and insert the IC memory card. Message "IC CARD NO BATTERY" will display in the main display of the operation panel. Replace the battery when the indicator lights.
- 2) Replace the battery when the power is on and the IC memory card is loaded in the main unit. If the battery is changed when the power is turned off and the IC memory card is removed from the main unit, any information saved will be erased. Care must be taken.
- 3) Pull out the battery holder by hooking your nail in the slot of the battery holder.
- 4) Replace with new battery and insert the battery holder into the IC memory card.

The above procedure completes the battery replacement.

Cautions

- (1) **When loading or replacing the battery, confirm that the polarity is correct.**
- (2) **After inserting the battery holder in the IC memory card, be sure to set the lock of the battery holder to the LOCK side.**
- (3) **Battery: CR2016**

3.8 Precautions During Operation

3.8.1 Mounting the input cover

- (1) When carrying temperature measurement and high-sensitivity measurements, be sure to mount the attached input cover. It will reduce errors generated by the operations shown below.
 - 1) If the U-1641 is used in direct sunlight or windy locations, differences of temperature in the terminal and the inside of the machine will cause errors.
 - 2) If a terminal plate is used, when connecting the thermocouple, temperature changes may occur in the terminal unit resulting in errors. Connect the thermocouple line direct to the terminal.
 - 3) Sudden changes of temperature will cause errors.
- (2) Remove the fixing screws for input unit No.1 and 8 and attach the input cover stay by hand. Connect the cable or thermocouple to the input terminal, then mount the input cover.

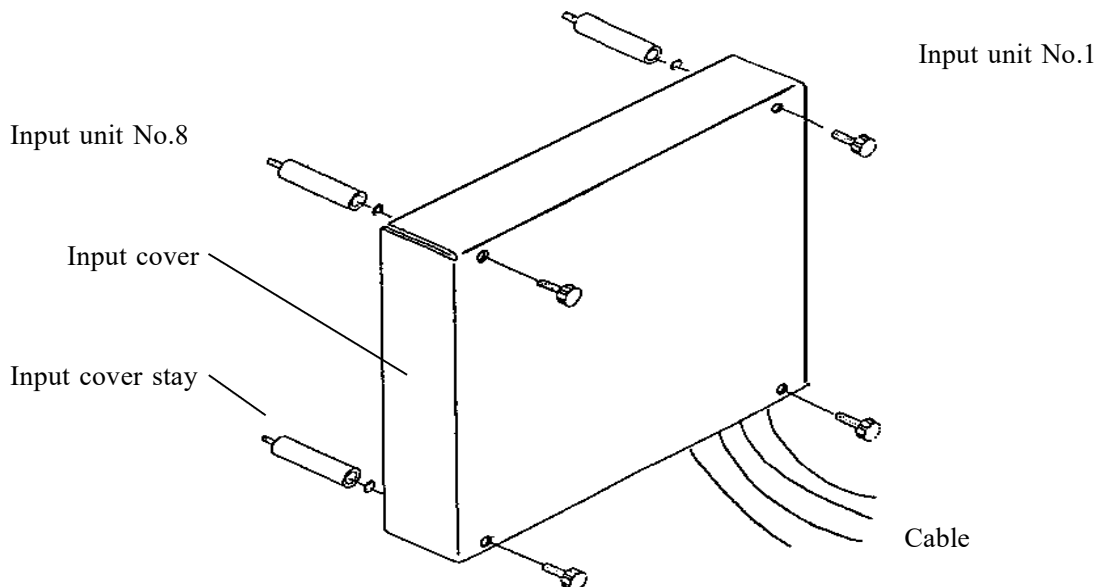


Fig. 3.9-1

3.8.2 Recording pen

Fiber tip is used in the recording pen. Therefore, if the U-1641 is not used for long periods with the auto pen cap mechanism set, ink may dry at the pen tip. If the U-1641 will not be used for long period, be sure to cover the recording pen with the attached cap, put it in the package bag and surely seal the bag.

3.8.3 Environment

Use the U-1641 in temperature 0 to 45 °C and a humidity 45 to 80%. Outside these ranges will adversely affect the entire recording. It is also recommended to use the U-1641 in the environment with no vibration and with small amount of dust.

3. HANDLE PROCEDURE

3.9 Maintenance

3.9.1 Replacing the fuse

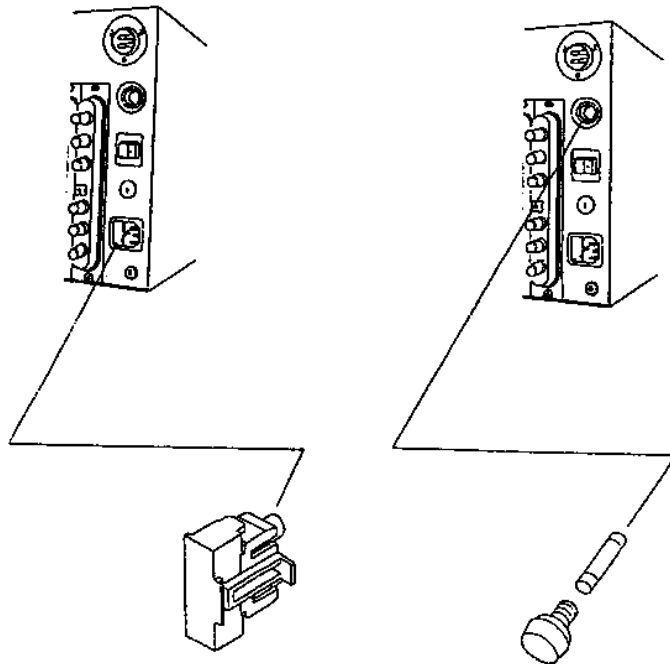
For safety, it is recommended to replace the fuse every two years of operation.

(1) AC power

- 1) Fuse holder is located at the lower portion of the power connector on the rear panel.
- 2) Insert a flat-head screwdriver into the slot of the fuse holder and pull it forward. Fuse holder can be taken out.
The fuse holder contains the fuse being used and a spare fuse.
- 3) Replace the used fuse with the spare fuse or a new fuse.
Fuse used: 250 V, 5 A time-lag type
- 4) Replace the fuse holder at the original position to complete replacement.

(2) DC power (option)

- 1) Fuse holder is located at the lower portion of the DC power connector of the rear panel.
- 2) By rotating the head of the fuse holder to the left, the holder can be removed.
- 3) Replace the battery.
Used fuse: 250 V, 30 A
- 4) Replace the fuse holder at the original position to complete replacement.



3.9.2 Cleaning

Clean the surface of the U-1641 by wiping it with soft cloth. Do not use thinner or alcohol.

3.9.3 Abnormal operation

If the operation becomes abnormal due to an unknown cause, turn on the power switch while pressing the FEED key. The set conditions will be initialized. If the abnormal operation continues, contact the agent from whom you purchased the U-1641 or PANTOS.

4. OPERATION

4. OPERATION

4.1 Description of Keys

KEY LOCK By pressing the KEY LOCK key several times, the red LED will repeat light and go out. While the red LED is lit, the recorder is in the key lock state. In the key lock state, keys other than the KEY LOCK key and FEED key are not accepted. To escape from the key lock state, press the KEY LOCK key to turn off the red LED.

MONITOR/INPUT/AUX.

These three keys change the contents displayed in the EL display. As the function of the operating unit is altered according to displayed contents of the EL display device, refer to 4.2 "Description of Function" for details.

MONITOR The MONITOR key is used to display waveform or numerical value. Pressing this key several times changes the display style.

INPUT The INPUT key sets the EL display in the mode to set the condition for the input amplifier. Input amplifier state will display. Range of the input amplifier can be changed by operating other keys.

AUX. The AUX. key sets the EL display in the mode to set the operating conditions for the main unit. Continuously pressing this key several times will display various condition setting screens to allow check and conditions change.

SELECT Four SELECT keys move the cursor in the EL display up/down and right/left. Some differences of screen or cursor position will restrict the movement of the cursor to vertical or horizontal only. In any case, this key is used to change the set item.

DATA The DATA key changes numerical value and mode of the item selected by the SELECT key. Numerical value and mode are automatically selected according to the set item.

UP/DOWN The UP or DOWN key change the numerical values and mode. By continuously pressing the key, values and mode are continuously changed. Pressing it for short time changes only one step.

FINE	<p>Each time the FINE key is pressed, the yellow LED repeatedly light and go out. By pressing the UP or DOWN key when the yellow LED is lit, the step amount to change decreases. To increase the step amount, press the FINE key so the yellow LED goes out.</p> <p>To increase resolution enter a value smaller than decimal point with the ten key. For an example in the 1 V range; inputting as 1.000 V, fine adjustment can be made at every 0.001 V.</p>
ENTRY	<p>Use the ENTRY key for some setting item. Basically, the ENTRY key is used to switch between ON and OFF.</p>
TEN KEY 0 - 9 . -	<p>Used to directly input numerical values for data or selecting item.</p> <p>Numerical value can be set with the DATA UP or DOWN key or FINE key, and the ten key can also be used to set. Data without a negative (-) mark at the top is treated as positive value.</p>
SET	<p>When the data value is entered with the ten key, be sure to press the SET key to complete the setting. Numerical values change when the SET key is pressed.</p>
CLEAR	<p>Pressing the CLEAR key clears the set switch of that item. This key is used when a ten key setting is incorrect.</p>
MARKER	<p>Pressing the MARKER key records the marker in overlapping the recorded waveform. Draws a line of approximately 4 scales in the left direction viewed from the front. Operating time is approximately 80 ms.</p> <p>Accordingly, when the chart paper is fed at 40 mm/s, it is recorded as a trapezoid signal of approximately 2 scales. Marker is overlapped to the input value simultaneously for all channels. This key is used to check that the record and marking of a phenomenon are simultaneous.</p>
At SYNC on	<p>When the SYNC (synchronizer) key is on, the recording is made simultaneous against time axis. Therefore, the marker is also recorded simultaneously for the time axis. If the marker is deviated from the time axis, it can be corrected by fine adjustment (operating method : description of function : synchronizer fine adjustment). Pen No.1 records simultaneously with pressing the MARKER key.</p>
At SYNC off	<p>By pressing the MARKER key when the real time recording is complete, all pens record the marker simultaneously. Accordingly, deviation of the marker is deviation of time axis.</p>

4. OPERATION

PEN CHANGE	When the PEN CHANGE key is pressed, a pen cartridge moves to the position that allows easy pen replacement. Four states can be set for pen change and change the pen one after another. To escape from pen change state, press the PEN CHANGE key several times.
PRINT	This key operates the printer manually. By pressing this key while the chart paper feed is stopped, the pen recording will stop and print. While the chart paper is being fed, prints the record conforming to the chart paper feed so print does not overlap.
MANUAL	Prints the input value when the key is pressed. Only prints the channel that the logging print is ON.
STATUS	Prints the set condition and limiter value of the input amplifier. Only prints STATUS for the channel that the EL display is ON.
MEMORY CARD	The MEMORY key writes and reads the setting condition to/from an IC memory card. If an IC memory card is not correctly inserted, this key will not work.
SAVE	Press this key to write data such as the sensitivity of the input amplifier currently set to an IC memory card. Because several seconds are required to write, wait a short time after pressing this key before removing out an IC memory card or turning off the power.
LOAD	Press the LOAD key to read the set conditions stored in an IC memory card. By pressing the LOAD key, conditions previously set will be lost. If the previous set conditions are required, save them beforehand.
SYNC	The recording pen is designed to move the time axis separated by approximately 4 mm. Therefore, real-time recording generates a deviation in the time axis by 4 mm during recording between the channels. Synchronizer and compensate this deviation of the time axis using the built-in memory and adjust the time axis for all channels on the record. When the SYNC key is pressed and the orange LED lights, the synchronizer is on and compensating deviations in the time axis.
While SYNC on	Compensates deviations of the time axis in the record. Accordingly, pen movement is slower than the input signal. When the chart paper feed stops, pen movement stops.

While SYNC off	Deviates the time axis in the record is deviated. Pen moves in real time following the input signal. This is convenient for fine adjustment of the zero point in the record.
FEED	Feeds chart paper only while the FEED key is pressed. Operates at the maximum speed irregardless of the chart paper speed setting. Feeds the chart paper with the pen lowered. After stopping the chart paper by SYNC. ON, pressing the FEED key outputs the remaining data.
STOP	Stops the chart paper feed.
START	Pressing the START key starts the feed of chart paper. By pressing the START key during start again, the chart paper feed will stop.
MEASURE ON ALL/1-16	When the ALL key is on, press keys 1 to 16. If the indicator lamp is lit, recording will start. Press the ALL key once again. When the indicator lamp goes out, recording pens will be stored in the pen cap holder. When the ALL key is turned off, channels with keys 1 to 16 on (LED lamp is lit) will simultaneously measure off and then store the recording pens in the pen cap holder.

4. OPERATION

4.2 Description of Function

MONITOR	Pressing the MONITOR key will display waveform or numerical values.
WAVE/1:	All waveform are overlapped and displayed. This is identical to an image of the record with pen.
WAVE/2, WAVE/4:	Displays recordings in two divisions or four divisions. All though the image is different from that of a record, this is convenient for monitoring specific channels separately.
DIGITAL:	Displays numerical values. For channels with scale conversion on, displays the value will be convert into a scale and then displayed. Exact values can be read.
SELECT (UP, DOWN)	
ENTRY	Operates keys to move the cursor up and down. Does not operate the cursor right and left. When the ENTRY key is pressed, the waveform of the channel will display in reverse in black and white. The same display will also display a DIGITAL numerical value. In the DIGITAL value display, the display ON/OFF can be changed. Recording with a pen can be done even though a waveform is not displayed.
UP/DOWN ten key	The DATA UP or DOWN key changes the chart speed. The FINE key can also be used. The ten key can also be used to change the chart speed.
INPUT	Pressing the INPUT key calls the setting for the input unit. Because the input unit is directly operated by the INPUT key, set values that do not carry out scale conversion.
SELECT (UP/DOWN, right and left)	
	The SELECT key operates all up, down, right, and left keys. The selected items are displayed in reverse in black and white. Cursor is moved by this key.
UP DOWN ten key	The DATA UP or DOWN key or ten key sets a numerical value or selects an item. The FINE key can also be used. The ten key can also be used to set items that are set with numerical values.
Displays CH	Selected channel in reverse in black and white. Selection of channel is carried out simultaneously when item is selected.

TYPE	<p>Selects the input type when the selected item is TYPE. Displays the type of voltage and thermocouple. Type can change with the DATA UP or DOWN key.</p> <p>V ↔ mV ↔ J ↔ K ↔</p>
FILTER	<p>The FILTER ON/OFF changes with the DATA UP or DOWN key. When the FILTER key is on, a 1 Hz filter is added.</p>
RAN. SPAN	<p>RAN. SPAN selects two types of ranges. It is changed with the DATA UP or DOWN key.</p> <p>When RANGE is displayed, the measuring range is determined with range and bias. Bias, indicated in % , can be set within a range of ± 100%. Bias is a value showing the pen position on the chart paper when the input signal is 0. When the bias is set at 50%, the center of the chart paper is the zero point. Range is the level of the entire width of the chart paper. When 1 V range is specified, the difference of the level at the right end and left end of the chart paper is 1 V. When SPAN is displayed, input the measured value at the left end and right end of the chart paper.</p> <p>Example : If right end is -1 V, and left end is +1 V, input signal of range -1 V to +1 V is recorded.</p>
RANGE/ SPAN-L	<p>Sets the range for the range mode, and the level at the left end position for the span mode. The RANGE/SPAN-L is valid when the display is reversed in black and white. This display automatically changes for individual channels depending on the RAN/SPAN selection.</p>
BIAS%/ SPAN-R	<p>Sets the bias for the range mode and level at the right end position for the span mode.</p>
"E"	<p>If the setting is not correct, E will display at the outside of the frame for the CH display. Possible causes may be that the range and bias values are outside the maximum range and the span value is outside the range settings.</p>
Auxiliary (AUX.)	<p>Press the AUX. key to set the auxiliary functions. Pressing the AUX. key several times changes the items to be set one by one. Press the key several times until the screen that displays the function you want to change appears. To do a only check without changing any settings, do the same operation.</p>
SELECT (up/down. right/left)	<p>The SELECT key selects all items depending on the type of auxiliary function.</p>

4. OPERATION

UP/DOWN These keys set the numerical value or change the item (ON/OFF change)
FINE and select characters. In any of these cases, they are used to change the
 contents of the item.

ENTRY The ENTRY key is an auxiliary key used when changing the contents of
 the item with the DATA UP or DOWN key, such as when selecting chara-
 cters or starting the clock in a time setting.

List of auxiliary functions

Name	Functions
Limiter LIM.	Controls the limiter printing and operation of external switch (option).
Chart paper feed trigger CHART	Speed of chart paper feed changes depending on trigger setting.
Scale SCALE	Sets the numerical values and at scaling unit.
Date DATA	Sets the time for the built-in clock. Clock starts instantly when the ENTRY key is pressed.
Name TAG	Sets the name for each channel.
Fine adjustment ADJUST	Fine adjustment of the pen. PEN is for pen interval of synchronizer, ZERO is for the zero point, and WIDTH is for full-scale point. By pressing the ENTRY key after selecting the item with the SELECT key, calibration signal will be generated.
IC card ICCARD	Controls IC memory card. Up to 8 types of status can be memorized.

5. DESCRIPTION OF OPERATION

5.1 Waveform Recording

This section explains operations until the input signal is recorded by the pen.

Input amplifier

Input unit Maximum voltage applied to the input terminal is ± 30 V when the input range is a thermocouple or at a high sensitivity of 30 V. When the range is 1 V or more, the unit will not be damaged even if voltages up to 200 V are applied. Voltage widths that can be recorded are less than the maximum voltage and are determined by the range.

Range When the range is determined by the bias, the bias become the range. The range and bias that are set at the right end and left end are determined indirectly. In this case, the level with a larger absolute value is converted into the range. For example, if a setting is made with the range of 9 V to 10 V, 10 V is the standard range, the recording is 1 V ($10\text{ V} - 9\text{ V} = 1\text{ V}$) and the measurement span is 10 V. Accordingly, the measurement is carried out in a span from 0 to 10 V, and only the portion of 9 V to 10 V is recorded. In this case, resolution of the record is approximately 1/10 of a recording from 0 V to 1 V.

Filter 10 Hz digital filter is supplied. When using 50/60 Hz, noise levels of -50 dB can be removed. (Normal mode) It is also possible to set a filter of approximately 1 Hz separately. This filter is the primary filter.

A/D converter The input signal amplified by the input amplifier is converted into a digital value by A/D conversion. For the A/D conversion, all channels are divided into two blocks with each block converted alternately in 2 ms intervals. Therefore, you can get data A/D conversion every 4 ms from each channel.

Data processing Data from the A/D converter is processed at every 4 ms for each channel regardless of the thermocouple and voltage. For the thermocouple, temperature offset (linearize) is carried out at every 4 ms. Cold contact point compensation is also carried out.

Cold contact point compensation, CJC

Temperature at the input terminal is measured with one temperature sensor for one unit. During measurement by the thermocouple, compensation processing is carried out with this input terminal temperature. Temperature at the cold contact point is measured every 256 ms and updated. When measuring the temperature, be sure to mount the input cover.

5. DESCRIPTION OF OPERATION

Pen operation The pen is driven to its position following the input signal that is processed. If a square wave is input simultaneously to all pens, the motors for all pens will consume the maximum voltage. So, to limit maximum power consumption, the pen speed is made slow for square waves input simultaneously to all pens.

Synchronizer

SYNC

The synchronizer memorizes the data with a resolution of time axis equal to 0.05 m (1/20 mm). Synchronized with the chart paper feed, it outputs the data of the proper channel at proper timing in order to make the time axis in the record agreed.

Input value

Synchronizer compares the data with the stored data every 4 ms and stores the maximum and minimum values between 0.05 mm feed and the mode. The time to send the 0.05 mm is different depending on the chart speed. The comparison is carried out at a fixed timing of 4 ms. Accordingly, phenomenon that occurs for short times is stored regardless of the chart speed.

Mode

For the mode value, the existence of a maximum value and minimum value and values generated later are stored.

Mode table

Phenomenon	Maximum value	Minimum value	Final value
Fixed	Does not exist	Does not exist	Does not exist
Single increment	Exist	Does not exist	Maximum value
Single decrement	Does not exist	Exist	Minimum value
Complex 1	Exist	Exist	Maximum value
Complex 2	Exist	Exist	Minimum value

5.2 Setting Function

- Same range** For setting multiple numbers of input units in the same condition and for setting partial numbers in different conditions, you can copy the setting of only one channel.
- COPY MODE** Press the INPUT key to call the screen to set the input condition. With the SELECT key, move the cursor to the location where the copy source channel is displayed. Condition of copy source channel will be copied. After placing the cursor at the channel display, press the ENTRY key. ← will display at the outside of the column for copy source channel. Determine the copy source in this way. Using the SELECT key, move the cursor to the channel display you want to set the same condition as the copy source and press the ENTRY key. When the same condition of the channel to copy as the copy source displays, you can copy it. By changing the copy destination one by one, you can copy as many times as you want. Moving the cursor to a location other than channel display terminates copy mode. For multiple copy sources, escape from the copy mode and enter the copy mode again. Setting for the copy source is again possible.
Even if a portion of the condition are different, settings are easily done by copying and changing the conditions.
- Same scaling** When many inputs units are the same scaling, copy mode can be used in the scaling setting screen. The same method for the same range is available.
- Built-in clock** For the built-in clock, set the time as 00 seconds the instant the ENTRY key is pressed. Error of this setting is within one second. Because the built-in clock is backed up by the battery, it will continue operation approximately one month even if the power is disconnected. If some errors in the setting are detected, move the cursor to the location of the detected value, and correct the setting.
Example of error: Month of 18 or February 31st.

5. DESCRIPTION OF OPERATION

5.3 Display Function

Waveform display sampling

Waveform displays using data sampled at every 64 ms.

Because approximately 15.6 samplings are carried out in one second, the display is around -3dB for an input signal of approximately 3 Hz. Since this sampling is not related to the chart speed, waveform up to approximately 3 Hz can be displayed at any time.

However, if the input signal changes extremely when chart speed is slow, waveform is written over.

Digital display sampling

Digital display sampling is not fixed. The current value appears one by one. If there are only a few display channels, the sampling cycle will become short. If the input signal exceeds 1 Hz, it may be synchronized with the sampling. When it is synchronized, digital value becomes a constant although the waveform display and pen record will change. By changing the number of the displayed channels, the synchronization of digital display stops. In any case, even if the digital display is done against for an input signal exceeding 1 Hz, the value read will be not important.

6. SPECIFICATIONS**6.1 Main Unit**

Basic specifications

Model:	U-1641
Number of input:	8 to 16
Operation method:	Automatic balancing system (digital servo system)
Type or input unit:	Plug-in type (2 channels for 1 unit)
Reference point:	Right end of chart paper (Possible to change to left standard by setting)

Recording

Recording pens:	Felt-point pen
Effective recording width:	250 mm
Pen interval:	4 mm
Pen name:	NDL- * *
Accuracy:	$\pm 0.25\%$ of measurement accuracy and effective recording width including linearity and dead band
Maximum pen speed:	Approx. 1600 mm/s
Synchronizer:	ON, OFF 20 data/mm
Measure ON/OFF:	Each channel individually
Recording paper:	Roll paper No.25020P50 (50 m), No.2501P50 (20 m)
Paper speed:	10 - 2400 mm/min, /h Set at every 1 mm
Resolution of time axis:	0.05 mm
Sampling speed:	Max. 4 ms

6. SPECIFICATIONS

Rapid chart drive:	2400 mm/min (Reverse rotation not allowed.)
Accuracy for chart drive:	$\pm 0.1\%$ when a recording length is 1 m over.
Chart end detection:	Provided (CHART EMPTY is displayed.) Pen-up and Feed stop
Swing-out protection:	Signal limiter
Paper winding-up:	Equipped (option)
Superimposed marker:	Operates by operation switch and external remote controller Link with synchronizer ON/OFF Width: approx. 10 mm On time: 50 ms
Auto pen cap:	Pen is automatically stored at the specified position during power OFF and measurement OFF.
Display section	
Display:	5" EL display, 320 x 256 dots
Display mode:	(1) Range display Simultaneous display for all channels (2) Digital measurement value display 6 digits (Mark, measurement data, decimal point) Date, chart speed (3) Wave (4) AUX (optional screen) Limiter, Chart paper feed trigger, Scaling (physical amount), Time, Tag name, Logging printing, Pen adjustment, Comment, Printing, IC card, Floppy disk (option)
Trend function	
Number of transmission:	3 steps
Operation	
Scaling:	Range: -10000 to +10000 Decimal point and unit are set arbitrarily

Limit switch (output is an option)

Number of level:	2 for each channel
Type:	Both upper and lower limit
Warning indicator:	If the limit value is exceeded, an alarm sounds. With ON/OFF function
Output (option):	2 contact points/ch, photo-MOS output Max. 8 channels

GP-IB interface (extra-cost option)

Standard:	Based on IEEE standard 488-1978
Mode:	Both input and output of setting value and measurement value

RS-232C interface (extra-cost option)

Standard:	Based on EIA RS-232C
Mode:	Both input and output of setting value and measurement value
Speed:	75, 150, 300, 600 bps 1.2K, 2.4K, 4.8K 9.6K bps

IC memory card

Function:	Set value
Capacity:	256 K bytes
Model:	JS256G3-CZ-15
Battery:	2016 series If the battery has run down, the message "NO BATTERY" is displayed. Life: 5 years or more. (using BR2325 battery, in the ambient temperature 25 °C, in the state removed from the main unit)

6. SPECIFICATIONS

CF card (extra-cost option)

Disk used: 3.5" 2HD
Format: Windows
Date capacity: 64 M bytes ~ 4 G bytes

External remote controller 1

Signal: TTL level
Transistor switch
Contact signal

Following functions can be operated from the external devices:
Operation panel and OR.

Chart paper feed: Start-up and stop

Chart paper rapid feed: Start-up and stop (feed)
L: start-up
H: stop

Select of clock for chart-paper feed:

Select the external clock or internal clock.

Chart paper can be fed in synchronization with the external clock.

L: external
H: internal

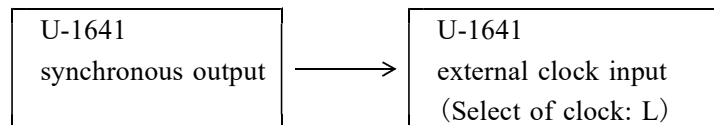
6. SPECIFICATIONS

External clock input: 50 $\mu\text{m}/1$ clock TTL
Max. frequency: 800 Hz
Min. pulse width: 10 μs

Superimposed marker: Simultaneously for all channels
L: ON

Chart paper feed: Used when operating the units in parallel

Synchronous output: 1 clock/25 μm TTL



Measurement ON/OFF: Simultaneously for all channels
L: OFF
H: ON

External remote controller 2 (extra-cost option)

EXT 1: Chart speed 1
EXT 2: Chart speed 2

Built-in clock

Accuracy: ± 4 seconds by day
Recording digit: NN year NN month NN day NN hour
NN minute NN second

Back-up

Item: Each setting, built-in clock

Battery: Lithium battery, built-in the body

Memory holding time: Approx.1 month (at 25 $^{\circ}\text{C}$)

6. SPECIFICATIONS

Operation

Pen lift:

All pens move to the pen rest when the power is turned OFF. (All pen simultaneous operation type)

Measurement key is OFF -- Pen up -- Pen-rest
(During this operation, pens other than the one that is in the measure OFF operation dose not move.)

Measurement key is ON -- Pen up -- Moves to recording position -- Pen down
(During this operation, other pens than the one that is in the measure ON operation does not move.)

6. SPECIFICATIONS

Standard specification

Withstand voltage:	Between power supply and control signal: 3750 V AC, 1 minute
	Between power supply and chassis (GND): 1500 V AC, 1 minute
	Between analog input and chassis (GND): 500 V AC, 1 minute
	Between each analog input: 500 V AC, 1 minute
Insulation resistance:	Between power supply and chassis (GND): 100 Mohm or more at 500 V DC
	Between I/O control and chassis (GND): 20 Mohm or more at 250 V DC
	Between analog input and chassis (GND): 100 Mohm or more at 500 V DC
Operating environment:	5 to 45 °C, 35 - 80%RH
Storage environment:	-5 to 50 °C, 35 - 80%RH
Power supply:	90 - 132 V AC / 170 - 265 V (Changeover method), 47 - 440 Hz 9 - 16 V DC (extra-cost option)
Vibration:	0.1 G or less
Shock:	Not accept
Power consumption:	Maximum: 8 pens, 240 W 10 pens, 240 W 12 pens, 250 W 14 pens, 260 W 16 pens, 270 W
	At balanced: 8 pens, 150 W 10 pens, 155 W 12 pens, 160 W 14 pens, 165 W 16 pens, 170 W
Dimensions:	Approx. 438(W) x 290(H) x 520(D) mm
Weight (including AC voltage/temperature input unit):	8 ch : 13 kg
	10 ch : 16 kg
	12 ch : 19 kg
	14 ch : 21 kg
	16 ch : 24 kg

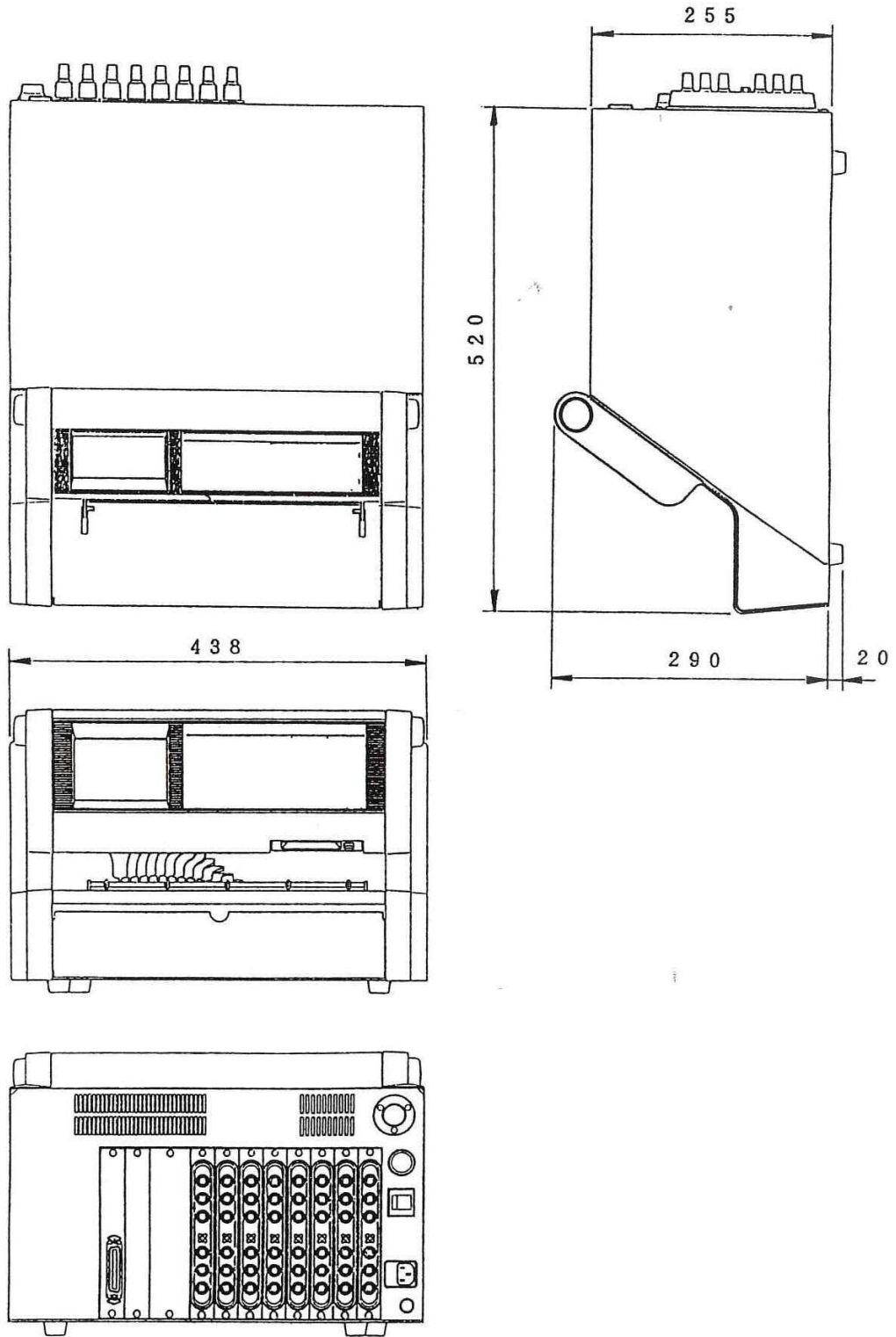
6. SPECIFICATIONS

Accessories:

Power cable:	1
20 m chart paper No.2501P50:	1
IC card:	1
Pens (various colors) NDL:	1 each
Dust cover:	1
5A fuse (built-in type):	1
Input cover:	1
Input cover stay:	4
Dropping pipet:	1
Grounding adapter:	1
Instruction manual:	1

External view

U-1641



Rear View

CFcard and DC-DC power supply are options.

6. SPECIFICATIONS

6.2 Input Unit 16TCV1

6.2.1 Introduction

This unit is used as a DC voltage/Temperature input unit for the U-1641 series. Two channel measurements can be done with one unit. The settings for each channel are done independent as well as being insulated from each other.

6.2.2 Input

Model name:	DC voltage/Temperature input unit 16TCV1
Compatible machines:	U-1641 series
Input format:	Unbalanced, floating
Input resistance:	1 Mohm fixed
Signal source resistance:	Less than 1 Kohm
Types of inputs:	Voltage Thermocouple: JIS 7 types (J, K, E, T, S, R, B) Temperature measurement resistor: Pt 100 ohm 3 wire (option)
Measurement range:	Voltage: $\pm 100 \mu\text{V}$ to $\pm 50 \text{ V}$ Measurement for range $100 \mu\text{V}$ to $500 \mu\text{V}$ is carried out with magnifying function. By using a voltage divider (option), measurements can be made up to $\pm 500 \text{ V}$. (When a voltage divider is used, a digital value multiplied by 10 is input.) Thermocouple (Conforms to JIS) J: $-210 \text{ }^\circ\text{C}$ to $1200 \text{ }^\circ\text{C}$ K: $-270 \text{ }^\circ\text{C}$ to $1372 \text{ }^\circ\text{C}$ E: $-270 \text{ }^\circ\text{C}$ to $1000 \text{ }^\circ\text{C}$ T: $-270 \text{ }^\circ\text{C}$ to $400 \text{ }^\circ\text{C}$ S: $-50 \text{ }^\circ\text{C}$ to $1767 \text{ }^\circ\text{C}$ R: $-50 \text{ }^\circ\text{C}$ to $1767 \text{ }^\circ\text{C}$ B: $100 \text{ }^\circ\text{C}$ to $1820 \text{ }^\circ\text{C}$ Temperature measurement resistor: -200 to $660 \text{ }^\circ\text{C}$ Pt 100 ohm 3 wire (option)

6. SPECIFICATIONS

Zero point movement range:	Setting with RANGE and BIAS: 0 to $\pm 200\%$, 0.1% increment Setting with SPAN-L, SPAN-R: $\pm 1.000\%$ (Setting in the range 1.0 to 1.1 V is possible.)
Measurement accuracy:	Voltage input: $\pm (0.05\% \text{ (rdg)} + 0.03\% \text{ (range)} + 1 \mu\text{V})$ Thermocouple input: $\pm (0.05\% \text{ (rdg)} + 0.5 \text{ }^\circ\text{C})$ J, K, E, T $\pm (0.05\% \text{ (rdg)} + 1 \text{ }^\circ\text{C})$ S, R, B Temperature measurement resistor (option): $\pm (0.05\% \text{ (rdg)} + 0.2 \text{ }^\circ\text{C})$ Pt100 ohm Cold junction compensation: $\pm 0.5 \text{ }^\circ\text{C}$ J, K, E, T $\pm 1 \text{ }^\circ\text{C}$ S, R, B
Temperature characteristics:	Zero $\pm (0.2\mu\text{V}/^\circ\text{C} + 0.01\% \text{ (range)}/\text{FS}/^\circ\text{C})$ FS $\pm 0.01 \text{ (range)}/\text{FS}/^\circ\text{C}$ 30 minutes after power is applied $\pm 0.5\% /\text{FS}$
Noise-proof characteristics:	Common mode reduction ratio (CMRR): More than -150 dB (50/60 Hz) Normal mode reduction ratio (NMRR): More than -50 dB (50/60 Hz)
Resolution:	14 bits
Sampling period:	4 ms
Withstand voltage:	Between analog input and chassis (GND): 500 V AC for 1 minute Between each analog input: 500 V AC for 1 minute
Insulation resistance:	Between analog input and chassis (GND): More than 100 Mohm at 500 V DC
Filter:	ON: 1 Hz, OFF 10 Hz (-3 dB)

6. SPECIFICATIONS

*1 range Select range from Table 2 in accordance with setting values.

- 1) When input setting is "SPAN": Range of setting value is either of SPAN-L or SPAN-R, larger one.

Example:

If setting is SPAN-L: 1.2 V and SPAN-R: 1 V, range 1 to 1.2 V is recorded.

As the setting value range is 1.2 V, measurement calculation range is 2.048 V, and accuracy is calculated as:

$$\pm (0.05\% \times 0.2 \text{ V} + 0.03\% \times 2.048 \text{ V} + 1 \mu\text{V}) = \pm 0.714 \text{ mV}$$

- 2) When input setting is "RANGE":

- (1) Zero point setting: 0 to 100%

From Table 2, decide the setting value range and measurement accuracy calculation range.

Example:

If setting range is 1.5 mV and zero point is set to 20%, the range between -0.7 mV to 1.2 mV is recorded. As the setting value range is 1.5 mV, measurement calculation is 2 mV, and accuracy can be calculated as follows:

$$\pm (0.05\% \times 1.5 \text{ mV} + 0.03\% \times 2 \text{ mV} + 1 \mu\text{V}) = \pm 2.35 \mu\text{V}$$

- (2) Zero point is - side and +100% or more

Numerical value of the setting value plus zero point position becomes the setting value range in Table 2.

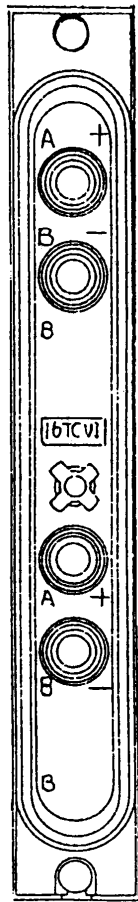
Example:

If setting range is 1.5 mV and zero point is set +200%, the range between 3 mV to 4.5 mV is recorded. As the setting value range is $1.5 \text{ mV} \times 200\% + 1.5 \text{ mV} = 4.5 \text{ mV}$, measurement calculation is 8 mV, and accuracy can be calculated as follows:

$$\pm (0.05\% \times 4.5 \text{ mV} + 0.03\% \times 8 \text{ mV} + 1 \mu\text{V}) = \pm 5.65 \mu\text{V}$$

Set value range	Range
100 μV - 999 μV	1 mV
1 mV - 1.999 mV	2 mV
2 mV - 3.999 mV	4 mV
4 mV - 7.999 mV	8 mV
8 mV - 15.99 mV	16 mV
16 mV - 31.99 mV	32 mV
32 mV - 63.99 mV	64 mV
64 mV - 127.9 mV	128 mV
128 mV - 255.9 mV	256 mV
256 mV - 511.9 mV	512 mV
512 mV - 1023 mV	1024 mV
1.024 V - 2.047 V	2.048 V
2.048 V - 4.095 V	4.096 V
4.096 V - 8.191 V	8.192 V
8.192 V - 16.37 V	16.38 V
16.38 V - 32.76 V	32.76 V
32.77 V - 65.53 V	65.54 V

6.2.3 External view



6. SPECIFICATIONS

6.3 Input Unit 16RTD1

6.3.1 Introduction

The 16RTD1 is a platinum resistance thermometer bulb for the U-1641 series and incorporated in the DC voltage/temperature unit (16TCV1). It can measure two channels by one unit. Each channel is set independently and insulated electrically.

6.3.2 Input

Model name: DC voltage/Temperature input unit 16TCV1

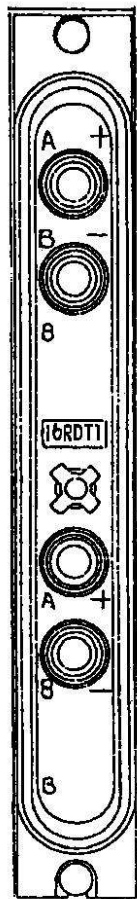
Compatible machines: U-1641 series

Temperature measurement resistor:
Pt 100 ohm 3 wire, 1 mA

Measurement range: -200 to 660 °C

Measurement accuracy: $\pm (0.05\% \text{ (rdg)} + 0.2 \text{ } ^\circ\text{C})$ Pt 100 ohm

6.3.3 External view



6.4 DC-DC Converter 16DCP1

6.4.1 Introduction

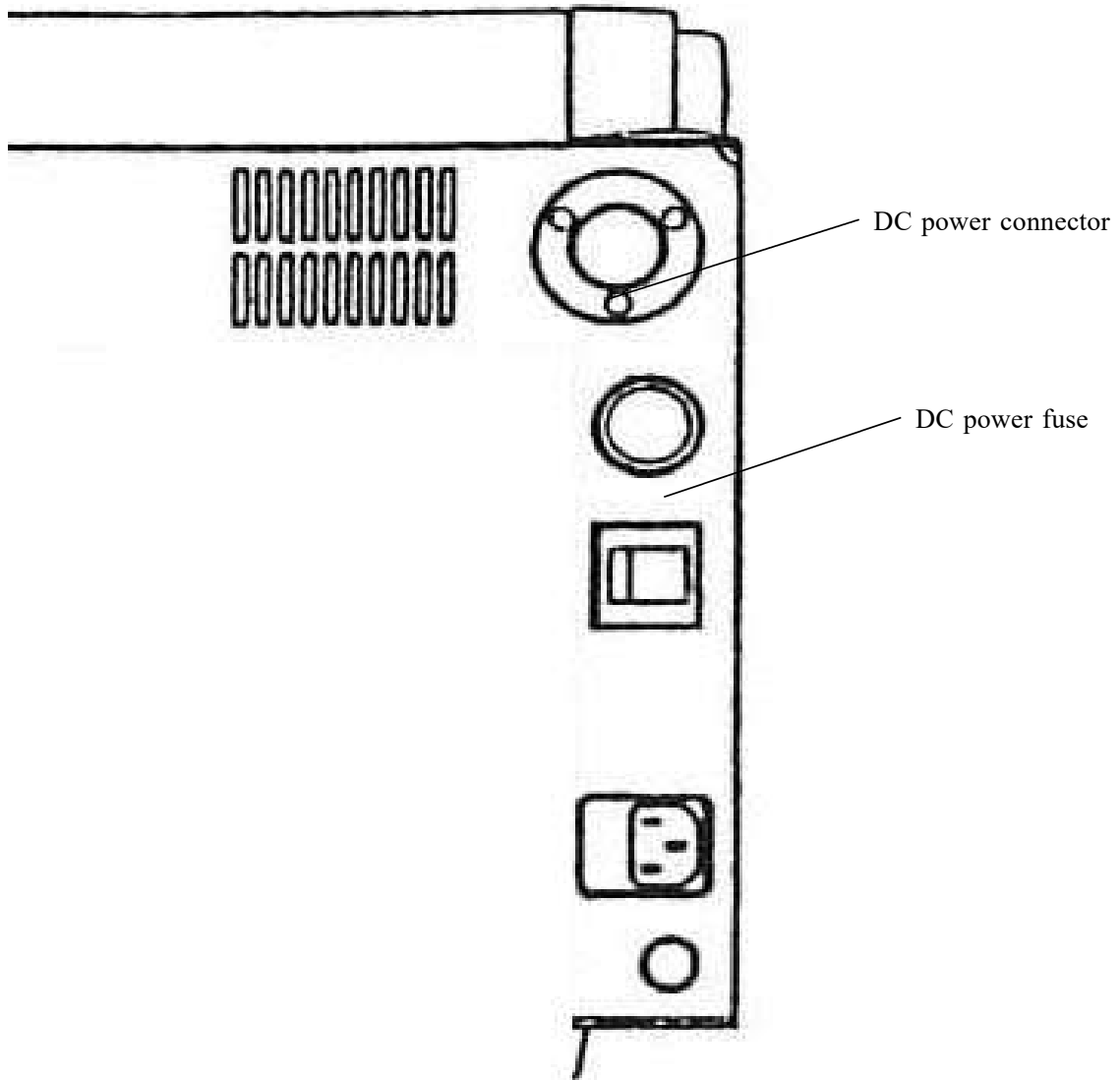
This converter is installed inside the main body of power supply equipment which used DC drives. It is applicable for automotive use but, since it can be used with AC drives also, it can be used as a back-up of an AC power supply.

6.4.2 Specifications

Model name:	16DCP1 (-00 version) DC-DC converter	
Circuit type:	Switching type	
Input voltage:	12 V DC (9 V DC to 16 V DC)	
Input protection:	Equipped with protection circuits for decreases and increases in input voltage and reverse connections. If the input voltage goes outside the normal range (9 V DC to 16 V DC), the unit will not operate.	
Power consumption:	Maximum:	16 pens, 165 VA 14 pens, 160 VA 12 pens, 155 VA 10 pens, 145 VA 8 pens, 145 VA
	When balanced:	16 pens, 105 VA 14 pens, 101 VA 12 pens, 97 VA 10 pens, 93 VA 8 pens, 90 VA
Operating environment:	Corresponds to main unit	
Insulation resistance:	Between power supply and chassis (GND): More than 50 Mohm (500 V DC mega)	
Withstand voltage:	Between power supply and chassis (GND): 500 V DC for 1 minute	
Shape:	Internal in main unit	
Weight:	Approximately 800 g (Not including weight of main unit and power supply cord)	
Accessory items:	Fuse 30 A:	1
	DC power supply cord:	1

6. SPECIFICATIONS

6.4.3 External view

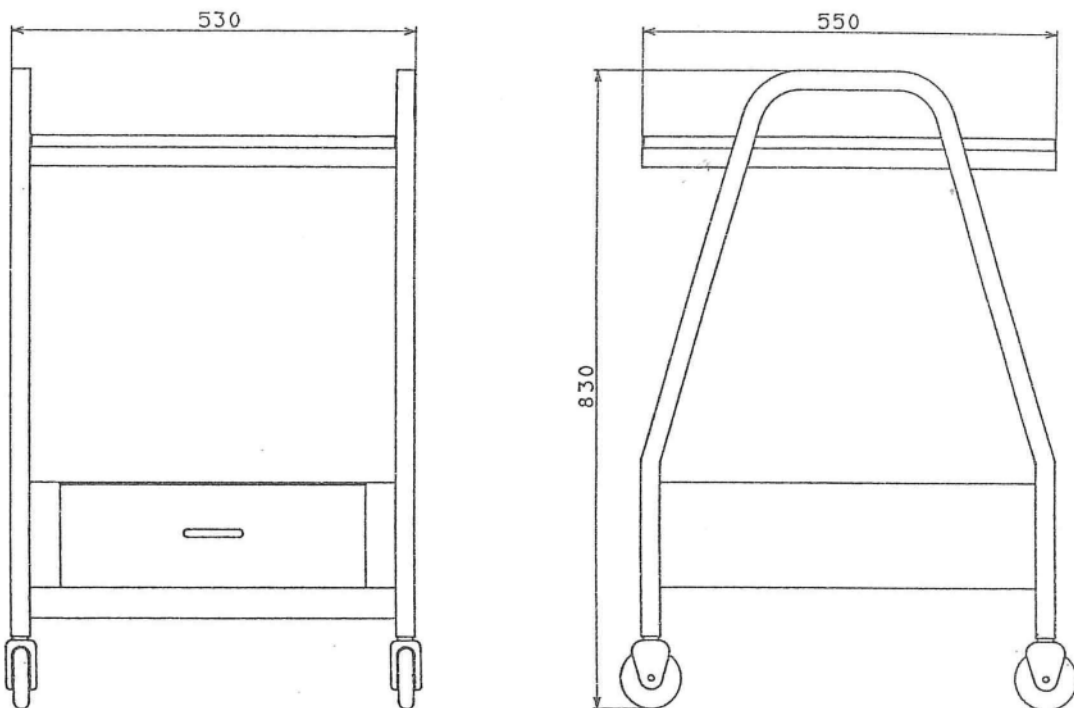


6. SPECIFICATIONS

6.5 Chart Paper Take-up Device 16TAK1 (option)

Model:	16TAK1 (-00 version)
Applicable chart paper:	Roll type chart paper No.25020P50 (50 m) No.2501P50 (20 m)
Action:	Independent drive (not interlocked with the chart paper feed mechanism of the U-1641.)
Weight:	Approx. 300 g
Accessories:	Chart paper take-up bobbin 1 Chart paper holder, right 1, left 1

6.6 Cart for U-1641 16CART1 (option)

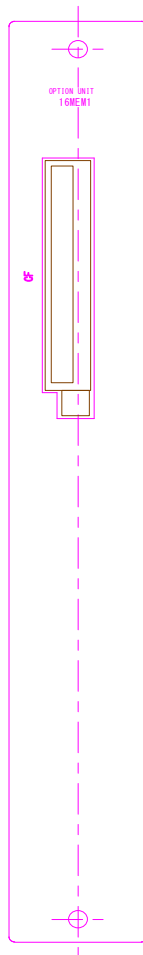


6. SPECIFICATIONS

6.7 CFcard Unit 16MEM1 (option)

Applicable main frame:	U-1641 and U-841 series
Media:	CFcard
Format:	Windows
Data capacity:	64 Mbyte ~ 4 Gbyte
Save:	Real time data is forwarded to a CFcard.
Road:	Save the data of the CFcard.
Delete:	Delete the data of the CFcard
Sampling time:	Can be established irrespective of the chart speed. Setting area 4 msec ~ 9996 msec
Record time:	Set automatically from a save, length, sampling time, and displayed by a screen.

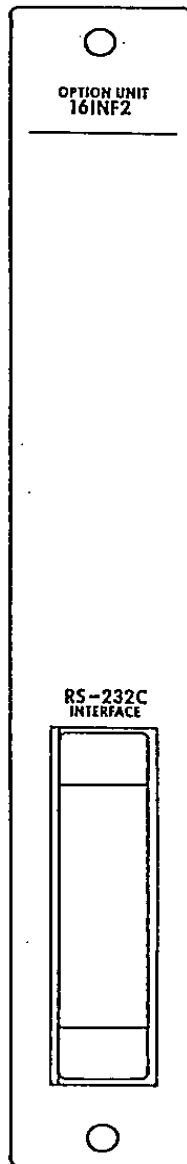
6.7.1 External view



6.8 Interface Unit 161NF2 (option)

- Applicable main frame: U-1641 and U-841 series
- Standard: Conforms to EIA RS-232C
- Mode: Input / Output of the setting values and measurement values
- Transmission speed: 1.2 K, 2.4 K, 4.8 K, 9.6 K bps

6.8.1 External view

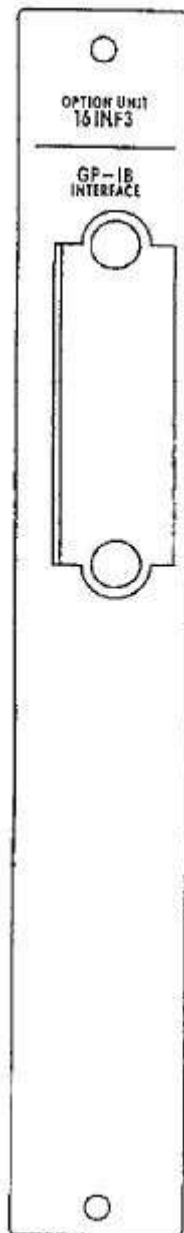


6. SPECIFICATIONS

6.9 Interface Unit 161NF3 (GP-IB) (option)

Applicable main frame:	U-1641 and U-841 series
Standard:	Conforms to IEEE std 488-1978
Mode:	Input / Output of the setting values and measurement values

6.9.1 External view



6.10 Limit Output 16LIM2 (option)

Applicable main frame:	U-1641
Output element:	Photomos relay
Load:	Combined use for AC / DC
Load voltage:	400V (AC peak value)
Load current:	150 mA max.
On resistance:	16 ohm max.
Accessory:	Connector 2

6.10.1 External view

