Instruction Manual

LR 4100

Model 3711 and 3712
LR4100 Recorders

YOKOGAWA
Yokogawa Electric Corporation

IM 3711-01E
3rd Edition

MODEL 3711 H1 -LR4110
Suffix -3/D/REM/RS232C
Ser 49UB0801

How to use this Instruction Manual

This Instruction Manual describes the standard functions and operation procedures of Model 3711 and 3712 LR4100 recorders. For operation methods of other options, see other instruction manuals listed below.

Product name	Model	Instruction Manual No.
GP-IB interface	/GP-IB	IM3711-10E
RS-232 interface	/RS232C	IM3711-10E
Calculation function	/MATH	IM3710-30E
Built-in alarm	/AK-04	IM3710-40E
Remote control	/REM	IM3710-50E

The Operation Guide is provided at the bottom of the recorder for you who are interested in operating the equipment soon or who will use only the conventional analog recorder functions.

For those who wish to understand the product and application operations in details, read the manual.

CONTENTS

1. UPON RECEIVING THE PRODUCT

The LR4100 Recorder has been delivered after a thorough in-house inspection. However, make sure of the following when you receive it.

1.1 Checking the Model and Its Specifications

The LR4100 recorder is provided with a nameplate on it's rear panel that indicates the Model, etc. as shown in Fig. 1.1. When you receive your recorder, check the information on the nameplate to make sure that it is as specified by your order. Also, when you contact us, inform us of the Model and serial number as given on the nameplate.

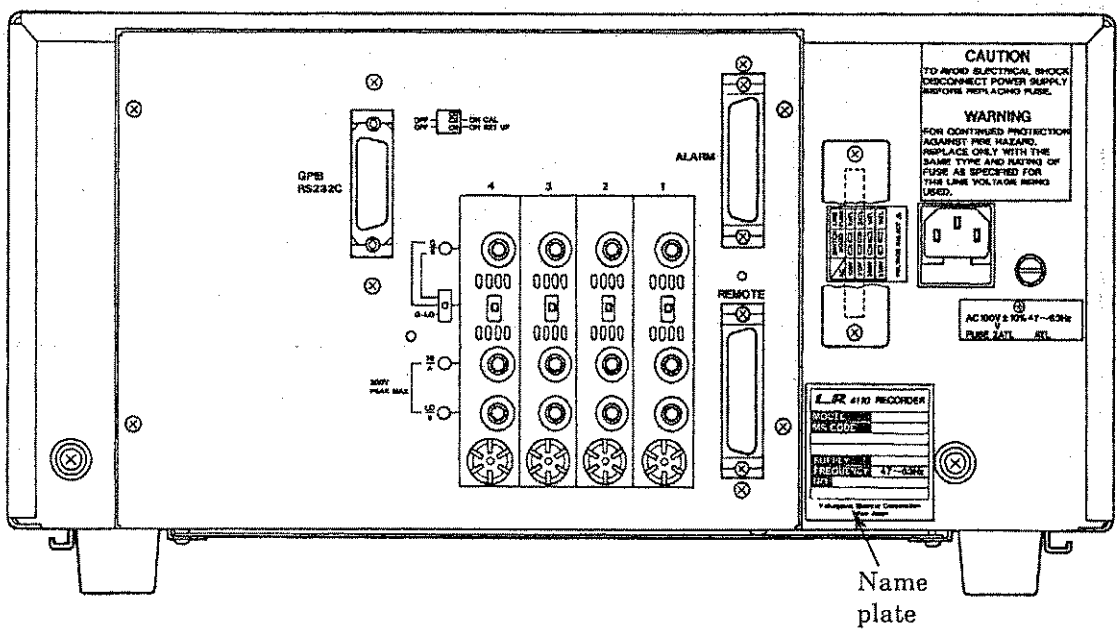


Figure 1.1

Model and Suffix Code

Model	Suffix Code	Description
3711	.....	LR4110 Recorder (with printer & electrical pen lift)
3712	.....	LR4120 Recorder (without printer, with manual pen lift)
No.of channels	1	1 - pen model
	2	2 - pen model
	3	3 - pen model
	4	4 - pen model
Input types & max sensitivity	1	10mV F.S. (DC V,TC)
	2	1mV F.S. (DC V,TC)
	3	0.1mV F.S. (DC V,TC)
	4	10mV F.S. (DC V,TC, RTD)
	5	1mV F.S. (DC V,TC, RTD)
	6	0.1mV F.S. (DC V,TC, RTD)
Power requirements	-1	100 V AC (50 & 60 Hz)
	-3	115 V AC (50 & 60 Hz)
	-5	200 V AC (50 & 60 Hz)
	-7	230 V AC (50 & 60 Hz)
Optional features	/ GP-IB	GP-IB interface
	/ RS232C	RS - 232C interface
	/ MATH	Mathematical functions
	/AK - 04	Alarms (internal, 4 points)
	/ REM	Remote controls
	/ DF	°F dispray

Name		Standard accessories	Model	
			Part No	Order Q'ty
Ribon cassette			B9585SM	1 unit (1 pc. / unit)
Z - fold chart (344mm x 20m)			B9619AH	10 unit (1 pc. / unit)
* Disposal felt - tip pen cartridge	1st channel(red)	—	B9586□A	1 unit (3 pcs. / unit)
	2nd channel(green)	—	B9586□B	
	3rd channel(blue)	—	B9586□C	
	4th channel(brown)	—	B9586□D	
	1st to 4th channel	1 pc. each	B9586□K	
IC Memory card (setting data)		1 pc.	3789 01	1 unit (1 pc. / unit)
IC Memory card (setting & measured data)		—	3789 04	
Dust cover		—	B9619AV	
Lithium battery (for mainframe)		1 pc.	B9588ZB	
Lithium battery (for 378901)		1 pc.	B9586JU	2 units (1 pc. / unit)
Lithium battery (for 378904)		—	B9586JV	
Measurement leads (1m)		—	B9409JA	1 set
Power cord		1 set	Order by name	
Fuse		1 pc.	Order by name	
Rack adapter (ANSI & JIS)		—	378982	1 set

* Note : Specify one of code (X, Y or Z) in □.
Y... Standard (pen speed of lower than approx. 800mm/s).
Z... High speed (pen speed of higher than approx. 800mm/s).
X... Low speed (chart speed of lower than approx. 100mm/s).

1.2 Checking the Accessories and Appearance

The recorder is provided with the accessories shown in Fig. 1.2.

Check the accessories to make sure that they are all there. Further, visually check the recorder to make sure that it has not been damaged.

Should the number of accessories be short or the recorder be damaged, contact the representative where you purchased it.

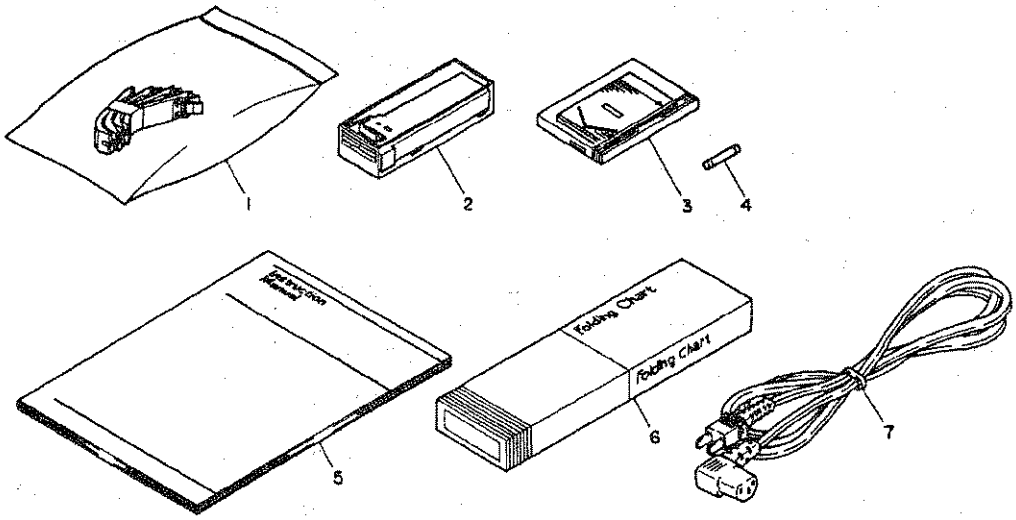


Figure 1.2

Table 1.1

No.	Name	Part No.	Q'ty	Remarks
①	Pen cartridge	–	1/color	Same as No. of pens
②	Ribbon cassette	B9585 SH	1	3711 Only
③	IC card	3789 01	1	
④	Fuse	A9134 KF or A9132 KF	1	100 V or 200 V system (Installed in fuse holder0
⑤	Instruction Manual	–	1	
⑥	Chart	B9619 AH	1	About 20 m
⑦	Power supply cable	A9009 WD	1	

1.3 Prior to Using the Recorder

After unpacking the recorder, open the front door to remove shipment packing.

(1) Using a Phillips screwdriver, remove the lock screw and bracket usedto hold the chart tray in place during transportaion.

(2) When the bracket is removed, retighten the lock screw in the place. Insert the bracket into the pencap storing boss located on the front panel and cap the pen cap on it to store the bracket. When shipping the recorder, reuse the bracket.

(3) Press the stoppes located on the right ob the chartcompartmentt unit to lift the unit.

(4) Pull the unit forward and remove it from the recorder.

(5) Remove the sheet covering the unit front.

(6) Remove the cushions located on both left and right sides.

(7) Remove the vinyl string (LR4110) fixing the printer carriage to the center.

(8) This complete unpacking.

The recorder is now ready for use with reference to the instruction manual.

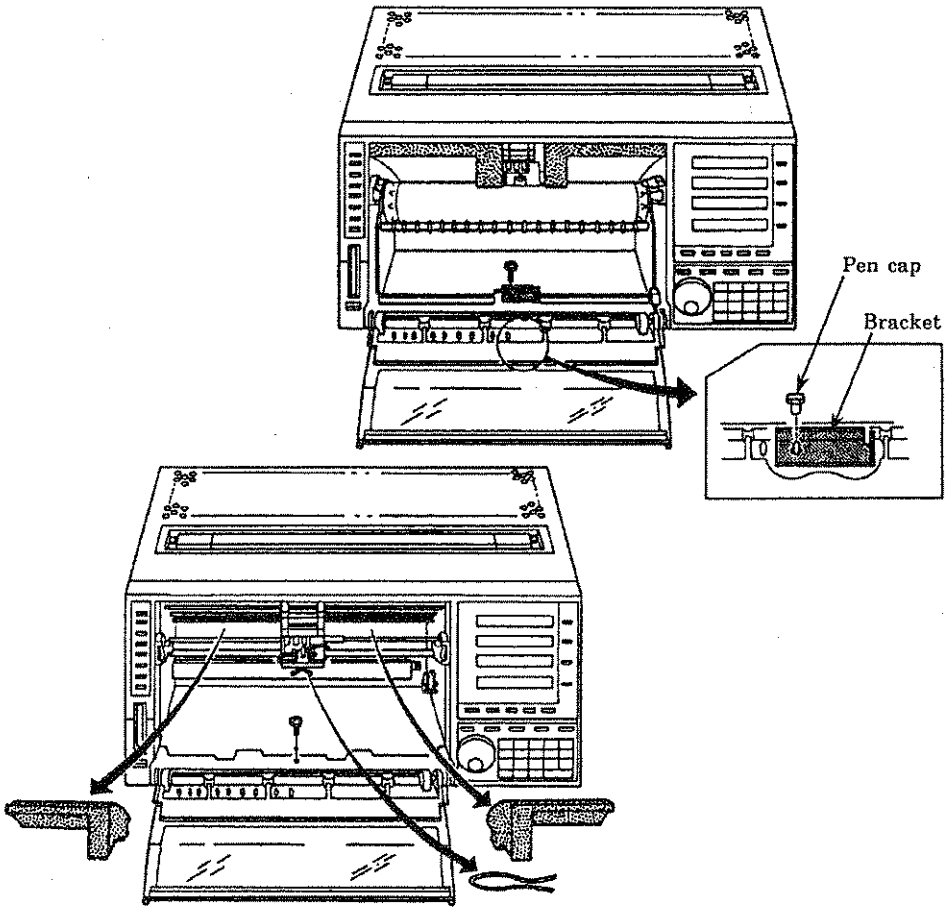


Figure 1.3

2. OUTLINE

2.1 Product Outline

The LR4100 is a high performance, multipen recorder based on YOKOGAWA's long experience with the highly reputed HR and uR series recorders and incorporates the latest technology.

Any DC voltage, thermocouple or RTD input can be selected for each channel. In addition to analog recording, the recorder also allows measured values, dates, scales, alarm lists, and messages to be printed out or partial suppression-recorded through the use of a wire dot printer. Easy-to-read fluorescent display tubes are used and the recorder is capable of selecting measured data, bar-graph and range data displays for each channel. Thus, while the LR4100 offers high performance, it is easy to operate. Basic items such as range and chart speed can be easily set interactively with the display unit via function keys and setting knobs.

Further, the recorder range of applications can be expanded by adding various optional functions, such as a memory function in the form of an IC card, calculation and GP-IB / RS-232C communication functions, and an alarm output.

2.2 Features

■ **Highly Functional and Intelligent**

- Wide range of DC voltage, thermocouple and RTD inputs
  A single LR4100 recorder can cope with all DCV, TC and RTD inputs. Further, it has cryogenic gold-iron-chromel (KP vs Au7Fe) TC input and a cryogenic platinum and rare cobalt RTD (J263*B) input which are built into it as standard equipment.
- Versatile print-out functionsIncludes (LR4110 model only)
  Includes measured data, date, scale markings, alarms, messages, manual prints, lists, etc.
- A choice of 3 display functions
  Measured data, bar-graph and range data can be selected asrequired.
- Zone recording (recording area adjustment)
  The recording range can be arbitrarily set by adjusting the penposition.
- Partial suppression and extension
  The LR4100 can suppress the recording of unnecessary areas and extend the recording of important areas.
- AUTO Span Shift
  Selecting this mode automatically shifts the recording span by + 50%, and continues recording when an input exceeds the measuring range (span).

■ **Computer Friendly**

- GP-IB and RS-232C interfacesBi-directional communication is available in which both interfaces allow data output and panel setting. Further, communication input can be analog-recorded, enabling raw measured data and communication input data to be recorded simultaneously.

- Simple operation
  The LR4100 can be operated as simply as conventional analog recorders, even though it has multifunction capabilities. Using the function keys and setting knobs, various settings are made simply by using an interactive system with the display unit.
- New recording mechanism
  The adoption of new pens allows the recorder to record for about 1500 m (about twice that of conventional units).
  Further, the chart is 30 m long (twice that of conventional charts), enabling continuous operating time to be extended considerably. In addition, the provision of grooves in the platen has almost eliminated ink blots at the chart folding lines, which is a problem at low chart feed speeds in conventional recorders.

■ **High-speed Response 1600 mm/s**

Maximum pen speed is 1600 mm/s, significantly improving traceability at high-speed.

■ **IC Memory Card**

An IC memory card stores the set values and measured data.

- Set value memory (standard).
  Previously-used set values can be stored in an IC memory card and used again simply by inserting the IC memory card into the unit.
- Set value and data memory (optional)
  Can store measured data in which an alarm or external contact is triggered. Memory capacity is 256K bytes and the memory can store a maximum of 32,000 data/channel.
  Stored data can be recorded or output for communication as required.

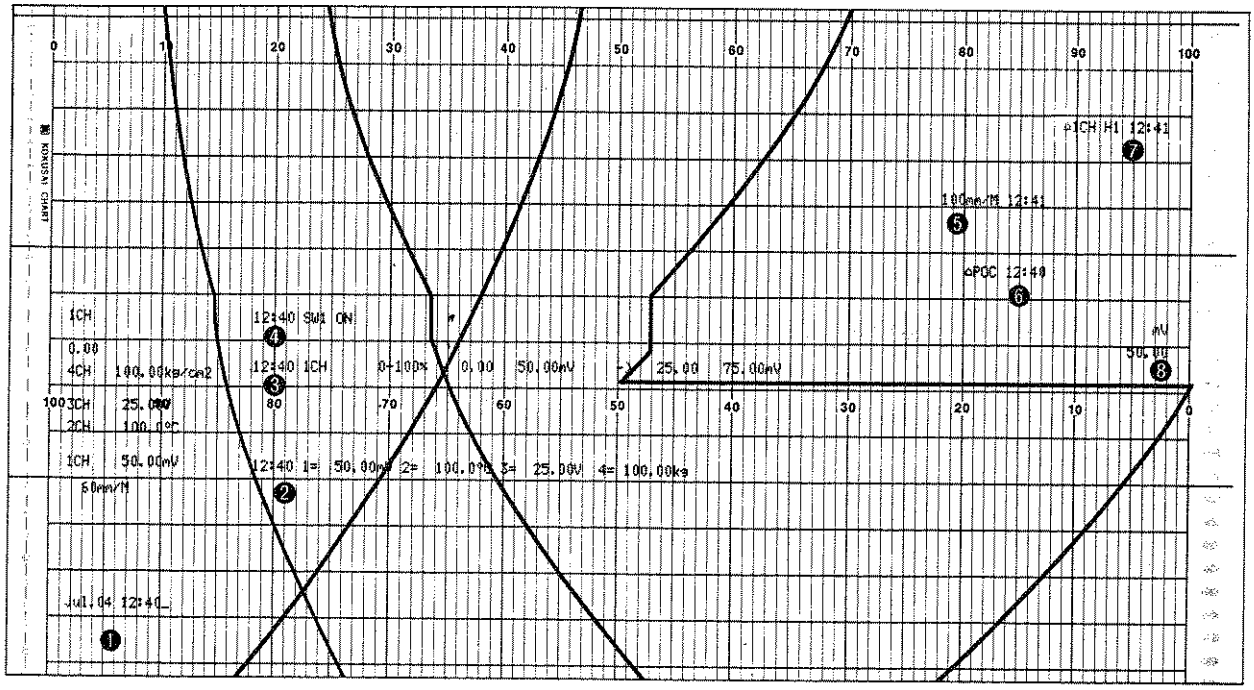
■ **A Wide Range of Optional Features**

- Mathematical functions (/MATH)
  This function is in addition to the standard difference calculation and scaling functions and is capable of executing various calculations much as arithmetic operations, square root extraction (SQR), absolute value (ABS), common logarithms (LOG) and exponents (EXP). Calculated data can be recorded or output for communication.
- Remote control function (/REM)
  Chart start/stop, chart speed control, chart speed change, recording ON / OFF selection, message, and manual print-out are controlled remotely. Selecting recording ON / OFF allows the pens to be raised and lowered independently.
- Alarm output (/AK-04)
  Four alarm outputs can be obtained and two upper or lower limit alarm levels can be set per channel.

2.3 Recording Examples

2.3.1 Four Analog Recording Channels Plus Various Print-outs (LR4110 model only)

An Example of Recording/Printout (LR4110)



(1) Fixed Time Print-out (*)

Executes print-out per specified time span (minimum : 1 minute).

(2) Manual Print-out

Pressing the MAN PRINT key prints out the time and measured data for all channels in a single line.

(3) Range Change Print-out

The range change and time contents are printed out when therange is changed in the AUTO Span Shift mode.

(4) Message Print-out

Can be set arbitrarily within 70 characters (with time data)

MESSAGE (0) : Pressing the MESSAGE key starts print-out.

MESSAGE (1 to 4) : If the REMOTE function (optional) is provided, print-out is executed at external contact input. (4 points maximum).

(5) Print-out at Chart Speed Change

Chart speed and the time prior to and following a chart speed change are printed out.

(6) Phase Synchronization ON / OFF Print-out

The ON / OFF mark and time are printed out when phase synchronization is ON / OFF.

(7) Alarm Print-out (*)

The channel No., alarm type, and ON / OFF time are printed out.

(8) Scale Print-out (*)

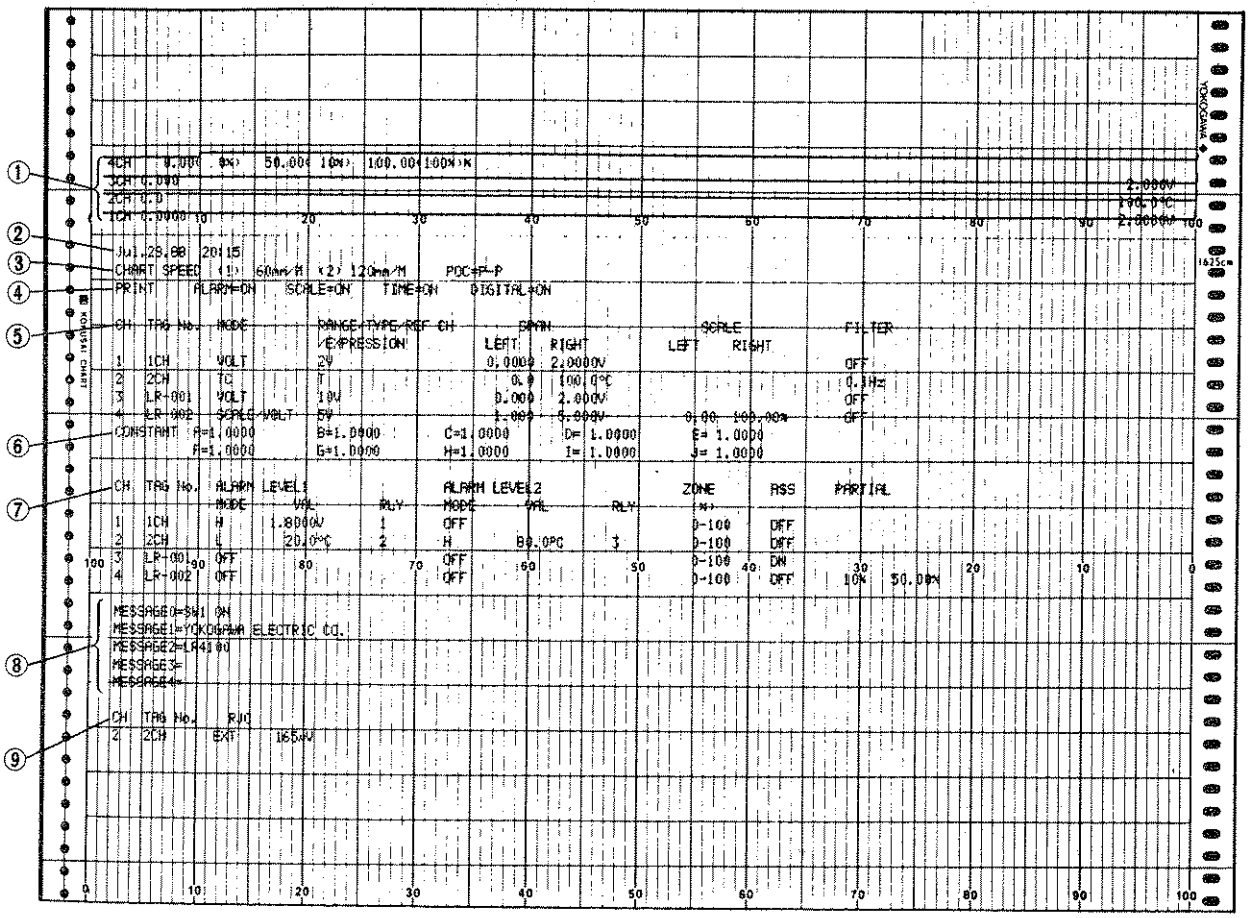
0% and 100% values are printed out at the same intervals as fixed time print-out.

When the chart paper is fed for a fixed length, the print-out marked with (*) executes the next line printing.
Hence if the chart feading speed is slow, it takes much time to start print-out. The print-out marked with (*) is disabled while chart feed is halted.
Any of the print-out other than that of the marked with (*) executes print-out with the change recoginized.
When the chart feed is halted, one line is fed after pointing (manujal print message print-out). For other cases, print-out is disabled while chart feed is halted.
When starting the chart, each print-out is executed corresponding to the chenge At this time line feeding after print-out is disabled.
Hence, if the chart feed speed is slow print-out may overlap the previous print-out data. Futher when multiple print-out causes occur at a time, print-out may be executed with a little lag time.
Furthermore, when the chart is fed in high speed the print-out may be slanted.

<Relationship between Fixed-time Printout and Chart Feeding Speed>

Chart Feeding Speed				Fixed Time Print-out Intervals
mm/min	inch/min	mm/h	inch/h	
1200~300	45.0~12.0	—	—	Every minute
299~ 30	11.9~1.2	—	—	Every 10 minute
29~ 10	1.1~0.5	1200~120	45.0~5.0	Every hour
—	—	119~60	4.9~2.4	Every 2 hours
—	—	59~40	2.3~1.6	Every 3 hours
—	—	39~20	1.5~0.8	Every 6 hours
—	—	19~10	0.7~0.5	Every 12 hours

2.3.2 List Print-out



2.3.2 List Print-out Description (LR4110 only)

① Scale : Recording is performed with a pen corresponding to each channel scale. (however only when scale print-out is on in SET UP mode)

② Date and time

③ Print-out mode setting contents of chart speeds (1) and (2) and phase synchronization (POC)

④ Contents of fixed time print-out

ALARM : Alarm print-out ON / OFF
SCALE : Scale print-out ON / OFF
TIME : Time print-out ON / OFF
DIGITAL : Measured data print-out ON / OFF

⑤ Measuring conditions

CH : Channel No.
TAG No. : Used instead of the channel No. (up to 7 characters)
MODE : Measuring mode
RANGE / TYPE / REF / EXPRESSION
Range/thermocouple type/difference calculation reference
CH / calculation expression (when "/MATH" is used)
SPAN LEFT : Input span left
SPAN RIGHT : Input span right
SCALE LEFT : Scaling left
SCALE RIGHT : Scaling right
FILTER : Input filter frequency (OFF /0.1 Hz/1 Hz)

⑥ Calculation contant (with MATH is used)

⑦ Alarm conditions and others

CH : Channel No.
TAG No. : Used instead of the channel No. (up to 7 characters)
ALARM (LEVEL 1 and 2)
MODE : H, L or OFF
VAL : Alarm set-value
RLY : Output relay No.
ZONE : Recording range (0 to 100%)
ATSS : Automatic recording span shift ON/OFF
PARTIAL : Partial suppression and extension recording limit value

⑧ MESSAGE : Contents of messages 0 to 4 (up to 70 characters)

⑨ RJC content : External reference junction compensation (EXT RJC)CH (TAG NO.) and reference junction compensation voltage

3. FUNCTIONAL DESCRIPTION

3.1 Front Panel

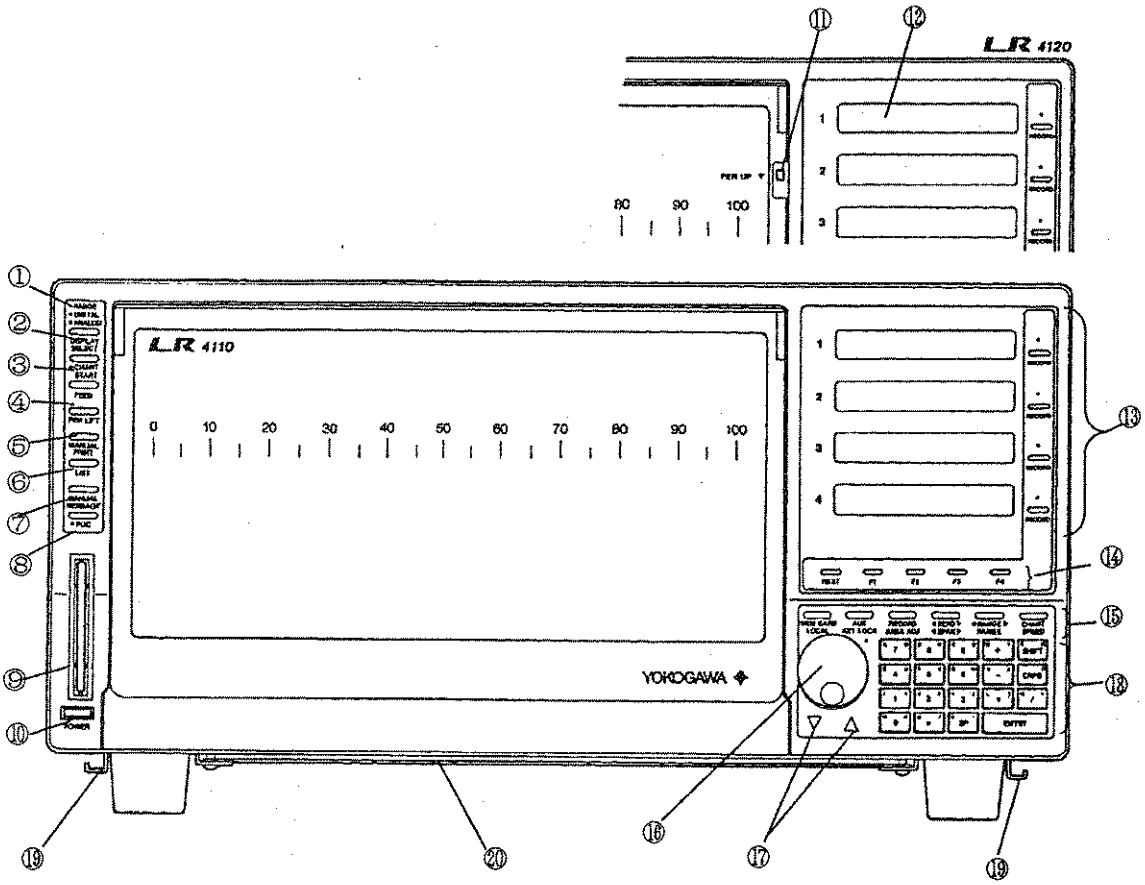


Figure 3.1 LR4110 Front Panel (4 - channel model)

① **DISPLAY SELECT**
Used to select measured data, bar-graph and range data.
Measured data and bar-graph are about 1 second display renewal intervals.

② **CHART START**
Starts / stops the chart feed. The LED lights up when the chart is being fed.

③ **FEED**
Feeds the recording chart.

④ **PEN LEFT (LR4110 only)**
Used to raise / lower the pens simultaneously. Setting the RECORD keys to ON / OFF allows the pens to be raised/lowered individually.

⑤ **MANUAL PRINT (LR4110 only)**
Prints out measured data when this switch is pressed. For analog recording, all the channel measured data is printed out continuously at high speed in about 1.5 seconds.

⑥ **LIST (LR4110 only)**
Prints out the present setting state. Further, each channel's scale is written by a corresponding pen.

⑦ **MANUAL MESSAGE (LR4110 only)**
Prints out the setting conditions of Message (0). (Up to 70 characters)
Note) The print-out of messages (1) to (4) is started by external contact input (option). Using communication function (option). print-out is possible.

⑧ **POC (Pen Offset Compensation)**
Used to turn phase compensation ON / OFF(not provided with the one - pen model). When phase compensation is set to ON, the LED lights up, and when it's set to ON / OFF, the time and the ON / OFF mark are printed out.

⑨ **IC memory card insertion slot**
Used to insert a set value memory card (attached) or a set value and data memory card (option).

⑩ **POWER switch**
Turns the power supply ON / OFF.

⑪ **PEN lift lever (LR4120 only)**

⑫ **Display units**
Equipped with easy to read fluorescent display tubes which are used to display and set data. A display unit consists of 20 characters / line, and the number of display lines is the same as the number of input channels. other than tow lines for one - pen recorder.

⑬ **RECORD**
Sets recording to ON / OFF. Measurement continues even if it is set to OFF and therefore, display and communication output (option) are available. When this is set to OFF, The Pens move to the right end and raised automatically.

⑭ **Function keys**
F1 to F4 : Function keys corresponding to setting displays (menus)
Next : A NEXT key for menus (display scroll)

⑮ **Function keys**

CHART SPEED	:	Selects chart speed.
◂RANGE▸	:	Allows a measuring range to be set for each channel by using the setting knob. Pressing this key after the SHIFT key enables you to set any measuring scale, execute scaling or set the filter frequency by using the ALPHANUMERIC and ENTRY keys.
RANGE		

◀ZERO▶ : Enables you to adjust the pen's zero positionfor
◀SPAN▶ each channel with the setting knob. Pressing this key after the SHIFT key allowsyou to adjust the span.

RECORD : Sets the recording zone arbitrarily by movingthe pen
AREA ADJ position.

AUX : Sets alarms, tag numbers, messages and the clock.

KEY LOCK : When this key is pressed successively to the SHIFT key, the keys from ⑭ to ⑱ can be locked.

MEM CARD : A setting key for use with an IC card.

LOCAL : When this key is pressed successively to the SHIFT key, sets the mode in LOCAL mode when the GP-IB is used.

⑯ **Setting knob** : Sets range and chart speed. When the setting knob is used, the LED on the upper right lights up. Fine to coarse adjustment for ZERO SPAN adjustment and RECORD AREA ADJ is available by changing the rotation speed.

⑰ **Cursor key**

Shifts the cursor on the setting display panel up and down.

⑱ **ALPHANUMERIC key** : Sets various digital data and characters.

ENTRY key : Enters the setting contents.

SHIFT key : Pressing this key once enters the characters at the upper left of the ALPHANUMERIC key. Pressing this key twice enters the characters at the upper right of the ALPHANUMERIC key. In the range program mode and at span adjustment, select a function key after this key has been pressed.

CAPS key : When the LED at the upper right is OFF, uppercase letters are available and, when it is ON, lowercase letters are available.

⑲ **Atches** : Used to carry the recorder. They are more convenient than a normal handle when carrying it for extended period of time.

⑳ **Operation Guide insertion guides**

The operation guide is inserted into the guides that describes the basic operation method.

3.2 Rear Panel

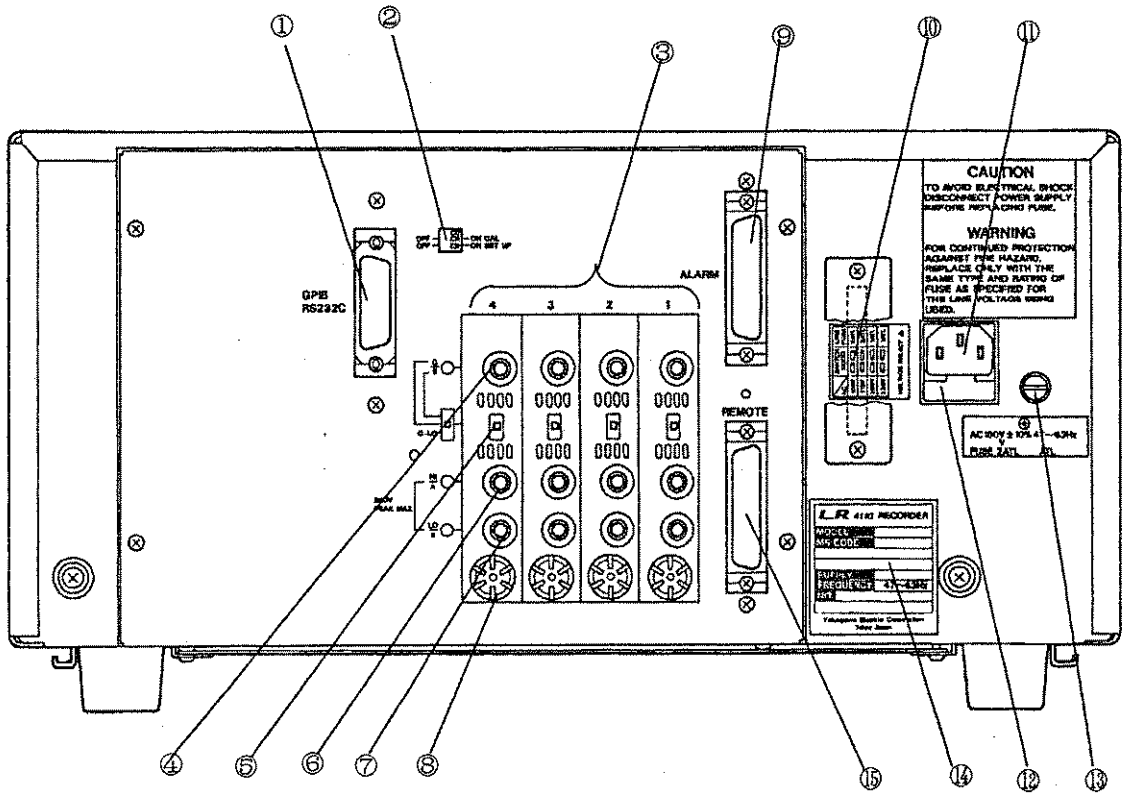


Figure 3.2 Rear Panel (4-channel model)

① **GP-IB / RS-232C connector (Option)**
GP-IB or RS-232C communication interface connector.

② **CAL / SET UP switch**
CAL : Calibration adjustment switch -- used only when the recorder is calibrated. This switch should not be touched by the uses.
SET UP : Used to change the chart speed unit from mm to inches (by setting it to ON)

③ **Input module**
One, two, three or four modules are built into the recorder as specified.

④ **Guard terminal or B-terminal**
Used as a guard terminal for voltage or thermocouple input and as a B-terminal for RTD input.

⑤ **Guard/B-terminal select switch**
Used to select the guard or B-terminal.
G : Selects the guard for voltage and thermocouple Input
B : Selects the B-terminal for RTD input
G-LO : Shorts G(Guard) and LO(minus) terminals.

⑥ **Positive terminal**
Used as a positive terminal for voltage and thermocouple inputs and as an A-terminal for RTD input.

⑦ **Negative terminal**
Used as a negative terminal for voltage and thermocouple inputs and as a B-terminal for RTD input.

⑧ **Reference junction compensating section**
Has a built-in transistor that executes reference junction compensation when a thermocouple is used.

⑨ **Alarm connector (Option)**
An alarm output (4 points) connector

⑩ **Supply voltage select section**
Has a built-in slide switch used to transfer voltage between 100 / 115 / 200 / 230 V AC. For selection details, see Section 7.2.

⑪ **Power supply connector**

⑫ **Fuse holder (spare fuse also contained)**

⑬ **Ground terminal**

⑭ **Nameplate**
Check the Model and supply voltage inscribed on the nameplate.

⑮ **Remote control connector (Option)**
The chart speed can be controlled using external control signals.

4. INSTALLATION

4.1 Installation Location

Install the recorder where :

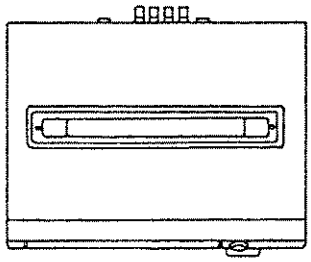
(1) Mechanical vibration is low.
(2) There are no corrosive gasses or where concentrations are low.
(3) Temperature is stable and near a normal temperature of 23°C.
(4) There is no direct, high radiation heat source.
(5) Magnetic field effects are low, and
(6) Humidity is not too high or too low. Ideally it should be kept to about 55%.

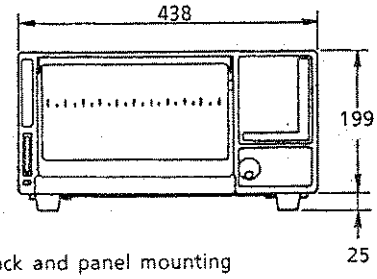
4.2 External Dimensions and Panel Cutout

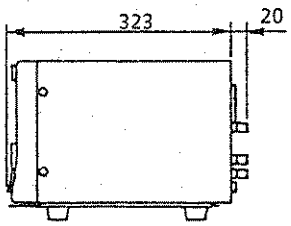
Fig. 4.1 shows the external dimensions and panel cutout.

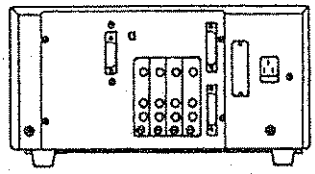
(1) For rack mounting, use the optional rack brackets 3789 82. If the recorder is mounted on a ANSI rack, install a sheet spacer (an accessory) at the bottom of the recorder. The spacer is not necessary for mounting on an JIS rack. Remove four feet on the recoder bottom.
(2) For panel mounting, use rack brackets. It is recommended that a shelf be provided as a support for the rear side of the recorder because it is quite heavy.

Unit : mm





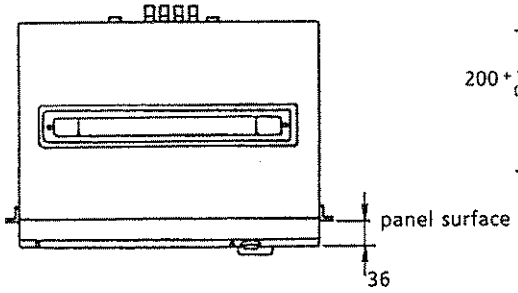


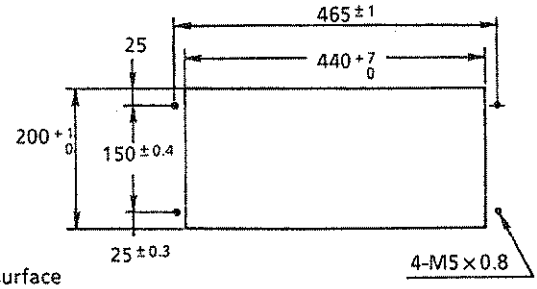


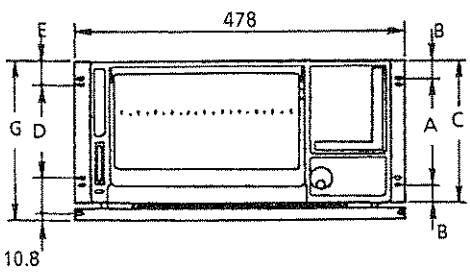
Rack and panel mounting

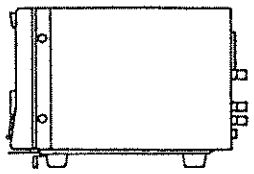
Rack type	A	B	C	D	E	F	G
JIS	150	24.5	$199^{\pm 1.5}$				
ANSI				133.4	32.8	44.5	221.5

Panel Cutout









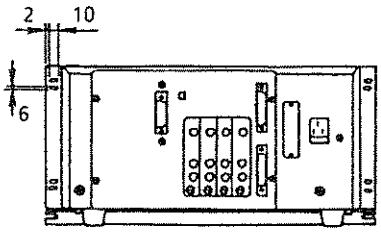


Figure 4.1 Dimensions and Panel Cut-out

5. WIRING

5.1 Power Supply

With the power switch OFF, connect the power supply cord to the power supply connector on the rear panel shown in Figure. 3.2.

5.2 Input

Connect the input terminals on the recorder rear panel as described below.

5.2.1 DC voltage and Thermocouple

The input terminal consists of three terminals; positive (H), negative (L) and guard (G).

(1) When the recorder is used in a laboratory or in a high-voltage range, connect an input line between terminals H and L with terminals L and G shorted (Fig. 5.1).

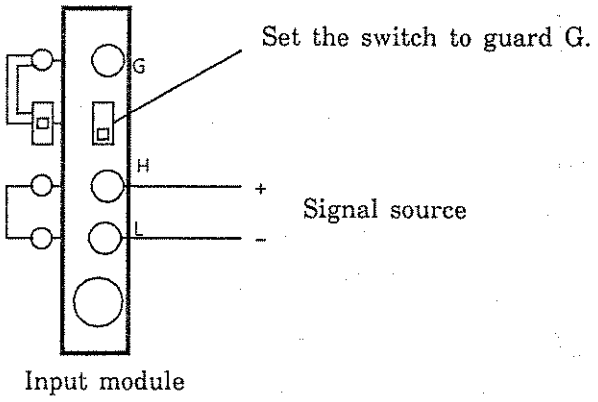


Figure 5.1

Instructions for high sensitive and temperature measurements

(1) The change in the temperature difference between the recorder interior and exterior may cause a zero drift, so when installing the recorder the following instructions must be observed.

① Use the recorder at an area where the recorder is hardly to be affected by the wind from an air conditioner supply opening.
(when starting or stopping the air conditioner, the ambient temperature considerably changes and the recorder is influenced by the thermoelectromotive force).

② Use the recorder at an area where the temperature change at day and night is small by avoiding the area where the temperature changes abruptly such as windy place or area subject to direct sunlight.

③ To keep the terminal temperature stable, always use the terminal cover supplied with the recorder. Avoid using the recorder with the air vent of the case closed.

(2) When wiring input terminals, if metal tips or wiring materals other than copper are used, several μv thermoelectomotive force may be generated, so for high sensitive measurement be sure, to use copper wire.
(3) When measuring thermocouples, if large capacity tip type terminals are used, the temperature at terminals changes and reference junction compensation error may occur. For connecting the thermocouples, thermocouple element wires must be connected directly.

(2) For high-sensitivity measurement, warm up the recorder for at least an hour.
If the recorder is likely to be affected by noise, etc. in high-sensitivity measurement, or if it is likely to be affected by common mode voltage, use the guard (G) terminal and when wiring, use shielded cables as where as possible. Figs. 5.2 thru 5.4 show general wiring examples.

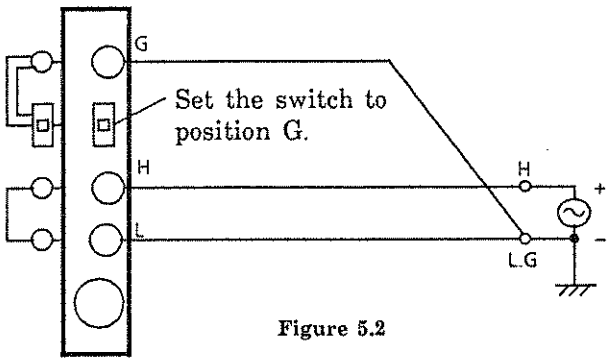


Figure 5.2

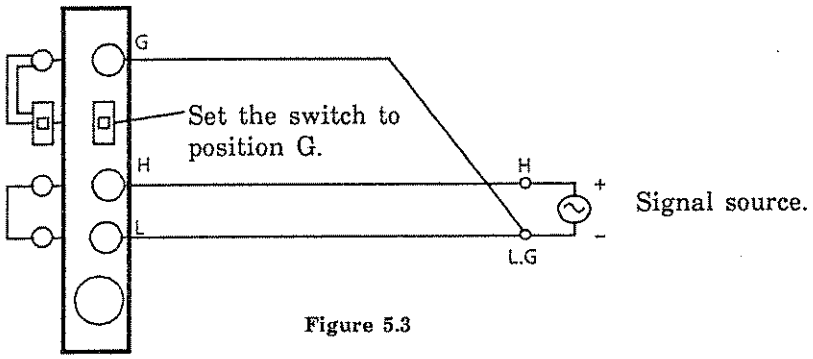


Figure 5.3

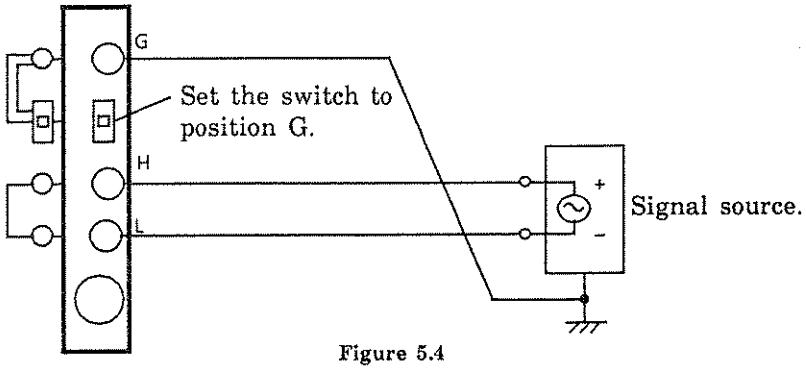


Figure 5.4

Notes:

1. The recorder should be grounded for any of the above cases.
2. The guard terminal function is not provided for low-sensitivity models.
3. For the high-sensitivity range use as short an input cord as possible.

4 Maximum input voltage is 250 V DC. If the voltage exceeds 250 V, the input circuit may be damaged.
5. Allowable signal source resistance is 1KΩ or less for DC voltage and thermocouple input. If it is greater, take a bias current of about 4 nA into account. In this case, 4 nA (signal source resistance) is added to the input voltage, and the voltage drop will be in error.
6. Maximum common mode voltage is 250 V AC rms. If it exceeds this value, an error may occur or the input circuit may be damaged.

5.2.2 RTD Input

Use a three-wire RTD. The cryogenic platinum and cobalt RTD (J263*B) is of the four-wire type. However, it can also be used as a three-wire type.

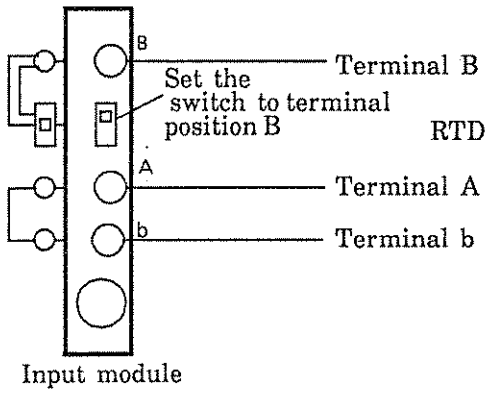


Figure 5.5 RTD Input Wiring

Notes:

1. Balance the three lead wire resistance lines for RTD input Further, the following error is due to lead wire resistance.
   Pt 100, Ni 100, J263*B : 0.1°C at 10 Ω.
   Pt 50 : 0.1°C at 5 Ω.
2. Maximum common mode voltage is 250 V AC rms. If it exceeds that value, an error may occur or the input circuit may be damaged.

High sensitivity and temperature measurement precautions

(1) If there is a change in the temperature difference between the recorder interior and exterior, it may cause a zero drift. Take care of the following points when installing the recorder.
   ① Stop air-conditioning equipment or use the recorder where there are no sudden changes in temperature. (When airconditioning equipment starts or stops, the temperature changes widely and the recorder is affected by ther-moelectromotive force.
   ② Use the recorder where there is no rapid change in tempera ture caused by exposure to wind, direct sunlight, etc. and where there is little change in diurnal temperature.
   ③ Always use a terminal cover to minimize the effects of wind, etc.

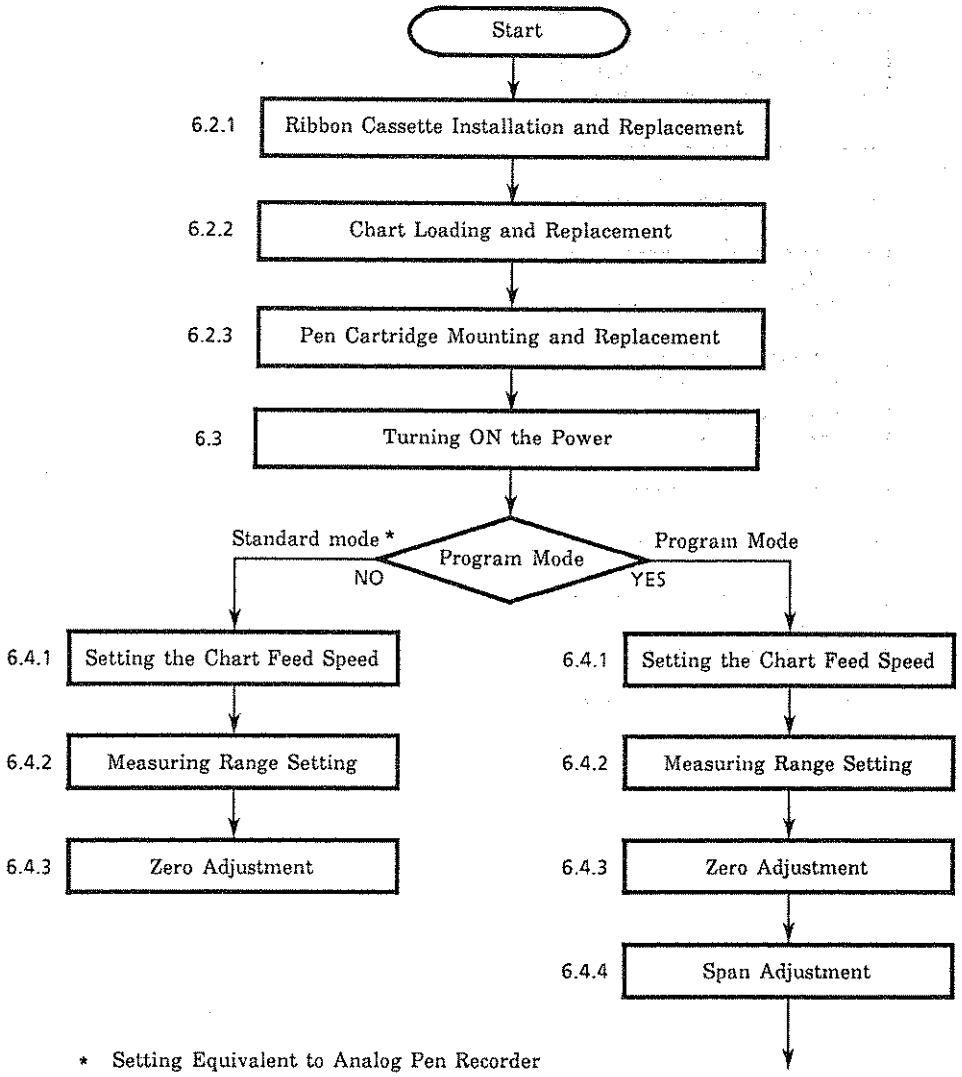
(2) Use of metal chips and wire other than copper for input wiring may result in a thermoelectromotive force of a few μV. Therefore, always use copper wires for high-sensitivity measurement.

6. OPERATION

6.1 Operating Procedure Flow Chart

General setting and operating procedures for the LR4100 are described in the following flow chart.

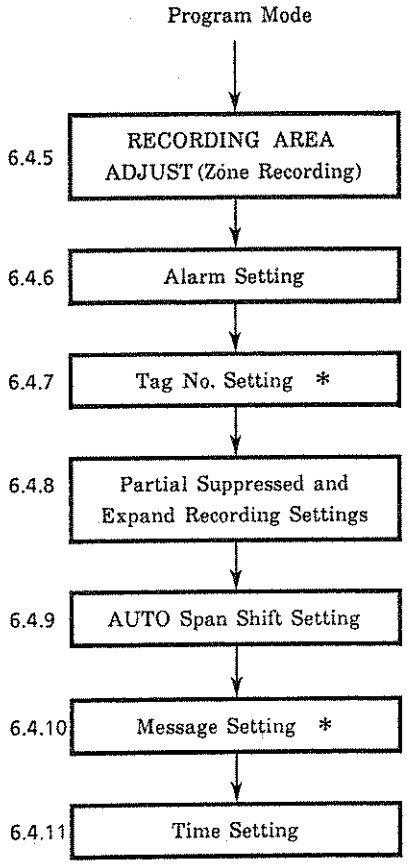
Two types of setting modes: standard and program modes, are available. When only the functions equivalent to those provided by conventional analog pen recorders are used, only the standard mode settings are required. When performing applied operations, make the settings in regular sequence in the program mode.



* Setting Equivalent to Analog Pen Recorder

Notes :

1. No setting is required for unrequired items :
   only the necessary items need be set.
2. When initializing setting information, see Section 6.4.12 Set value Information.
3. When using an IC memory card, see Section 6.4.13 IC memory Card.
4. When changing initially set values such as °C / °F see Section 6.4.14 Set up Mode.
5. When referring to the whole contents of the program, see Section 6.4.15 Program Table Setting.
6. See Section 6.4.16 Error Messages.



* LR4110 only

6.2 Preparation

6.2.1 Ribbon Cassette Installation and Replacement (LR 4110 only)

The ribbon cassette must be replaced with the power turned OFF.

(1) Open the front panel Ⓐ and push the right-hand stoppers Ⓑ on thechart tray to lift the unit. (Figure. 6.1)

(2) Pull the tray toward you to remove it from the recorder. (Figure. 6.2)

(3) Move the printer carriage to the extreme left, and all pens on the pen carriages to the extreme right.

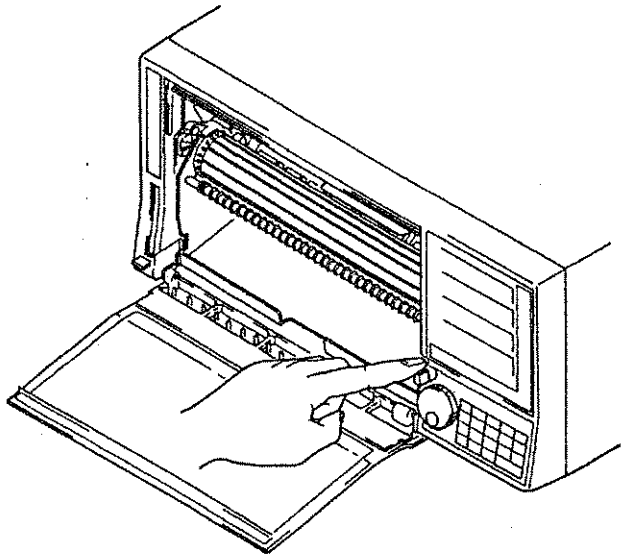


Figure 6.1

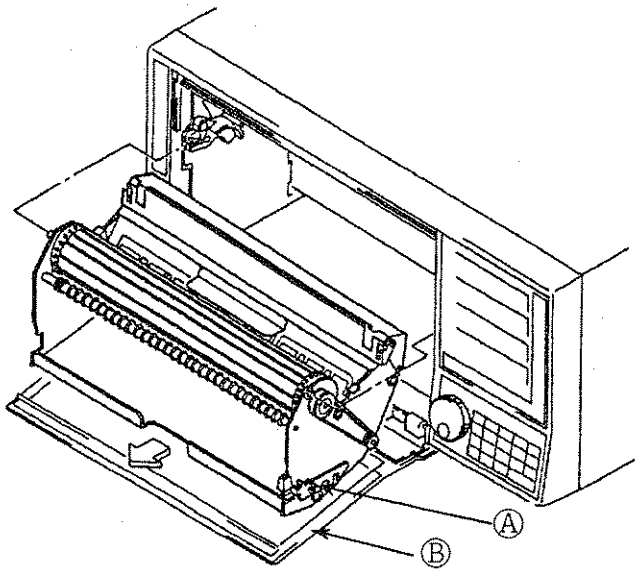


Figure 6.2

(4) Pull out the ribbon slightly from the ribbon cassette andnstall the ribbon onto the two guide pins. At this time,the ribbon adjustment knob must face down. (Figure. 6.3)
(5) Move the ribbon cassette approx. 20 mm to the right beyondthe printer carriage with the ribbon passed through the twoguide pins. (Figure. 6.4)
(6) Move that ribbon cassette back by approx. 10 mm toward theguide pins. Be sure to install the ribbon to the guide roller by dropping the slackened ribbon on the roller section so as to cover the front and rear of the printer head. (Figure. 6.5)
(7) Bring the ribbon cassette to the middle of the recorder, then change it from the right hand to the left hand to prevent the right hand from coming into contact with the pen carriage. Insert half of the cassette into the square hole on the right side plate and push the angled section at the end of the cassette. (Figure. 6.6)
(8) Push the cassette into the square hole on the right sideplate until it latches with a click. (Figure. 6.7)
(9) When the slack ribbon falls below the wire dot printer, repeat the above procedure to remove ribbon slackening.

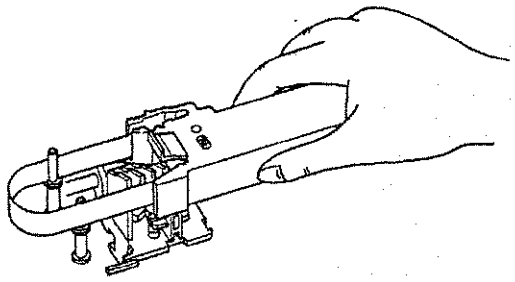


Figure 6.3

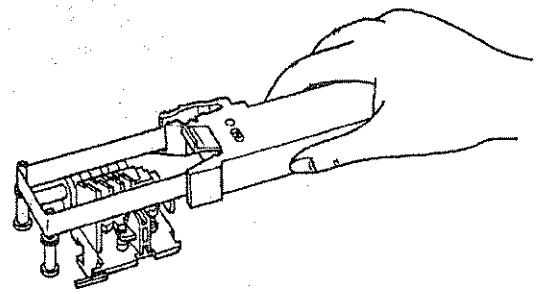


Figure 6.4

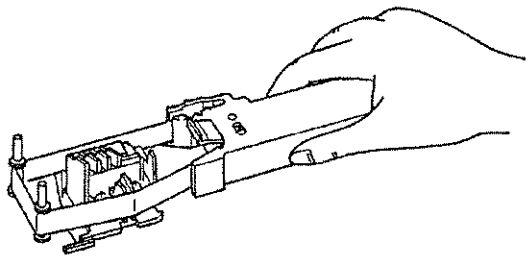


Figure 6.5

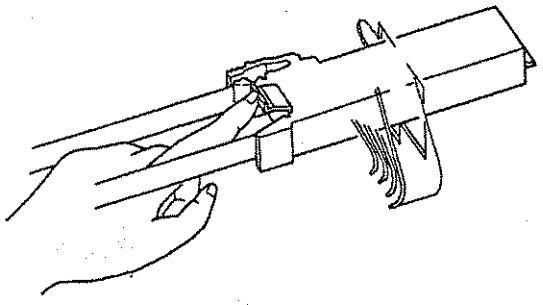


Figure 6.6

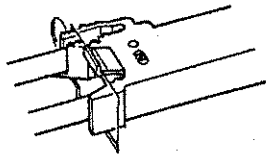


Figure 6.7

(10) When replacing the ribbon cassette, pinch the cassette latchlevers, then pull the cassette out of the hole. (Figure. 6.8)Use the same procedure when installing new cassettes.

(11) Fit the projections on the chart tray into the notches inhe recorder and push the tray toward the recorder untilit clicks (See Figure. 6.9).

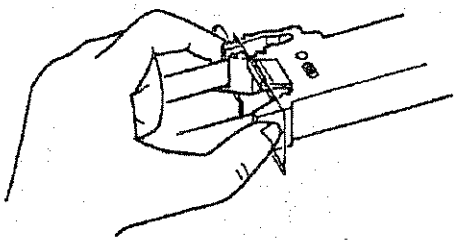


Figure 6.8

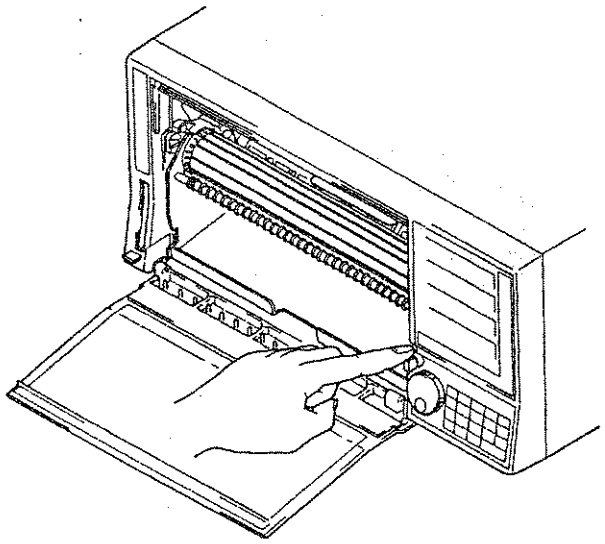


Figure 6.9

6.2.2 Chart Loading and Replacement

Chart replacement can be performed whether the power is turned on or not.

(1) Ruffle both ends of the chart so that the chart sheets can be fed one by one.(See Figure. 6.10).

(2) Open the front panel and remove the chart tray from the recorder. (See Figures. 6.1 thru 6.3)

(3) Remove the chart holding roller from the unit. Because there is a spring mechanism at the left of the roller, pushthe roller leftward to remove it. (Figure. 6.11)

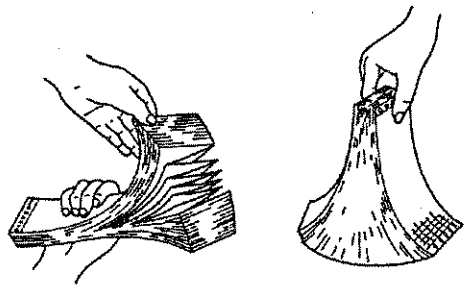


Figure 6.10

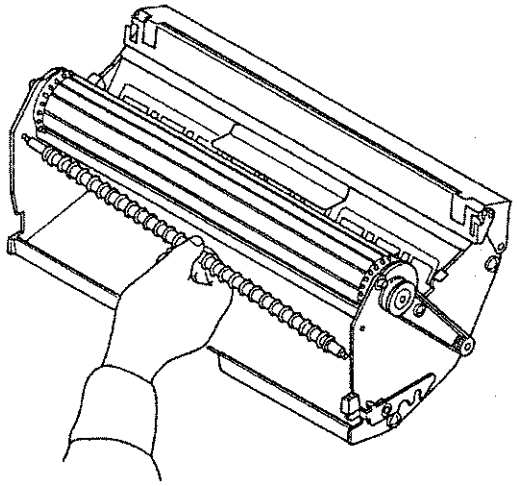


Figure 6.11

(4) Lift up both knobs of the metal chart holder at the rear section of the chart tray in the direction of the arrows. (see Figure. 6.12)

(5) Set the chart so that the round holes in the chart are positioned at the left and the chart end with both edges cut off is positioned to face you. (Figure. 6.13)

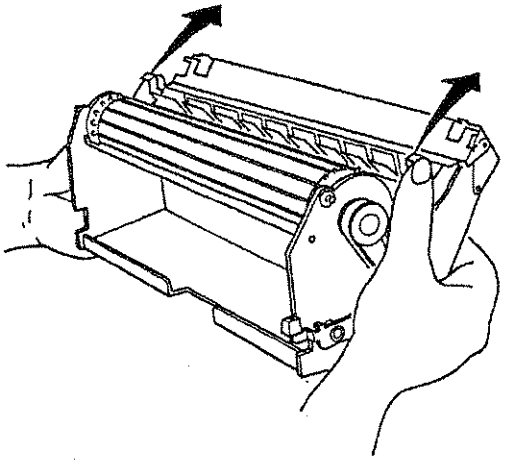


Figure 6.12

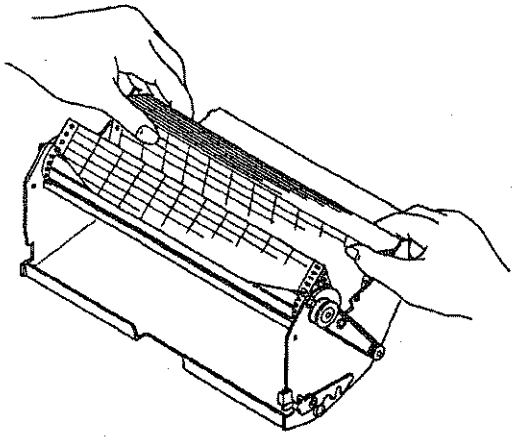


Figure 6.13

(6) To install the chart in parallel with the sprockets at both sides, align the ruled line Ⓐ indicated to the chart right and left edges in 5cm intervals with the follows Ⓑ located on the right and left side panels of the cassette.

(7) According to the numbers ① to ③ shown with the arrows, reinstall the chart bolding roller and metal holder in place (attach). In this case, the metal projections on the right and left sides should be matched with the oval holes on the right and left sides panels of the cassette securety as sbown with the arrow ③.

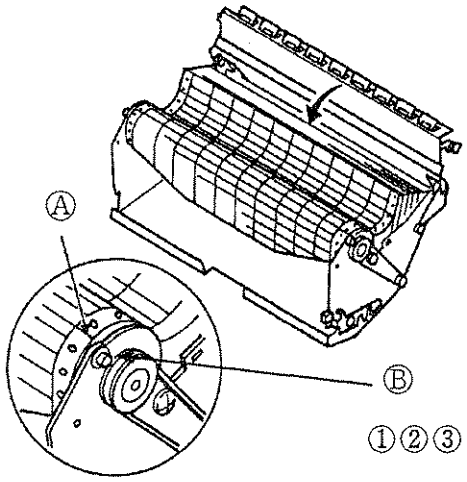


Figure 6.14

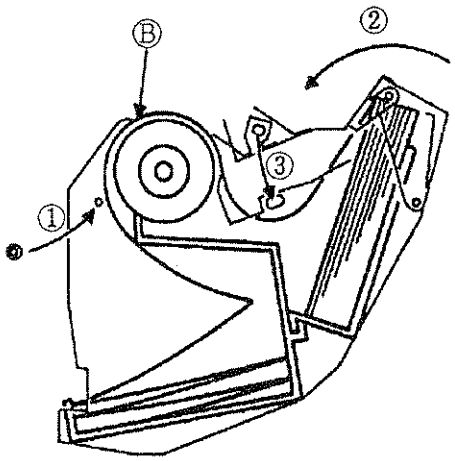


Figure 6.15

(8) Return both the right and left chart holders to their places on the housing holder. (See Figure. 6.12.)

(9) Set the projecting sections of the housing unit to the recorder support notch and push the unit to the recorder until a locking sound is heard. (See Figure 6.10.)

(10) Turn ON the power and press the FEED pushbutton on the left front panel of the recorder to feed more than three folded portions of the chart to the chart receiving section. In this case, make sure that the chart is feeding normally. Even when the chart is fed manually, press the FEED button to make sure that the feeding operation is normal.If the chart does not feed correctly, repeat the procedure from step (2) above.

(11) When the chart is nearly finished, a vermilion band indicating "RENEW CHART" appears on the chart. When this appears, install a new recorder chart.

(12) When the chart is finished, the CHART END indicator lights up at the top of the front panel. When this happens, replace the chart with a new one by following the procedure described in steps (1) to (10) above.

Note: Always use recorder charts (B9619AH) sent from Yokogawa Electric as use of other charts may cause problems.

6.2.3 Pen Cartridge Mounting and Replacement

Replace pen cartridges with the power supply OFF.

(1) Open the front door.

(2) It is recommended that the pens be mounted or replaced after the chart tray has been removed.

Press the tray at the right of the chart tray andremove the unit from the recorder (See Figure. 6.2.).

The pens can also be replaced without removing the chart tray, but it is rather difficult.

(3) Remove the cap from the pen cartridge and insert it into the pen cap holder at the bottom of the inside of the front door for storage.

(4) Install a pen cartridge to the holder.

Make sure that a pen corresponding to the pen number and color shown on the pen holder has been installed. Note, however, that pens with different numbers and colors can also be mounted.

When installing the cartridge, insert it into the holder so that the projection at the rear of the cartridge is positioned below the pen cartridge shaft, then press it onto the holder (Figure. 6.16).

Cartridge installation is complete when a locking sound is heard and the pen is flush with the holder.

(5) Pens can be removed from the pen holder by lifting the center portion of the cartridge upward (Figure. 6.17).

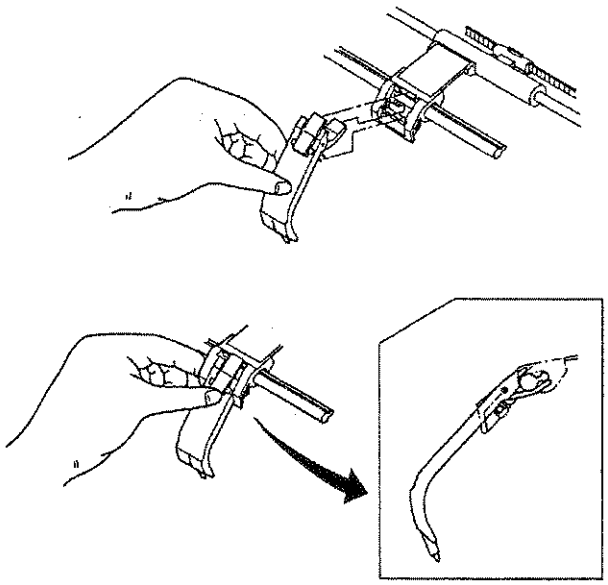


Fig 6.16

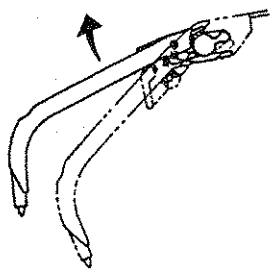


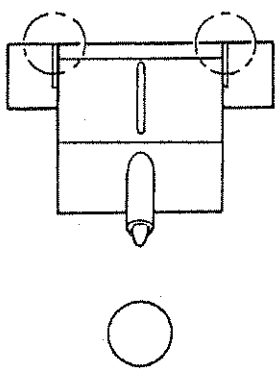
Fig 6.17

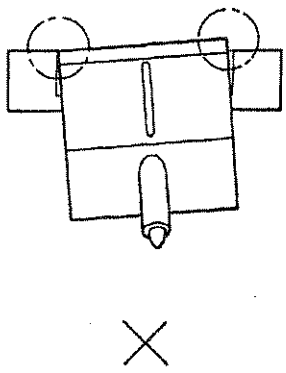
(6) There are three types of pens; standard, high-speed and low-speed.
A selection guide showing how to distinguish between them is set out below.

Standard	:	B9586 Y ☐ is used for normal recording with apen recording speed of about 800 mm / s or less Color of the bracket at the rear of the pen : Gray
High-speed type	:	B9586 Z ☐ is used for recording high-speed phenomenon requiring a pen recording speed of more than 800 mm/s color of the bracket at the rear of the pen : Blue
Low-speed type	:	B9586 X ☐ is used for low-speed feeding with a chart feed speed of about 100 mm/h or less Color of the bracket at the rear of the pen : White

Notes:

1. Forcing the pen holders right and left with the power supplied may damage their function.
2. If the recorder is not used for a long time, remove the pens and always cover them with pen caps.
   When the pens are stored in a packing bag and sealed securly, storage life will be lengthened.
3. A pen cartridge has latch sections at its right and left.
   Make sure that both latches are firmly set and that the cartridge is flush with the holder.
   Note that an inclined pen cartridge will not record correctly.





6.2.4 Battery Replacement

Set data protection batteries are installed prior to delivery.

(1) If the MAIN BAT errer message is displayed whil the power is turned on replace the batteries.

(2) Turn the power supply OFF and unscrew 4 screws; 2 on top of the recorder and 2 at the rear, using a Phillipsscrewdriver (Fig. 6.18).

(3) Pull the top cover to the rear to remove it. There is lithium battery pack on the right side when viewed from the front (Fig. 6.19). The battery pack incorporates lead wires and connectors.

(4) Remove the battery from the recorder using a Phillips screwdriver and then take the leads and connector off the battery.

(5) Mount a new battery (Part No. : B9588ZB) onto the connector of the main board from which the used battery was removed.

(6) Fix the battery in place with a screw.

(7) Install the cover to complete replacement.

Note:

Replacing the battery erases the set data. If the set data is required, store it in an IC card.

(For storing the set data, see Section 6.4.13.)

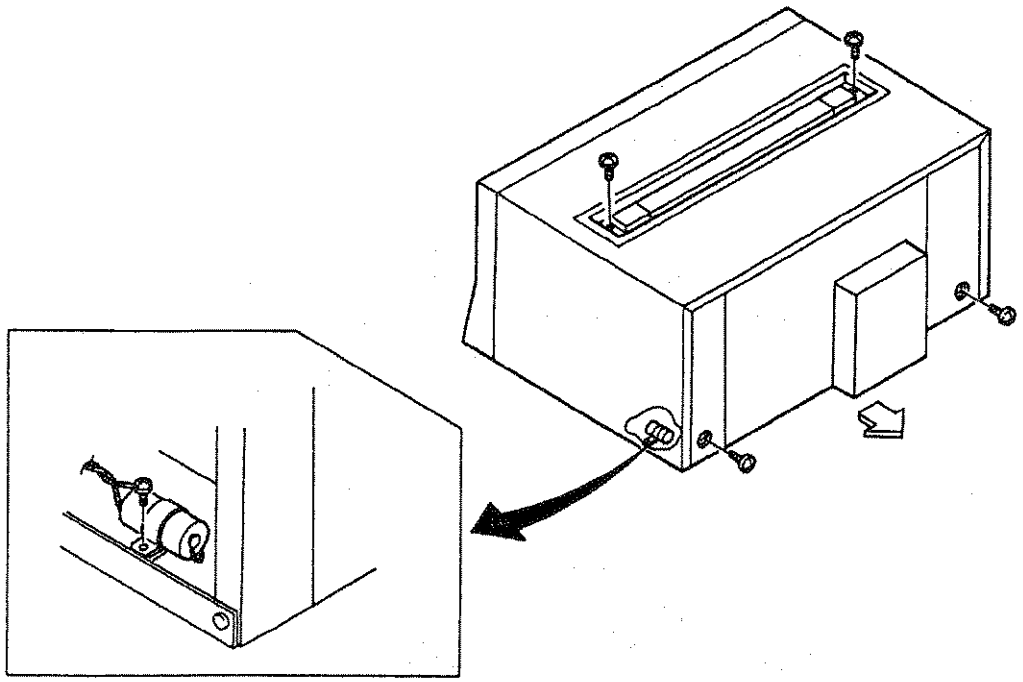


Figure 6.19

Figure 6.18

6.2.5 Battery Installation and Replacement (from the IC memory card)

The following describes the IC memory card set data protection battery installation and replacement procedure.

(1) Hold the IC memory card so that the side which shows the part number faces upward.
(2) Place your finger nail in the battery holder groove and pull it forward to take out the battery holder (Fig. 6.20).
(3) Insert a new battery (B9586JU or B9586JV : optional) into the battery holder.
(4) Insert the battery holder into the IC memory card.
This completes battery installation upon delivery. The following describes how to replace the battery.
(5) While operating the memory card menu, if the error message * * CARD BAT * * is displayed, the batteris are worn out, so replace the batteries. When the batteries are not installed in the recorder, the batttery error cannot be detected.
(6) The battery should be removed with the recorder power supply set to ON and the IC memory card installed in the recorder Note that replacing the battery when the power is OFF, or after the card has been removed from the recorder, erases the set data.
(7) Place your finger nail into the battery holder groove at the near right of the IC memory card to pull out the battery holder.
(8) Replace the battery with a new one and return the battery holder to the IC memory card.
This completes IC battery replacement.

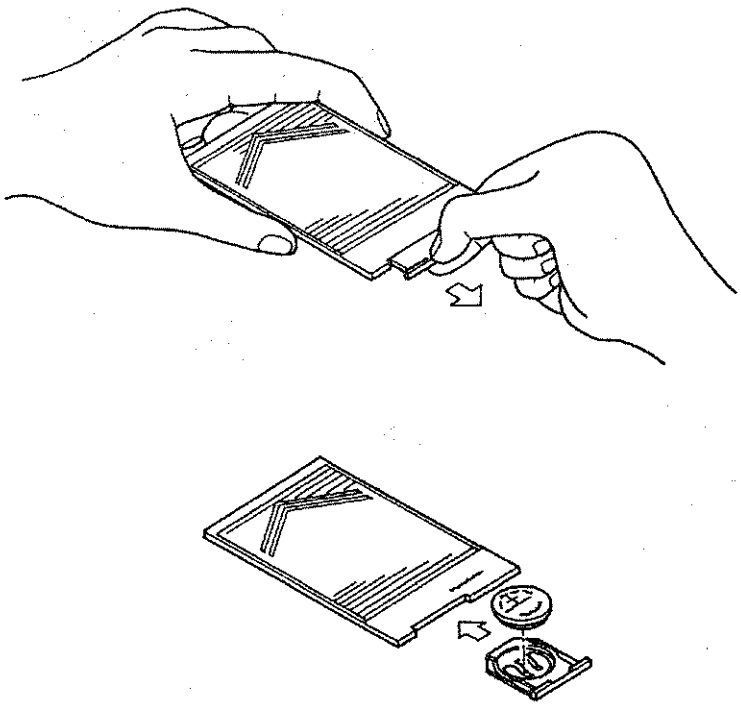


Figure 6.20

6.2.6 Front Door Removal

The LR4100 allows you to remove the front door so that the space available can be used effectively. The following describes removal and installation of the front door.

(1) Pull the front door forward. There is a front door removal slide pin at the bottom right of the front door (Fig. 6.21).

(2) Place your finger nail on the slide pin projection and slide it to the left. This allows the front door to be removed.

(3) When mounting the door, insert the slide pin into the recorder pin hole and fasten the door.

Note:

If the chart tray is fully loaded with a chart when the front door is removed, the chart may jump out of the recorder. Therefore, it is recommended that the recorder be used with the front door installed whenever possible.

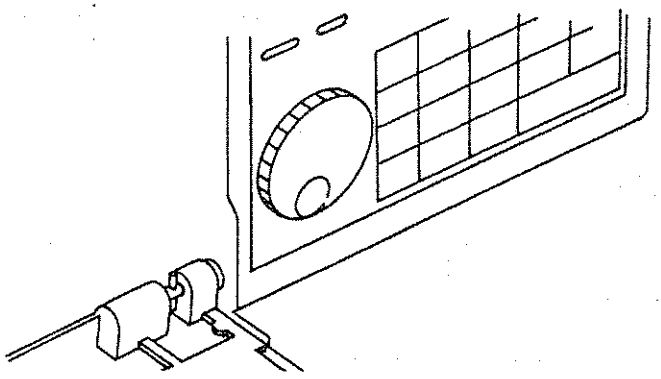


Figure 6.21

6.3 Turning the Power Supply ON

Turn ON the power on the front panel. The operation andprogram keys are set prior to shipment.

(1) Operation key

Key	Initial setting status
DISPLAY SELECT	DIGITAL
□CHART START	OFF
FEED	OFF
PENLIFT	UP
MANUAL PRINT	OFF
LIST	OFF
MANUAL MESSAGE	OFF
□POC	OFF
MEM CARD LOCAL	LOCAL (with GP-IB)
AUX KEY LOCK	OFF
□ RECORD	OFF

(2) Program key

Key	Initial setting status	
CHART SPEED	10mm / M	
◀RANGE▶ RANGE	MODE	VOLT
	RANGE	200V
	SPAN L	0.00V
	SPAN R	200.00V
	FILTER	OFF
◀ZERO▶ ◀SPAN▶	ZERO	0.00 to 200.00V
	SPAN	0.00 to 200.00V
RECORD AREA ADJ	0 to 100%	
AUX	ALARM	OFF
	TAG No.	CH
	MESSAGE	Space
	RCD	can not set
	RAM CLEAR	NO

6.4 Setting

Precautions

① Note that the number of display rows differs depending on the number of input channels between the setting panel described here and the actual setting panel.

② Depress the keys with your finger, when setting data.
Depress with nails or using a sharp tool may cause the damage to the instruments.

6.4.1 Setting the Chart Feed Speed

Two modes; standard and program, are used in setting chart feed speed.

(1) Standard mode

Function : Selects the chart feed speed corresponding to that of analog recorders via the function keys and setting knob.

[Key operation]	[Setting display]	[Description]
CHART SPEED (F3)	CHART SP1 : 10mm/H ← → mm/H mm/M	Press the CHART SPEED function key. If the speed is to be changed from mm/M to mm/H, press function key F3.
Setting knob		Set chart feed speed with the setting knob. Chart feed speeds that can be selected in the standard mode are shown in Table 6.1.
ENTRY ENTRY	CHART SP1 : 100mm/H ← → mm/H mm/M	Pressing the ENTRY key twice completes setting. Then, the display returns to the original status.

(Because setting becomes valid when the key is pressed once, press the ENTRY key to check to see if the chart is fed at the rate set.)

Table 6.1 Standard Mode Chart Feed Speed

mm / min mm / h	10	12	20	30	50	60	75
	100	120	150	200	300	500	600
	750	1000	1200				
*inch / min inch / h	0.5	1	1.2	2	3	5	6
	10	12	20	30	45		

* For transferring to inch series, see Section 6.4.14 Set Up Mode.

(2) Program mode

Function : Allows the recorder to set chart feed speed in 1 mm units by pressing the ALPHANUMERIC key.

[Key operation]	[Setting display]	[Description]
CHART SPEED (F3) N 0 # ⟆ C 9 S	CHART SP1 : 10mm/H ← → mm/H mm/M	Press the CHART SPEED function key. To change the speed from mm/M to mm/H, press function key F3. Set the data (digits) you desire by pressing the ALPHANUMERIC key.
ENTRY ENTRY	CHART SP1 : 100mm/H ← → mm/H mm/M	Pressing the ENTRY key twice completes setting. Then, the display returns to the original status.

(Because setting becomes valid when the key is pressed once, press the ENTRY key to check to see if the chart is fed at the rate set.)

6.4.2 Measuring Range Setting

Two modes, standard and program, can be used in setting the measuring range.

(1) Standard mode

Function : Selects the measuring range corresponding to that of analog recorder via the function keys, cursor keys and setting knob.

[Key operation] **[Setting display]** **[Discription]**

RANGE

```
1CH  200V 0.00~200.00
2CH  200V 0.00~200.00
3CH  200V 0.00~200.00
4CH  200V 0.00~200.00
```

Pressing the RANGE function key allows the display unit to show the present measuring range for every channel.
The cursor blinks at the CH1 setting display, indicating that the CH1 measuring range can be changed.

```
1CH  5V   0.000~5.000
2CH  200V 0.00~200.00
3CH  200V 0.00~200.00
4CH  200V 0.00~200.00
```

Turning the setting knob transfers the CH1 measuring range contents shown in Table 6.2 in the order of DC voltage, thermocouple and RTD successively.
Select any range.

(Lighting up of the LED at the top right of the setting knob indicates that setting knob operation is valid. Further, the pen moves corresponding to range change.)

or

```
1CH  5V   0.000~5.000
2CH  200V 0.00~200.00
3CH  200V 0.00~200.00
4CH  200V 0.00~200.00
```

Then, press the cursor key below the setting knob to shift the cursor to the next channel. This allows you to set the measuring range to the next channel.

ENTRY
ENTRY

```
1CH  5V    0.000~5.000
2CH  T     -200.0~400.0
3CH  50mV    0.00~50.00
4CH  10V   0.000~10.000
```

After the final channel measuring range has been set, press the ENTRY key twice. This enables the display to return to the original status.

Table 6.2 Standerd Mord Range and Span Table

DC Voltage Range				SPAN
High Sensitivity			100 μV	0 to 100μV
			200 μV	0 to 200μV
			500 μV	0 to 500μV
	Medium Sensitivity		1 mV	0 to 1 mV
			2 mV	0 to 2 mV
			5 mV	0 to 5 mV
		Low Sensitivity	10 mV	0 to 10mV
			20 mV	0 to 20mV
			50 mV	0 to 50mV
			100 mV	0 to 100mV
			200 mV	0 to 200mV
			500 mV	0 to 500mV
			1 V	0 to 1 V
			2 V	0 to 2 V
			5 V	0 to 5 V
			10 V	0 to 10 V
			20 V	0 to 20 V
			50 V	0 to 50 V
			100 V	0 to 100 V
			200 V	0 to 200 V

Temperature Range		SPAN °C	SPAN °F
TC	R	0.0 to 1700.0℃	100 to 3200 °F
	S	0.0 to 1700.0℃	100 to 3200 °F
	B	0.0 to 1800.0℃	100 to 3300 °F
	K	−200.0 to 1300.0℃	−300.0 to 2400.0°F
	E	−200.0 to 800.0℃	−300.0 to 1400.0°F
	J	−200.0 to 1100.0℃	−300.0 to 2000.0°F
	T	−200.0 to 400.0℃	−300.0 to 700.0°F
	N	0.0 to 1300.0℃	100.0 to 2300.0°F
	W	0.0 to 2300.0℃	100 to 4100 °F
	L (DIN)	−200.0 to 900.0℃	−300.0 to 1600.0°F
	U (DIN)	−200.0 to 400.0℃	−300.0 to 700.0°F
	Kp VS Aμ7Fe	0.0 to 300.0 K	0.0 to 300.0 K
RTD	Pt100: 1	−200.0 to 800.0℃	−300.0 to 1500.0°F
	Pt100: 2	−200.0 to 400.0℃	−300.0 to 700.0°F
	Pt100: 3	−100.0 to 100.0℃	−200.0 to 300.0°F
	Pt50 : 1	−200.0 to 600.0℃	−300.0 to 1100.0°F
	Pt50 : 2	0.0 to 600.0℃	0.0 to 1100.0°F
	Pt100: 1/JPt	−200.0 to 600.0℃	−300.0 to 1100.0°F
	Pt100: 2/JPt	−200.0 to 400.0℃	−300.0 to 700.0°F
	Pt100: 3/JPt	−100.0 to 100.0℃	−200.0 to 300.0°F
	Pt50 : 1/JPt	−200.0 to 600.0℃	−300.0 to 1100.0°F
	Pt50 : 2/JPt	0.0 to 600.0℃	0.0 to 1100.0°F
	Ni100 (DIN)	0.0 to 100.0℃	0.0 to 300.0°F
	Ni100 (SAMA)	−200.0 to 200.0℃	−300.0 to 400.0°F
	J263*B	0.0 to 300.0 K	0.0 to 300.0 K

(2) Program mode

Function :

Allows the recorder to set application modes other than the standard mode per channel to the program as shown in the tables below.

Seven settings are available in the standard function. For details, see the succeeding pages.

[OFF]

```
4CH
MODE : OFF
```

[VOLT]

```
4CH
MODE : VOLT
RANGE : 5V
SPAN  L : 0.000V
SPAN  R : 5.000V
FILTER : OFF
```

[TC]

```
4CH
MODE : TC
TYPE : S
SPAN  L :    0.0 °C
SPAN  R : 1760.0 °C
FILTER : OFF
```

[RTD]

```
4CH
MODE : RTD
TYPE : Pt100:1
SPAN L :   0.0 °C
SPAN R : 100.0 °C
FILTER : OFF
```

[DELTA]

```
4CH
MODE : DELT
REF CH : 1CH
SPAN L : 0.000mV
SPAN R : 5.000mV
FILTER : 1Hz
```

[SCALE]

```
4CH
MODE : SCALE/VOLT
RANGE : 200V
TYPE:(IN CASE OF
              SCALE/TC)
SPAN L :   0.00V
SPAN R : 200.00V
SCALE L : 1%
SCALE R : 100%
UNIT : %
FILTER : 0.1Hz
```

[COPY]

```
4CH
MODE : COPY CH:1CH
```

(Note) For the one-pen type, the upper most CH setting input is not provided.

[OFF]

Function :

Turns channels not used for measuring OFF.

Setting item : ① Channel Selection
② Channel OFF

Setting example : Setting CH4 to OFF

[Key operation]	[Setting display]	[Description]
SHIFT	1CH MODE : VOLT RANGE : 5V SPAN L : 0.000V SPAN R : 5.000V FILTER : OFF 1CH 2CH 3CH 4CH	Press the RANGE function key after the SHIFT key to enable the setting display to appear. The display unit always shows the present CH1 setting display. Press the F4 key to select CH4.
RANGE F4		
F1	4CH MODE : VOLT RANGE : 5V SPAN L : 0.000V SPAN R : 5.000V FILTER : OFF ↓ OFF VOLT TC RTD ↓ DELT SCAL COPY	The display unit shows the present CH4 setting contents. Press the F1 key to set the channel OFF mode.
ENTRY ENTRY	4CH MODE : OFF ↓ OFF VOLT TC RTD ↓ DELT SCAL COPY	The OFF mode appears. After confirming it, press the ENTRY key. This validates the setting contents. To complete the setting, press the ENTRY key once more. This enables the display to return to the original status.

Note : If the range is set OFF, alarms set so far will be released automatically. Apart from alarms, Auto Span Shift (and partial contraction / expansion mode) is also released automatically.

[VOLT]

Function :

Setting to measure VOLT (voltage).

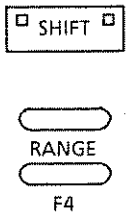
Setting item :

①	CH	:	Channel No.
②	RANGE	:	Measuring range
③	SPAN L	:	Span (measuring range) left value
④	SPAN R	:	Span (measuring range) right value
⑤	FILTER	:	Low-pass-filter frequency

Setting example :

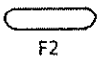
①	CH	:	4CH
	MODE	:	VOLT
②	RANGE	:	5V
③	SPAN L	:	1.000 V
④	SPAN R	:	5.000 V
⑤	FILTER	:	1 HZ

[Key operation] | **[Setting display]** | **[Description]**



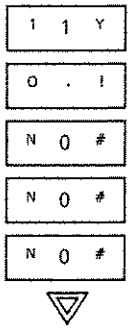
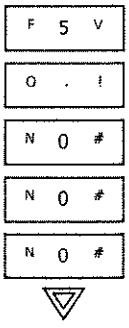

```
1CH
MODE : VOLT
RANGE : 5V
SPAN L : 0.000V
SPAN R : 5.000V
FILTER : OFF
 1CH 2CH 3CH 4CH
```

Press the function key "RANGE" after the SHIFT key to show enable the setting display panel. The display panel always shows the setting display panel corresponding to the present CH1.
Press the F4 key to select CH4.

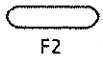



```
4CH
MODE : OFF




↓ OFF  VOLT    TC  RTD
↓ DELT SCAL  COPY
```

When the channel is selected, the cursor shifts automatically to MODE. Press the F2 key to set MODE to VOLT.

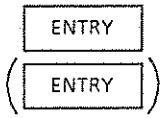
[Key operation]	[Setting display]	[Description]
	4CH MODE : VOLT RANGE : 2V SPAN L : 0.0000V SPAN R : 2.0000V FILTER : OFF	Select the range (5 V) using the setting knob. After range selection, press the cursor key to move to the next setting.
	4CH. MODE : VOLT RANGE : 5V SPAN L : 0.000V SPAN R : 5.000V FILTER : OFF ← → del	Set SPAN L using the ten key. The span setting range is as shown in Table 6.2. The number of digits is changed by entering numerics or by pressing the F1 (←) or F2 (→) keys. Unnecessary numerics can be deleted by pressing the F3 (del) key. After the setting ends, press the cursor key. When no numeric change is required, press the cursor key to move to the next setting.
	4CH MODE : VOLT RANGE : 5V SPAN L : 1.000V SPAN R : 5.000V FILTER : OFF ← → del	Set the right span (SPAN R) using the ten key. The setting procedure is the same as for the left span. After setting is finished, press the cursor key.

[Key operation] [Setting display] [Description]




```
4CH
MODE : VOLT
RANGE : 5V
SPAN L : 1.000V
SPAN R : 5.000V
FILTER : OFF
 0.1 1Hz OFF
```

Set the low pass filter frequency to 1Hz by pressing the F2 key.




```
4CH
MODE : VOLT
RANGE : 5V
SPAN L : 1.000V
SPAN R : 5.000V
FILTER : 1Hz
 0.1 1Hz OFF
```

Press the Entry key.
The details set at this time are used for the measurement, and the cursor returns to the CH position. Continue program setting as required, and when it is necessary to end the setting, press the ENTRY key to return the display to the original display.

Table 6.2 Span Setting Range

Input Range				Setting Range
High Sensitivity			100 µV	-110.00 to 110.00 µV
			200 µV	-220.00 to 220.00 µV
			500 µV	-550.0 to 550.0 µV
	Medium Sensitivity		1 mV	-1.1000 to 1.1000 mV
			2 mV	-2.2000 to 2.2000 mV
			5 mV	-5.500 to 5.500 mV
		Low Sensitivity	10 mV	-11.000 to 11.000 mV
			20 mV	-22.000 to 22.000 mV
			50 mV	-55.00 to 55.00 mV
			100 mV	-110.00 to 110.00 mV
			200 mV	-220.00 to 220.00 mV
			500 mV	-550.0 to 550.0 mV
			1 V	-1.1000 to 1.1000 V
			2 V	-2.2000 to 2.200 V
			5 V	-5.500 to 5.500 V
			10 V	-11.000 to 11.000 V
			20 V	-22.000 to 22.000 V
			50 V	-55.00 to 55.00 V
			100 V	-110.00 to 110.00 V
			200 V	-220.00 to 220.00 V

* Exceeding the setting range causes overrange

[TC]

Function :

Setting to perform measurement by TC

Setting item :

①	CH	:	Channel No.
②	Type	:	Thermocouple type
③	SPAN L	:	Span (measuring range) left value
④	SPAN R	:	Span (measuring range) right value
⑤	FILTER	:	Low-pass-filter frequency

Setting example :

①	CH	:	4CH
②	TYPE	:	T
③	SPAN L	:	100 °C
④	SPAN R	:	300 °C
⑤	FILTER	:	OFF

[Key operation] | **[Setting display]** | **[Description]**

SHIFT

RANGE

```
1CH
MODE : VOLT
RANGE : 5V
SPAN L : 0.000V
SPAN R : 5.000V
FILTER : OFF
   1CH 2CH 3CH 4CH
```

Press the function key "RANGE" after the SHIFT key to show the setting display panel. The display panel always shows the setting display panel corresponding to the present (No.1) CH.

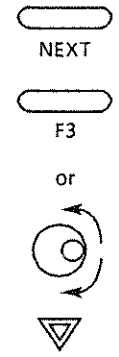
F4

```
4CH
MODE : OFF




↓ OFF  VOLT  TC  RTD
↓ DELT SCAL COPY
```

Press the F4 key to select CH4. When the channel is selected, the cursor shifts automatically to MODE. Press the F3 key to set MODE to TC.

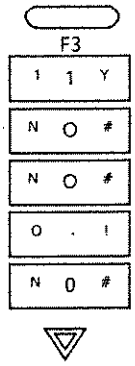
F3

[Key operation] **[Setting display]** **[Description]**



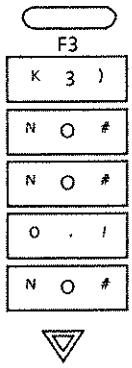

```
4CH
MODE : TC
TYPE : S
SPAN L :    0.0 ℃
SPAN R : 1760.0 ℃
FILTER : 1Hz
↓ R   S   B   K
↓ E   J   T   N
↓ W   L   U   Kpvs
```

Set thermocouples (type T) by pressing the NEXT and F3 keys or by turning the setting knob. After the setting ends, press the cursor key.




```
4CH
MODE : TC
TYPE : T
SPAN L : -200.0 ℃
SPAN R :  400.0 ℃
FILTER : 1Hz
  ←   →   del
```

Set SPAN L (100.0℃) by pressing the numeric keypad. The span setting range is as shown in Table 6.3. Press the cursor key.




```
4CH
MODE : TC
TYPE : T
SPAN L : 100.0 ℃
SPAN R : 400.0 ℃
FILTER : 1Hz
  ←   →   del
```

Set SPAN R (300.0) by pressing the numeric keypad, then press the cursor key.

[Key operation]	[Setting display]	[Description]
F3	4CH MODE : TC TYPE : T SPAN L : 100.0 ℃ SPAN R : 300.0 ℃ FILTER : 1Hz 0.1 1Hz OFF	Press the F3 key to turn OFF the filter. Press the ENTRY key.
ENTRY ENTRY	4CH MODE : TC TYPE : T SPAN L : 100.0 ℃ SPAN R : 300.0 ℃ FILTER : OFF	The details set at this time are used for the measure- ment and the cursor returns to the CH position. Continue program settings as required, then when it is necessary to end the setting, press the ENTRY key.

Table 6.3 Spans Setting Range

Input Range	°C	°F
R	0.0 to 1760.0	32 to 3200
S	0.0 to 1760.0	32 to 3200
B	0.0 to 1820.0	32 to 3308
K	−200.0 to 1370.0	−328.0 to 2498.0
E	−200.0 to 800.0	−328.0 to 1472.0
J	−200.0 to 1100.0	−328.0 to 2012.0
T	−200.0 to 400.0	−328.0 to 752.0
N	0.0 to 1300.0	32.0 to 2372.0
W	0.0 to 2315.0	32 to 4199
L (DIN)	−200.0 to 900.0	−328.0 to 1652.0
U (DIN)	−200.0 to 400.0	−328.0 to 752.0
Kp vs Au7Fe	0.0 to 300.0K	0.0 to 300.0K

[RTD]

Function :

Setting to perform measurement by RTD

Setting item :

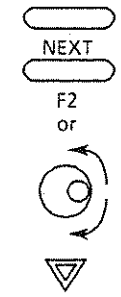
①	CH	:	Channel No.
②	Type	:	RTD type
③	SPAN L	:	Span (measuring range) left value
④	SPAN R	:	Span (measuring range) right value
⑤	FILTER	:	Low-pass-filter frequency

Setting example :

①	CH	:	4CH
②	TYPE	:	Pt100 : 1/JPt
③	SPAN L	:	0.0 °C
④	SPAN R	:	50.0 °C
⑤	FILTER	:	1Hz

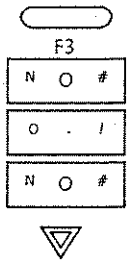
[Key operation]	[Setting display]	[Description]
SHIFT RANGE F4	1CH MODE : VOLT RANGE : 5V SPAN L : 0.000V SPAN R : 5.000V FILTER : OFF 1CH 2CH 3CH 4CH	Press the function key "RANGE" after the SHIFT key to show the setting display panel, which always displays the setting display panel corresponding to the present CH1.
F4	4CH MODE : OFF ↓ OFF VOLT TC RTD ↓ DELT SCAL COPY	Press the F4 key to select CH No.4. When the channel is selected, the cursor shifts automatically to MODE. Press the F4 key to set MODE to RTD.

[Key operation] **[Setting display]** **[Description]**



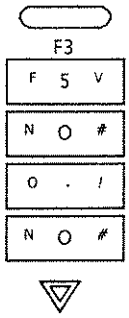

```
4CH
MODE : RTD
TYPE : Pt100:1/JPt
SPAN L : -200.0 °C
SPAN R :  600.0 °C
FILTER : OFF
↓ Pt1 Pt2 Pt3 Pt4
↓ Pt5 Pt1J Pt2J Pt3J
↓ Pt4J Pt5J Ni1D Ni1S
↓ J263
```

Selecting the RTD type (Pt 100 : 1/JPt)
The type can be selected by pressing the F1 to F4 keys or by turning the setting knob. Refer to table 6.4 for the relationship between RTD types, and their abbreviations.
After setting is finished, press the cursor key. (When the F1 to F4 keys are pressed, the cursor shifts automatically.)




```
4CH
MODE : RTD
TYPE : Pt100:1/JPt
SPAN L : -200.0 °C
SPAN R :  600.0 °C
FILTER : OFF
  ←   →   del
```

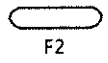
Set SPAN L (0.0 °C) by pressing the numeric keypad.
The span setting range is as shown in Table 6.4 Press the cursor key.




```
4CH
MODE : RTD
TYPE : Pt100:1/JPt
SPAN L :   0.0 °C
SPAN R : 600.0 °C
FILTER : OFF
  ←   →   del
```

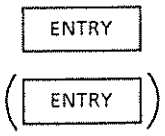
Set SPAN R (50.0 °C) by pressing the numeric keypad, then press the cursor key.

[Key operation] [Setting display] [Description]




```
4CH
MODE : RTD
TYPE : Pt100:1/JPt
SPAN L : 0.0 °C
SPAN R : 50.0 °C
FILTER : OFF
   0.1  1Hz  OFF
```

Press the F2 key to set the filter to 1 Hz.




```
4CH
MODE : RTD
TYPE : Pt100:1/JPt
SPAN L : 0.0 °C
SPAN R : 50.0 °C
FILTER : 1Hz
```

Press the ENTRY key. The details set at this time are used for the measurement and the cursor returns to the CH position.
Change the other CH setting when required, and when it is necessary to end the setting, press the ENTRY key.

Table 6.4 RTD Range

Menu Display	Display	Measuring Range	
		°C	°F
Pt1	Pt100: 1	− 200.0 to 850.0	− 328.0 to 1562.0
Pt2	Pt100: 2	− 200.0 to 400.0	− 328.0 to 752.0
Pt3	Pt100: 3	− 150.0 to 150.0	− 238.0 to 302.0
Pt4	Pt50 : 1	− 200.0 to 640.0	− 328.0 to 1184.0
Pt5	Pt50 : 2	− 50.0 to 600.0	− 58.0 to 1112.0
Pt1J	Pt100: 1/JPt	− 200.0 to 640.0	− 328.0 to 1184.0
Pt2J	Pt100: 2/JPt	− 200.0 to 400.0	− 328.0 to 752.0
Pt3J	Pt100: 3/JPt	− 150.0 to 150.0	− 328.0 to 302.0
Pt4J	Pt50 : 1/JPt	− 200.0 to 640.0	− 328.0 to 1184.0
Pt5J	Pt50 : 2/JPt	− 50.0 to 600.0	− 58.0 to 1112.0
Ni1D	Ni100/DIN	− 60.0 to 180.0	− 76.0 to 356.0
Ni1S	Ni100/SAMA	− 200.0 to 250.0	− 328.0 to 482.0
J263	J263 * B	0.0 to 300.0K	0.0 to 300.0K

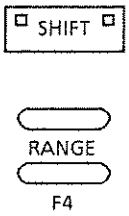
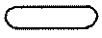
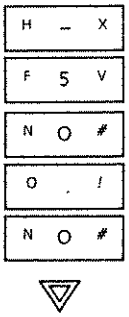
[DELTA]

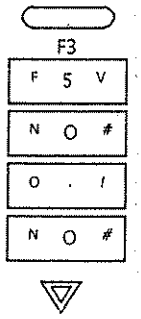
Function : Calculates the differential from the other channel (CH).

Setting item :
- ① CH : Which undergoes differential calculation
- ② REF CH : Reference channel
- ③ SPAN L : Span (measuring range) left value
- ④ SPAN R : Span (measuring range) right value
- ⑤ FILTER : Low-pass-filter frequency

Restrictions :
- ① The CH No. which undergoes differential calculation must be bigger than the reference CH No.
  Therefore if CH1 is specified to the CH which undergoes differentional calculation, DELTA mode cannot be selected.
- ② The CH No. which undergoes differential calculation and the reference CH RANGE (voltage) or TYPE (temperature) must be the same.
- ③ If the CH No. which undergoes differential calculation, or the reference CH MODE, RANGE or TYPE is changed, the DELTA mode is released automatically.
- ④ The differential calculation cannot be set when MODE is other than VOLT, TC and RTD.
- ⑤ For the one-pen model, DELTA mode cannot be selected.

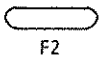
Setting example :
- ① CH : 4CH
- ② REF CH : 2CH (TC, TYPE T)
- ③ SPAN L : -50.0 ℃
- ④ SPAN R : 50.0 ℃
- ⑤ FILTER : 1Hz

[Key operation]	[Setting display]	[Description]
	1CH MODE : VOLT RANGE : 5V SPAN L : 0.000V SPAN R : 5.000V FILTER : OFF 1CH 2CH 3CH 4CH	Press the function key "RANGE" after the SHIFT key to show the setting display panel. The display panel always shows the setting display panel corresponding to the present CH1.
	4CH MODE : OFF ↓ OFF VOLT TC RTD ↓ DELT SCAL COPY	If the channel is selected, the cursor shifts to MODE automatically. Press the NEXT and F1 keys to set MODE to DELTA.
	4CH MODE : DELTA REF CH : 1CH SPAN L : -200.0 °C SPAN R : 400.0 °C FILTER : OFF 1CH 2CH 3CH 4CH	Set the reference CH (CH2).
	4CH MODE : DELTA REF CH : 2CH SPAN L : -200.0 °C SPAN R : 400.0 °C FILTER : OFF ← → del	Set SPAN L (-50.0°C) by pressing the numeric keypad. The span that can be set is as shown in Table 6.5. After completing setting, press the cursor key.



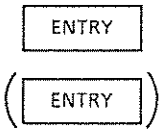

```
4CH
MODE : DELTA
REF CH : 2CH
SPAN L : -50.0 °C
SPAN R : 400.0 °C
FILTER : OFF
  ←    →    del
```

Set SPAN R (50.0 °C)
The decimal point position is corrected automatically during ENTRY by pressing the cursor key.




```
4CH
MODE : DELTA
TYPE : 2CH
SPA L :-50.0 °C
SPA R : 50.0 °C
FILTER : OFF
 0.1 1Hz OFF
```

Press the F2 key to set the filter frequency to 1 Hz.




```
4CH
MODE : DELTA
REF CH : 2CH
SPAN L :-50.0 °C
SPAN R :  50.0 °C
FILTER : 1Hz
```

Press the ENTRY key.
The details set at this time are used for the measurement, and as a result the cursor returns to the CH1 position. When completing the setting, press the ENTRY key again.

(1) Thermocouple

Table 6.5 DELTA Mode Setting Range

	°C	°F
	Range	Range
R	−1760.0 to 1760.0	−3200 to 3200
S	−1760.0 to 1760.0	−3200 to 3200
B	−1820.0 to 1820.0	−3295 to 3295
K	−1370.0 to 1370.0	−2498.0 to 2498.0
E	− 800.0 to 800.0	−1472.0 to 1472.0
J	−1100.0 to 1100.0	−2012.0 to 2012.0
T	− 400.0 to 400.0	− 752.0 to 752.0
N	−1300.0 to 1300.0	−2372.0 to 2372.0
W	−2315.0 to 2315.0	−4199 to 4199
L	− 900.0 to 900.0	−1562.0 to 1562.0
U	− 400.0 to 400.0	− 752.0 to 752.0
Kp vs Au 7Fe	− 300.0 to 300.0k	− 300.0 to 300.0K

(2) Resistance temperature detector

	°C	°F
	Range	Range
Pt100 : 1	− 850.0 to 850.0	−1562.0 to 1562.0
Pt100 : 2	− 400.0 to 400.0	− 752.0 to 752.0
Pt100 : 3	− 150.0 to 150.0	− 302.0 to 302.0
Pt50 : 1	− 640.0 to 640.0	−1184.0 to 1184.0
Pt50 : 2	− 600.0 to 600.0	−1112.0 to 1112.0
Pt100 : 1/JPt	− 640.0 to 640.0	−1184.0 to 1184.0
Pt100 : 2/JPt	− 400.0 to 400.0	− 752.0 to 752.0
Pt100 : 3/JPt	− 150.0 to 150.0	− 302.0 to 302.0
Pt50 : 1/JPt	− 640.0 to 640.0	−1184.0 to 1184.0
Pt50 : 2/JPt	− 600.0 to 600.0	−1112.0 to 1112.0
Ni100/DIN	− 180.0 to 180.0	− 356.0 to 356.0
Ni100/SAMA	− 250.0 to 250.0	− 482.0 to 482.0
J263•B	− 300.0 to 300.0K	− 300.0 to 300.0K

(3) Voltage

Range
+ 110% of each range Example : In 10mV range −11.000 to 11.000 mV

[SCALE]

Function :

Converts voltage outputs from various converters to the respective physical amounts, along with performing temperature range scaling.

Setting item :

①	CH	:	Channel No.
②	RANGE	:	Input type or TYPE
③	SPAN L	:	Span (measuring range) left value
④	SPAN R	:	Span (measuring range) right value
⑤	SCALE L	:	Scaling span left value
⑥	SCALE R	:	Scaling span right value
⑦	UNIT	:	Engineering unit (Up to 6 characters)
⑧	FILTER	:	Low - pass - filter frequency

Setting example :

①	CH	:	4CH
②	RANGE	:	5 V
③	SPAN L	:	1.000 V
④	SPAN R	:	5.000 V
⑤	SCALE L	:	0.00
⑥	SCALE R	:	100.00
⑦	UNIT	:	%
⑧	FILTER	:	1 Hz

[Key operation] **[Setting display]** **[Description]**

SHIFT

RANGE

F4

```
1CH
MODE : VOLT
RANGE : 5V
SPAN L : 0.000V
SPAN R : 5.000V
FILTER : OFF
   1CH 2CH 3CH 4CH
```

Press the function key "RANGE" after the SHIFT key to show the setting display panel. The display panel always shows the setting display panel corresponding to the present CH1. Press the F4 key to select CH4.

```
4CH
MODE : OFF




↓ OFF   VOLT   TC  RTD
↓ DELT  SCAL COPY
```

When the channel is selected, the cursor shifts automatically to MODE.
Press the NEXT and F2 keys to set MODE to SCALE.

NEXT

F2

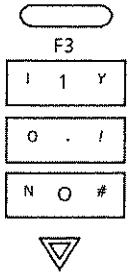
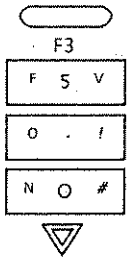
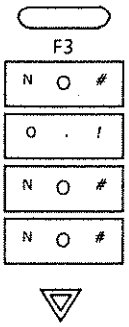
```
4CH
MODE : SCALE/VOLT
RANGE : 2V
SPAN L : 0.0000V
SPAN R : 2.0000V
SCALE L : 1.000ABC
SCALER : 10.000ABC
UNIT : ABC
FILTER : OFF
  VOLT   TC   RTD  COM
```

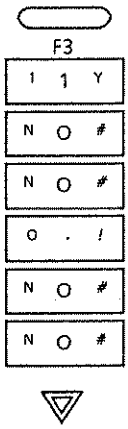
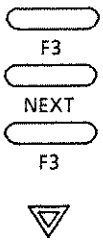
Press the F1 key to set SCALE MODE to VOLT (voltage). VOLT, TC (thermocouple), RTD (resistance temperature detector) and optional COM (communication) are available as SCALE MODES.

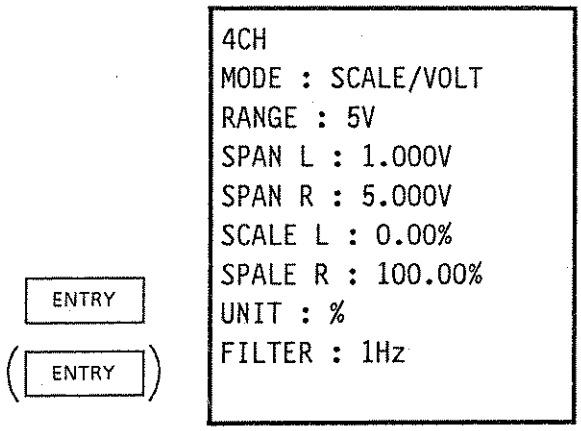
F1

```
4CH
MODE : SCALE/VOLT
RANGE : 2V
SPAN L : 0.0000V
SPAN R : 2.0000V
SCALE L : 1.000ABC
SCALE R : 10.000ABC
UNIT : ABC
FILTER : OFF
```

Select RANGE (5 V) by turning the setting knob, and after setting is finished, press the cursor key.

[Key operation]	[Setting display]	[Description]
	4CH MODE : SCALE/VOLT RANGE : 5V SPAN L : 0.000V SPAN R : 5.000V SCALE L : 1.000ABC SPALE R : 10.000ABC UNIT : ABC FILTER : OFF ← → del meas	Enter SPAN L (1.000 V), then press the cursor key. The decimal point position is corrected automatically during ENTRY. The application of meas, which is displayed on the menu at this time, is explained at the end of [SCALE].
	4CH MODE : SCALE/VOLT RANGE : 5V SPAN L : 1.000V SPAN R : 5.000V SCALE L : 1.000ABC SPALE R : 10.000ABC UNIT : ABC FILTER : OFF ← → del meas	Enter SPAN R (5.000 V) then, press the cursor key.
	4CH MODE : SCALE/VOLT RANGE : 5V SPAN L : 1.000V SPAN R : 5.000V SCALE L : 1.000ABC SPALE R : 10.000ABC UNIT : ABC FILTER : OFF ← → del	Set SCALE L (0.00), then press the cursor key.

[Key operation]	[Setting display]	[Description]
	4CH MODE : SCALE/VOLT RANGE : 5V SPAN L : 1.000V SPAN R : 5.000V SCALE L : 0.00ABC SPALE R : 100.00ABC UNIT : ABC FILTER : OFF ← → del	Set SCALE R (100.00), then press the cursor key.
	4CH MODE : SCALE/VOLT RANGE : 5V SPAN L : 1.000V SPAN R : 5.000V SCALE L : 0.00ABC SCALE R : 100.00ABC UNIT : ABC FILTER : OFF ↓ ← → del ↓ Ω μ % &	Set UNIT to %. Delete the present contents by pressing the F3 key, press the NEXT and F3 keys in this order, then press the cursor key. Set characters other than those on the menu by pressing the ALPHANUMERIC key. Up to 6 characters can be entered, but SCALE is displayed in 5 characters. In addition, data is displayed in 2 characters from the head.
	4CH MODE : SCALE/VOLT RANGE : 5V SPAN L : 1.000V SPAN R : 5.000V SCALE L : 0.00% SPALE R : 100.00% UNIT : % FILTER : OFF 0.1 1Hz OFF	Press the F2 key to set the filter frequency to 1Hz.



Press the ENTRY key.
The details set at this time are used for the measurement, and the cursor returns to the CH position. Continue program setting as required, and when it is necessary to end the setting, press the ENTRY key to return the display to the original display.

Notes :

1. When the scale L decimal point position differs from that of SCALE R, match this position with the smaller number of digits after the decimal point.
2. When SPAN is set from 1 to 5 V and SCALE from 0 to 10 kg, outputs are as follows for an input of 1.2 V.

SCALE	0 to 10kg	0.0 to 10.0kg	0.00 to 10.00kg
	↓	↓	↓
Output	0 kg	0.5 kg	0.50 g

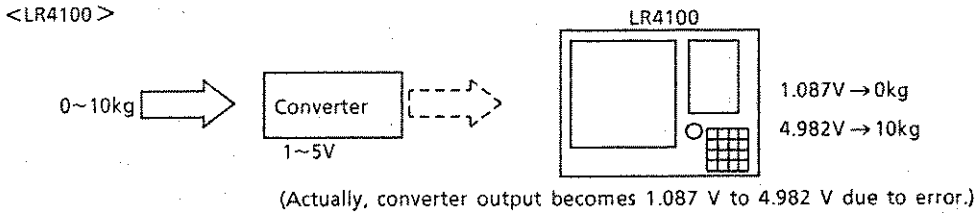
3. When the input exceeds SPAN L and SPAN R, the overflow display appears.
4. For the displayed value, the digits below the effective display digits are discarded. When the right and left value width of the scale volue is large (e · g · scale value is — 2.0000 and when the decimal point is rejected the scale width is 40000 and this is larger than 32767), the maximum og two digit error may cause in the displayed volue.

(Meas. function)

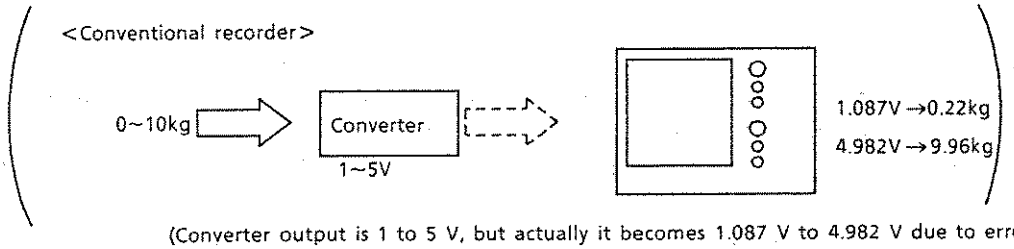
This recorder converter output voltages at ZERO and FULL can be set directly as span left and right values during VOLT range span setting.

Thus, slight converter errors are corrected automatically.

(Example) When the physical amount of 0 to 10 kg is converted by the converter and the converted result is recorded on the LR4100.



(Actually, converter output becomes 1.087 V to 4.982 V due to error.)



(Converter output is 1 to 5 V, but actually it becomes 1.087 V to 4.982 V due to error.)

The LR4100 reads converted signals as the actual measured values which are displayed digitally and printed out.

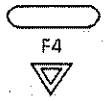
0kg→(1.087V), 10kg(→4.982V)

Thus, even if there is a slight error in converter output, the LR4100 maintains accurate measured values without needing to re-calibrate the converter as long as linearity is maintained between converter input and output.

Meas. function setting

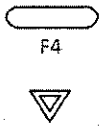
Pressing the F4 kye (meas.) during span setting can substitute the actual measured-value for the SPAN value.

[Key operation] **[Setting display]** **[Description]**




```
4CH
MODE : SCALE/VOLT
RANGE : 5V
SPAN L : 0.000V
SPAN R : 5.000V
SCALE L :
SCALE R :
UNIT :
FILTER :
  ←   →   del  meas
```

Conduct this setting with the input connected. Assume that the actual measured-value correspond to SPAN L 1.010 V and SPAN R 4.990 V.
Press the F4 key (meas) in the SPAN L item, then press the cursor key.




```
4CH
MODE : SCALE/VOLT
RANGE : 5V
SPAN L : 1.010V ----------→ The measuredvalue 1.010V is assigned.
SPAN R : 5.000V
SCALE L :
SCALE R :
UNIT :
FILTER :
  ←   →   del  meas
```

Press the F4 key in the item of SPAN R, then press the cursor key.

```
4CH
MODE : SCALE/VOLT
RANGE : 5V
SPAN L : 1.010V
SPAN R : 4.990V ----------→ The measured value 4.990 V is assigned.
SCALE L :
SCALE R :
UNIT :
FILTER :
```

The other setting is the same as the SCALE setting already described.

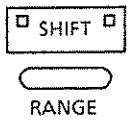
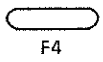
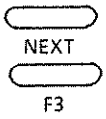
[COPY]

Function :

Setting in which the contents of the settings mode to the other CH are used without modification.
For the one-pen model, COPY function is not provided.

Setting item : ① CH : Channel No.
② Copy CH : Other channel No. to be copied.

Setting example : ① CH : 4CH
② Copy CH : 2CH

[Key operation]	[Setting display]	[Description]
	1CH MODE : VOLT RANGE : 5V SPAN L : 0.000V SPAN R : 5.000V FILTER : OFF 1CH 2CH 3CH 4CH	Press the RANGE function key after the SHIFT key to enable the setting display to appear. The display unit always shows the present CH1 setting display. Press the F4 key to select CH4.
		
	4CH MODE : OFF ↓ OFF VOLT TC RTD ↓ DELT SCAL COPY	When a channel is selected, the cursor moves to MODE automatically. Press the NEXT and F3 keys to set MODE to COPY.

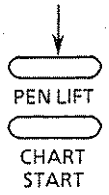
[Key operation]	[Setting display]	[Description]
F2	4CH MODE : COPY CH : CH 1CH 2CH 3CH 4CH	Select the CH (CH2) to be copied by pressing the F2 key. Thus, the contents of the CH2 are copied to CH4.
ENTRY (ENTRY)	4CH MODE : VOLT RANGE : 5V SPAN L : -5.000V SPAN R : 5.000V FILTER : OFF	Press the ENTRY key. The details set at this time are used for the measurement, and the cursor returns to the CH position. Continue program setting if required, and when it is necessary to end the setting, press the ENTRY key to return the display to the original display.

6.4.3 ZERO Adjustment

Function :

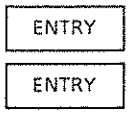
Adjustment of zero position and pen position parallel movement can be made independently according to the RECORD ON/OFF switch (⑬ in Section 3.1) status of each pen.
① RECORD OFF status
Pressing ◀ZERO▶ moves the pen to the zero position and as a result, any zero position can be set by turning the setting knob in the same way as with conventional analog pen recorders.
② RECORD ON status
Pressing ◀ZERO▶ enables the data to be moved (pen position) during measurement by turning the setting knob (SPAN also moves in parallel.)

[Key operation]	[Setting display]	[Description]
◀ZERO▶	1CH 0.000 ~ 5.000V 2CH 0.00 ~ 200.00V 3CH 0.00 ~ 200.00V 4CH 0.00 ~ 200.00V	Press the ◀ZERO▶ function key. All the pens set to the DC voltage range and RECORD OFF move to their zero positions and the display panel simultaneously shows the measuring range of each channel. The cursor flashes at the first channel position. * Ranges other than DC voltage (VOLT) ranges are displayed as "Cannot be set", and the chammel RECORD on continues to record the data currently measued.
ENTRY (ENTRY)	1CH 0.000 ~ 5.000V 2CH 0.00 ~ 200.00V 3CH 0.00 ~ 200.00V 4CH 0.00 ~ 200.00V	Select the channel to be zero-adjusted by the cursor.



Lower the pen by pressing the PEN LIFT key, then press the CHART START key to feed the chart.

Match the ZERO point to the main division on the chart by turning the setting knob while drawing a line with the pen.



When ZERO adjustment of each channel ends, press the ENTRY key twice, and the display returns to the original display panel.

Note : For ZERO and SPAN adjustments and VOLT measurement.
If the SPAN LEFT or RIGHT value exceeds the present input measuring range (refer to Table 6.2 and for the 5 V range : + 5.5 V), the suitable internal range is selected automatically.
If the SPAN is narrow and both ends of SPAN LEFT and RIGHT enter the present lower (high-sensitivity side) reference range (for 5 V range : + 5 V), the internal lower range is selected automatically.

6.4.4 SPAN Adjustment

Function :

Adjust SPAN (measuring range) by turning the setting knob. When the input changes suddenly during recording, SPAN can be changed immediately by using this mode without showing the range setting SPAN display panel.

Setting item :

① CH : Channel No.
② L : SPAN left value adjustment
③ R : SPAN right value adjustment
④ L&R : Adjustment of SPAN L and R.
⑤ srch : Searches the low range for the measuring range and sets a range which does not overflow so that SPAN automatically, becomes + 110% of range.

Setting example : Search the span of CH4 then change the range to -550 to 450 mV after selecting −550 to 550 mV.

Restrictions :
① SPAN can be adjusted only when MODE is set to VOLT, TC or RTD and COM (optional).
("Can not be set" is displayed in modes other than the above.)
② Only the voltage range can be searched.

[Key operation]	[Setting display]	Description]
SHIFT ZERO SPAN F4	1CH 0.000 ~ 5.000V 1CH 2CH 3CH 4CH	Press the SPAN key after the SHIFT key to enable the setting display to appear. The display unit always shows the present CH1 setting display. Press the F4 key to select CH4.
F4	4CH -550.0 ~ 550.0mV L R L&R srch	Press the F4 key to set the optimum span. Press the F4 key for a few seconds. * When srch is not made, this setting is not required.
F2	4CH -550.0 ~ 550.0mV L R L&R srch	Press the F2 key to change SPAN RIGHT to 450 mV.
	4CH -550.0 ~ 550.0mV L R L&R srch	Select 450.0 mV by turning the setting knob to the left.
ENTRY ENTRY	4CH -550.0 ~ 450.0mV L R L&R srch	Pressing the ENTRY key twice returns the display to the original display panel.

6.4.5 RECORDING AREA ADJUST (Zone recording)

Function :

The recording area (zone) can be freely set by the pen position. Since the pen position can be matched to a main division on the chart. Chart expansion and contraction can be corrected by setting the left side (Left) of the recording area to 0% and the right side (Right), to 100%.
Reference Recording chart may expand or contract up to approximatly 2mm when the humidty changes from 30 to 80% at the temperature of 23°C.

Setting item :
① CH : Channel No.
② L : Recording position at left
③ R : Recording position at right

Setting example :
① CH : 4
② L : 50%
③ R : 100%

[Key operation]	[Setting display]	[Description]
RECORD AREA ADJ F4	1CH 0 ~ 100% ↓ 1CH 2CH 3CH 4CH	Press the RECORD AREA ADJ key. Press the F4 key to select CH4. For the one-pen model CH input is not available.
F2	4CH 0 ~ 100% L R	Set the pen position to the Left (50%) value by turning the setting knob, then press the F2 key.
ENTRY ENTRY	4CH 50~100% L R	Match to the Right (100%) position by turning the setting knob. Pressing the ENTRY key twice returns the display to the original display panel.

6.4.6 Alarm Setting

Function :

The two level alarms can be set per one channel.
when an alarm occurs, the alarm can be printed out (LR4110 only) or output (option).

Setting item :

①	CH	:	Channel No.
②	L1 or L2	:	Level 1 or 2
③	MODE	:	H(high limit) or L(low limit)
④	VAL	:	Alarm set-value
⑤	RLY	:	Relay No. (1 to 4) Can be set, but output is optional.

Restrictions :

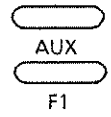
(1) Alarm setting may be turned OFF if the RANGE of the relevant channel is changed.
Therefore, carry out alarm setting after RANGE setting.

(2) For the one-pen model CH input is not available and display of possible setting range is also not available.

Setting example :

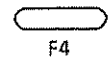
①	CH	:	4
②	MODE	:	L1
③	VAL	:	1.000 V
④	RLY	:	1

[Key operation] **[Setting display]** **[Description]**



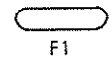

```
AUX


↓ ALM TAG RCD MSG
↓ CLK RAM
```

Pressing the AUX key turns the mode to the AUX mode to show the menu at the bottom of the display panel.
Press the F1 key to output the alarm (ALM) setting display panel.



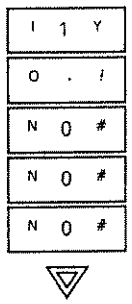

```
1CH (-5.500~5.500)
LI MODE : OFF
L2 MODE : OFF


   1CH 2CH 3CH 4CH
```

Press the F4 key to select CH4. The alarm range that can be set is displayed in parentheses after the CH No.




```
4CH (-5.500~5.500)
LI MODE : OFF
L2 MODE : OFF


  H   L  OFF
```

Press the F1 key to change the L1 (level 1) alarm mode to H.




```
4CH (-5.500~5.500)
LI MODE : H
 VAL : 0.000V
 RLY : OFF
L2 NODE : OFF


   ←    →   del
```

Set the alarm high-limit to 1.000V using the numeric keypad.
Then press the cursor key.

[Key operation]	[Setting display]	[Description]
	4CH(-5.500~5.500) L1 MODE : H VAL : 1.000V RLY : OFF L2 MODE : OFF ↓ OFF 1 2 3 4	Press the F2 key to select the output relay No. (1). (Relay output is not made available if the optional code /AK-04 is not provided.)
F2		
	4CH (-5.500~5.500) L1 MODE : H VAL : 1.000V RLY : 1 L2 MODE : OFF	Keep L2 (level 2) turned OFF. Pressing the ENTRY key once makes the alarm setting effective. When ending the setting, press the ENTRY key again.
ENTRY ENTRY		

Notes :

1. Alarm detection sampling is made every second.
   Therefore, it may take 1 sec. to detect the alarm after it is activated.
2. A slight variation in the measured-value may cause alarm ON / OFF repetitions. To prevent this, alarm hysteresis must be set. For details, refer to the SET-UP mode in Section 6.4.14

6.4.7 TAG No. Setting (LR4110 only)

Function :

A Tag No. of up to 7 characters representing the measured object can be set instead of the channel No. (1 to 4).

Setting item : TAG1 to 4
Letters and numerics up to 7 characters.

Setting example : Tag No. 1 is set to LR4100.

[Key operation]	[Setting display]	[Description]
AUX F2	AUX ↓ ALM TAG RCD MSG ↓ CLK RAM	Pressing the AUX key sets the mode to the AUX mode and as a result, the menu is shown at the bottom of the display Press the F2 key to show the TAG setting display panel.
SHIFT (* L) SHIFT SHIFT R 8 B U 4 E Y 1 I # O N # O N	TAG1 : 1CH TAG2 : 2CH TAG3 : 3CH TAG4 : 4CH ↓ ← → del ↓ Ω μ % &	Set TAG1 to LR4100.
	TAG1 : LR4100 TAG2 : 2CH TAG3 : 3CH TAG4 : 4CH ↓ ← → del ↓ Ω μ % &	When setting the Tag No. after TAG2, press the cursor key. After the setting is finished, press the ENTRY key. The setting becomes effective when the ENTRY key is pressed once. Pressing the ENTRY key again returns the display to the original display panel.
ENTRY ENTRY		

6.4.8 Partially Suppressed and Expanded Recording Setting

Function : For recording, the unnecessary recording section is suppressed and important recording section is extended.

Setting items :

① CH Channel No.
② PARTIAL : Partially suppressed and extended
③ RATE : Partial suppression factor
④ BDY : Partial suppression boundary value

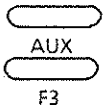
Restrictions :

① This function must be turned ON in the set-upmode. (Refer to Section 6.4.14.)
② This function is turned OFF if RANGE (MODE,RANGE, SPAN and scaling) is changed. Set thisfunction after RANGE setting is finished.

Setting example :

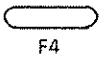
① CH : 4CH
② PARTIAL : ON
③ RATE : 25%
④ BDY : 1.000 V

[Key operation] **[Setting display]** **[Description]**




```
AUX

↓ ALM  TAG  RCD  MSG
↓ CLK  RAM
```

Press the AUX and F3 keys. The display is changed to the PARTIAL setting display panel.




```
1CH (-5.000~5.000)
PARTIAL : OFF

↓ 1CH  2CH  3CH  4CH
```

Press the F4 key to select CH4. Figures in ( ) on the right of the CH No are SPAN. BDY setting can be made within this range.
For the one - pen model, CH input and SPAN display are not available.

[Key operation]	[Setting display]	[Description]
F1	4CH (-5.000~5.000) PARTIAL : OFF ON OFF	Press the F1 key to turn PARTIAL ON.
J 2 Z F 5 V ▽	4CH (-5.000~5.000) PARTIAL : ON RATE : 10% BDY : 2.500V ← → del	Set RATE to 25%, then press the cursor key.
I 1 Y O . / N O # N O # N O #	4CH (-5.000~5.000) PARTIAL : ON RATE : 25% BDY : 2.500V ← → del	Set BDY to 1.000 V.
ENTRY ENTRY	4CH (-5.000~5.000) PARTIAL : ON RATE : 25% BDY : 1.000V	After setting is finished, press the ENTRY key. The setting becomes effective when the ENTRY key is pressed once. Set the other channel in succession when required. Pressing the ENTRY key again returns the display to the original display panel.

Example of partially expanded / suppressed - scale recording.

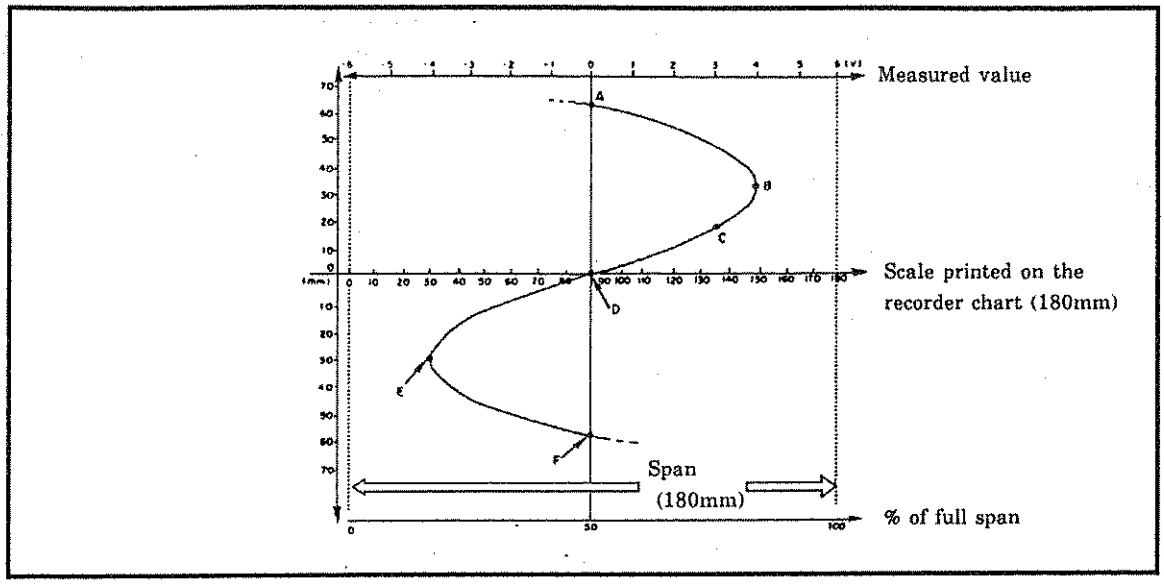


Figure A

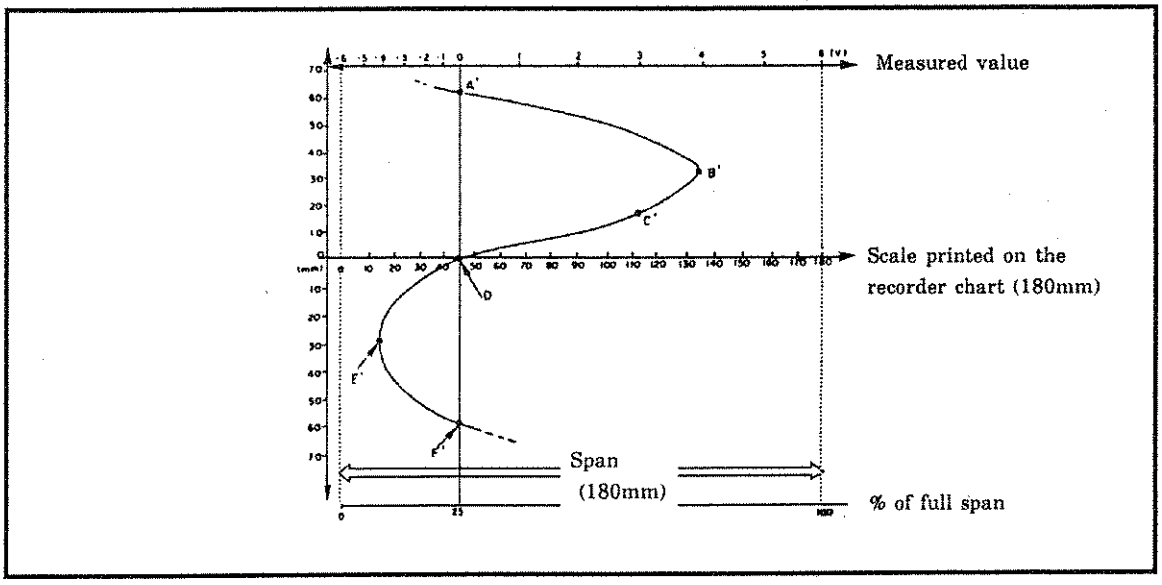


Figure B

(Explanatione of partially expanded / suppressed - scale recording)

- Figure A shows the ordinary recording when the span is set to 180mm.
  At this time point 0V is located at 90mm (50% of span) from the left edge on the recorder chart (measured value full span (−6 to 6V) is set to 180mm).
- Figure B shows the partially suppressed scale recording. At this time point 0V is located at 45mm (25% of span) from the left edge on the recorder chart (measured value full span (−6 to 6V) is set to 180mm).
  It is chear that bordering on the partially suppressed border value, the value of recording span (180mm in the example) multiplied by numerical value (%) of the partially suppressed scale recording width, and the value of recording span multiplied by the value (%) subtructed the partially suppressed scale recording width from 100 are allocated to the leftt hand side (hare indicates negative side) on the recorder chart and the right hand side (here indicatrs positine side) respectiveiy.

6.4.9 AUTO Span Shift Mode Setting

Function :

When input exceeds the recording span, the + 50% span is shifted automatically to continue recording.

Setting items :
① CH : Channel No.
② AUTO SPAN SHIFT : AUTO Span Shift ON/OFF

Restrictions :
① This mode must be turned ON in the SET-UP mode. (Refer to Section 6.4.14.)
② This mode can be used only when RANGE is in VOLT, TC or RTD and/or COM. (NO DELTA, SCALE anD MATH can be set.)
③ If RANGE is changed to OFF, DELTA, SCALE or MATH, this mode is turned OFF automatically. Set this mode after RANGE change.
④ The span shift range is up to VOLT range + 10% (For the 1V range : 1.1 V, and for ranges other than VOLT : within their measuring ranges.)

Setting example :
① CH : 4
② AUTO SPAN SHIRT : ON

[Key operation]	[Setting display]	[Description]
AUX F3	AUX ↓ ALM TAG RCD MSG ↓ CLK RAM	Press the AUX and F3 keys. The display changes to the AUTO SPAN SHIFT setting dis - play panel.
F4	1CH (-5.000~5.000) AUTO SPAN SHIFT:OFF ↓ 1CH 2CH 3CH 4CH	Press the F4 key to select CH4. CH selection is not avaiilable for one - pen model.
F1	4CH (-5.000~5.000) AUTO SPAN SHIFT: OFF ON OFF	Press the F1 key to turn AUTO SPAN SHIFT ON.
ENTRY ENTRY	4CH (-5.000~5.000) AUTO SPAN SHIFT: ON	After setting is finished, press the ENTRY key. The setting becomes effective when the ENTRY key is pressed once. Set the other channels in succession when required. Pressing the ENTRY key again returns the dis- play to the original display panel.

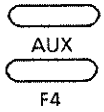
6.4.10 Message Setting (LR4110 only)

Function : Print-out is made when a message of up to 70 characters is set, and the MANUAL MESSAGE key at the front is pressed (MESSAGE 0), or optional external contact input (MESSAGE 1 to 4) is accepted.

Setting items : Letters or numerics of up to 70 characters.

Restrictions : MESSAGE 1 to 4 can be set, but no print-out is made when no optional remote function (/REM) is provided. Print-out by the communication function is available.

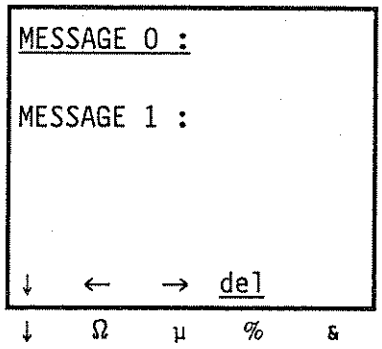
Setting example : Set MESSAGE 0 to SW1 ON.

[Key operation]	[Setting display]	[Description]
	AUX ↓ ALM TAG RCD MSG ↓ CLK RAM	Pressing the AUX key sets the mode to the AUX mode to show the menu at the bottom of the display panel. Press the F4 key to show the MESSAGE (MSG) setting display panel.

[Key operation]

SHIFT
SHIFT
C 9 S
SHIFT
SHIFT
G 6 W
! 1 Y
SHIFT
0 . !
SHIFT
N O *

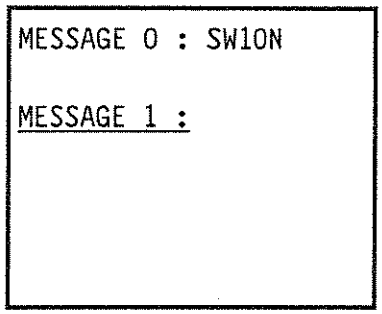
[Setting display]



[Description]

Set MESSAGE to SW1 ON. For lower case letters, make the setting after the CAPS key is pressed.

ENTRYT
ENTRYT



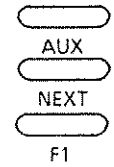
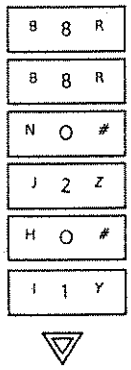
When setting the Tag No. after MESSAGE1, press the cursor key.
After the setting is finished, press the ENTRY key. The setting becomes effective when the ENTRY key is pressed once. Pressing the ENTRY key again returns the display to the original display panel.

6.4.11 Time Setting

Function : Set year, month, day, hour, min., and sec.

Setting items : ① DATE : Year/month/day
② TIME : Hour/min./sec.

Setting example : ① DATE : Feb. 1, 1988
② TIME : 12 - hour, 34 - min. and 56 - sec.

[Key operation]	[Setting display]	[Description]
	AUX ↓ ALM TAG RCD MSG ↓ CLK RAM	Pressing the AUX key sets the mode to the AUX mode. Press the NEXT and F1 keys to show the time (CLK) setting display panel.
	DATE : 88/01/01 TIME : 00:00:00 ← →	Set the data to Feb. 1, '88. When only certain numerics are changed, shift the digit by pressing the F1 or F2 key to set the new numerics, then press the cursor key.

[Key operation]	[Setting display]	[Description]
I 1 Y J 2 Z K 3 C E 4 V F 5 V G 6 W	DATE : 88/02/01 TIME : 00:00:00 ← →	Set the time to 12 hours, 34 min. and 56 sec. When only certain numerics are changed, shift the digit by pressing the F1 or F2 key to set the new numerics. Time is changed every 24 hours.
ENTRY ENTRY	DATE : 88/02/01 TIME : 12:34:56	After setting is finished, press the ENTRY key twice. Time is enabied when the ENTRY key is pressed once.

6.4.12 Set-value Initialization (RAM CLEAR)

Function :

Setting information currently set (excluding CLOCK) is all initialized.

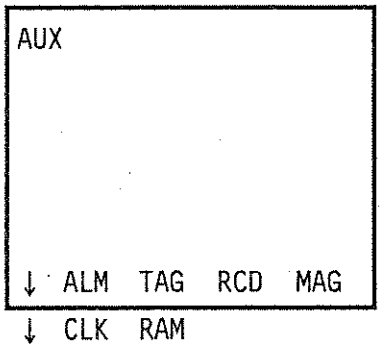
[Key operation]

AUX

NEXT

F2

[Setting display]

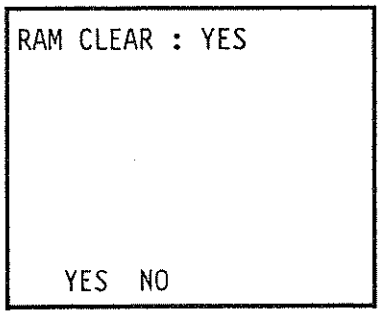


[Description]

Pressing the AUX key sets the mode to the AUX mode.
Press the NEXT and F2 keys to show the RAM CLEAR setting display panel.

F1

ENTRY



When returning to the initial setting, press the F1 key.
To suspend the procedure at this stage, press the F2 key.
The setting becomes effective when the ENTRY key is pressed once, the display then returns to the original display.

6.4.13 IC Memory Card Setting

Precautions
There are two types of IC memory cards as follows:
Standard Card (Part No. 378901) ..... Memory Capacity 8KB
Optional Card (Part No. 378904) ..... Memory Capacity 256KB

1. 8KB IC memory card

Function : The contents of settings such as range, etc. corresonding to up to 3 files can be stored in an IC memory card and used as required.

Setting items :

① SET : Set condition SAVE (write) and LOAD (read) and File name registration (up to 6 characters).

② INIT : IC card initialization and VOLUME name registration during initialization (up to 6 characters).

Operation : ① Load the lithium cells attached to the IC card by referring to Section 6.2.5.

② Face the up and down display mark of the IC memory card to downward, then insert the IC memory card into the slot on the right front side of the mainframe. If the mark is upsidedown, the card cannot be inserted into the slot.

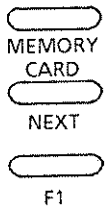
③ IC memory card initialization when the IC memory card is used for the first time after delivery, it must be initialized. The user's name and experimental details of up to 6 characters can be set for each IC memory card as VOLUME name during initialization. If an IC memory card already holding the set-value is initialized, the contents of the memory may be deleted.

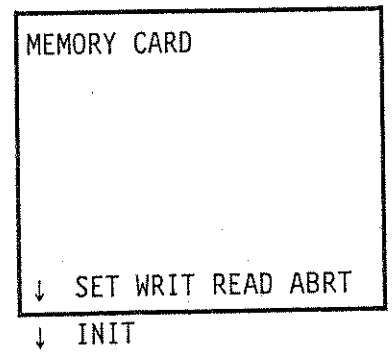
<Setting Information Memory>

Setting example

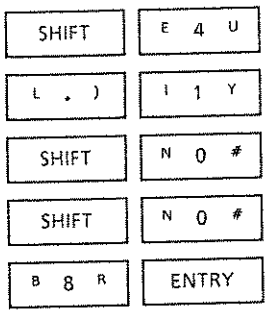
(1) Initialize the IC card, then register the VOLUME name (LR4100).
(2) Register FILE1 as LR1 to perform SAVE and LOAD.

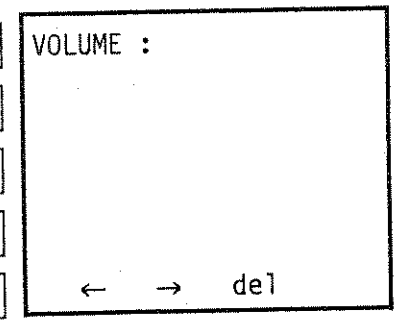
[Key operation] **[Setting display]** **[Description]**



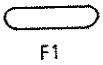


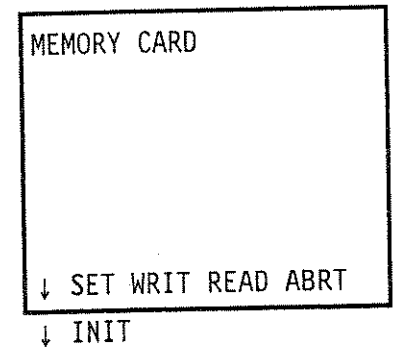
Press the MEMORY CARD function key to show the setting display panel.
Press the NEXT and F1 keys (INIT) to show the initialize display panel.



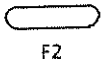


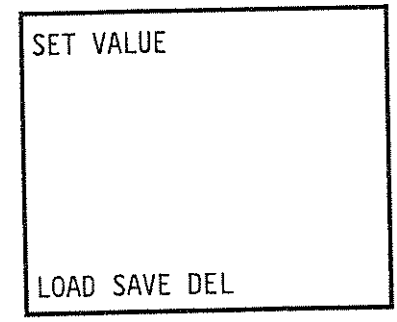
Register the VOLUME name as LR4100. (Error occurs in all spaces)
Press the ENTRY key to end initialization.
The display shows the MEMORY CARD menu.





This is the operation for saving currently set setting information. First, press the F1 key (SET) to show the setting information memory menu.





Press the F2 key (SAVE) to show the SAVE setting display panel.
When deleting setting information which is no longer necessary, press the F3 key (DEL).

[Key operation] **[Setting display]** **[Description]**

SHIFT | E 4 U
L .) | I 1 Y
SHIFT | ENTRY
SHIFT

```
LR4100 7K

← → del
```

Enter the FILE name (LR1), then press the ENTRY key to end SAVE.
In addition, residual memory is displayed between the VOLUME and FILE names.
When the FILE name has already been entered, select the file name with the cursor key.

F1

```
MEMORY CARD

↓ SET WRIT READ ABRT
↓ INIT
```

This is the operation for loading the setting information which has been saved in LR1.
First, press the F1 key (SET).

F1

```
SET   VALUE

LOAD SAVE DEL
```

Press the F1 key (LOAD) to show the LOAD setting display panel.

ENTRY

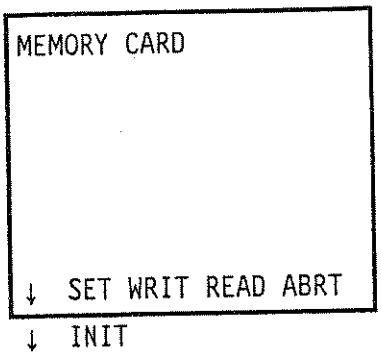
```
LR4100 5K LR1
```

Select the FILE name to be loaded by the cursor key.
Since there is only FILE1 (LR1) here, FILE1 can be loaded simply by pressing the ENTRY key.

[Key operation]

DISPLAY SELECT

[Setting display]

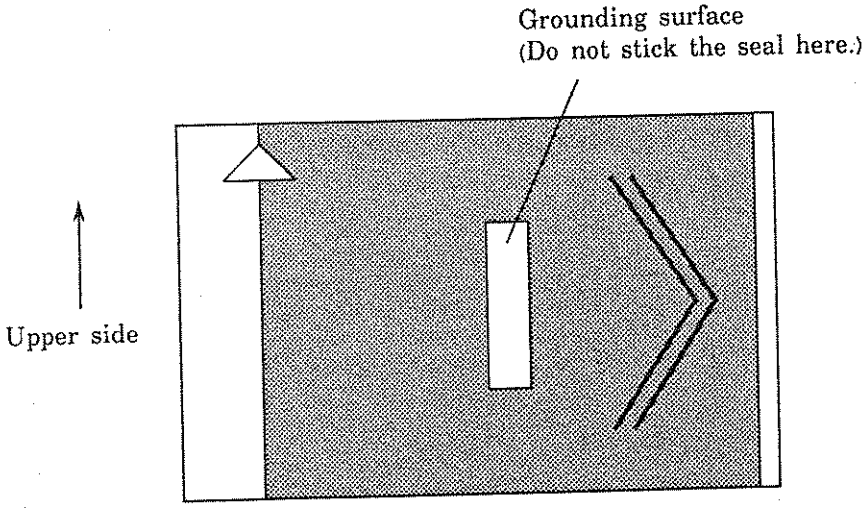


[Description]

Press the DISPLAY SELECT key to exit from the memory setting display panel.

Notes:

- The standard IC memory card (8K bytes) cannot store measured values (which is possible with optional 3789 04). Therefore, the MEMORY CARD menu on the setting display panel shows WRIT (F2), READ (F3) and ABRT (F4) which cannot be used. without optional IC memory card 3789 04.
- The IC memory card has a seal attached to it for VOLUME and FILE entry. However, never stick the seal to the grounding surface at the rear center of the IC memory card as the effectiveness of the static electricity measures is lost and the stored content may be detected.



- IC memory cards being used for the first time must be initialized, otherwise, they will not be effective.

2. 256KB IC Memory Card

<Setting Information Memory>

Function :

An IC memory card is used to store measured and panel setting data.
The measured data storing function is manually or trigger executed by alarms CHART END or external contact signals. Interface input data and computed data (/ MATH Model) can also be stored.
Stored panel setting data can be easily retrieved from the memory card for repeated use in the recorder.
Stored data can also be read and transmitted at any time.

Setting Items

SET : Loads and saves panel setting data.
WRIT : Sets weiting (sampling) conditions and writes measured data.
READ : Sets readout conditions and prints out measured data (sampled data)
ABRT : Interrupts WRITE or READ operations.
INIT : Initializes the memory card.

Operation

Items (1) to (4) are the same as those of the previous section

1. 8KB IC Memory Card (3789 04) (see 6-63)

<Setting Data Memory>
Setting Example
Same as the example described in the previous section (See p6-63 to p6-66)

<Measured Data Memory>

1. Preliminary

(1) Each card has a 256 byte memory capacity, which is used to store measured and panel setting data.
A total number of 48 files can be stored in the memory.
Two files are always requied: one for measured data, the other for setting data.

(2) The card dedicated 1K byte to file management. Therefore, 255K bytes is available for data storage.
2K bytes / file is used for panel setting data. The required measured data capacity calculation is given below.

(3) Every measured data file produced, produces a corresponding setting data file.

- The measured data file size is calculated as follows.

([Sampled data length]×2)×[Sampling channel number]+512
↓
File header information data length

Sampled data length : Sampling length designated data length
Sampling channel number : Channel number with RANGE ON.

- 1000 bit 4 channel data
  (2×1000×4+512)/1024=8.3125
  uses about 8K bytes.

- 32000 bit 4 channel data
  (2×32000×4+512)/1024=250.5
  uses about 250K bytes. Here 1K byte=1024 bytes

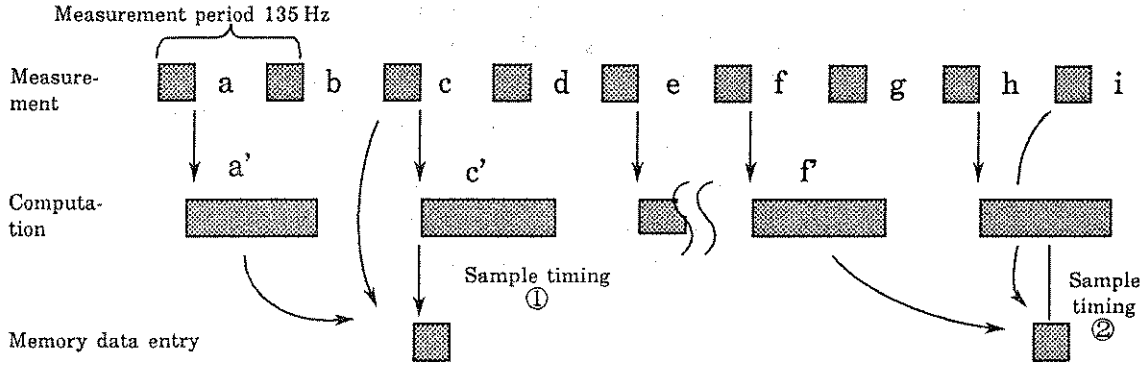
- A panel setting data file simultaneously produced with a measured data file always requires 1K byte of memory (equivalent to one channel). This file is for LR4100 internal use only and is not used for LOAD/SAVE on the information SET display.

(4) The IC card (256K bytes) has a maximum of 48 files.
Example:

Number of panel setting data files; 3
Number of measured data files; 4
} The number of files
3+4×2=11
↑
One measured data file produces one panel setting data file.

Memory Card Data

(1) MATH data which is computed with conputational expressions comes after the measurement data stored in the memory card (see the figure below).



<Computation Flow>

Refer to the figure above as an aid to the following explanation:

In sample timing (1), the measured data (c) and computated value a' are entered in the memory data entry area. a' is a computation result from the measured data a. In sample timing (2), the measured data "i" and computed value f' are entered in the memory data entry area. The computation results are taken from previously measured data.

Note: Panel display and recording data are output simultaneously. Measured data sent via communications is displayed simultaneously with the panel display or recording data.

(2) Reading stored data.

Data in a computation channel, which is already stored in the memory card, can be computed and read. This permits modification of the computation expressions and data to be re-calculated.

When computational constants are modified and used for the computation of new data, press the F1 key to turn OFF the data entry sent and start computation.

Note: When communications input values (C1 to C4) are used in the computation channel in the memory card, send these values via communications for data reading. Data in measurement mode (COM) is stored in memory, so this data can be read easily.

When communications input data (C1 to C4) must be displayed, proceed as follows:

(Example)

Set channel 1 to COM and apply a communications input value to channel 1 with CV1. Set channel 2 to "MATH". Set computational expressions using data in channel 1 (do not use C1 in this case).

When data is read an input channel is set with computational expressions after which data can be computed.

<Measured Data Memory>
Writing Data (WRITE)

Function : Writes measured data onto the IC memory card while simultaneously producing measuring ranges and coefficients (/MATH option).

Setting Items

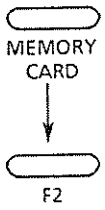
① FILE : Setting measuring conditions
- FILE Name ; max. 6 characters
- MEM LEN ; Data length setting
  - 1000 / 2000 / 4000 / 8000 / 16000 / 32000 data / CH
- TRIG MODE ; Trigger mode on or off
- SAMPL ; Sampling rate setting 0.2 / 0.5 / 1 / 3 / 5 / 9 / 135 Hz
- PRE TRIG ; Used when TRIG MODE on.
  - 0 to 100%, 10% increments

② DEL : Deletes unnecessary files.

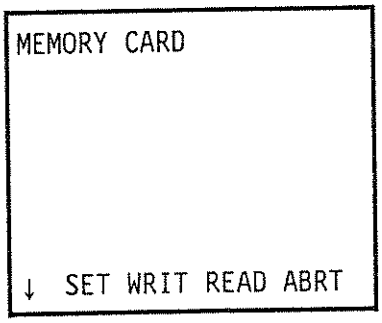
Setting Example

①	FILE name	:	LR 1
②	MEM LEN	:	2000 (2K)
③	TRIG MODE	:	ON
④	SAMPL	:	9 Hz
⑤	PRE TRG	:	10%
⑥	TRIGGER	:	Alarm Only ON.

[Key operation]



[Setting display]

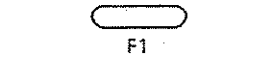


↓ INIT

[Description]

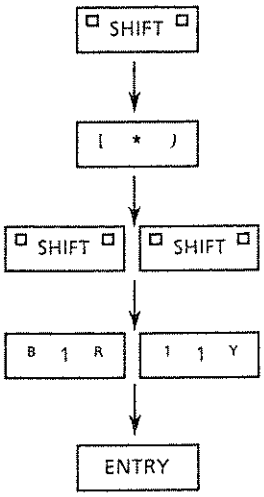
Press the MEMORY CARD key to call up the display, and then press F2 key to disjplay the WRITE screen.

[Key operation] [Setting display] Description]



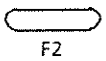

```
WRITE


FILE DEL
```

Press F1 (FILE) key to register the file name.



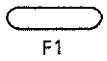
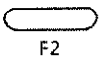

```
LR4100 255K


←  →  DEL
```

Enter LR1.
Total number of 48 files are shared by SET and WRITE.
The same name can be used with both SET and WRITE because they are independent of each other.
Press ENTRY key.




```
MEM LEN : 2000
TRIG MODE : OFF
SAMPL :135Hz


↓  1K  2K  4K  8K
↓  16K 32K
```

Press F2 key to enter 2000 (2K) into MEM LEN.
All channels excepting those with RANGE OFF can sample respective data.

[Key operation]	[Setting display]	Description]
	MEM LEN : 2000 TRIG MODE : OFF SAMPL : 135Hz ON OFF	Press F1 key to turn ON the TRIG MODE. In TRIG mode, if any of trigger conditions_ALARM, CHART and RMT_is true (satisfied), data entry is started. In free made, data entry is started manually.
	MEM LEN : 2000 TRIG MODE : ON SAMPL : 135Hz PRE TRIG : 10% TRIG ALARM : ON TRIG CHART : OFF TRIG RMT : OFF ↓ 0.2 0.5 1 3 ↓ 5 9	Set the sampling rate (SAMPL) to 9 Hz. The sampling rate can be selected from 0.2, 0.5, 1, 3.5, 9 and 135 Hz.
	MEM LEN : 2000 TRIG MODE : ON SAMPL : 9Hz PRE TRIG : 10% TRIG ALARM : ON TRIG CHART : OFF TRIG RMT : OFF ↓ 0 10 20 30 ↓ 40 50 60 70 ↓ 80 90 100	Set the PRE TRIG to 10% which allows MEM LEN to memorize an extra 10% of the data before the trigger acts. In the free mode (when the TRIG MODE is OFF), start weiting press the ENTRY key.

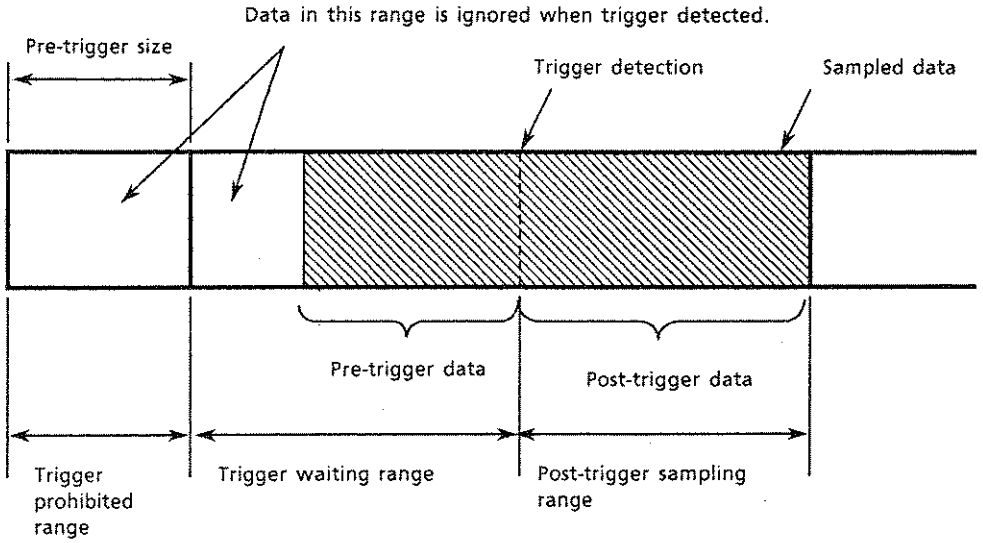
[Key operation]	[Setting display]	Description]
F2	MEM LEN : 2000 TRIG MODE : OFF SAMPL : 9Hz PRE TRIG : 10% TRIG ALARM : ON TRIG CHART : OFF TRIG RMT : OFF ON OFF	Set TRIG ALARM. In TRIG ALARM ON status, alarms are entered in memory.
F1	MEM LEN : 2000 TRIG MODE : OFF SAMPL : 9Hz PRE TRIG : 10% TRIG ALARM : ON TRIG CHART : OFF TRIG RMT : OFF ON OFF	Set TRIG CHART. In TRIG CHART ON status, data is entered in the memory card when the recorder is out of paper.
F1 ↓ ENTRY	MEM LEN : 2000 TRIG MODE : ON SAMPL : 135Hz PRE TRIG : 10% TRIG ALARM : ON TRIG CHART : OFF TRIG RMT : OFF ON OFF	Set TRIG RMT. In TRIG RMT ON status, when /REM option is added, data is entered in the memory card with a remote contact input. When the ENTRY key is pressed, the recorder is in the trigger wait status. Data entry is started in the free mode (in "TRIG MODE OFF") when the ENTRY key is pressed.

[Key operation]	[Setting display]	Description]
DISPLAY SELECT	MEMORY CARD ↓ SET WRIT READ ABRT ↓ INIT	To exit from the MEMORY CARD display, press the DISPLAY SELECT key. To abort writing, press F4 (ABRT) key.

[Trigger Conditions]

① Pre-trigger

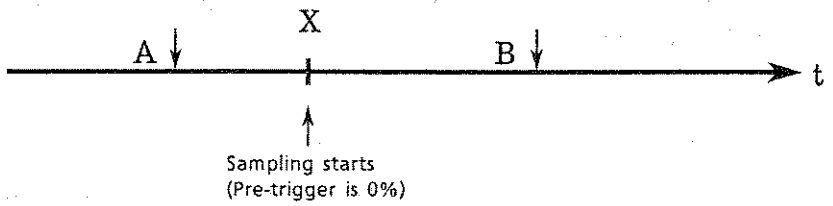
For data sampling in the trigger mode use the pre-trigger.
The pre-trigger is detected only for trigger set point values over 0%.
Any data prior to the pre-trigger data is ignored. Sampling continues for data following the trigger sampling period.



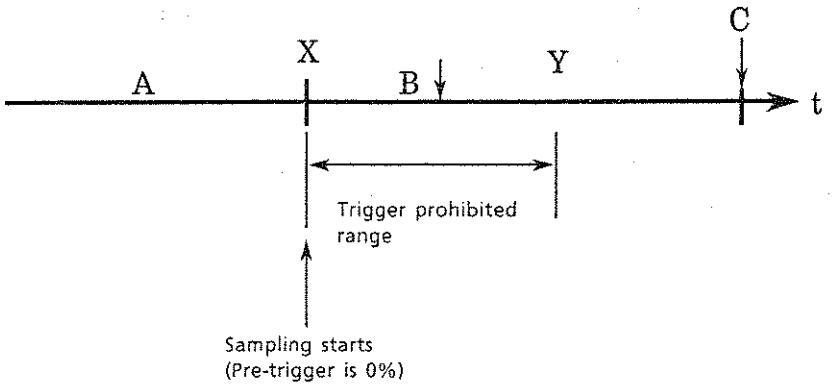
② Internal Alarm Trigger

A trigger can be produced in an alarm state.

At the beginning of the trigger waiting range, the alarm having already occurred produces a trigger during the sampling period.

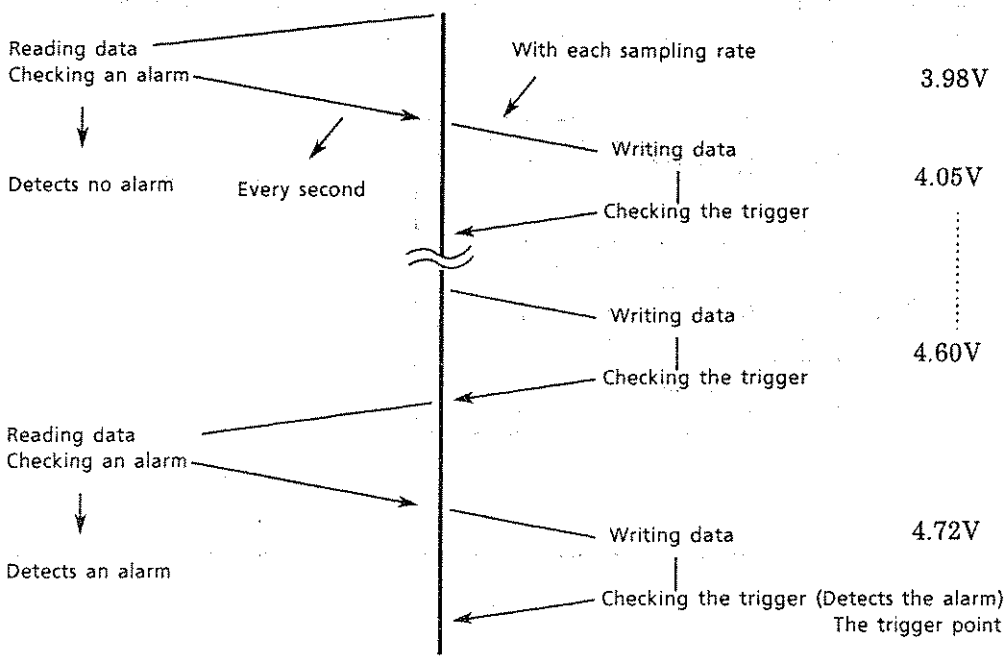


- The trigger is detected at point X when the alarm occurs at point A and sampling starts from point X.
- The trigger is detected at point B when sampling starts from point X and the alarm occurs at point B.



- If the alarm occurs at point A or B the trigger is detected at Y.
- If the alarm occurs at C the trigger is detected at C.

③ Alarm Trigger Detection



Assume that a high alarm is set at 4V.

On the initial search, an alarm is not detected as the sampled data is 3.98V. When the sampled data reaches 4V, the alarm is detected 1 second later at 4.60V. The trigger is then detected from the sampled data.

Therefore, data exceeds the alarm level prior to reaching the trigger point.

Especially, when sampling is executed in 135Hz in trigger mode, several tenth points alarm data may exist prior to the beginning of the trigger.

[WRITE Completion Conditions]

Data sampling terminates upon any one of the following conditions:

(1) Sampling completion of data assigned to the data length.

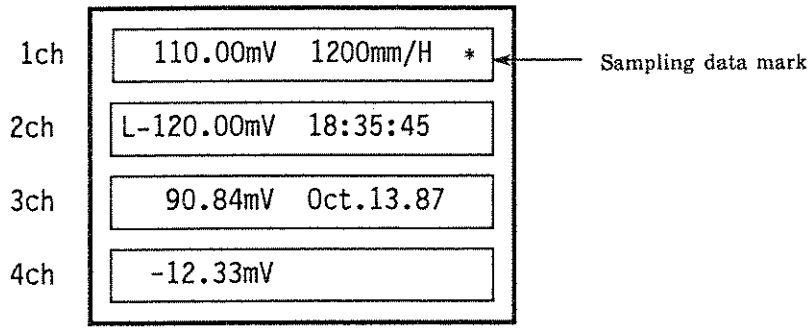
(2) Measuring condition variation detection. e.g. measuring range change.

(3) Using the F4 ABRT key.

In the case (3) above, if trigger has not been detected, the data file cannot remain in the IC memory card.

[WRITE Indication]

During data sampling, an (*) appears in the sampling channel as shown in the figure below (only for the channel displaying the measuring data).



CAUTION

Do not remove the IC memory card from the recorder whilst writing, as data sampling will be interrupted and data already entered will remain on the IC memory card.
Sometimes sampling continues for a few seconds after removal of the card (the time period is determined by the sampling rate).

(1) Data remaining on the card cannot be used as the file ends incorrectly.
Note therefore that when reusing this stored file the incomplete file is ignored. Howerever, the file remains stored in the card.

(2) The incomplete file can be deleted along with other files by using DEL function in the MEMORY CARD WRITE menu.

Reading Data (READ)

Function :

Performs IC memory card measured data printouts or produces interface outputs (optional).

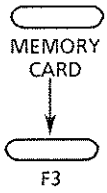
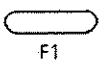
Setting items :

① FILE : Sets necessary data output conditions.
- FILE Name ; File name to be output.
- SAMPL ; 0.2/0.5/1/3/9/135 Hz
- START ; Set the output start point
- LOAD ; Decides whether measured data and panel setting data effective while in DATA.

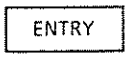
② INFO : Indicates the DATA panel setting data.

Setting example :

① FILE Name : LR1
② SAMPL : 9 Hz
③ START : 1
④ LOAD : OFF

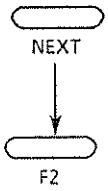
[Key operation]	[Setting display]	Description]
	MEMORY CARD ↓ SET WRIT READ ABRT	Press the MEMORY CARD key, then the F3 key to display the READ panel.
	↓ INIT	
	DATA FILE INFO	Press the F1 key to call up the FILE setting display. To display the INFO panel, press F2 key.

[Key operation] **[Setting display]** **Description]**




```
LR4100 8K LR1
FILE02 FILE03
```

Select the file to be retrieved using the cursor.
In this example, only press the ENTRY key because the file name is LR1.

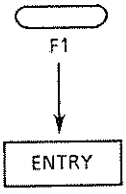



```
SAMPL : 135Hz
START : 1
LOAD  : ON

↓  0.2  0.5   1   3
↓    5    9  135
```

To select SAMPLE 9Hz, press ENTRY then F2 key.

```
SAMPL : 9Hz
START : 1
LOAD  : ON
```

Set the output start point. In this example, output begins from data 1. Therefore, no change to the display is necessary. Continue to the next screen using the cursor key.
An error message appears if the set data length exceeds DATA LEN in the INFO display.




```
SAMPL : 9Hz
START : 1
LOAD  : ON

      ON  OFF
```

Press F1 to load the printout conditions (data for RANGE or /MATH).
Press ENTRY to execute READ.

[Key operation]	[Setting display]	Description]
DISPLAY SELECT	MEMORY CARD ↓ SET WRIT READ ABRT ↓ INIT	Exit from the MEMORY CARD screen by proessing the DISPLAY SELECT key. Press the F4 (ABRT) key to terminated the READ process.

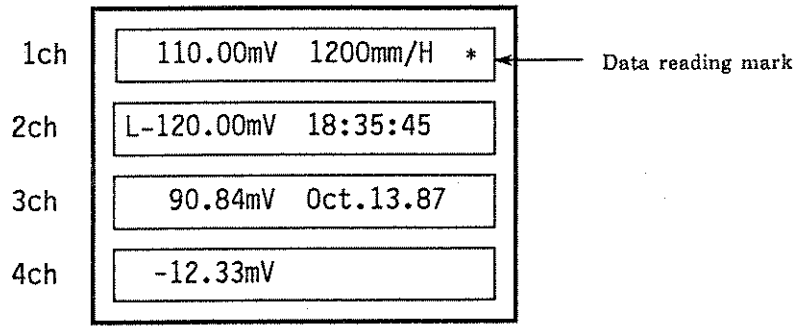
CAUTION

(1) If READ is ON when setting the necessary items, the recorder reads the setting (RANGE, SPAN) and measured data. Setting data entering the recorder overrides the current setting data.

(2) When LOAD is OFF, the measuring range or chart speed can be READ through the panel setting condition display.
If the measuring range differs from the sampling set range, the indicated and recorder printed characters differ from those at sampling even though the recorded waveform is similar to the original one.
The non-selected channel sampling data (OFF) is not reproduced. The OFF channel shows current input data.

[READ Indication]

During reading, an (*) appears in the reading channel as shown in the figure below (only for the channel showing the measuring the measuirng data).



[READ Completion Operations]

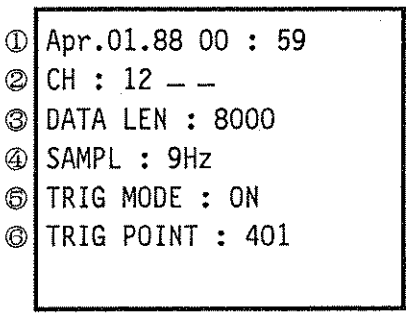
(1) Reading is terminated automatically after the recorder READs all assigned data. The memory channel changes to RECORD OFF. To restart the recording mode revert back to RECORD ON.

(2) The same procedure applies to ABRT (F4 key) executed during the READ mode.

WRITE Information (INFO)

Function : Display writing information.

Indicating Items :



① Displays the sampling start time when TRIG is OFF.
Displays the TRIG ON time.

② Displays the data writing channel number. Channels with RANGE MODE OFF are shown as (-). (In the above example the 3rd and 4th channels are in this mode.)

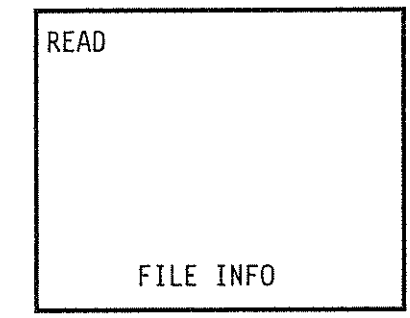
③ Displays the data length actually sampled.

④ Displays the sampling rate set value.

⑤ Indicates whether the TRIG MODE is ON or OFF.
The following TRIG is not indicated if the current TRIG is OFF.

⑥ Displays the trigger starting point.

Operation : Press F2 when the READ setting condition panel is displayed.



<IC Memory Card (3789 04) Specifications> (Supplement)

Function: Panel setting and measured data storage.

Medium: IC memory card

Memory Capacity: 256K bytes

Sampling Mode:

Free Mode; Manual start

Trigger Mode; Starts with tirgger conditions

Sampling Rate:

Free Mode; 135 / 9 / 5 / 3 / 1 / 0.5 / 0.2 Hz ··· possible to switch common setting to each channel

Trigger Mode; 9 / 5 / 3 / 1 / 0.5 / 0.2 Hz ··· possible to switch common setting to each channel

Data Length: 1000 / 2000 / 4000 / 8000 / 16000 / 32000 data / channel, common setting for each channel, 2 bytes / data resulting in 32000 data (max) for 4-channel model.

Sampling: Each selected channel data stored simultaneously (excepting RANGE OFF channel).

Trigger Condition:

Alarm Detection; Starts with any alarm ON (Detecting interval is 1 second)

External Contact Signal; Storing begins with an external contact (ON) signal, available for optional model with /REM function.

Chart End Detection; Starts with chart end.

Pre-trigger: Can be set from 0 to 100%, 10% increments.

Memory Data: Panel setting data

Measured data

Interface input data (for Model with /GP-IB or /RS232C)

Output:

Printout; data output rate ... 135 / 9 / 5 / 3 / 1 / 0.5 / 0.2 Hz, possible to switch

Interface Output (for Model with /GP-IB or /RS232C); ASCII to BINARY output

Battery: Lithium battery (lifetime approx. 3 years)

6.4.14 SET UP Mode

Function : Performs initial settings such as °C/°F selectionand chart speed mm or inch selection.

Setting items : The outline of functions executed in the SET UP mode is shown in the following.

Menu	Setting Item	Function					Details
		NEXT	F1	F2	F3	F4	
UNIT	TEMP UNIT		°C	°F			Sets temperature setting units
	CHART SPD UNIT		mm	inch			Sets speed setting units
PRN (Not available for LR4120)	CHANGE INFO		ON	OFF			Chart speed change print out
	TIME INFO		T/M	TIME	OFF		Time print out
	ALARM INFO		ON	OFF			Alarm print out
	SCALE INFO		ON	OFF			Scale print out
	MESSAGE TIME		ON	OFF			Time print out during massage print out
	TAG/CH		CH	TAG			TAG or CH selection during print out
RCD	*POC TRACE		P-P	MEAN			Pen offset compensation
	1CH FORM ∫ 4CH FORM		OFF	PART	ATSS		Recording format
RMT (option)	Remot control		ON	OFF			Presence or absence of remote control
	CHART SPD 2		ON	OFF			Presence or absence of CHART SPD 2 by remote control
	CHART CLOCK		INT	EXT			Internal external switching of chart feed clock
COM (option)	GPIB ADDRESS	○ ○ ○ ○	0 4 8 12	1 5 9 13	2 6 10 14	3 7 11 15	GP-IB address
	RS BAUD RATES	○ ○	75 1200	150 2400	300 4800	600 9600	RS232C, Baud rate
	RS STOP BITS		1	1.5	2		RS232C, Stop bit
	RS PARITY		EVEN	ODD	NINE		RS232C, Parity error check
	RS DATA BITS		7	8			RS232C, Data bit length
	RS HANDSHAKE	○ ○	OFF: C:R	X:E	X:R	C:E	RS232C, Handshake
RJC	1CH RJC ∫ 4CH RJC		INT	EXT			RJC INTERNAL/EXTERNAL
OTHR	ALARM HYS		←	→	del		Alarm hysteresys
	MATH ERR						Data handring during calculation error
RAM	RAM CLEAR		YES	NO			Setting information initialization

* For the setting of RMT and COM, refer to the optional instruction manual.
* Not available for one-pen model.

Operation : SET-UP mode setting Turn ON the SET UP switch ((4) in Section 3.2) with the recorder power turned OFF, then turn ON the recorder power while pressing the ENTRY key to set to the SET UP mode.
After SET-UP mode has been set, and in normal operation mode, turn off the SET UP switch.
The updated setting contents are not affected even if the setting is executed with the SET UP switch turned off.

(1) UNIT setting

Function : Sets temperature and chart speed units.

Setting items :

① TEMP UNIT : °C or °F
② CHART SPD UNIT : mm or inch

Setting example

Note : If the TEMP UNIT is changed, RANGE MODE is initialized.

[Key operation]	[Setting display]	[Description]
	SET UP ↓ UNIT PRN RCD RMT ↓ COM RJC OTHR RAM	Press the F1 key to enter the UNIT setting mode.
F1		
	TEMP UNIT : °C CHART SPD UNIT : mm °C °F	Press the F2 (oF) key to select the temperature unit. (Prior to shipment)
F2		
	TEMP UNIT : °F CHART SPD UNIT : mm mm inch	Press the F2 (inch) key to determine the chart speed (mm)
F2		
	TEMP UNIT : °F CHART SPD UNIT : inch	After completing the setting, press the ENTRY key. If the ENTRY key is pressed once, the display returns to the SET UP menu and, if it pressed twice, the start-up state is returned.
ENTRY (ENTRY)		

(2) PRN Setting (LR4110 only)

Function : Performs various digital print-out related settings.

Setting items :

① CHANGE INFO	:	Print-out ON/OFF during chart speed change and POC selection
② TIME INFO	:	Fixed time print-out related setting. T/M : Prints out time and measured value TIME : Only fixed time print out. OFF : No print out is made.
③ ALARM INFO	:	Alarm print-out ON/OFF
④ SCALE INFO	:	Scale print-out ON/OFF during fixed time print out and list print out.
⑤ MESSAGE TIME	:	Time print out ON/OFF during MESSAGE print out.
⑥ TAG/CH	:	TAG and CH selection of fixed time, alarm and scale print out.

Setting example

① CHANGE INFO	:	OFF
② TIME INFO	:	TIME
③ ALARM INFO	:	OFF
④ SCALE INFO	:	OFF
⑤ MESSAGE TIME	:	OFF
⑥ TAG/CH	:	TAG

* For print-out, refer to Section 2.3.

[Key operation]	[Setting display]	[Description]
	SEP UP ↓ UNIT PRN RCD RMT ↓ COM RJC OTHR RAM	Press the F2 key to enter the PRN setting mode.
F2	CHANGE INFO : ON TIME INFO : T/M ALARM INFO : ON SCALE INFO : ON MESSAGE TIME : ON TAG/CH : CH ON OFF	Select CHANGE INFO by pressing the F2 (OFF) key. (Set ON prior to shipment.)
F2	CHANGE INFO : OFF TIME INFO : T/M ALARM INFO : ON SCALE INFO : ON MESSAGE TIME : ON TAG/CH : CH T/M TIME OFF	Set TIME INFO to TIME by pressing the F2 key. (Set to T/M prior to s hipment.)
F2	TIME INFO : TIME ALARM INFO : ON SCALE INFO : ON MESSAGE TIME : ON TAG/CH : CH ON OFF	Select ALARM INFO by pressing the F2 (OFF) key. (Set ON prior to shipment.)

[Key operation]	[Setting display]	[Description]
	ALARM INFO : OFF SCALE INFO : ON ON OFF	Select SCALE INFO by pressing the F2 (OFF) key. (Set ON prior to shipment.)
F2		
	SCALE INFO : OFF MESSAGE TIME : ON ON OFF	Select MESSAGE TIME by pressing the F2 (OFF) key. (Set ON prior to shipment.)
F2		
	MASSAGE TIME : OFF TAG/CH : CH CH TAG	Select TAG/CH by pressing the F2 (TAG) key. (Set CH prior to shipment.) Even if TAG is selecuted by CH in MANUAL PRINT mode.
F2		
	CHANGE INFO : OFF TIME INFO : TIME ALARM INFO : OFF SCAL INFO : OFF MESSAGE TIME : OFF TAG/CH : TAG	After setting is finished press the ENTRY key. If the ENTRY key is pressed once, the display returns to the SET UP menu and, if it is pressed twice, to the start-up state.
ENTRY		
ENTRY		

(3) RCD setting

Function : Sets phase synchronization method and recording format.

Setting items :

① POC TRACE : Setting during phase synchronous recording (not available for one-pen mmodel)

P-P : Records maximum and minimum values

MEAN : Records the mean value.
Mean value is that of the maximum and minimum values sampled while the chart is fed by 1 step (0.05 mm).

* Recording is set to MEAN recording automatically at chart speeds exceeding 180 mm/H. (poc input is not available for one-pen model)

② 1 to CH4 FORM : Recording format

OFF : Normal mode

PART : Performs partially suppressed and extended recording

ATSS : Performs AUTO Span Shift.

Restrictions : PART and ATSS cannot be used in the samechannel. However, one of them must be selected.

Setting example

POC TRACE : MEAN

1 to CH4 FORM

1CH : ATSS

2CH : PART

[Key operation]	[Setting display]	[Description]
	SET UP + UNIT PRN RCD RMT	Press the F3 key to enter the RCD setting mode.
F3	↓ COM RJC OTHR RAM	
	POC TRACE : P-P 1CH FORM : OFF ↓ 4CH FORM P-P MEAN	Select POC TRACE by pressing the F2 (MEAN) key. (Set to P-P prior to shipment.)
F2		

[Key operation]	[Setting display]	[Description]
	POC TRACE : MEAN 1CH FORM : OFF 2CH FORM : OFF ↓ 4CH OFF PART ATSS	CH1 select form (Set OFF prior to shipment.)
F3		
	POC TRACE : MEAN 1CH FORM : ATSS 2CH FORM : OFF ↓ 4CH OFF PART ATSS	CH2 and the succeeding channels in the same way as for CH1. (Prior to shipment it is set to OFF.)
F2		
	POC TRACE 1CH FORM : ATSS 2CH FORM : PART ↓ 4CH OFF PART ATSS	After setting is finished press the ENTRY key. If the ENTRY key is pressed once, the display returns to the SET UP menu and, if it is pressed twice, to the start-up state.
ENTRY		
ENTRY		

(4) RJC setting

internally or externally.

Function : Sets whether or not thermocouple range RJC (reference junction compensation) is made

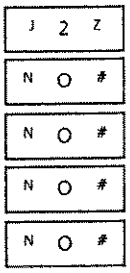
Setting items :

① CH : Channel No.
② INT/EXT : Internal (INT)/external (EXT) selection of reference junction compensation
③ Reference junction compensation voltage when EXT is selected.
Set the value in the range of −20000 to 20000 μV.

Setting example

① CH : 1
② INT/EXT : EXT
③ Compensation voltage : 0μV

[Key operation]	[Setting display]	[Description]
	SET UP + UNIT PRN RCD RMT ↓ COM RJC OTHR	Press the NEXT and F2 key to enter the RJC setting mode.
NEXT F2		
	1CH RJC : INT 2CH RJC : INT ↓ 4CH RJC : INT INT EXT	Select RJC by pressing the F2 (EXT) key. (Set to INT prior to shipment.)
F2		

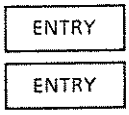



```
1CH RJC : EXT ____ μV
2CH RJC : INT
 ⌇
4CH RJC : INT


  ←   →   del
```

When set to EXT, the RJC value can be entered to the right of EXT.
Set the value in the −20000 to 20000 μV range.
When the ZEROCON or deway flask (0°C) is used, input 0μV.

```
1CH RJC : EXT     0μV
2CH RJC : INT
 ⌇
4CH RJC : INT


  INT EXT
```

Similarly, the same setting is made up to CH4.
After setting is finished press the ENTRY key. If the ENTRY key is pressed once, the display returns to the SET UP menu and, if it is pressed twice, to the start-up state.



(5) OTHER setting

Function : Set alarm hysteresis and processing during calculation error.

Setting items :

① ALARM HYS : Alarm hysteresis setting range 0 to 100%
Hysteresis should be specified using ratio with respect to recoding span width currently set.

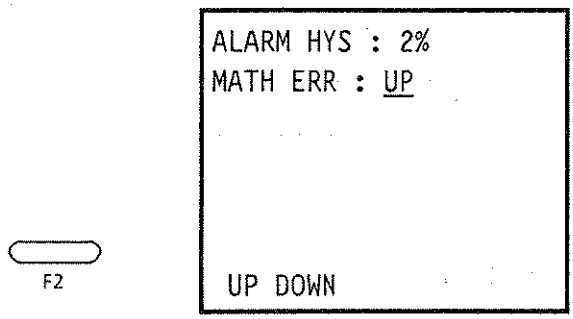
② MATH ERR : Data processing during calculation error occurrence
UP : Processed as (+) overflow
DOWN : Processed as (−) overflow

Setting example :

① ALARM HYS : 2%

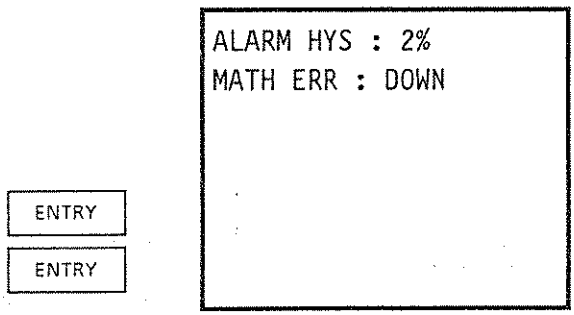
② MATH ERR : DOWN

[Key operation]	[Setting display]	[Description]
NEXT, F3	SET UP ↓ UNIT PRN RCD RMT ↓ COM RJC OTHR RAM	Press the NEXT and F3 key to enter the OTHER setting mode.
1 2 3	ALARM HYS : 0% MATH ERR : UP ← → del	Set alarm hysteresis within the 0 to 100% range. Set hysteresis in % with respect to span width. (0%set at the factory.)



Set MATH ERR to F2 (DOWN).
(Set to UP prior to shipment.)

F2



After setting is finished press the ENTRY key.
If the ENTRY key is pressed once, the display returns to the SET UP menu and, if it is pressed twice, to the start-up state.

ENTRY

ENTRY

(6) RAM CLEAR setting

Function : Returns the SET UP, range, etc. settings currently set to their initial values.

Note : SET-UP TEMP UPNIT and time setting are not cleared.

[Key operation]	[Setting display]	[Description]
	SET UP ↓ UNIT PRN RCD RMT ↓ COM RJC OTHR RAM	Press the NEXT and F4 key to enter the RAM CLEAR setting mode.
NEXT F4		
	RAM CLEAR : NO ↓ YES NO	Press the F1 key when returning to the initial setting. (Set to ON prior to shipment.) To suspend the procedure at this stage, press the F2 key. If the ENTRY key is pressed once, the display returns to the SET UP menu to execute RAM CLEAR, and if the ENTRY key is pressed twice, the display returns to the start-up state.
F1 ENTRY ENTRY		

6.4.15 Program Table

Table 6.6 shows the functions which can perform settings at the initial settings prior to shipment.

Table 6.6

		NEXT	F1	F2	F3	F4
Function Selection	CH	*↓	1CH	2CH*	3CH*	4CH*
	MODE	↓	OFF	VOLT	TC	RTD*
		↓	DELT	SCAL	COPY	COM*
		↓	MATH*			
	FILTER		0.1Hz	1Hz	OFF	
	TC TYPE	↓	R	S	B	K
		↓	E	J	T	N
		↓	W	L	U	KpvsAu7Fe
	RTD TYPE	↓	Pt1(Pt100 : 1)	Pt2(Pt100 : 2)	Pt3(Pt100 : 3)	Pt4(Pt50 : 1)
		↓	Pt5(Pt50 : 2)	JPt1(Pt100 : 1 / JPt)	JPt2(Pt100 : 2 / JPt)	JPt3(Pt100 : 3 / JPt)
		↓	JPt4(Pt50 : 1 / JPt)	JPt5(50 : 2 / JPt)	Ni1D(Ni100 : 1 / DIN)	Ni1S(Ni100 : 1 / SANA)
		↓	J263*B			
	Sub mode		VOLT	TC	RTD*	COM*
	MOVE SPAN		L	R	L & R	Srch
	RECORD AREA ADJUST		L	R		
	AUX	↓	ALM	TAG*	RCD	MSG*
		↓	CLK	RAM		
	ALM		H	L	OFF	
	ALM(RLY)	↓	OFF	1	2	3
		↓	4			
		↓				
	Recording format		ON	OFF		
	SPAN SCALE, etc		←	→	del	
	SCALE mode span		←	→	del	meas
	Unit, etc.	↓	←	→	del	
		↓	Ω	μ	%	&
	Chart speed		←	→	mm / H	mm / M

Setting knob Selection								
Chart speed mm / min mm / h	10	12	20	30	50	60	75
	100	120	150	200	300	500	600
	750	1000	1200				
Chart speed inch / min inch / h	0.5	1	1.2	2	3	5	6
	10	12	20	30	45		
Range high-sensitivity	100μV	200μV	500μV	1mV	2mV	5mV	10mV
	20mV	50mV	100mV	200mV	500mV	1V	2V
	5V	10V	20V	50V	100V	200V	
Range medium-sensitivity	1mV	2mV	5mV	10mV	20mV	50mV	100mV
	200mV	500mV	1V	2V	5V	10V	20V
	50V	100V	200V				
Range low-sensitivity	10mV	20mV	50mV	100mV	200mV	500mV	1V
	2V	5V	10V	20V	50V	100V	200V

* Depending on Model name (No. of pens) and options these functions may not be provided.

6.4.16 Error Message

Incorrect operation panel key operation causes an error message to be displayed.

The details of incorrect settings can be read from the numerics next to the error display. Therefore, re-set in this case.

Table 6.7

Error No.	Details
1	Grammar incorrect
2	The entered value exceeds the specified range or it is a value which cannot be set.
3	CH No. unsettable.
4	The entered constant exceeds the specified range or it is a value which cannot be set.
5	Character unsettable.
7	The entered mode type is not appropriate.
9	An unsettable range is selected.
10	The equation setting is inappropriate.
12	The set value is out of the settable range or is incorrect.
13	The set value is out of the settable range or is incorrect.
26	The RJC value is out of 20000 in the SET UP mode and at RJC EXT.
27	The ALARM HYS set-value exceeds 0 to 100% in the SET UP mode and at RTC OTHER.
31	Memory card related error. When this error is output, the following may be considered as a cause. 1. No memory card is inserted. 2. The memory card is not inserted correctly. 3. There is no data to be loaded during loading. 4. DATA DELETE while the memory card is used. 5. There is a mistake in the file name <all-space> 6. There is a mistake in the volume label <all-space> 7. Not initialized 8. Insufficient memory 9. The 8K byte card is used for data recording and regeneration.
61	Alarm setting VAL (alarm value) exceeds the settable range.
62	The partial suppression and extension, and BDY partial suppression prints are set out of their settable ranges.
64	Incorrect data and time settings.
66	Chart speed is set out of the following settable ranges. mm unit 10~1200 inch unit 0.5~45

7. MAINTENANCE

7.1 Fuse Replacement

It is recommended that the fuse be replaced every 2 years as part of preventative maintenance.

(1) The fuse holder is at the bottom of the power connector on the rear panel. (Fig. 7.1)

(2) Insert a screwdriver into the top of the fuse holder then pull it forward to remove the fuse holder.
The fuse holder can house 2 fuses; the fuse in service and a spare fuse. (Fig. 7.2)

(3) Replace the fuse in service with a new or spare fuse.
Fuse in service
100 V system : 2 A time lag type
Part No. A9134KF
200 V system : 1 A time lag type
Part No. A9132KF

(4) Return the fuse holder to its original position to complete fuse replacement.

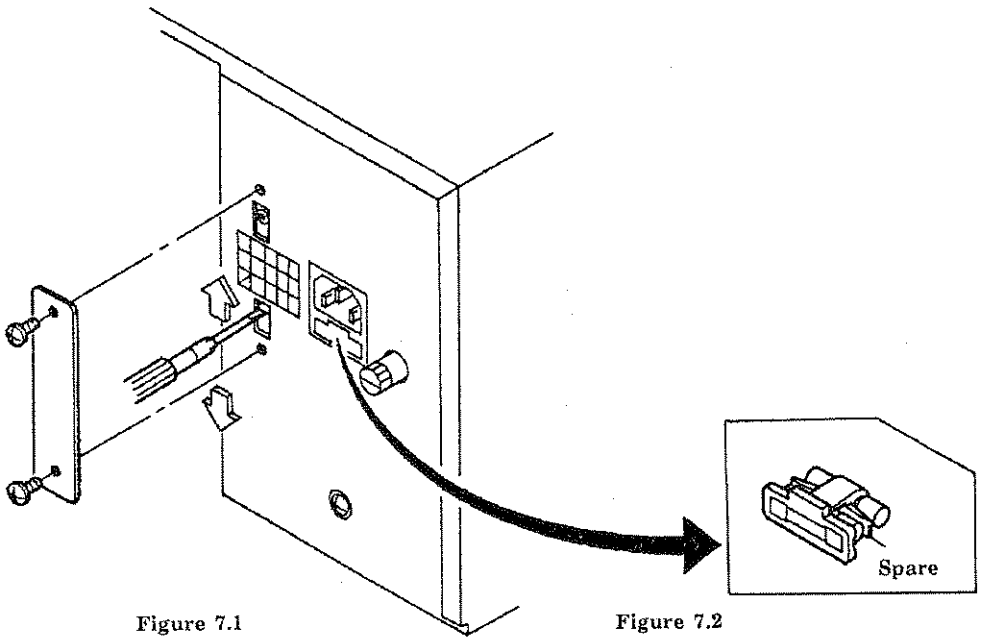


Figure 7.1

Figure 7.2

7.2 Power Supply Voltage Change

The power supply of this recorder can be changed to any of 100/115/200/230 V AC + 10 % after delivery.

(1) Remove the plate from the power supply voltage select section on the rear panel. (Refer to Fig. 7.3.)
The power supply voltage select slide switch is in this section.

(2) Set the switch positions to the power supply voltage required.
The positions are as follows.

Power supply voltage	Switch positions	Fuse	Remarks
100V		2A	
115V		2A	Switch position
200V		1A	
230V		1A	

(3) When the power supply voltage is changed to a 100 V system from a 200 V system, and vice versa. always change the fuse.

100 V system : 2A time lag type
Part No. A9134KF

200 V system : 1 A time lag type
Part No. A9132KF

(4) The change has been completed if the plate is installed.

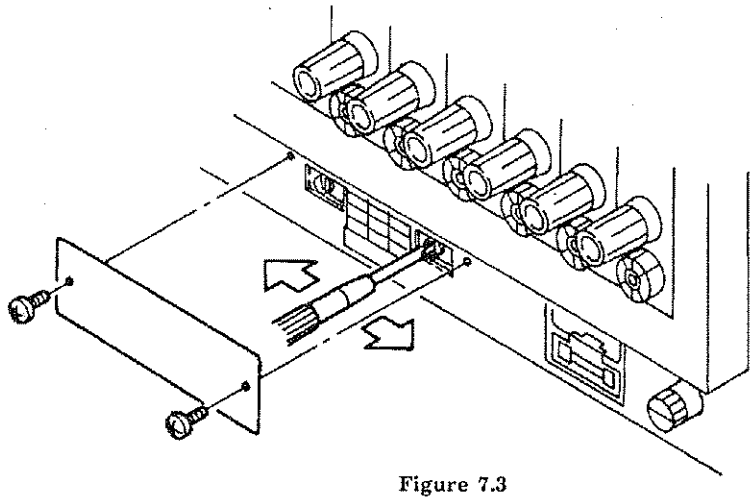


Figure 7.3

7.3 Cleaning

When cleaning the LR4100 panel, wipe off dust using a soft cloth. Never attempt to clean the panel with thinner or alcohol.

8. SPECIFICATIONS

MEASUREMENTS

Drive System: Automatic null-balancing digital servo mechanism with brushless DC servomotor.

Type of Input: Floating, guarded and shielded (No guard on 10 mV F.S. model).

Input Types & Measuring Ranges: DC V... 10 mV to 200 V F.S., 1 mV to 200 V F.S., or 0.1 mV to 200 V F.S.
TC (ANSI, DIN, JIS)...Type R, S, B, K, E, J, T, N, W, L (DIN), U (DIN),
TC (NBS)...KP vs Au7Fe (4 to 280K),
RTD...Pt 100 (1mA), JPt 100 (1mA), Pt 50 (1mA), Ni 100
RTD (YOKOGAWA)...J263•B (2 to 300K; Pt-Co).
Pt 100: JIS C1604-1989, JIS C1606-1989
DIN IEC751, IEC751
JPt 100: JIS C1604-1989, JIS C1606-1989
Pt 50: JIS C1604-1981, JIS C1606-1986
Ni 100: DIN, SAMA

Accuracy: DC V... ±(0.05% of rdg + 0.03% of range + 0.5 μV).
TC... ±(0.05% of rdg + 0.5°C) for K, E, J, T, L, U and KP vs Au7Fe, ±(0.05% of rdg + 1°C) for R, S and B, ±(0.1% of rdg + 0.5°C) for N, ±(0.1% of rdg + 1°C) for W.
RTD... ±(0.05% of rdg + 0.2°C) for Pt 100 Ω and Ni 100 Ω, ±(0.05% of rdg + 0.3°C) for Pt 50 Ω and J263•B. (at 23±2°C, 55±10% R.H.).

Reference Junction Compensating Accuracy (TC): ±0.5°C for K, E, J, T, N, W, L, U and KP vs Au7Fe, ±1°C for R, S and B (measuring range of down to −100°C).

Bias Current: 4 nA.

Filter: 0.1, 1 Hz or OFF (selectable).

Zero Set: Adjustable.

Measuring Cycle: 135 Hz.

Pen Offset Compensation (Standard): Average, max./min. recording selectable (with compensation ON/OFF switch), resolution on time axis... 0.05 mm.

Input Impedance: Approx. 1 MΩ (DC V & TC).

Allowable Source Resistance: Less than 1 kΩ (DC V & TC).

Temperature Coefficient: Zero drift...0.05μV/°C+0.01% of range/°C, F.S. ...0.01% of range/°C.

Maximum Allowable Input Voltage: 250 V DC.

Maximum Common Mode Voltage: 250 Vrms AC.

Commom Mode Rejection: More than 150 dB at AC.

Normal Mode Rejection: More than 50 dB at 50 or 60 Hz.

RECORDING & PRINTING

Writing System: Ink writing using disposable felt-tip pen cartridges (analog data).

Printing System*: Wire-dot printer using ribbon cassette (digital data).

Effective Recording Span: 250 mm (analog data).

Pen Offset between Channels: Approx. 4 mm on the time axis.

Number of Channels: 1, 2, 3 or 4.

Recording Colors: 1st pen...red, 2nd pen...green, 3rd pen...blue, 4th pen...brown.

Recording Accuracy: Measurement accuracy + ±0.2% of effective recording span (including non-linearity, dead-band and error between ranges).

Maximum Pen Speed: Approx. 1,600 mm/s.

Maximum Pem Acceleration: Approx. 8G.

Printing Rate*: Approx. 1.5 s/line.

Chart: Z-fold chart (344 mm x 20 m).

Chart Speeds: 10 to 1,200 mm/min & mm/h (1 mm steps), and 0.5 to 45.0 inch/min & inch/h (0.1 inch steps).

Change of Chart Speed: Changes chart speed with remote control signals (optional).

RECORD ON/OFF Selectors: Independently provided for each channel on the front panel (ON... measurement/recording, OFF... measurement).

Pen Lift*: All pens are simultaneously lifted and lowered.

Chart Drive: Pulse motor drive.

Chart Speed Accuracy: ±0.1% (at recording of longer than 1 m).

Digital Data Printout*: Time, chart speed, channel number (tag number), measured data and engineering unit are printed out at the following intervals:

Chart speed		Printing intervals
mm/min	mm/h	
1,200 to 300	–	1 min
299 to 30	–	10 min
29 to 10	1,200 to 120	1 h
–	199 to 60	2 h
–	59 to 40	3 h
–	39 to 20	6 h
–	19 to 10	12 h

Tag Number Printout*: Tag number can be printed out in place of channel number (up to 7 alphanumerics).

Alarm Printout*: Channel number, alarm type, and the time of alarm ON/OFF are printed.

Scale Markings Printout*: 0% and 100% scale values can be printed out at the same interval as digital printout.

Program List Printout*: Contents of entire setting memory can be listed on the chart.

Manual Printout*: Time and measured data for all channels can be printed out in a single line by a push of MANUAL PRINT key.

Message Printout*: Message of up to 70 characters can be printed at a push of MANUAL MESSAGE key (Message 0), or by external contact signal (Message 1 to 4; optional, up to 4 channels).

Change of Chart Speed Printout*: Chart speed and time can be printed out at the change of chart speed.

Pen Offset Compensation ON/OFF Printout*: ON, OFF mark and time can be printed out.

Change of Range Printout*: Changed contents and time can be printed at the change of range (on Auto recording span shift mode).

Partially Expanded-Scale Recording: Any portion within full scale can be expanded or reduced for each channel.

Auto Recording Span Shift Mode: Automatically shifts to ±50% of span, and recording continues when the input exceeds the measuring span.

External Input Span: Small error of external converter can be corrected by setting the span with actual input voltage (zero...span left, full...span right).

*Note: **LR4110** only.

DISPLAY

Type of Display: Vacuum fluorescent display (5 x 7 dot matrix, blue), 20 characters for each channel.

Display Modes: 3 display modes can be selected at a push of DISPLAY SELECT key; Digital data display... Measured data (7 digits), date and time, or chart speed, Bar graph display (2.5% resolution), Range data display.

ALARMS

Number of Alarm Set Levels: Up to 2 levels/channel.

Alarm Types: High (H), low (L), delta high (dH), and delta low (dL).

Alarm Outputs (Optional): Up to 4 points (internal, contact rating... 24 V DC and AC 1A).

COMPUTING FUNCTIONS

Standard Functions: Scaling (ranges... −22000 to +22000), and delta T.

Optional Mathematical Functions: +, −, ×, ÷, square root, absolute value, logarithm, exponential function (up to 4 channels).

GENERAL SPECIFICATIONS

Standard Memory Card: For storing the setting data (memory capacity of 8K bytes), standard accessory... lithium battery, 1 pc. (battery life of about 5 years).

Battery-Backup Memory: Maintains all setting for about 10 years (at room temperature) when power is removed.

Chart END Alarm: Automatic pen lift (**LR4110** only) at out-of-chart condition (alarm output, optional).

Mounting: Desk-top or flush panel mounting (may be inclined up to 10° backward from vertical).

Operating Temperature Range: 0 to 40°C (32 to 104°F).

Humidity Range: 30 to 80% relative humidity.

Insulation Resistance: More than 100 MΩ at 500 V DC between power line and case, and between input terminals and case.

Dielectric Strength: 1,500 V AC for one minute between power line and case, and between input terminals and case.

Power Requirements: 100, 115, 200 or 230 V AC (must be specified), for both 50 and 60 Hz.

Power Consumption: 1 channel model... 85 VA max., 45 VA balanced, 2 channel model... 100 VA max., 50 VA balanced, 3 channel model... 115 VA max., 55 VA balanced, 4 channel model.. 130 VA max., 60 VA balanced.

Dimensions: Approx. 199 (H) x 438 (W) x 323 (D) mm, 7-7/8 x 17-1/4 x 12-3/4".

Weight (Approx.):

Model	1-channel	2-channel	3-channel	4-channel
LR4110	12.5 kg (27.6 lbs)	13 kg (28.7 lbs)	13.5 kg (29.8 lbs)	14 kg (30.9 lbs)
LR4120	11.5 kg (25.4 lbs)	12 kg (26.5 lbs)	12.5 kg (27.6 lbs)	13 kg (28.7 lbs)

OPTIONAL FEATURES

■ GPIB INTERFACE (/GP-IB)

Functional, Electrical and Mechanical Specifications: Meets the IEEE Standard 488-1978.

Talker Functions: Input of measured data (ASCII), output of measured data (ASCII and binary), input/output of setting data (ASCII), output of memory data (ASCII and binary).

Listener Functions: Controls except for power ON/OFF, key lock ON/OFF and chart drive.

■ RS-232C INTERFACE (/RS232C)

Functional, Electrical and Mechanical Specifications: Meets the EIA RS-232C.

Controller Interface Functions: Input of measured data (ASCII), output of measured data (ASCII and binary), input/output of setting data (ASCII).

Data Transfer Rates: 75, 150, 300, 600, 1,200, 2,400, 4,800, 9,600 bps.

■ SETTING & MEASURED DATA MEMORY (/MEM)

Medium: Memory card **(378904)**

Sampling Rate: Free mode (manual start)... 135, 9, 5, 3, 1, 0.5, 0.2 Hz, trigger mode (starts by trigger conditions)... 9, 5, 3, 1, 0.5, 0.2 Hz.

Memory Capacity: 256K bytes.

Data Length: 1,000, 2,000, 4,000, 8,000, 16,000, 32,000 data/channel (common setting to each channel, 2 bytes/data).

Trigger Condition: Alarm detection, CHART END or external contact input (optional).

Pre-Trigger: 0 to 100% (10% steps).

Memory Data: Measured data, interface input data and computed data.

Output: Interface and recording output.

Standard Accessory: Lithium battery... 1 pc. (battery life of about 3 years).

■ REMOTE CONTROLS (/REM)

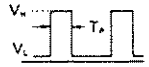
Remote Control Signals: External contact, open collector or TTL-level signal.

Chart Drive Control: Start... L logic level or closed contact, Stop... H logic level or open contact.

Change of Chart Speed: Chart speed 2... L logic level or closed contact, Chart speed 1... H logic level or open contact.

Manual Printout*: Printout date & time and measured data ... L logic level or closed contact.

Chart Speed:

Remote control signal waveforms	Sine, triangular, rectangular waves	Pulse train
Signal level	 4V < Vp < 24V	 +4V < VH < +24V −24V < VL < +0.5V TA > 300μs
Max. signal source impedance	600 Ω	50 Ω
Chart speed	0.15f cm/min (f... Hz or PPS)	
Max. frequency	800 Hz	800 PPS

Message Printout*: Start... L logic level or closed contact.
Pen Lift*: All recording pens lowered... L logic level or closed contact, all recording pens lifted... H logic level or open contact.
RECORD ON/OFF Selection: OFF (measurement)... L logic level or closed contact, OFF (measurement/recording)... H logic level or open contact.
External Trigger: Data memory (**/MEM**), write... L logic level or closed contact.
*Note: **LR4110** only.

■ ALARMS (/AK-04)

Number of Outputs: 4 points (internal).
Contact Rating: 24 V DC and AC 1A.
Outputs: Alarm, FAIL alarm and chart END alarm outputs.

9. ADJUSTMENT

CAUTION

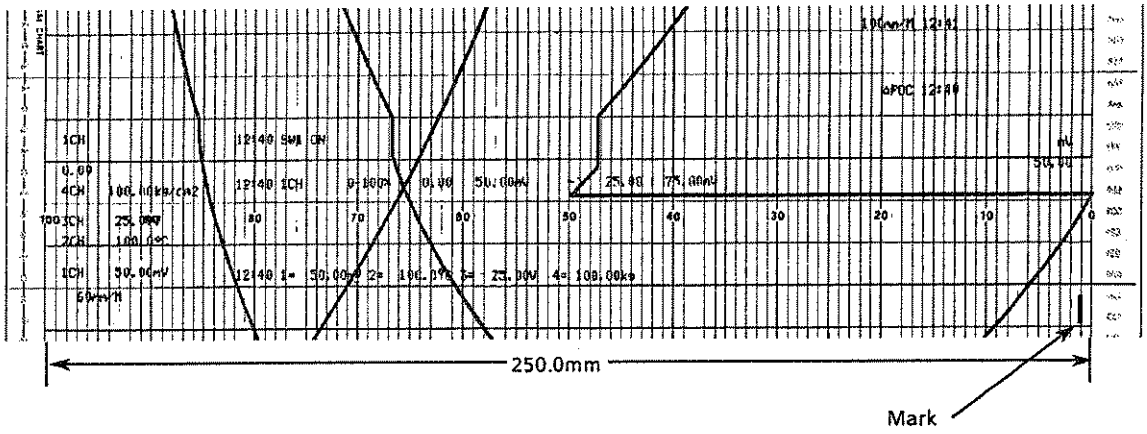
1. The following adjustment procedures are for service technicians that have recieved professional training. If the adjustments are made by the user these adjustment procedures must be thoroughly read and followed carefully.
2. Adjustment data are stored in a non - volatile memory, however note that. if the memory is handled carelessly, the data may be erased.

9.1 Span Adjustment

- Adjust the span when the MAIN CPU BOARD ASS'Y is replaced or pen zero span is incorrect.

1. Procedures

(1) Using a ruler, mark the chart at a point 250.0mm from the 0% position which is regarded as the standard point.
(2) Install the chart
(3) Perform the following key operations and set each pen absolute value (each pen must be installed securely).



[Key operation]	[Setting display]	[Description]
	SET UP ↓ UNIT PRN RCD RMT	While pressing AUX set up the power supply.
NEXT NEXT F1		Press NEXT twice and select F1 ADJ.
	↓ COM RJC OTRH RAM ↓ ADJ	
	ADJ SPAN A/D RAM	Select F1 SPAN.
F1		
	1CH 120~14924 2CH 123~14915 4CH 120~14930 L R	Specify L position (0% side) or R position (100% side) by selecting F1 or F2 Adjust (0 to 16,000) with the setting knob. When the corresponding channeladjustment is complete, specify the next CH using the cursor keys ▽ and △.
F1orE2		
	SET UP ↓ UNIT PRN RCD RMT	When setting is complete, press ENTRY to store the measuement data in the non-volatile memory. Press ENTRY once, the panel returns to the SET UP menu, press again and the panel returns to the startup status.
ENTRY (ENTRY)		

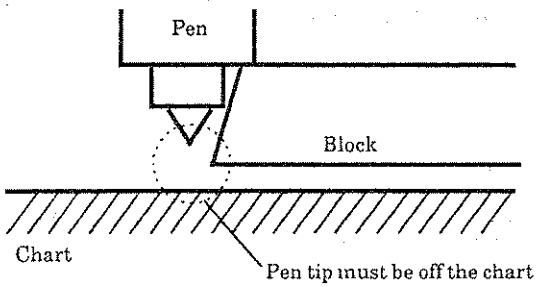
2. Adjustment Instructions

① Adjustments should be made while observing chart expansion or contraction and confirming the correct position of the RIGHT side SPAN using a correct jig such as a glass scale.

② Care must be taken not to cause an error by erroneous pen installation.

*1. For the LEFT side SPAN, the 0% mark on the chart can be regarded as standard as chart expansion and contraction can be ignored.

③ When the LEFT side SPAN is adjusted, turn each pen RECORD switch OFF, and confirm that each pen runs on the left side block and the pen tip is off the chart.



9.2 A / D Accuracy Adjustment

(1) General

The accuracy adjustment for the LR employs a method to store the measurement errors in the non - volatile memory located in the input module and performs measurement compensation in place of using a method with a potentiometer.

(2) Adjustment Environment

To ensure standard traceability and mainframe specifications, the accuracy adjustment should be performed in thermally stabilized conditions as follows:

23° C ± 5° C, 55 ± 10% R.H.

For high - or medium - sensitivity specifications, zero point shift due to air- conditioning equipment or abrupt temperature changes cannot be ignored. therefore an appropriate air screen should be used.

(3) Standards

The standards used for instrument calibration or inspection must be satisfy the following specifications. The operating conditions are :

23° C ± 5° C, 55 ± 100% R.H.

FUNCTION	OUTPUT	ACCURACY	FUNCTION	OUTPUT	ACCURACY
DC V	± 20V ± 2V ± 1V ± 500 mV ± 200 mV ± 100 mV ± 50 mV ± 20 mV ± 10 mV	± 0.006 %	RTD	40 Ω 160 Ω 100 Ω	± 5m Ω
	0 mV	± 0.1μV			

(4) Warm up the instrument for at least one hour prior to adjusting the instrument.

(5) A/D Calibration

For A/D conversion, each full scale value is converted as follows:

LEFT side (-) -24,000 counts

RIGHT side (+) +48,000 counts

To check that this conversion is performed correctly,

① Complete a zero adjustment

② Check number of counts (error) of each ± full span.

The operating procedure is as follows:

[Key operation] **[Setting display]** **[Description]**

NEXT
NEXT
F1

```
SET  UP


↓ UNIT PRN RCD RMT
```

While pressing [AUX], set up the power supply.
Press [NEXT] twice and select F1 ADJ.

```
↓ COM RJC OTHR RAM
↓ ADJ
```

```
ADJ


  SPAN  A/D  RAM
```

Select F2 A/D
Here Specify changed INPUT UNIT ASS'Y CH. NO. and make a zero adjustment.

F2

F1~4

```
1CH
ID :  2
20V :   -28


100mV : -14
  1CH  2CH  3CH  4CH
```

See the next page for setting item details.
If the calibration data satisfies the following standard values:

- ± 1000 or less at zero calibration and RIGHT side calibration.
- However, the accuracies can only be regarded as normal on ± 2000 in the 100 μV range.

ENTRY
(ENTRY)

```
SET  UP


↓ UNIT PRN RCD RMT
```

Press [ENTRY] once to return the panel to the SET UP menu when setting is completed.
Press again, the panel returns to the starting status.

• For A/D calibration, the setting items on the panel are as follows:

However, in the field, only ZERO calibrtation should be performed if necessary but other items must not be changed.

Panel Display	Function Display					Sensitivity			Operating Procedure and Others
		F1	F2	F3	F4	High	Medium	Low	
CH	↓	1CH	2CH	3CH	4CH				
		ID	←	→	del				Enter ID code. 0 : High-sensitivity RTD provided (B9619PX). 1 : Medium - sensitivity RTD provided (B9619PV). 2 : Low - sensitivity RTD provided (B9619PT). 3 : High - sensitivity RTD not provided (B9619PW). 4 : Medium-sensitivity RTD not provided (B9619PU). 5 : Low - sensitivity RTD not provided (B9619PS).
20V :		—	+			○	○	○	Calibration of A/D (Voltage range) Enter voltage which is now displayed. Example (calibration of 10 mV) ① Enter - 10 mV and press F1. ② Enter + 10 mV and press F2 + then move to any item.
2V :		—	+			○	○	○	
1V :		—	+			○	○	○	
500mV :		—	+			○	○	○	
200mV :		—	+			○	○	○	
100mV :		—	+			○	○	○	
50mV :		—	+			○	○	○	
20mV :		—	+			○	○	○	
10mV :		—	+			○	○	○	
200mV :		—	+			○	○	○	Adjustment of internal attenuator
20mV :		—	+			○	○	○	
100μV (Z) :		ZERO				○			Calibration of A/D (ZERO adjustment) performs ZERO adjustment Enter 0 V and press F1 ZERO.
200μV (Z) :		ZERO				○			
1mV (Z) :		ZERO				○	○		
10mV (Z) :		ZERO				○	○	○	
RTD :		40Ω	160Ω						Calibration of A/D (only when RTD range is provided.) ① Connect resistance of 40 and press F1 40Ω ② Connect resistance of 160 and press F2 160Ω
RTD:(Z)		100Ω							Calibration of A/D (only when RTD range is provided) Connect resistance of 100Ω and press F1 100Ω

(6) Instructions for connections etc. when calibrating the instrument

When calibrating the instrument, the instrument and the standards to be used must be carefully connected so that they are in a very stable condition.

Take special care when two or more channels are calibrated concurrently, as interference may easily occur between the two instruments. Therefore, connect the instrument as follows (for voltage input).

- LR : Independent GUARD (Guard transfer switch must be positioned at center). However, all guard terminals between channels may be connected.

Use a twisted copper wire (not plated) and connect each channel separately (50 cm or more).

However, Input voltage may be applied to all channels simultaneously.

- DC voltage standard : Using independent GUARD, connect to LR. (2552)
- Precision Digital Multimeter : Using LO - GUARD, connect to the LR. (2501A)

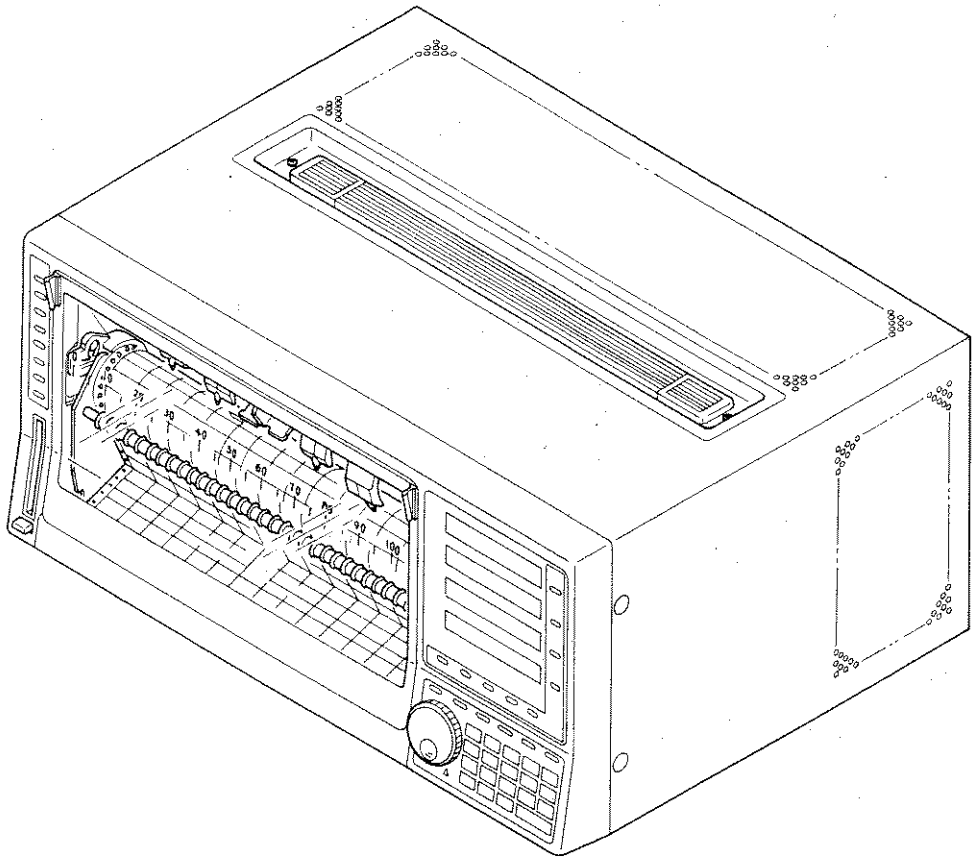
Before A / D calibration; perform zero adjustment.

For RTD calibration, do not forget to operate the selector switch of the input module G / B terminals.

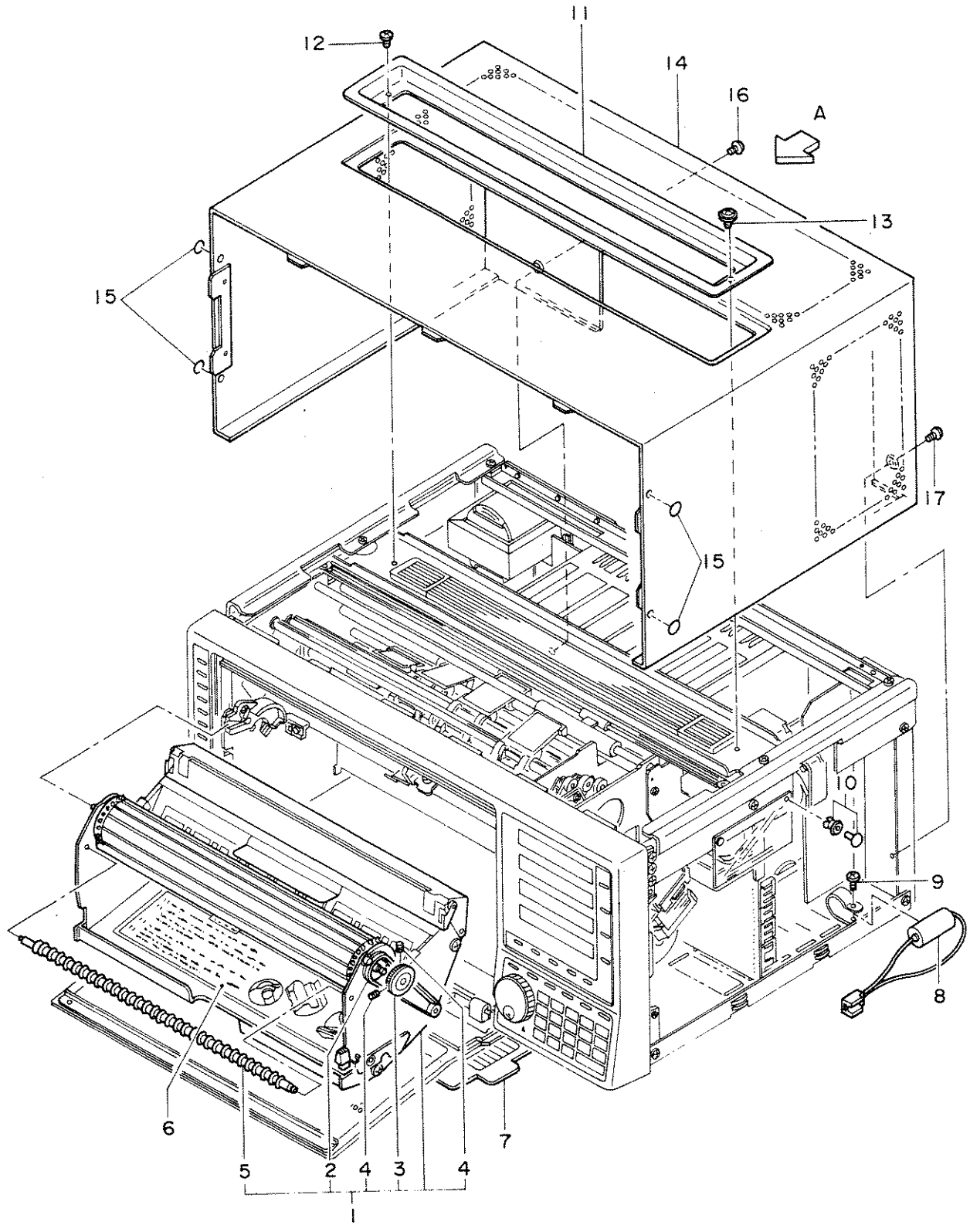
Customer Maintenance Parts List

Models 3711 and 3712
LR4100 Recorders

LR 4100



CMPL 3711-01E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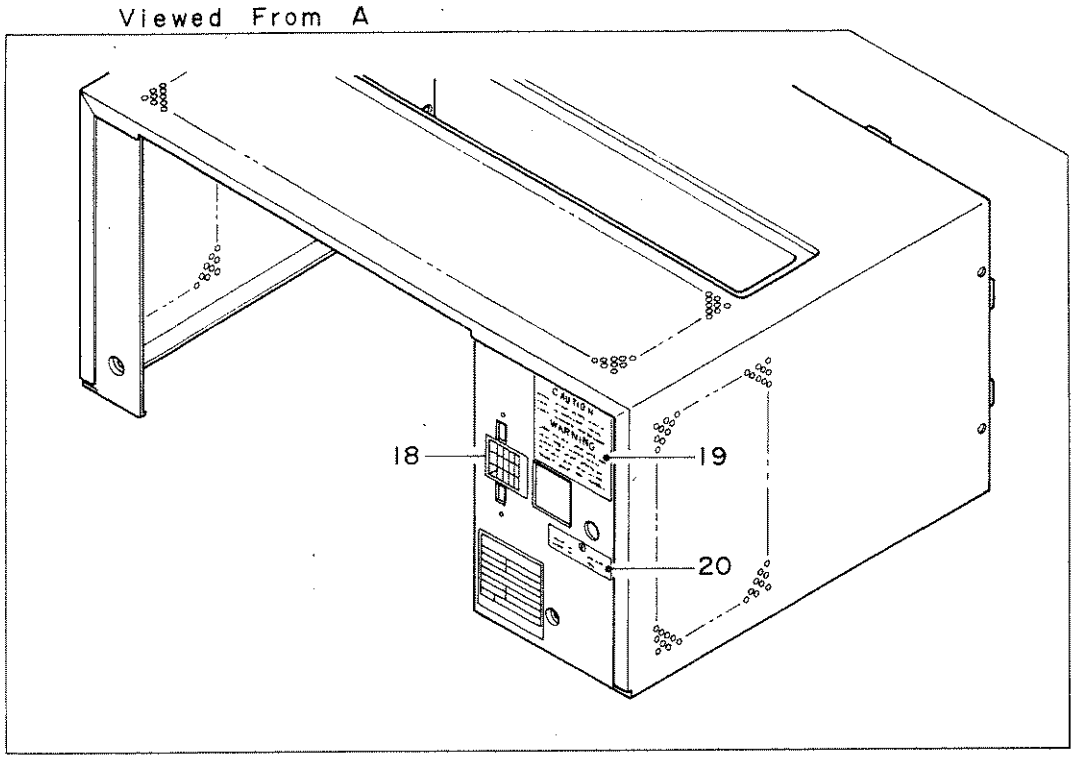
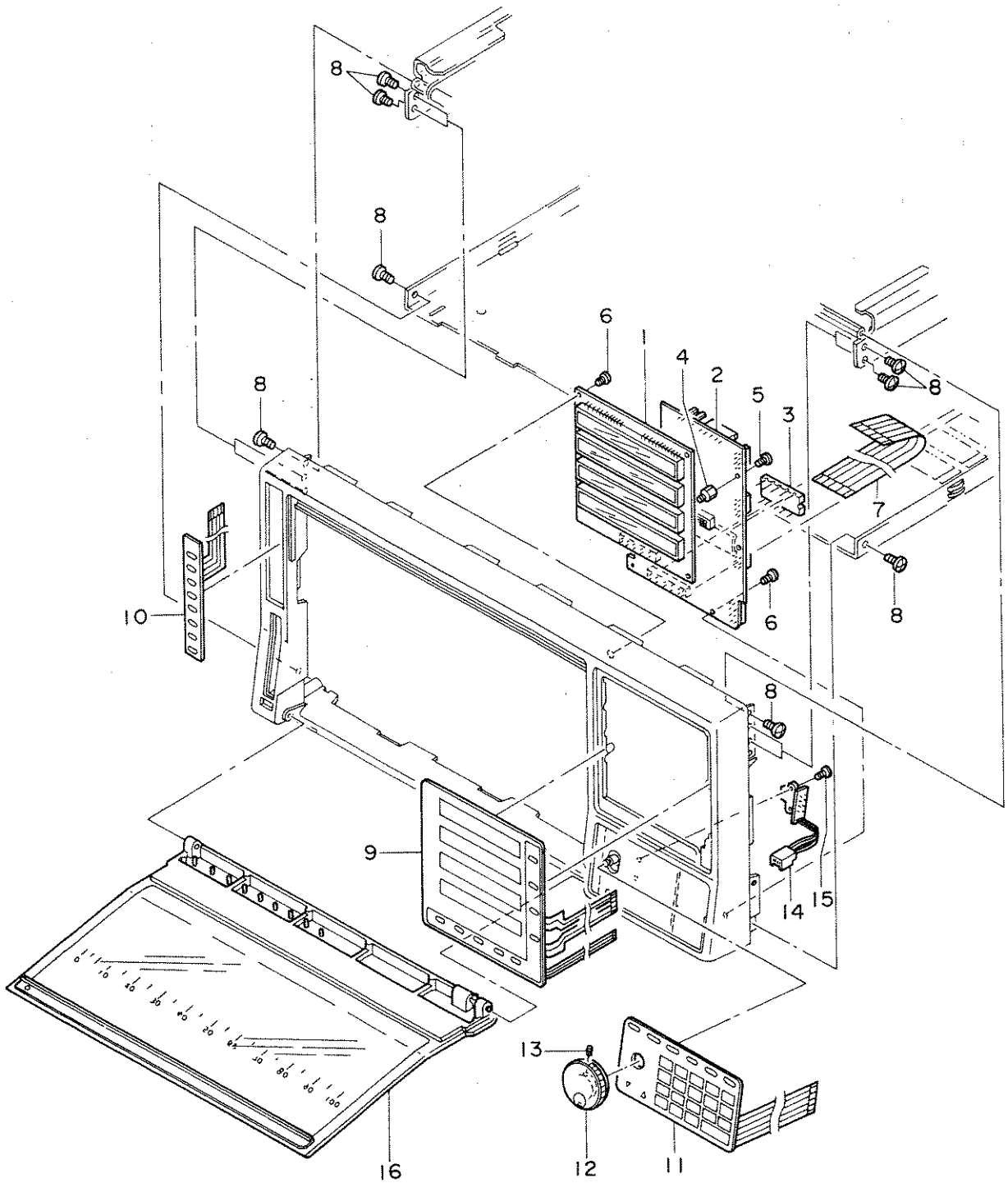


Item	Part No.	Qty	Description
1	B9619HA	1	Chart Cassette Assembly
2	B9619JD	1	Belt
3	—	1	Pulley
4	Y9203SE	2	Setscrew
5	B9585PF	1	Collar Assembly
6	B9619AL	1	Nameplate (for japanese) } (select either one)
	B9619AN	1	Nameplate (for english)
7	B9585AB	1	Nameplate (for japanese) } (select either one)
	B9585BB	1	Nameplate (for english)
8	B9588ZB	1	Battery Assembly
9	Y9306LS	1	B. H. Screw, M3 x 6
10	B9543SQ	2	Rivet
11	—	1	Cover
12	Y9304LS	1	B. H. Screw, M3 x 4
13	Y9306LK	1	B. H. Screw, M3 x 6 (with toothed lockwasher)
14	—	1	Cover Assembly
15	B9585AX	4	Plate
16	Y9306LK	1	B. H. Screw, M3 x 6 (with toothed lockwasher)
17	Y9304LS	1	B. H. Screw, M3 x 4
18	B9585AT	1	Nameplate (for power supply voltage select)
19	B9585AU	1	Nameplate (for warning label)
20	Below	—	Nameplate
	B9585AP	1	100 V AC } (select)
	B9585AQ	1	115 V AC
	B9585AR	1	200 V AC
	B9585AS	1	230 V AC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Item	Part No.	Qty	Description
1	B9619BE	1	VFD *1 *2
	B9619BF	1	VFD *3
	B9619BG	1	VFD *4
2	B9619SF	1	Display Board Assembly
3	B9619UF	1	ROM Assembly
4	—	3	Rod
5	Y9304LS	3	B. H. Screw, M3 x 4
6	Y9305TY	4	Tapping Screw, M3 x 5
7	B9585BG	1	Cable (VFD ↔ mother board)
8	Y9405LS	8	B. H. Screw, M4 x 5
9	B9619CG	1	Panel Assembly *1
	B9619CH	1	Panel Assembly *2
	B9619CJ	1	Panel Assembly *3
	B9619CK	1	Panel Aseembly *4
10	B9619FF	1	Keyboard *5
	B9619FG	1	Keyboard *6
	B9619FA	1	Keyboard *7
	B9619FB	1	Keyboard *8
11	B9619FD	1	Keyboard
12	B9585BX	1	Knob Assembly
13	Y9203SE	1	Setscrew
14	B9585DV	1	Interrupter Assembly
15	Y9204KB	2	B. H. Screw, M2, 3 x 4
16	B9619BP	1	Cover Assembly

Note

*1: For Models 37 $\frac{1}{2}$ 1□ (1 channel)

*2: For Models 37 $\frac{1}{2}$ 2□ (2 channels)

*3: For Models 37 $\frac{1}{2}$ 3□ (3 channels)

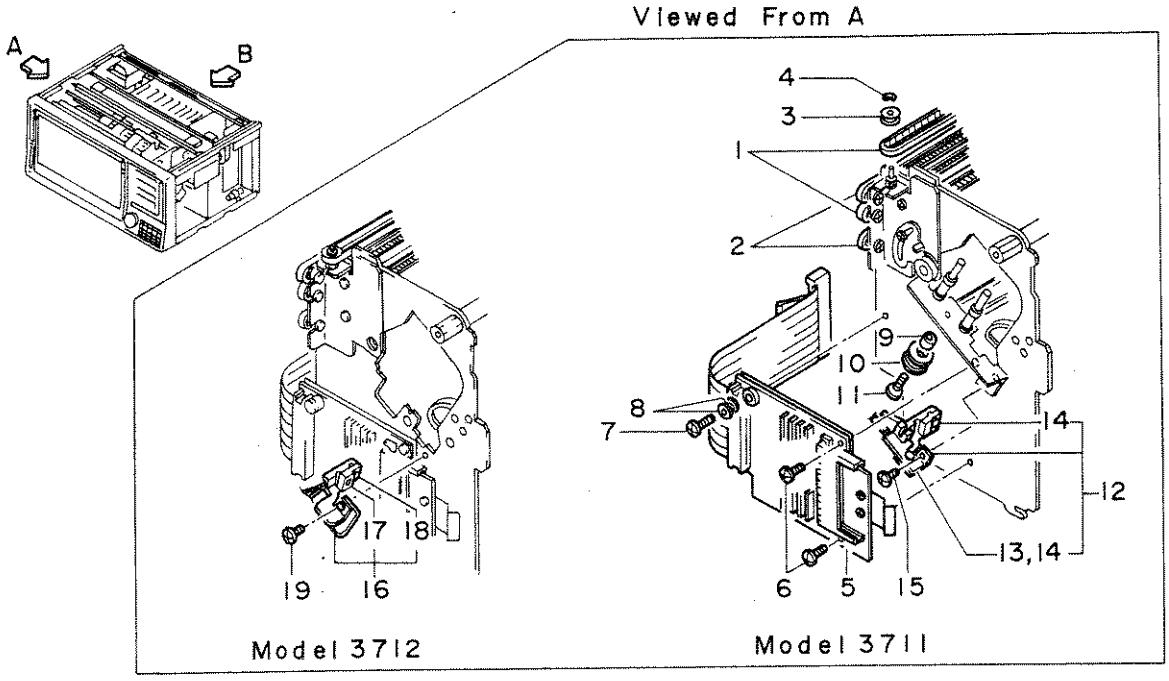
*4: For Models 37 $\frac{1}{2}$ 4□ (4 channels)

*5: For Model 3711 1□ (1 channel)

*6: For Models 3711 $\begin{matrix}2\\3\\4\end{matrix}$ □ (2, 3 and 4 channels)

*7: For Model 3712 1□ (1 channel)

*8: For Models 3712 $\begin{matrix}2\\3\\4\end{matrix}$ □ (2, 3 and 4 channels)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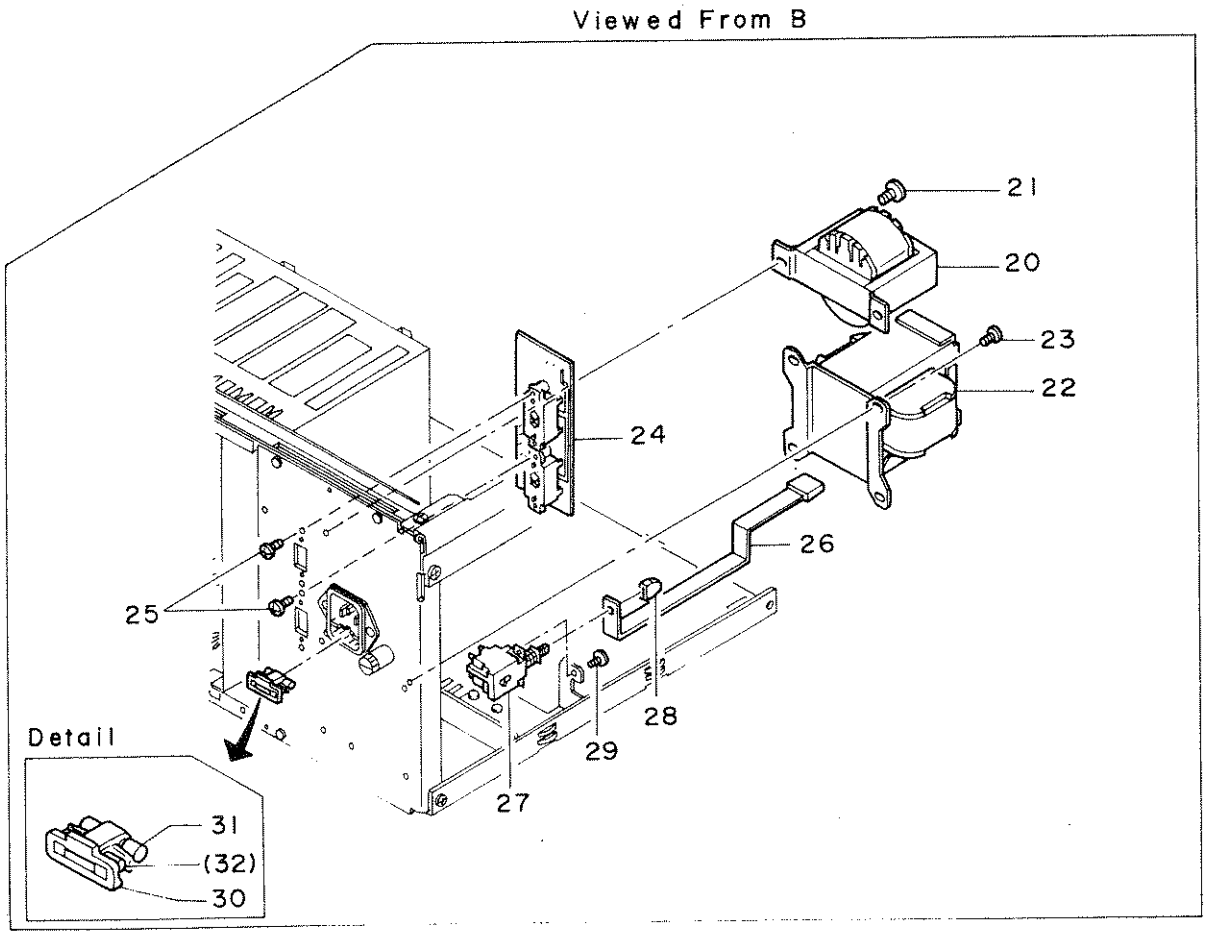
Model 3712
Model 3711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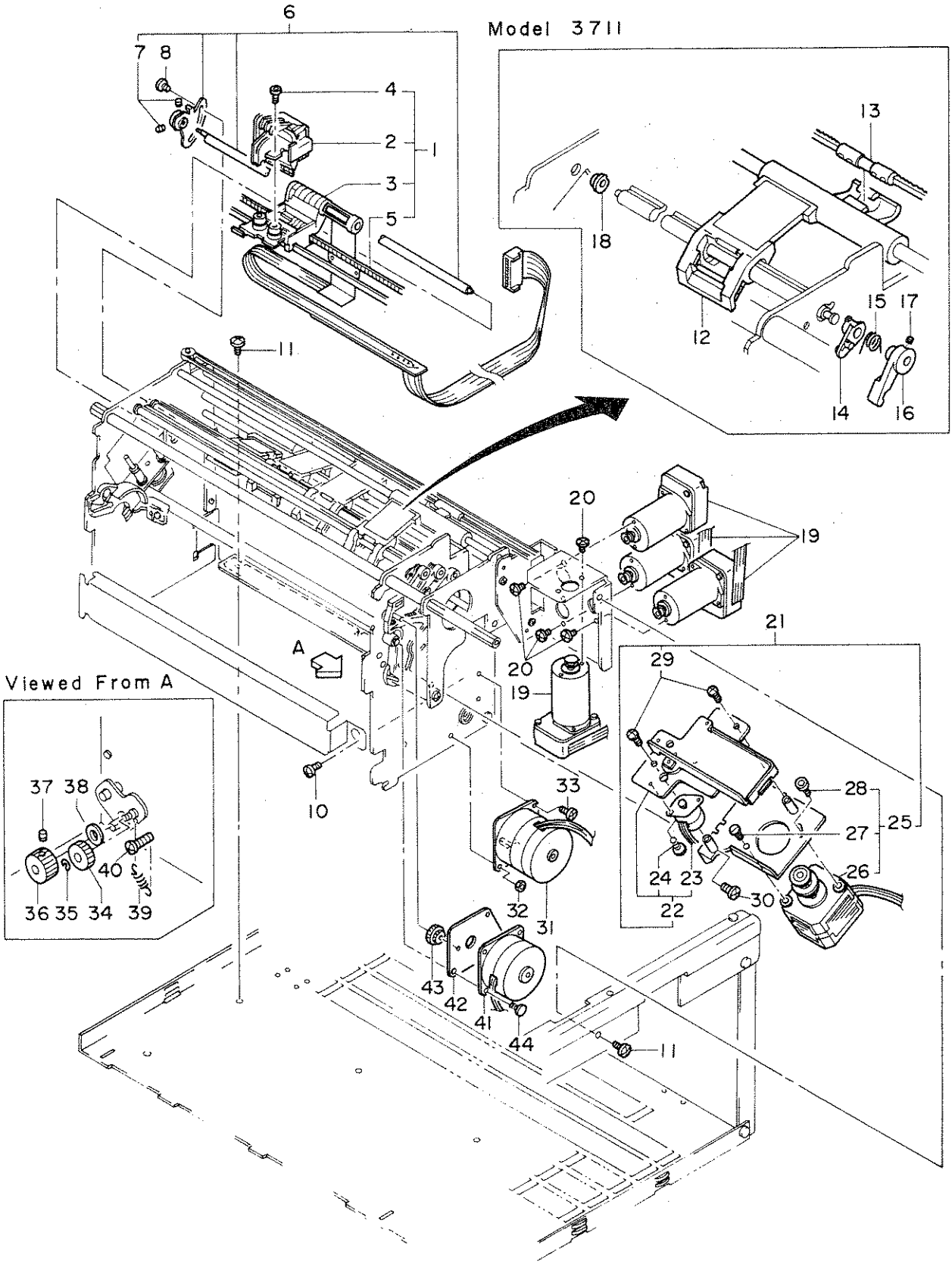
Item	Part No.	Model	Qty 1□	Qty 2□	Qty 3□	Qty 4□	Description
			371 1 2	371 1 2	371 1 2	371 1 2	
1	B9585JK		1	1 2	2 2	2 2	Belt
2	B9585JJ			1 1	1 2	2 4	Belt
3	B9585HK		1	2 3	3 4	4 4	Pulley
4	Y9150ET		1	1 1	1 1	1 1	E-Ring
5	B9619QQ		1	1 1	1 1	1 1	Memory Card Adapt Assembly
6	Y9308LS		2	2 2	2 2	2 2	B. H. Screw, M3 x 8
7	Y9314LS		1	1 1	1 1	1 1	B. H. Screw, M3 x 14
8	Y9401WB		2	2 2	2 2	2 2	Washer
9	B9585RS		1	1 1	1 1	1 1	Collar
10	B9811DW		1	1 1	1 1	1 1	Bearing
11	Y9412LB		1	1 1	1 1	1 1	B. H. Screw, M4 x 12
12	—		1	1 1	1 1	1 1	Sensor Bracket Assembly } (only for Model 3711)
13	B9619VL		1	1 1	1 1	1 1	Sensor Assembly
14	Y9204KB		2	2 2	2 2	2 2	B. H. Screw, M2, 3 x 3
15	Y9203KB		1	1 1	1 1	1 1	B. H. Screw, M2, 3 x 3
16	—		1	1 1	1 1	1 1	Bracket Assembly
17	B9619VK		1	1 1	1 1	1 1	Sensor Assembly } (only for Model 3712)
18	Y9204KB		1	1 1	1 1	1 1	B. H. Screw, M2, 3 x 4
19	Y9404LS		1	1 1	1 1	1 1	B. H. Screw, M4 x 4
20	B9586CQ		1	1 1	1 1	1 1	Transformer Assembly
21	Y9405TY		1	1 1	1 1	1 1	Tapping Screw, M4 x 5
22	B9619VM				1 1	1 1	Transformer Assembly
	B9619VP		1	1			Transformer Assembly
23	Y9405TY		4	4 4	4 4	4 4	Tapping Screw, M4 x 5
24	B9619XG		1	1 1	1 1	1 1	PCB, Assembly
25	Y9305TS		4	4 4	4 4	4 4	Tapping Screw, M3 x 5
26	—		1	1 1	1 1	1 1	Lever Assembly
27	A9200SP		1	1 1	1 1	1 1	Push Switch
28	A9049ZG		1	1 1	1 1	1 1	Knob
29	Y9304LS		2	2 2	2 2	2 2	B. H. Screw, M3 x 4
30	—		1	1 1	1 1	1 1	Fuse Holder
31	A9134KF		1	1 1	1 1	1 1	Fuse (100 V AC series, 2A timelag) } (select either one)
	A9132KF		1	1 1	1 1	1 1	Fuse (200 V AC series, 1A timelag) }
(32)	A9134KF		1	1 1	1 1	1 1	Fuse (100 V AC series, 2A timelag) } (select either one)
	A9132KF		1	1 1	1 1	1 1	Fuse (200 V AC series, 1A timelag) } (accessory)


Model 3711
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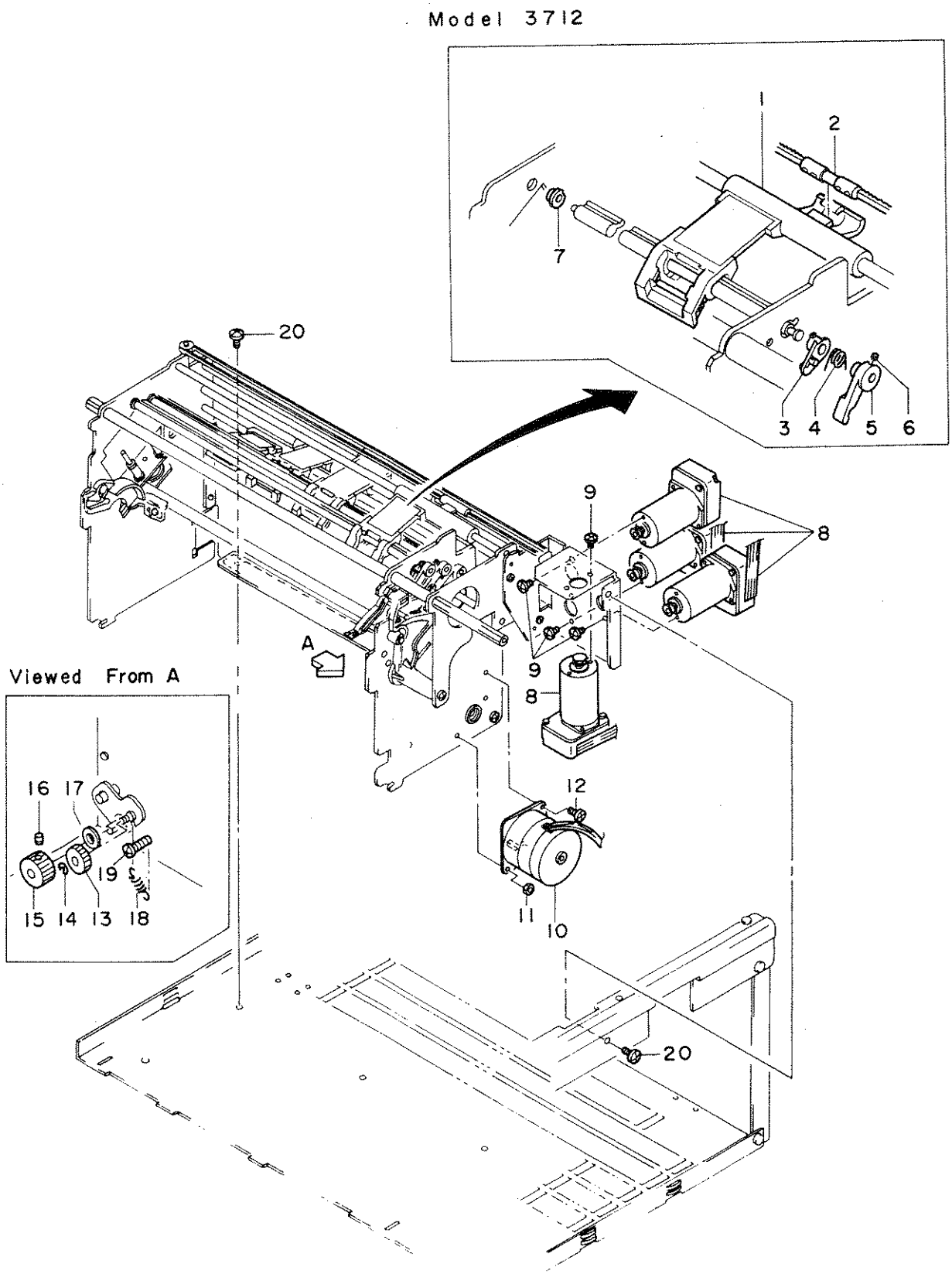
Item	Part No.	Model / Qty 3711 1□	3711 2□	3711 3□	3711 4□	Description
1	B9619JG	1	1	1	1	Carriage Assembly
2	B9585QH	1	1	1	1	Head Assembly
3	B9619JM	1	1	1	1	Sub Carreage Assembly
4	Y9306ZX	2	2	2	2	Hex soc. H. Cap Screw, M3 x 6
5	B9585QV	1	1	1	1	Belt
6	—	1	1	1	1	Shaft Assembly
7	Y9303SJ	2	2	2	2	Setscrew
8	Y9305LS	1	1	1	1	B. H. Screw, M3 x 5
9	—	1	1	1	1	FPC, Bracket
10	Y9305LS	1	1	1	1	B. H. Screw, M3 x 5
11	Y9405LS	4	4	4	4	B. H. Screw, M4 x 5
12	B9619JW	1	1	1	1	Carriage Assembly (for 1st -pen, red)
	B9619JX		1	1	1	Carriage Assembly (for 2nd-pen, green)
	B9619JY			1	1	Carriage Assembly (for 3rd-pen, blue)
	B9619JZ				1	Carriage Assembly (for 4th -pen, brown)
13	B9585JL	1	2	3	4	Rod
14	B9585JS	1	2	3	4	Bushing
15	B9585JV	1	2	3	4	Spring
16	B9585JU	1	2	3	4	Lever
17	Y9304SJ	1	2	3	4	Setsctrew
18	B9585JR	1	2	3	4	Bearing
19	B9585TA	1	2	3	4	Motor Assembly
20	B9590DS	2	4	6	8	Screw
21	—	1	1	1	1	Drive Assembly
22	—	1	1	1	1	Ribbon Drive Assembly
23	B9573RL	1	1	1	1	Motor Assembly
24	Y9203JB	2	2	2	2	Pan . H. Screw, M2 x 3
25	—	1	1	1	1	Caeeiage Drive Assembly
26	B9585RB	1	1	1	1	Motor Assembly
27	B9585RD	1	1	1	1	Screw
28	Y9306ZX	1	1	1	1	Hex, Soc, H. Cap Screw, M3 x 6
29	Y9405LB	2	2	2	2	B. H. Screw, M4 x 5
30	Y9405LS	2	2	2	2	B. H. Screw, M4 x 5
31	B9585HX	1	1	1	1	Motor
32	Y9301BS	1	1	1	1	Nut
33	Y9304LS	1	1	1	1	B. H. Screw, M3 x 4
34	B9585HR	1	1	1	1	Gear
35	Y9200ET	1	1	1	1	E-Ring
36	B9585HY	1	1	1	1	Gear
37	Y9304SJ	1	1	1	1	Setscrew
38	B9585PZ	1	1	1	1	Spacer
39	A9021KN	1	1	1	1	Spring
40	Y9316LS	1	1	1	1	B. H. Screw, M3 x 16
41	B9585GV	1	1	1	1	Motor Assembly
42	B9565JD	1	1	1	1	Gear
43	—	1	1	1	1	Plate
44	Y9304LS	3	3	3	3	B. H. Screw, M3 x 4

(for chart drive)


Model 3712
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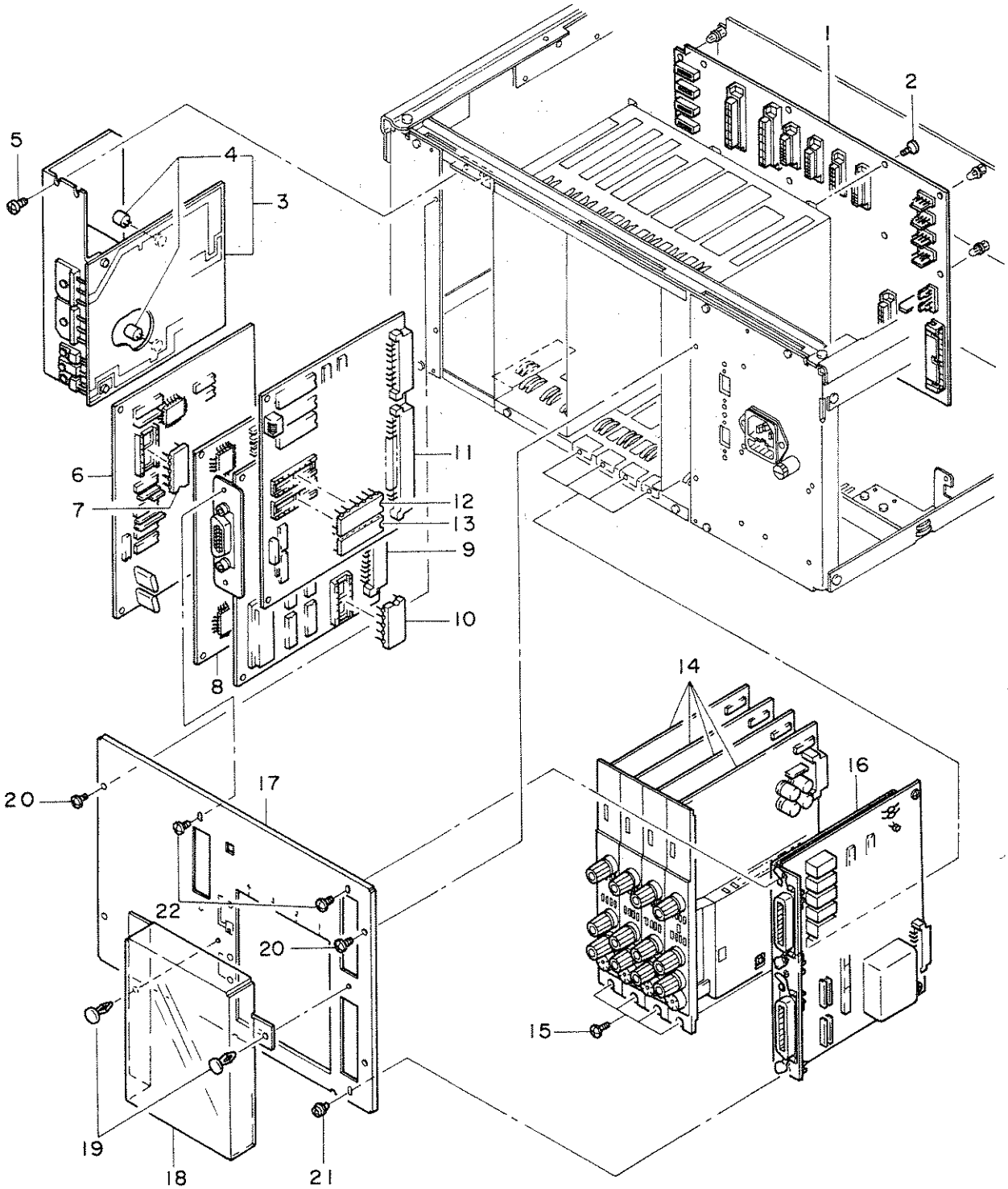
Item	Part No.	Model / Qty 3712 1□	3712 2□	3712 3□	3712 4□	Description
1	B9619JW	1	1	1	1	Carriage Assembly (for 1st-pen, red)
	B9619JX		1	1	1	Carriage Assembly (for 2nd-pen, green)
	B9619JY			1	1	Carriage Assembly (for 3rd-pen, blue)
	B9619JZ				1	Carriage Assembly (for 4th-pen, brown)
2	B9585JL	1	2	3	4	Rod
3	B9585JS	1	2	3	4	Bushing
4	B9585JV	1	2	3	4	Spring
5	B9585JU	1	2	3	4	Lever
6	Y9304SJ	1	2	3	4	Setscrew
7	B9585JR	1	2	3	4	Bearing
8	B9585TA	1	2	3	4	Motor Assembly
9	B9590DS	2	4	6	8	Screw
10	B9585HX	1	1	1	1	Motor
11	Y9301BS	1	1	1	1	Nut
12	Y9304LS	1	1	1	1	B. H. Screw, M3 x 4
13	B9585HR	1	1	1	1	Gear
14	Y9200EJ	1	1	1	1	E-Ring
15	B9585HY	1	1	1	1	Gear
16	Y9304SJ	1	1	1	1	Setscrew
17	B9585PZ	1	1	1	1	Spacer
18	A9021KN	1	1	1	1	Spring
19	Y9316LS	1	1	1	1	B. H. Screw, M3 x 16
20	Y9405LS	4	4	4	4	B. H. Screw, M4 x 5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Item	Part No.	Model	Qty 371 1/2 1□	371 1/2 2□	371 1/2 3□	371 1/2 4□	Description
1	B9619SM		1	1	1	1	Mother Board Assembly (Model 3711) } (select either one)
	B9619SN		1	1	1	1	Mother Board Assembly (Model 3712) }
2	Y9304LS		8	8	8	8	B. H. Screw, M3 x 4
3	B9619SR		1	1	1	1	Power Board Assembly
4	B9586JJ		2	2	2	2	Fuse
5	Y9304LS		2	2	2	2	B. H. Screw, M3 x 4
6	B9619SE		1	1	1	1	Printer Board Assembly (only for Model 3711)
7	B9619UE		1	1	1	1	ROM Assembly
8	B9619SD		1				Servo Board Assembly
	B9586ED			1			Servo Board Assembly
	B9619SC				1		Servo Board Assembly
	B9586EC					1	Servo Board Assembly
9	B9586EG		1	1	1	1	GP-IB Board Assembly *1 } (select either one)
	B9586EH		1	1	1	1	RS 232C Board Assembly *2 }
10	B9586GG		1	1	1	1	ROM Assembly *1
	B9586GH		1	1	1	1	ROM Assembly *2
11	B9619SA		1	1	1	1	CPU Board Assembly *3 } (select either one)
	B9619SB		1	1	1	1	CPU Board Assembly *4 }
12	B9619UA		1	1	1	1	ROM Assembly *3 *4
13	B9619UB		1	1	1	1	ROM Assembly *4
14	B9619PS		1	2	3	4	Input Unit Assembly *8
	B9619PT		1	2	3	4	Input Unit Assembly *9
	B9619PU		1	2	3	4	Input Unit Assembly *10
	B9619PV		1	2	3	4	Input Unit Assembly *11
	B9619PW		1	2	3	4	Input Unit Assembly *12
	B9619PX		1	2	3	4	Input Unit Assembly *13
15	Y9304LS		1	2	3	4	B. H. Screw, M3 x 4
16	B9619QJ		1	1	1	1	Remote Board Assembly *5 } (select)
	B9619QK		1	1	1	1	Alarm Board Assembly *6 }
	B9619QL		1	1	1	1	Remote/Alarm Board Assembly *7 }
17	—		1	1	1	1	Cover
18	B9619BC		1	1	1	1	Cover
19	B9544DL		2	2	2	2	Clip
20	Y9308LS		4	4	4	4	B. H. Screw, M3 x 8
21	Y9306LK		1	1	1	1	B. H. Screw, M3 x 6 (with toothed lockwasher)
22	Y9304LS		3	3	3	3	B. H. Screw, M3 x 4

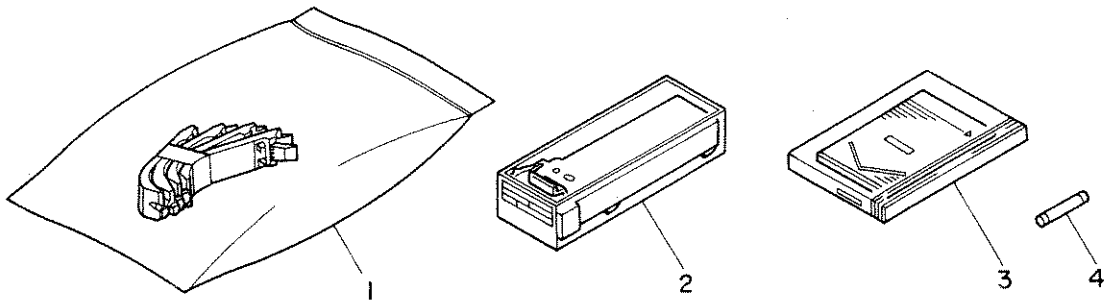
Models	Suffix Code (options)	
371 1/2 □□□	/GP-IB	*1
	/RS232C	*2
	/MATH	*4
	/REM	*5
	/AK04	*6
	/AK04/REM	*7

Note 3

Models		Input Types	Max Sensitivity	
371 1/2 □	□1	DCV, TC	10 mV. F. S.	*8
	□4	DCV, TC, RTD		*9
	□2	DCV, TC	1 mV. F.S.	*10
	□5	DCV, TC, RTD		*11
	□3	DCV, TC	0.1 mV. F. S.	*12
	□6	DCV, TC, RTD		*13

Note 2

*3: Standard Board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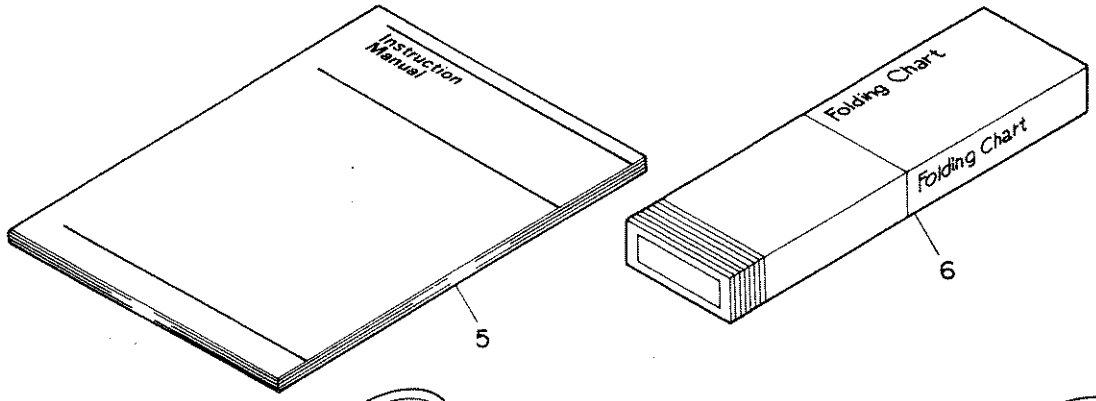
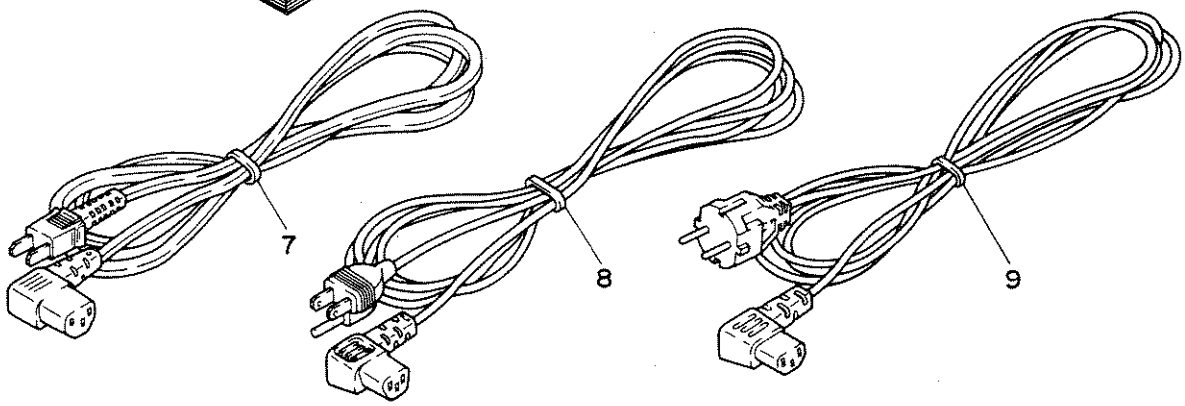

Instruction Manual
5
Folding Chart
Folding Chart
6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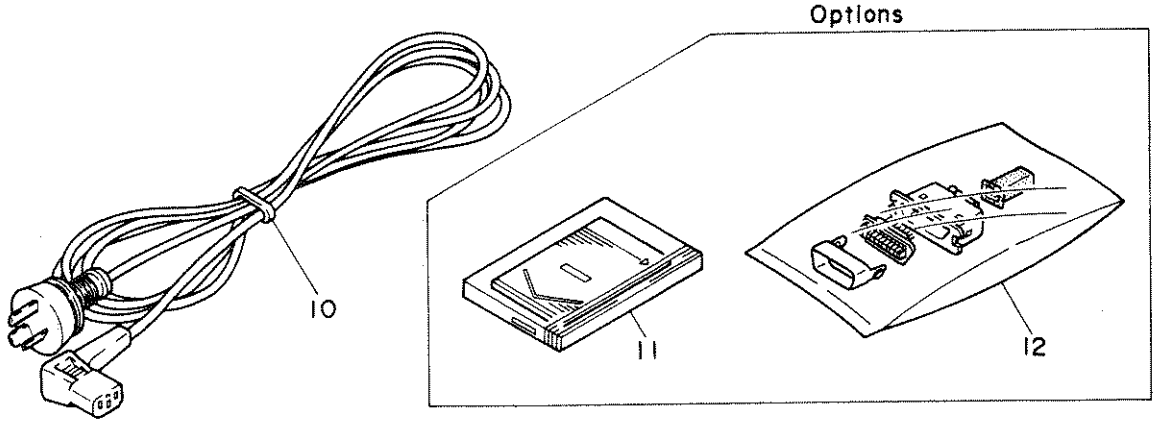
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Options
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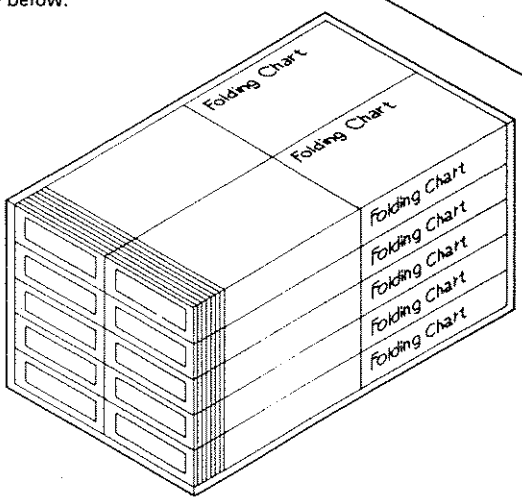
Item	Part No.	Model / Qty: 3711 1□	3711 2□	3711 3□	3711 4□	3712 1□	3712 2□	3712 3□	3712 4□	Description
1	—	1set			1set					Disposal Felt-tip Pen Cartridge (1st pen)
	—		1set			1set				Disposal Felt-tip Pen Cartridge (1st and 2nd pens)
	—			1set				1set		Disposal Felt-tip Pen Cartridge (1st, 2nd, 3rd and pens) } *1
	—				1set				1set	Disposal Felt-tip Pen Cartridge (1st, 2nd, 3rd and 4th pens)
2	B9585SH	1	1	1	1					Ribbon Caset
3	378901	1	1	1	1	1	1	1	1	Memory Card (seeting data)
4	A9134KF	1	1	1	1	1	1	1	1	Fuse (100 V AC series, 2A timelag) } (select eitherone)
	A9132KF	1	1	1	1	1	1	1	1	Fuse (200 V AC series, 1A timelag) } *2
5	—	1	1	1	1	1	1	1	1	Instruction Manual
6	—	1	1	1	1	1	1	1	1	Z-Fold Chart *3
7	A9009WD	1	1	1	1	1	1	1	1	Power Supply Card (other than below)
8	A9008WD	1	1	1	1	1	1	1	1	Power Supply Card (UL standard)
9	A9011WD	1	1	1	1	1	1	1	1	Power Supply Card (VDE standard) } (select)
10	A9026WD	1	1	1	1	1	1	1	1	Power Supply Card (SAA standard)
11	378904	1	1	1	1	1	1	1	1	Memory Card (seting and measured data)
12	A9026KC	1	1	1	1	1	1	1	1	Connector (specify Model 371□□□□ . . . . . /AK04) } (option)
	A9026KC	1	1	1	1	1	1	1	1	Connector (specify Model 371□□□□ . . . . . /AK04/REM) } (option)

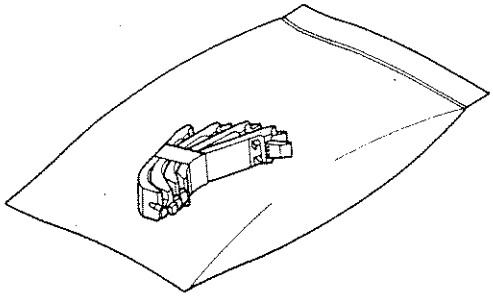
Note
*2: Located in the fuse Holder, see pages 6 and 7 Item 32

Note
Z-fold chart and pen package is supplied in packs — order part number see below.
(One pack is the minimum order quantity.)

Name		Spares Part No.	Order Qty	
Z-fold chart (344 mm x 30 m)		B9585AH	10 units (1 chart/unit)	*3
*Disposable felt-tip pan cartidge	1st channel (red)	B9586□A	1 unit (3 pcs./unit)	*1
	2nd channel (green)	B9586□B		
	3rd channel (blue)	B9586□C		
	4th channel (brown)	B9586□D		
	1st to 4th channels	B9586□K	1 unit (3 pcs. each/unit)	

*Note: Specify one of code (X, Y or Z) in □.
Y . . . Standard (pen speed of lower than approx. 800 mm/s).
Z . . . High speed (pen speed of higher than approx. 800 mm/s).
X . . . Low speed (chart speed of lower than approx. 100 mm/h).





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