ADVANTEST®
ADVANTEST CORPORATION

R7430/74301 Series

Data Logger

Operation Manual

MANUAL NUMBER FOE-8324325C02

Applicable models

- ***R7430***
- ***R7430A***
- ***R7430B***
- ***R74301A***
- ***R74301B***

This product has been discontinued.
The Operation Manual is provided by ADC Corporation
under the agreement with Advantest Corporation.

First printing December, 1989
Printed in Japan

MANUAL CHANGES

ADVANTEST Corporation

Date	October 15, 1998	Manual No.	OEC02
Manual Name	R7430/74301 SERIES	Manual Change No.	EMC-01

The year ranges for these equipment clocks have been changed as shown below.

Old: **88** to **03**

New: **98** to **13**

As a result, the date described in the manual has also changed.

1 "Year" settings on the screens have been changed.

2 Page 4-14
<1> date, ① has been changed.

① Using the numeric keys, enter the data within the allowable setting range displayed.

[**98**] y [10] m [26] d

Day (01 to 31)

Month (01 to 12)

Year (**98** to **13**)

3 Page 8-17
Section 8.5.1, ③ has been changed.

③ Scan Format

Code	Description	Format	Initial value
CK	Data and time setting. (Immediately executed)	CKYYMMddhhmm Enter all 10 digits, tow for each of YY, MM, dd, hh, and mm. YY: **98** to **13**	—

Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

• Warning Labels

Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

Symbols of those warning labels are shown below together with their meaning.

DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

• Basic Precautions

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
- When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
- Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
- Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
- Be sure to use fuses rated for the voltage in question.
- Do not use this instrument with the case open.
- Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.
Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.
Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.
The parts inside are not user-replaceable. For a part replacement, please contact the Advantest sales office for servicing.

Each product may use parts with limited life.
For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
  Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.
- Store and operate the products under the following environmental conditions.
  An area with no sudden temperature changes.
  An area away from shock or vibrations.
  An area free from moisture, dirt, or dust.
  An area away from magnets or an instrument which generates a magnetic field.
- Make back-ups of important data.
  The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

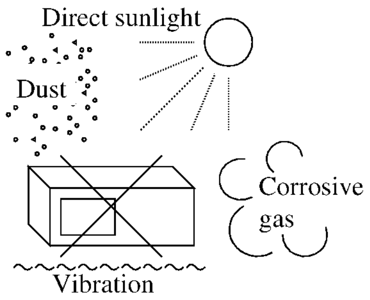
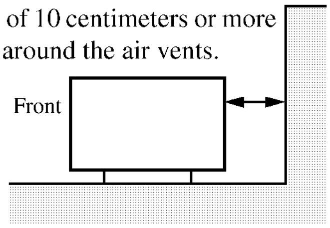


Figure-1 Environmental Conditions

- Operating position

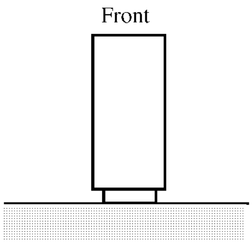


A clear space of 10 centimeters or more must be kept around the air vents.

The instrument must be used in a horizontal position.
A cooling fan, which prevents the internal temperature from rising, is equipped with the instrument.
The air vents on the case must be unblocked.

Figure-2 Operating Position

- Storage position



This instrument should be stored in a horizontal position.
When placed in a vertical (upright) position for storage or transportation, ensure the instrument is stable and secure.

-Ensure the instrument is stable.
-Pay special attention not to fall.

Figure-3 Storage Position

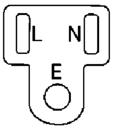
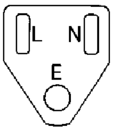
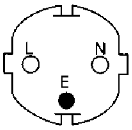
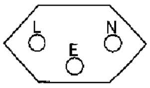
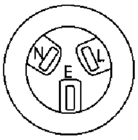
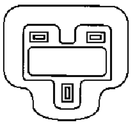
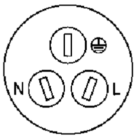
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

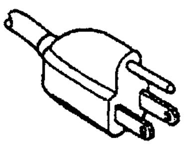
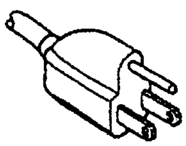
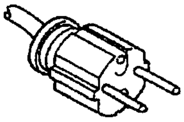
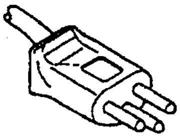
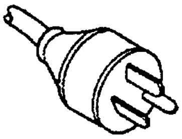
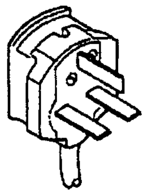
Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

No. ECA01

Table of Power Cable Options

There are six power cable options (refer to following table).

Order power cable options by Model number.

	Plug configuration	Standards	Rating, color and length	Model number (Option number)
1		JIS: Japan Law on Electrical Appliances	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
2		UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
3		CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
4		SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
6		BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417

PREFACE

This operation manual describes collectively the data loggers R7430, R7430A, and R7430B, and their expansion terminals R74301A and R74301B.

TABLE OF CONTENTS

1. GENERAL INFORMATION

This section first describes how to use this operation manual, and then offers a product overview of the data logger R7430 series and the expansion terminal R74301 series. This section also describes precautions to be observed during operation and the preparations to be made for measurement. Those who will operate the R7430 for the first time should first read this section.

1.1 How To Use This Operation Manual

This operation manual is organized as follows:

1. GENERAL INFORMATION

Those who will operate the R7430 for the first time should first read this section.

2. R7430 SERIES

Those who will use the R74301 should first read this section.

3. PANELS AND TERMINAL BOARD DESCRIPTION

This section briefly describes the operator panels of the R7430 and R74301, and the terminal boards common to these two types of units.

4. OPERATING PROCEDURES

5. FOR ACCURATE MEASUREMENT

This section explains how to connect to the R7430 the material to be measured, and how to suppress the occurrence of noise.

6. MEASUREMENT EXAMPLES

7. EXTERNAL CONTROL

8. GPIB

9. OPERATION DESCRIPTION

10. MAINTENANCE AND INSPECTION

This section describes maintenance and inspection jobs, such as operational checks, data calibration, and recording paper replacement, together with the precautions to be taken during these jobs. It also describes how to transport and store the R7430.

11. PERFORMANCE SPECIFICATIONS AND ACCESSORIES

APPENDIX

Error messages are listed in this appendix.

LIST OF FIGURES
LIST OF TABLES
EXTERNAL VIEW

1.2 Product Overview

The data logger R7430 has a simultaneous multiframe measurement function, a high-speed data output function, and a trend record printout function that makes the R7430 easy to use as a monitor. High-resolution measurement supported by 5-1/2 digit display is possible since analog-to-digital conversion based on variable integral time is used for the R7430. It is also possible to select the desired measurement accuracy and speed by changing the integral time. In addition, use of digital transmission via optical cables allows data to be measured at a maximum distance of four kilometers with four R7430 units.

[Featurs]

(1) High-resolution Measurement (Maximum display: "549999")

Analog-to-digital conversion based on variable integral time allows high-resolution measurement supported by 5-1/2 digit display.

(2) High-speed Measurement (300 data samplings/second)

High-speed measurement at a standard rate of 300 data samplings/second (300 data samplings/0.6 second, maximum) is possible, based on the design concept that places emphasis on simultaneity of measurements. A thermal printer built into the R7430 can provide digital printout at a rate of one frame/three seconds. High-speed output of data via a GPIB (General-purpose Interface Bus) system, based on DMA (Direct Memory Access), is also possible.

(3) A Distributed System that Allows each Terminal Spacing to be Extended to a Maximum of One Kilometer

A maximum of 60 data samplings can be obtained with a single R7430 unit. Addition of the expansion terminal R74301 to the R7430 allows a maximum of 300 data samplings to be obtained with four R74301 units. The spacings between each terminal can be extended to a maximum of one kilometer.

(4) Digital/Trend Combined Recording

Any desired type of printing can be freely selected from seven types including digital printing, trend printing, and their combinations. A maximum of 12 data samplings can be printed out with trend printing, and a maximum of 30 data samplings, with combined-type digital printing.

(5) Computation

The R7430 can compute the differences, ΔI, from initial data, the differences, ΔN, from other channel data, the differences, ΔT, from the preceding data, scaling factors, and the maximum, minimum, and average data per unit frame or in simultaneous multiframe measurements.

(6) Two-dimensional Programming Using the CRT Screen

You can create programs while watching the CRT display.
You can easily select and set necessary program data items under scroll operations; you no longer have to look at a data selection table as before.
Also, the minimum number of functions required can be readily set by predividing program data into a basic type and an optional type.

1.3 Before Operating R7430/74301

This section describes the preparatory jobs to be done before operating R7430/74301 (in the remainder of the manual, these units are referred to collectively as the equipment unless otherwise specified).

1.3.1 Accessory Check

Upon receipt of this equipment, run checks thereon as shown below.

① Run visual check against any and all damages or imperfections.
② Check the quantity and rating of standard accessories to assure their conformance with Table below.

Should there any flaw, or damage, or missing or insufficient part, contact the nearest dealer or the sales and support offices.

You should specify the model (or the stock No.) when reordering an accessory part.

Table 1 - 1 R7430 Standard Accessories

Name	Model	Stock No.	Q'ty	Remarks
Recording paper	A09076	—	1	
Fuse	T2A/250V	DFT-AA2A	2	For 100/120VAC
	T1.25A/250V	DFT-AA1R25A		For 220/240VAC (Option)
Power cable	A01402	DCB-DD2428×01	1	
Flange	—	MPX-68749	2	
Operation manual	—	JR7430/74301	1	Japanese version
	—	ER7430/74301		English version

Table 1 - 2 R74301 Standard Accessories

Name	Model	Stock No.	Q'ty	Remarks
Fuse	T0.4A/250V	DFT-AAR4A	2	For 100/120VAC
	T0.2A/250V	DFT-AAR2A		For 220/240VAC (Option)
Power cable	A01402	DCB-DD2428×01	1	
Indoor-type optical cable	A01238-0001	—	1	

1.3.2 Environmental Requirements for Operation

The following lists environmental requirements that must be satisfied to ensure normal operation of the equipment:

(1) Ambient Environment

Always operate the equipment at ambient temperatures from +5 to +40°C (for R7430) or from 0 to +50°C (for R74301), and at relative humidities below 85% (for both R7430 and R74301).

Do not operate the equipment in places where dust occurs, where potentially corrosive gases occur, or that are exposed to direct sunlight.

Also, do not operate the equipment in drafty places. Otherwise, resulting temperature differences on the input terminal board may cause measurement errors during thermocouple thermometry.

(2) Line Noise

This equipment, although designed to be able to withstand AC line noise, must be operated under a noiseless environment as far as possible.
Use a noise rejection filter if required.

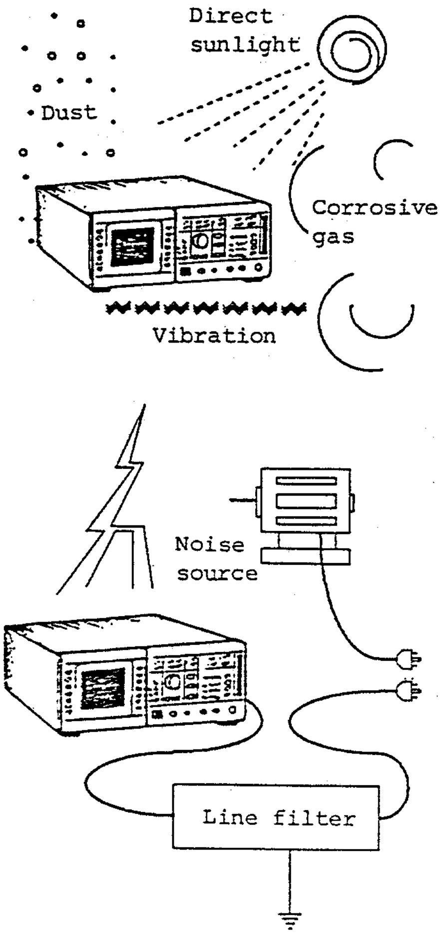
(3) Cooling and Ventilation

The equipment has air vents on its side to prevent the internal temperature from increasing. Keep the air vents clear.

(4) Vibration and Shocks

The equipment contains precision machine parts that are susceptible to shocks and vibration, such as the CRT, the printer, etc.
Do not operate the equipment in places that are exposed to continual vibration or strong mechanical shocks.

Avoid such places given below.



To avoid a large amount of noise superposed in the power line, use the noise filter.

Figure 1 - 1 Operating Environment

1.3.3 Power Requirements

Before connecting the power cable, make sure that the power switch is set to the OFF position.

The value of the supply voltage, which has already been factory-preset prior to shipment, is indicated on the rear panel of the equipment (see Fig. 1-2 below). The equipment must always be operated at the preset voltate.

Use a line frequency of 50Hz or 60Hz. Program the value of the intended line frequency on the programming screen "<8>auxiliary".

If you will use a private power generator or a DC-AC inverter, precheck that sine waveforms are generated without distortion in frequency.

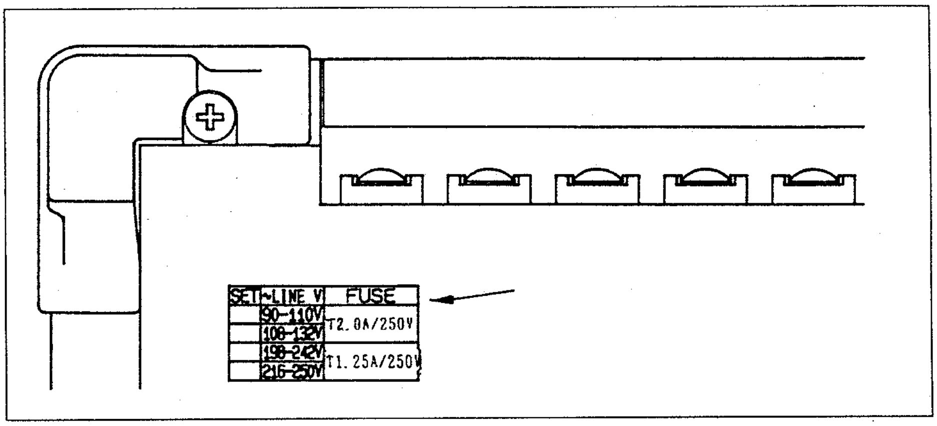


Figure 1 - 2 Preset Supply Voltage Indication on the Rear Panel

1.3.4 Power Cable

The plug of the power cable has three pins, of which the round one is the grounding pin. See Figure 1-3 (a). Always use a grounded power outlet. If the power plug is to be used in two-pin form, this can be done as follows:

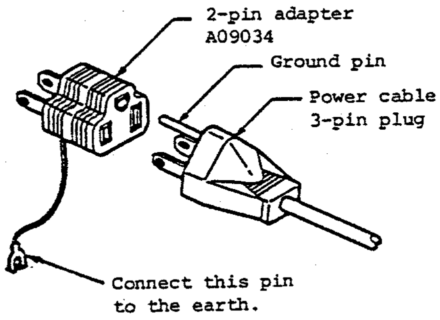
First, correctly connect either the grounding lead of the adapter A09034 (supplied) or the GND terminal located on the rear panel to an external grounding terminal or to ground. (NOTE: See CAUTION below.)

Then, connect the adapter to the plug. The power plug can now be used in two-pin form.

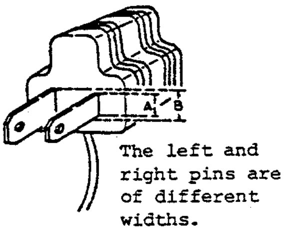
NOTE

When connecting the grounding lead of the adapter to an external grounding terminal or to ground, be careful not to contact the lead with the AC power line. Inadvertent contact may damage the equipment or other units that may have been connected to the equipment.

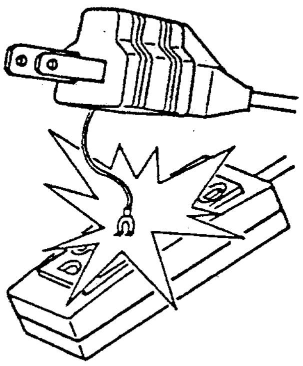
The two electrodes (pins) of the adapter A09034 are of different widths as shown in Figure 1-3 (b). Before inserting the adapter into an outlet, therefore, make sure that the plug points in the correct direction with respect to the outlet.
Use an optional adapter KPR-13 if the adapter A09034 does not fit into the outlet to be used.



(a) Power plug



(b) Adapter A09034



Be careful not to short circuit the adaptor ground lead line.

Figure 1-3 Power Cable Plug & Adapter

1.3.5 Setting Measurement Unit Numbers

Before setting the power switch to ON, set different numbers for each measurement unit using the UNIT NO. switches located on the rear panel.

NOTE

Set measurement unit numbers so that the same number does not exist in the entire measurement system. Correct measurement cannot be performed with identical numbers.
Number setting must be done before setting R7430 power switch to ON. Reset the power switch to OFF before making any changes to be number settings.

1.3.6 Recharging the Battery

The equipment contains an Ni-Cd (nickel-cadmium) battery to keep the operating parameter settings stored in memory even after the power switch has been set to OFF.

If, following the power ON sequence, the message below is displayed together with an buzzer sounding, then it indicates that the battery voltage has decreased below a predetermined level.

```
Battery low & default program!!!
```

In that case, turn on the power switch and leave it on for eight hours or more (for temporary recharging) or for 48 hours or more (for full recharging).

NOTE

The memory contents will be initialized if the message "Battery low & default program!!!" is displayed following the power ON sequence.
Set the program data once again before starting measurement operations.

1.3.7 Setting Recording Paper

The equipment will have been delivered with recording paper unset. Set recording paper (supplied) as directed in Subsection 10.2.1, "Replacing the Recording Paper."

1.3.8 Warming up the Equipment

After the power switch has been turned on, the equipment needs warming-up for about 30 minutes until it stays within the specifications.
(This figure applies to the case where the equipment is stored at the same ambient temperature as the operating one.)

2. R7430 SERIES

2.1 Configurations of R7430 Series

The R7430 series fall into two broad categories: data loggers and expansion terminals.
The relationship between the number of measurement units and the number of input ports is shown in Table 2-1 below.
If an expansion terminal is to be connected to the data logger, an optical link (option No. +70) is required for that data logger.

Table 2 - 1 Configuratins of the R7430 Series

Product name		No. of measurement units	No. of input ports
Data logger	R7430	0	0
	R7430A	1	30
	R7430B	2	60
Expansion terminal	R74301A	1	30
	R74301B	2	60

Note: When resistance thermometer bulbs are to be used, two ports are required for each input.

2.2 Schematic Block Diagram of R7430 and R74301

A schematic block diagram of the data logger R7430 and the expansion terminal R74301 is shown in Figure 2-1.

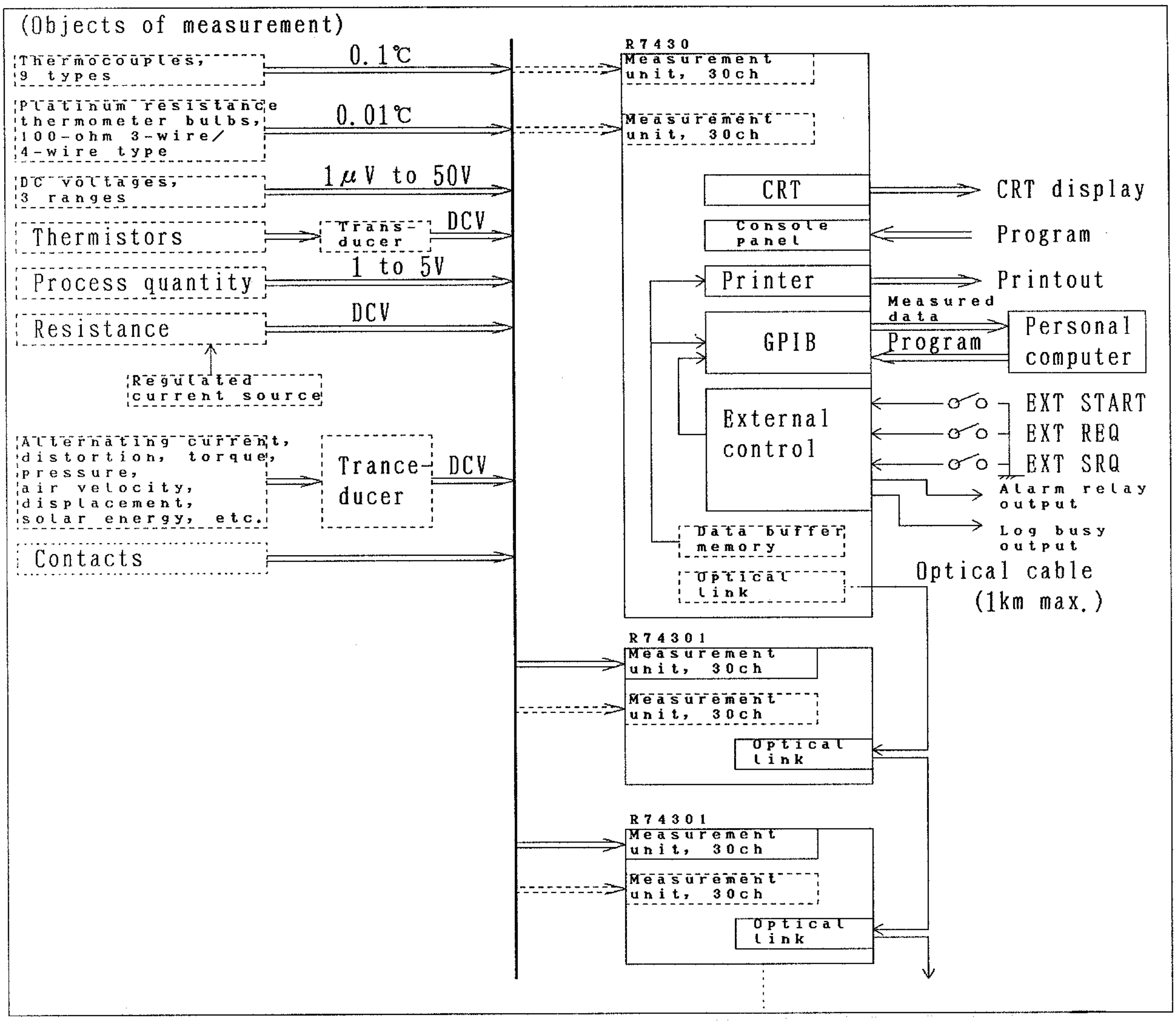


Figure 2 - 1 Schematic Block Diagram of R7430 and R74301

2.3 Connecting Between R7430 and R74301

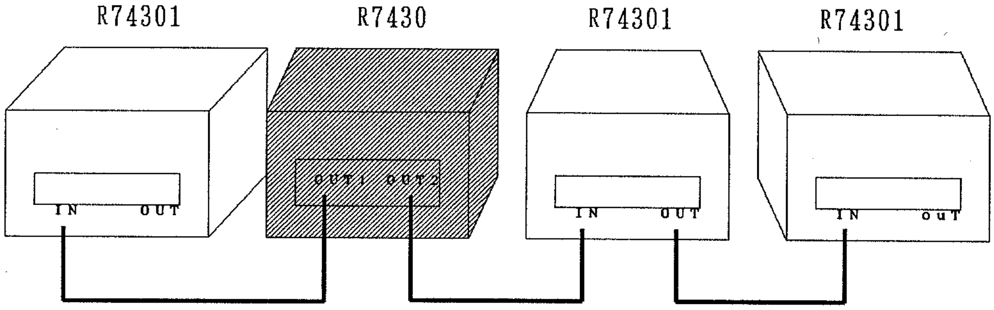
This section describes how to connect between the data logger R7430 and multiple expansion terminal R74301 units.

[Procedure]

① Ensure that the power switches of the R7430 and each R74301 are set to OFF.

② Connect the OUT1 or OUT2 connector of the R7430 and the IN connector of a first R74301 unit using an optical cable listed in Section 11.4, "Accessories."

③ Connect the OUT connector of the second R74301 unit and the IN connector of a third R74301 unit.



Note: Connect all units IN-OUT. They must not be connected IN-IN or OUT-OUT.

Figure 2 - 2 R7430-R74301 Connection

2.4 System Configurations of R7430 and R74301

2.4.1 System Configuration Examples

System configuration examples of the R7430 and the R74301 are shown in Figure 2-3.

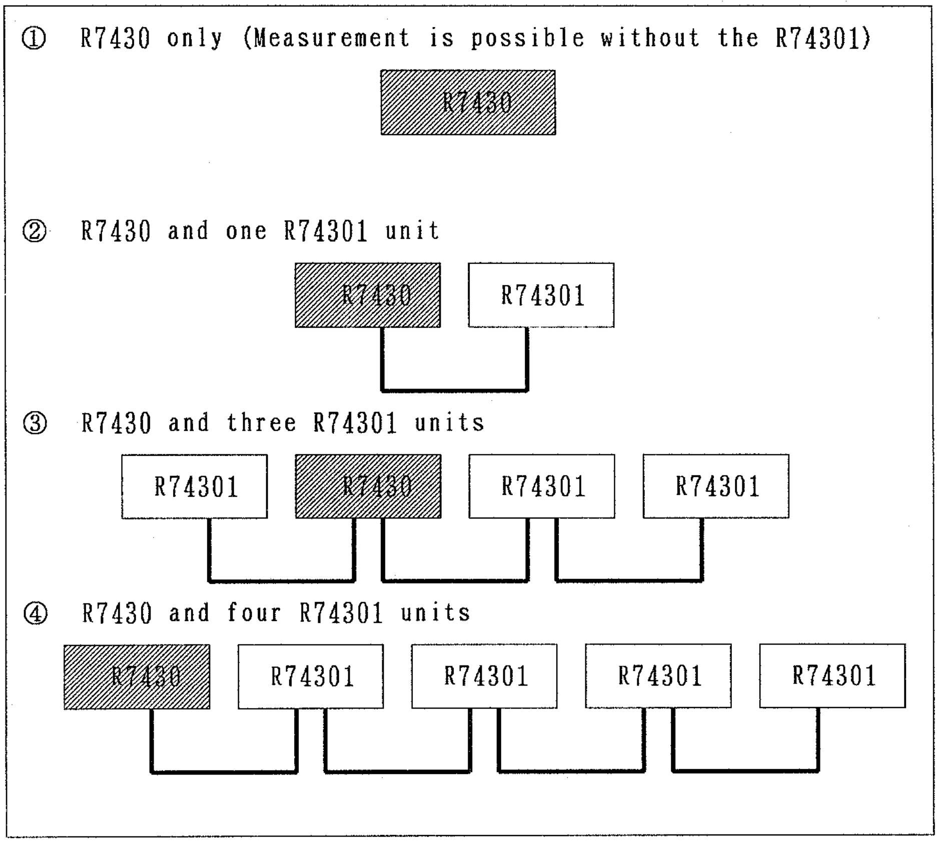


Figure 2 - 3 System Configuration Examples of R7430/R74301

2.4.2 Powering on under the Particular System Configuration

Both R7430 and R74301 have an independent power supply. Turn the powr on as follows to operate both units as one system:

[Operating procedure]

① Set the R74301 power switch to the STANDBY position.

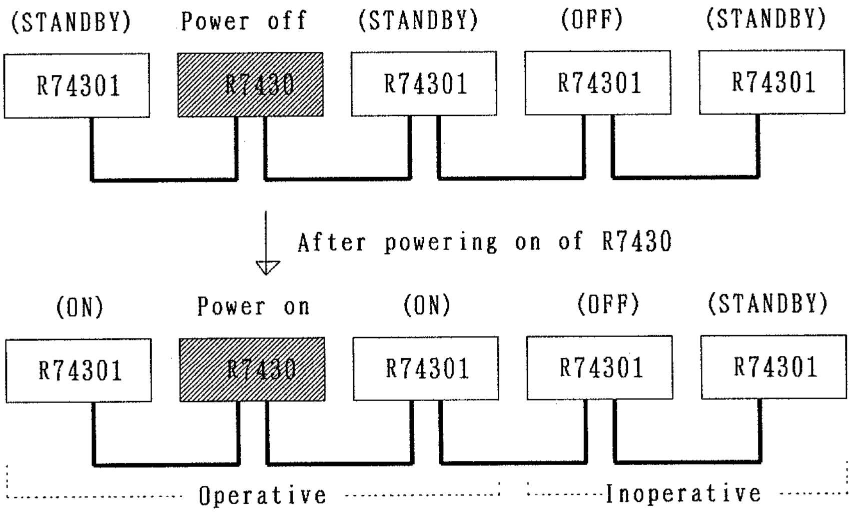
② Set the R7430 power switch to the ON or OFF position.

Setting the R74301 power switch to STANDBY activates part of the R74301 power circuit. The R74301 can now be turned on or off, depending on whether you turn the R7430 on or off.

NOTE

To operate both R7430 and R74301 as one system, the power supply of the latter must be placed in a STANDBY status.

If the R74301 power switch is set to OFF, that is, if the R74301 power is not placed in a STANDBY status, then all units on the OUT side of that R74301 unit will become deactivated.



3. PANELS AND TERMINAL BOARD DESCRIPTION

The panels of the R7430 are described in Section 3.1, the panels of the R74301 are described in Section 3.2, and the terminal boards common to the R7430 and R74301 are described in Section 3.3.

3.1 R7430 Panels

3.1.1 Front Panel

Read this subsection seeing the R7430 front panel explanatory diagram given as figure 3-3 at the end of Section 3. In this subsection, the component parts of the front panel are described in the order that their callout numbers ① through ㉘ appear in Figure 3-3.

① POWER Switch

Use this switch to turn the power on or off.

② LOCK/LOCAL Key

Set this key to LOCK to operate the R7430 in manual mode. Pressing this key three times in succession during manual operation will turn the key lamp on to indicate that all other keys on the panel have been placed in a locked status.
Pressing the key another three times in succession during manual operation will turn the key lamp off to indicate that the locked status has been released.

Set the key to LOCAL to operate the R7430 in remote-control mode. Pressing the key once during remote-control mode will release the mode, allowing you to operate the R7430 using the other keys of the panel.

③ GPIB Status Indicator LEDs

These LEDs indicate the operational status of GPIB-controlled units. The LEDs consist of the following:

SEQ LED:	Lights when a service request is issued to the GPIB controller.
TLK LED:	Lights when TALKER (data send mode) is set.
LTN LED:	Lights when LISTENER (data receive mode) is set.
RMT LED:	Lights when remote control is provided.
OUT LED:	Lights when GPIB TALKER output is enabled.

④ START/STOP Key

Use this key to control the starting and stopping of log scan measurement.

⑤ SNGL LOG (single log scan measurement) Key

Use this key to start single log scan measurement.

⑥ CALL CH (call channel) Key

Use this key to make a continuous display of a maximum of 10 any channel data samplings at intervals of about one second.

⑦ LOG MISSED Status Indicator LED

This LED lights if the setting of the log scanning interval is too small.

⑧ STORE Key

Use this key to specify whether data is to be stored (ON), or not to be stored (OFF), into a data buffer memeory (option).

⑨ RECALL Key

Use this key to recall data from a data buffer memory (option).

⑩ PRINTER FEED Keys

Use this key to feed printing paper into the printer.

⑪ PRINTER ON/OFF Key

Use this key to specify whether data is to be output (ON), or not to be output (OFF), onto the printer.

⑫ Ten Key

$\boxed{0}$ – $\boxed{9}$, $\boxed{.}$: Use these keys to set data.
$\boxed{C}$: Use this key to cancel data settings.

⑬ Arrow Keys

⇧ ⇩ ⇦ ⇨ } Use these keys to move the cursor, or use the keys together with the EXEC/COPY key (see ⑱ below) to copy a program group.

⑭ Rotary Key

While the DATA LED (see ⑮ below) remains lit, use this key to select data to be set. While the CURSOR LED (see ⑯ below) remains lit, use this key to move the cursor.

⑮ DATA LED

This LED lights when the rotary key is set to the data send mode.

⑯ CURSOR LED

This LED lights when the rotary key is set to the cursor mode.

⑰ MODE Key

Use this key to select between the DATA and CURSOR modes of the rotary key.

⑱ EXEC/COPY Key

Press this key during programming when the message "Press 'EXEC' key" is displayed. You can use this key together with arrow keys ⑬ to copy a program group.

⑲ Printer

The printer is contained within the R7430.

⑳ PROG (Program) Key

Use this key to select between a programming screen and a measurement screen.

㉑ NEXT Key

Press this key to proceed to the next programming item screen.

㉒ PREV (Previous) Key

Press this key to return to the immediately preceding programming item screen.

㉓ MENU Key

Using this key, you can return to the menu screen (see Figure 4-3) at any one time during programming.

㉔ FWD (Forward) Key

Press this key to proceed to the next programing screen during group-programming.

㉕ BACK Key

Press this key to go back to the immediately preceding programming screen during group-programming.

㉖ PRINT Key

Press this key to make a hardcopy printout of the entire CRT screen display.

㉗ CRT

The CRT displays data, error messages, etc.

㉘ INTENSITY

Use this control to adjust the brightness level of the CRT screen displaly.

3.1.2 Rear Panel

Read this subsection seeing the R7430 rear panel explanatory diagram given as Figure 3-4 at the end of Section 3. In this subsection, the component parts of the rear panel are described in the order that their callout numbers ① through ⑫ appear in Figure 3-4.

① Line Connector

The power cable (supplied) must be connected to this connector.

② Fuse Holder

③ GND (Grounding) Termial

The grounding terminal is connected to the chassis of R7430.

④ GPIB Connector

Use this connector to provide GPIB control.

⑤ EXT (External) CONTROL Connector

Use this connector to provide external control.

⑥, ⑦ OUT1 and OUT2 Connectors (Option No. +70)

Use these connectors to connect an expansion terminal (R74301) to the R7430 using an optical cable.

⑧, ⑨ UNIT NO. Switches

Use these switches to set measurement unit numbers. Set scanning channel numbers of the order of 100.

NOTE

Set measurement unit numbers so that the same number does not exist in the entire measurement system. Correct measurement cannot be performed with identical numbers.
Number setting must be done before setting the R74301 power switch to ON. Reset the power switch to OFF when changing number settings.

⑩, ⑪ EXT CAL (External Calibration) Switches

Use these switches to calibrate data.

NOTE

Usually, keep the EXT CAL switches set to OFF.

⑫ Terminal Board Cover

This cover protects the input terminals from a direct draft of air. Remove the cover only when connecting input signal lines. See Section 3.3 for a description of the terminal board itself.

3.2 R74301 Panels

3.2.1 Front Panel

Read this subsection seeing the R74301 front panel explanatory diagram given as Figure 3-5 at the end of Section 3. In this subsection, the component parts of the front panel are described in the order that their callout numbers ① and ② appear in Figure 3-5.

① STANDBY LED

When you set the POWER switch of the rear panel to STANDBY, this LED will light to indicate that you can remotely turn the R74301 on or off from the R7430.

② POWER LED

Either turning the R74301 power on or off from the R7430 with the STANDBY LED on or setting the LOCAL POWER switch of the rear panel to ON will turn the POWER LED on to indicate that the R74301 has been set ready for operation.

3.2.2 Rear Panel

Read this subsection seeing the R74301 rear panel explanatory diagram given as Figure 3-6 at the end of Section 3. In this subsection, the component parts of the rear panel are described in the order that their callout numbers ① through ⑫ appear in Figure 3-6.

① Line Connector

The power cable (supplied) must be connected to this connector.

② Fuse Holder

③ GND (Grounding) Terminal

The grounding terminal is connected to the chassis of the R74301.

④ POWER Switch

Pressing this switch places the power in a STANDBY status, and re-pressing the switch places the power in an OFF status.

⑤ LOCAL POWER Switch

The R7430 must be turned on before the main power of the R74301 unit connected to the former can be turned on. If the main power of the connected R74301 unit only is to be turned on for inspection or other purposes, first place that R74301 unit in a STANDBY status using POWER switch ④ and then press the LOCAL POWER switch. Use POWER switch ④ to turn the R74301 off.

⑥ IN Connector

Use this connector to connect an optical cable to the OUT connector of the R7430 or intended R74301 unit.

⑦ OUT Connector

Use this connector to connect an optical cable to the IN connector of R74301 unit.

⑧, ⑨ UNIT NO. Switches

Use these switches to set measurement unit numbers. Set scanning channel numbers of the order of 100.

NOTE

Set measurement unit numbers so that the same number does not exist in the entire measurement system. Correct measurement cannot be performed with identical numbers.
Number setting must be done before setting the R74301 power switch to ON. Reset the R74301 power switch to OFF when changing number settings.

⑩, ⑪ EXT CAL (External Calibration) Switches

Use these switches to calibrate data.

NOTE

Usually, keep the EXT CAL switches set to OFF.

⑫ Terminal Board Cover

This cover protects the input terminals from a direct draft of air.
Remove the cover only when connecting input signal lines.
See Section 3.3 for a description of the terminal board itself.

3.3 Terminal Board

On removing the terminal board cover, you will see a terminal board that has various input terminals for measurement of DC voltages, temperatures, etc.
Both the R7430 and the R74301 use a terminal board of the same construction.

The terminal board has a horizontal construction so as to enable easy cabling and suppress terminal-to-terminal temperature distribution nonunifomity which can cause temperature measurement errors.

As shown in Figure 3-1 below, the input terminals have an independent, round-molded construction so that the thin wires will not become damaged or move out of position as the screw is being tightened.

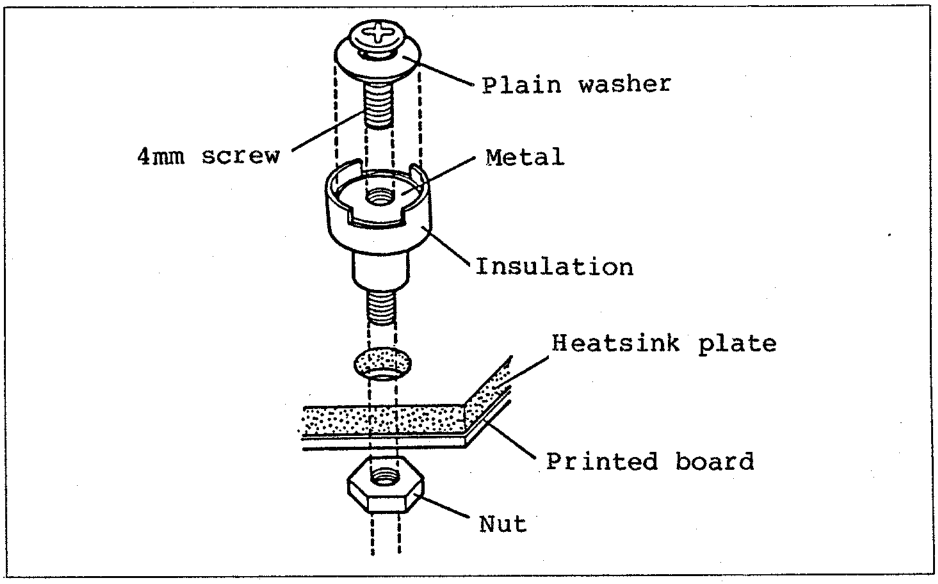


Figure 3 - 1 Construction of the Input Terminal

Functions of the terminals

An explanatory diagram of the terminal board is given in Figure 3-2. Here, its component parts are described in the order that their callout numbers ① through ⑨ appear in Figure 3-2.

① GUARD Terminal

This terminal is connected to the guard casing of the measuring section of the R7430/R74301.

② LO Terminal

This terminal is an analog-line grounding terminal.

③ MPT OUT (+) Terminal

The output existing after a plus (+) input signal has been selected via a scanner is connected to this terminal. Usually, connect a strapping bar between this terminal and AD IN (+) terminal ④.

④ AD IN (+) Terminal

This terminal is a plus (+) input terminal to the analog measurement circuit. Usually, connect a strapping bar between this terminal and MPX OUT (+) terminal ③.

⑤ MPX OUT (+) Terminal

The output existing after a minus (-) input signal has been selected via a scanner is connected to this terminal. Usually, connect a strapping bar between this terminal and AD IN (-) terminal ⑥.

⑥ AD IN (-) Terminal

This terminal is a minus (-) input terminal to the analog measurement circuit. Usually, connect a strapping bar between this terminal and MPX OUT (-) terminal ⑤.

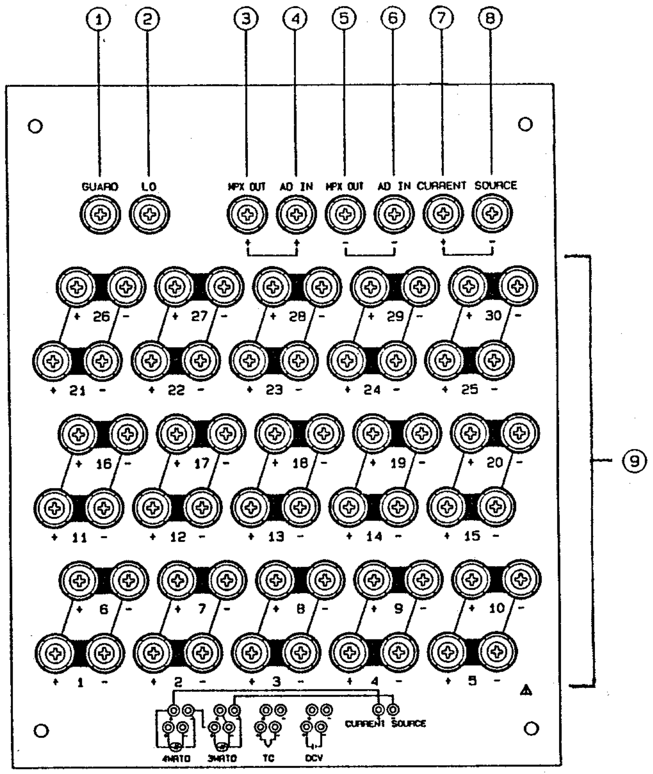
⑦, ⑧ CURRENT SOURCE Terminals

A regulated current of 1mA for measurement of platinum resistance thermometer bulbs (Pt) is output via these terminals. Usually, connect a strapping bar between these terminals.

⑨ 1 to 30CH Terminals

Use these terminals to connect the input signal lines for measurement of DC voltages, temperatures, etc.

Front panel side



Rear panel side

Figure 3 - 2 Layout of Terminals

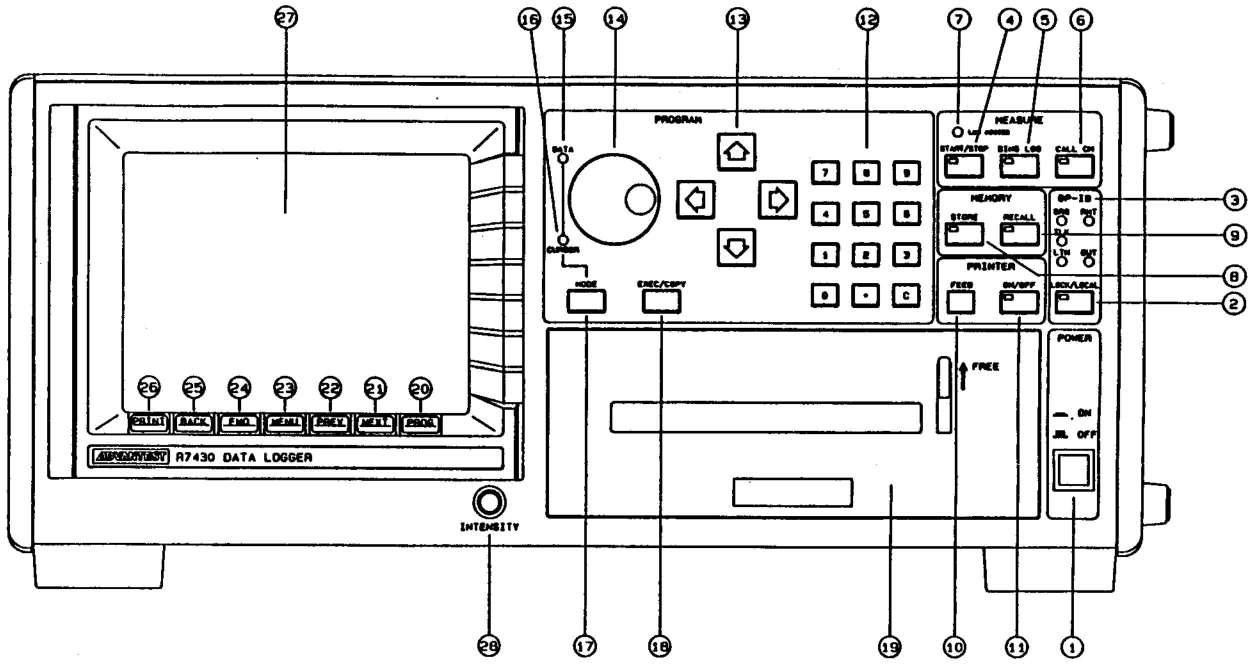


Figure 3 - 3 R7430 Front Panel

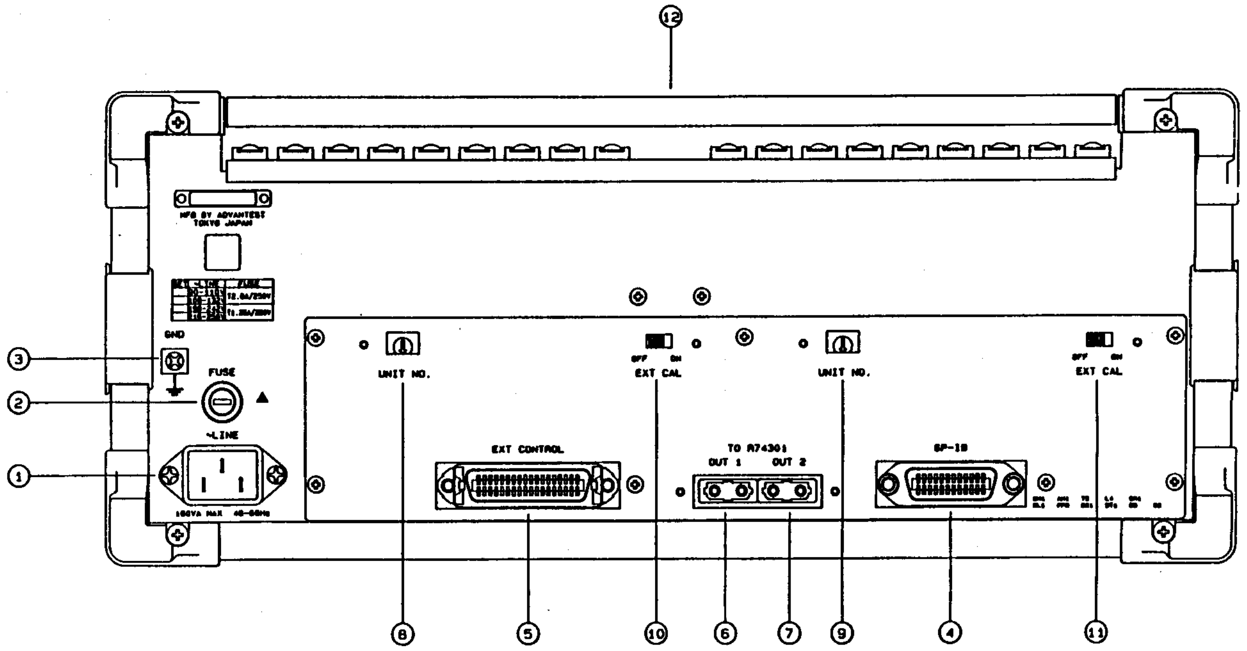


Figure 3 - 4 R7430 Rear Panel

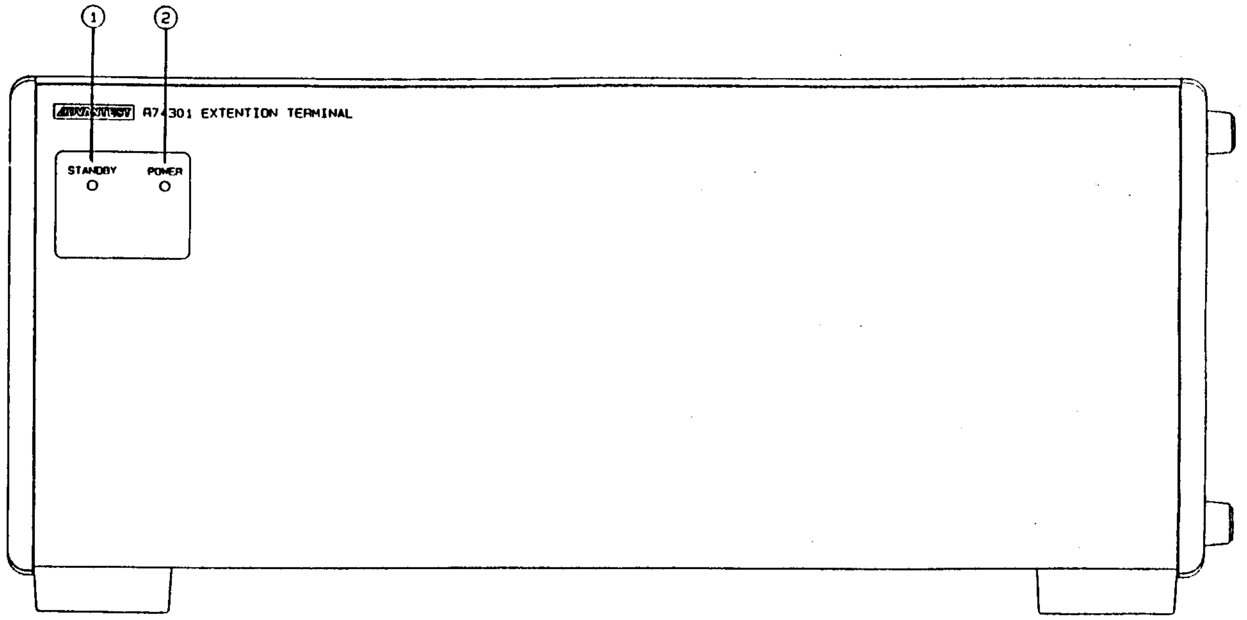


Figure 3 - 5 R74301 Front Panel

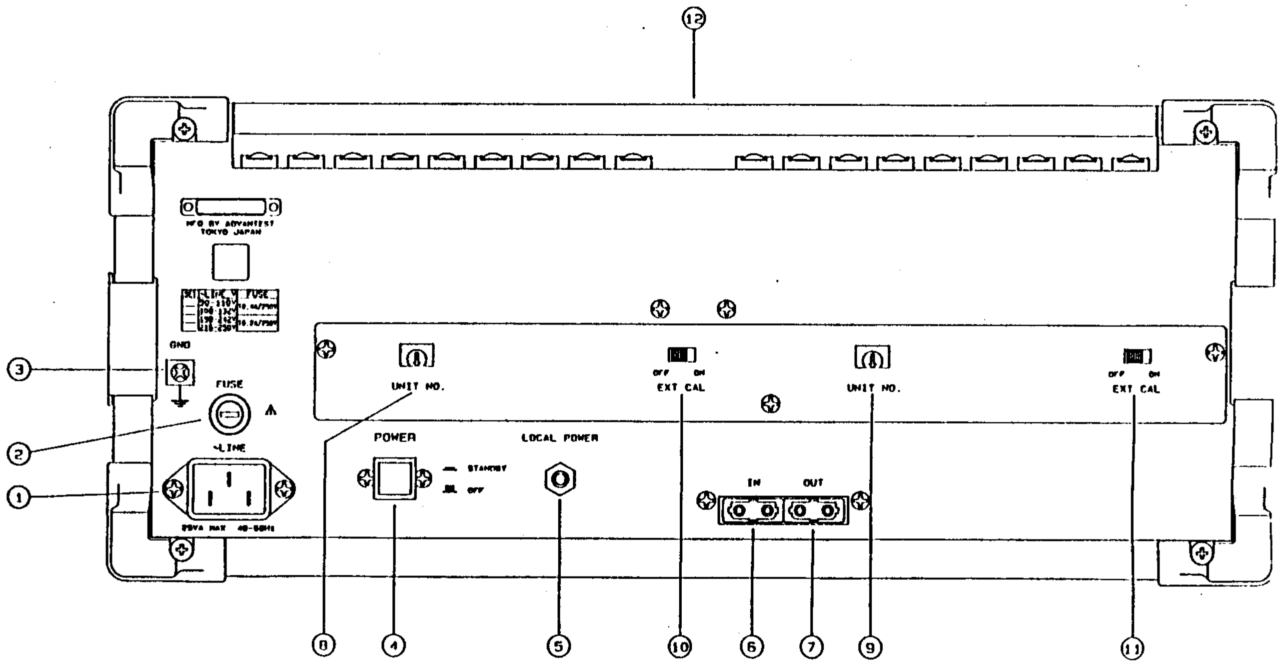


Figure 3 - 6 R74301 Rear Panel

4. OPERATING PROCEDURES

4.1 Basic Operations

4.1.1 Power-on System Actions

When you set the power switch of the R7430 to ON, its automatic self-diagnostics will start running.
The self-diagnostic items are listed below.

① LED test

② ROM test

③ RAM test

④ Timer IC set value check

⑤ Battery voltage test

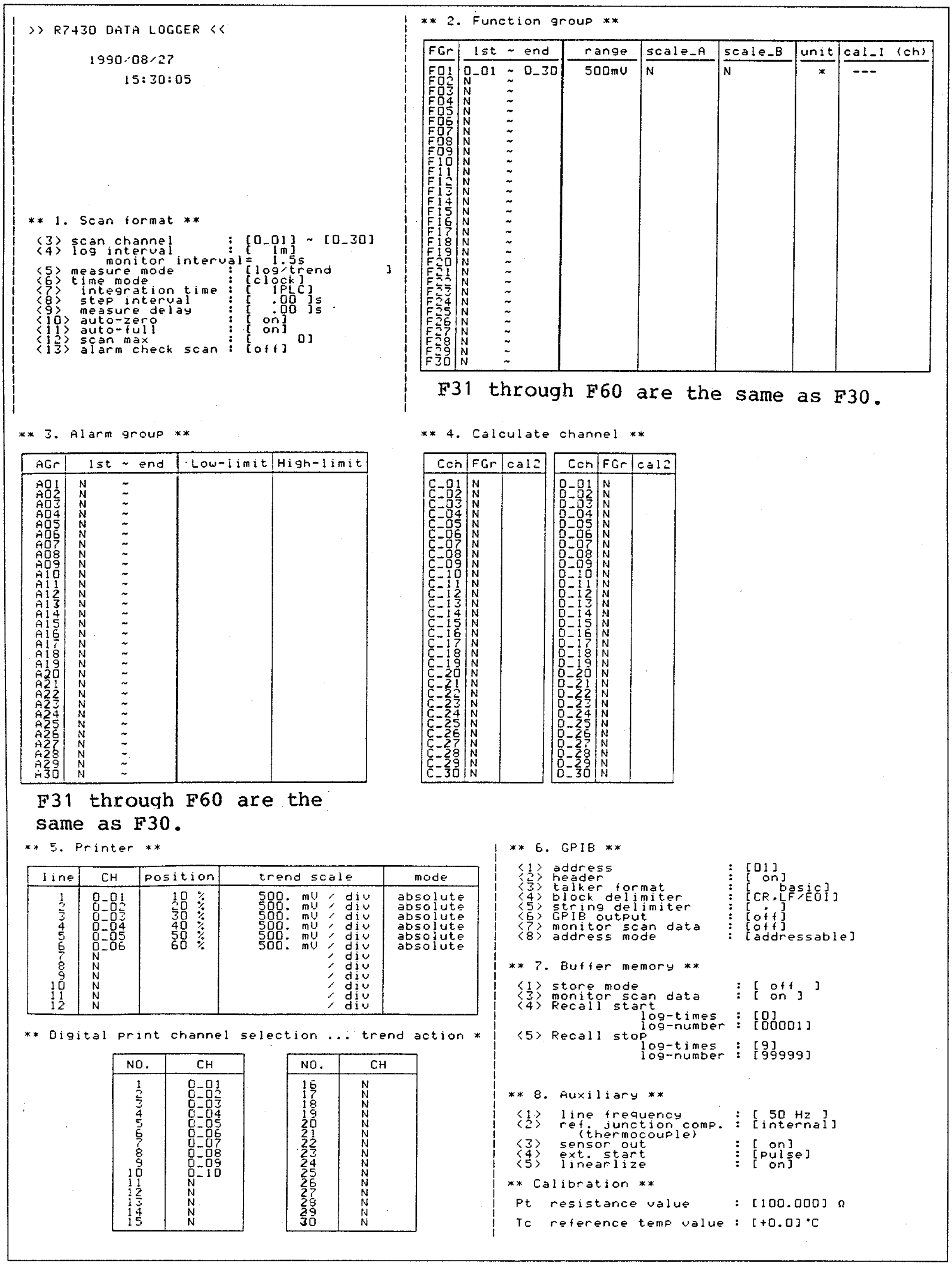
⑥ Program data check

⑦ ROM/RAM tests of measurement units

The display of the time of day will start when self-diagnosis comes to a normal end.
If errors occur during self-diagnosis, the appropriate error messages for the errors will be displayed.
See Subsection 10.1.2, "Self-diagnostics", for a further detailed description of how the self-diagnostics operate.

NOTE

If you operate the equipment for the first time, press EXEC, ⇦, ⇧, ⇨, ⇩, and EXEC, in that order, when time display starts following the power-on sequence. This will initialize the entire program data prestored within the equipment. Data within a data buffer memory (option), however, will remain unchanged.



```
>> R7430 DATA LOGGER <<

        1990/08/27
            15:30:05


** 1. Scan format **

 <3> scan channel         : [0_01] ~ [0_30]
 <4> log interval         : [   1m]
         monitor interval=   1.5s
 <5> measure mode         : [log/trend        ]
 <6> time mode            : [clock]
 <7>  integration time    : [   1PLC]
 <8>  step interval       : [   .00 ]s
 <9>  measure delay       : [   .00 ]s
 <10> auto-zero           : [ on]
 <11> auto-full           : [ on]
 <12> scan max            : [        0]
 <13> alarm check scan    : [off]
```

** 2. Function group **

FGr	1st ~ end	range	scale_A	scale_B	unit	cal_I (ch)
F01	0_01 ~ 0_30	500mV	N	N	*	---
F02	N ~					
F03	N ~					
F04	N ~					
F05	N ~					
F06	N ~					
F07	N ~					
F08	N ~					
F09	N ~					
F10	N ~					
F11	N ~					
F12	N ~					
F13	N ~					
F14	N ~					
F15	N ~					
F16	N ~					
F17	N ~					
F18	N ~					
F19	N ~					
F20	N ~					
F21	N ~					
F22	N ~					
F23	N ~					
F24	N ~					
F25	N ~					
F26	N ~					
F27	N ~					
F28	N ~					
F29	N ~					
F30	N ~					

F31 through F60 are the same as F30.

** 3. Alarm group **

AGr	1st ~ end	Low-limit	High-limit
A01	N ~		
A02	N ~		
A03	N ~		
A04	N ~		
A05	N ~		
A06	N ~		
A07	N ~		
A08	N ~		
A09	N ~		
A10	N ~		
A11	N ~		
A12	N ~		
A13	N ~		
A14	N ~		
A15	N ~		
A16	N ~		
A17	N ~		
A18	N ~		
A19	N ~		
A20	N ~		
A21	N ~		
A22	N ~		
A23	N ~		
A24	N ~		
A25	N ~		
A26	N ~		
A27	N ~		
A28	N ~		
A29	N ~		
A30	N ~		

F31 through F60 are the same as F30.

** 4. Calculate channel **

Cch	FGr	cal2
C_01	N	
C_02	N	
C_03	N	
C_04	N	
C_05	N	
C_06	N	
C_07	N	
C_08	N	
C_09	N	
C_10	N	
C_11	N	
C_12	N	
C_13	N	
C_14	N	
C_15	N	
C_16	N	
C_17	N	
C_18	N	
C_19	N	
C_20	N	
C_21	N	
C_22	N	
C_23	N	
C_24	N	
C_25	N	
C_26	N	
C_27	N	
C_28	N	
C_29	N	
C_30	N	

Cch	FGr	cal2
D_01	N	
D_02	N	
D_03	N	
D_04	N	
D_05	N	
D_06	N	
D_07	N	
D_08	N	
D_09	N	
D_10	N	
D_11	N	
D_12	N	
D_13	N	
D_14	N	
D_15	N	
D_16	N	
D_17	N	
D_18	N	
D_19	N	
D_20	N	
D_21	N	
D_22	N	
D_23	N	
D_24	N	
D_25	N	
D_26	N	
D_27	N	
D_28	N	
D_29	N	
D_30	N	

** 5. Printer **

line	CH	position	trend scale	mode
1	0_01	10 %	500. mV / div	absolute
2	0_02	20 %	500. mV / div	absolute
3	0_03	30 %	500. mV / div	absolute
4	0_04	40 %	500. mV / div	absolute
5	0_05	50 %	500. mV / div	absolute
6	0_06	60 %	500. mV / div	absolute
7	N		/ div	
8	N		/ div	
9	N		/ div	
10	N		/ div	
11	N		/ div	
12	N		/ div	

** Digital print channel selection ... trend action *

NO.	CH
1	0_01
2	0_02
3	0_03
4	0_04
5	0_05
6	0_06
7	0_07
8	0_08
9	0_09
10	0_10
11	N
12	N
13	N
14	N
15	N

NO.	CH
16	N
17	N
18	N
19	N
20	N
21	N
22	N
23	N
24	N
25	N
26	N
27	N
28	N
29	N
30	N

```
** 6. GPIB **

 <1> address                : [01]
 <2> header                 : [ on]
 <3> talker format          : [    basic]
 <4> block delimiter        : [CR,LF/EOI]
 <5> string delimiter       : [ , ]
 <6> GPIB output            : [off]
 <7> monitor scan data      : [off]
 <8> address mode           : [addressable]

** 7. Buffer memory **

 <1> store mode             : [ off  ]
 <3> monitor scan data      : [ on ]
 <4> Recall start
               log-times    : [0]
               log-number   : [00001]
 <5> Recall stop
               log-times    : [9]
               log-number   : [99999]


** 8. Auxiliary **

 <1>  line frequency        : [ 50 Hz ]
 <2>  ref. junction comp.   : [internal]
        (thermocouple)
 <3>  sensor out            : [ on]
 <4>  ext. start            : [pulse]
 <5>  linearlize            : [ on]

** Calibration **

 Pt  resistance value       : [100.000] Ω

 Tc  reference temp value   : [+0.0] °C
```

Figure 4 - 1 Initialized Parameters

4.1.2 Selecting Between the Measurement Screen and Programming Screens

The time of day is displayed after completion of self-diagnosis following a power-on sequence.
The screen on which the time of day is displayed is referred to as the measurement screen, and all other screens are referrd to as programming screens. Selection between the measurement screen and programming screens is performed each time you press the PROG key.

4.1.3 Moving the Cursor

Use the cursor control keys, ⇦, ⇨, ⇧, ⇩ to move the cursor.
Pressing and holding down any of these keys continuously moves the cursor automatically because of a repeat function.
If the CURSOR LED is on, you can also move the cursor using the rotary key. In that case, the cursor will move horizontally if you have pressed the ⇦ or ⇨ key previously, or vertically if you have pressed the ⇧ or ⇩ key previously.

4.1.4 Entering Numeric Data/Character Data

If data indicated by the cursor is blinking, then this indicates that numeric data must be entered.
If data indicated by the cursor is not blinking, then this indicates that character data must be entered.

Use the keys $\boxed{0}$ through $\boxed{9}$ and $\boxed{.}$ to enter numeric data.
Use the rotary key to select and enter character data. The rotary key allows you to select the DATA or CURSOR mode using the MODE key. If the DATA LED is on, the rotary key works as a DATA key, which allows you to select character data. If you are to enter character data (that is, if the cursor-indicated data is not blinking), select the desired data during the DATA key mode after making sure that the DATA LED is on.
Depending on the type of data to be enterd, one of the following characters will be displayed at the right bottom of the particular programming screen:

Numeric data ..... KEY
Character data ... NOB
EXEC key .... EXE

4.1.5 Copying a Screen

A copy of the screen being displayed on the CRT can be output onto the printer by pressing the PRINT key. This key, however, is operative only when measurement or screen copy printout operations are not in progress.

4.2 MEASURE Keys

The MEASURE keys are used to make the equipment perform measurement operations. Measurement is performed according to user-programmed parameters.

4.2.1 START/STOP Key (Log Scan Measurement/Monitor Scan Measurement)

Pressing the START/STOP key turns the key LED on and starts measurement operations based on user-programmed parameters. Re-pressing the START/STOP key turns the key LED off and stops the measurement operations.
With external contacts signals, you can also carry out similar operations to those mentioned above.
See Section 7.3 for a description of external start/stop input signals.

NOTE

1. If an external start/stop input signal is generated during pulse mode:

   The START/STOP switch on the panel and an external start/stop command will perform the same function. Thus, the start of measurement can be directed from one end, and the end of measurement, from the other end.

2. If an external start/stop input signal is generated during level mode:

   Any external start signal with the equipment active, or any external stop signal with the equipment inactive, will be ignored if input.

Measurement will automatically stop when the maximum allowable number of scans are performed.

NOTE

If the maximum allowable number of scans is set to zero, measurement will continue until the STOP key is pressed.

4.2.2 SNGL LOG Key (Single Log Scan Measurement)

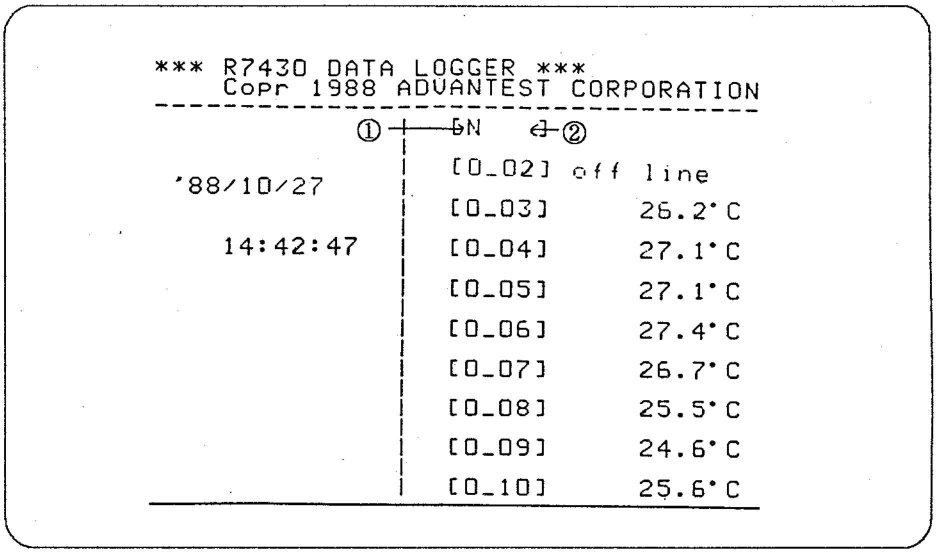
Pressing SING LOG key turns the key LED on and starts a single scan measurement operation. The LED turns off at the end of measurement. This key is valid even during measurement. The key, however, will become invalid if it is pressed during log scanning or monitor scanning.

4.2.3 CALL CH (Call Channel) Key

Pressing CALL CH ☐ key turns the key LED on and starts call channel measurement operations.
During call channel measurement, a maximum of ten any channels of data will be measured at intervals of about one second and the results will be displayed on the CRT.
In the absence of the corresponding measurement unit, the message "off line" will be displayed in stead of measured data. If the measurement mode is turned off, that is, if call channel N is set, then the CRT display will be blank.

NOTE

Measured call channel data will not be displayed while a programming screen remains on the CRT display.



```
*** R7430 DATA LOGGER ***
    Copr 1988 ADVANTEST CORPORATION
-----------------------------------
               |  N
'88/10/27      | [0_02] off line
               | [0_03]     26.2°C
    14:42:47   | [0_04]     27.1°C
               | [0_05]     27.1°C
               | [0_06]     27.4°C
               | [0_07]     26.7°C
               | [0_08]     25.5°C
               | [0_09]     24.6°C
               | [0_10]     25.6°C
```

Figure 4 - 2 Display Example of Measured Call Channel Data

[Selecting a Call Channel]

(1) Move the cursor to the position indicated as ① in Figure 4-2.

(2) Set the operation mode of the rotary key to DATA using the MODE ☐ key.

(3) Select a measurement unit number using the rotary key.
Call channel measurement will not occur if you select N at this time.

(4) Move the cursor to the position indicated as ② in Figure 4-2.

(5) Select a measurement channel number using the rotary key. The display of "off line" on the data display screen indicates that the corresponding channel does not exist.

(6) Repeat the above five steps as required. Up to a maximum of 10 channels can each be set separately.

NOTE

1. Call channel measurement is repeated at intervals of about one second. If, however, it takes more than one second to complete a single measurement operation, the measurement interval will be limited according to that measurement time. For example, since about two seconds per channel are required with an integral time setting of 100PLC, it takes about 20 sconds for 10 channels and thus the measurement interval becomes about 20 seconds.

2. Call channel measurement will skip during scan measurement. If the scan measurements include the channel that has been set using the CALL CH key, the corresponding data will be displayed as call channel data.

4.3 PROGRAM Keys

The PROGRAM keys consist of seven screen control keys and five parameter setting/entry keys. The operation of setting parameters on a programming screen is referred to as programming.

4.3.1 Screen Control Key Operations

The seven keys displayed at the bottom of the CRT display are referred to as the screen control keys. You can use these keys to select a programming screen on which the desired parameters can be set. The following outlines the function of each such key:

① PRINT (Printing out a copy of the CRT screen display)

② BACK (Going back to the immediately preceding group-programming screen)

③ FWD (Proceeding to the next group-programming screen)

④ PREV (Returning to the previous programming item screen)

⑤ NEXT (Proceeding to the next programming item screen)

⑥ MENU (Changing the particular programming screen to the menu screen)

⑦ PROG (Changing between the measurement screen and a programming screen)

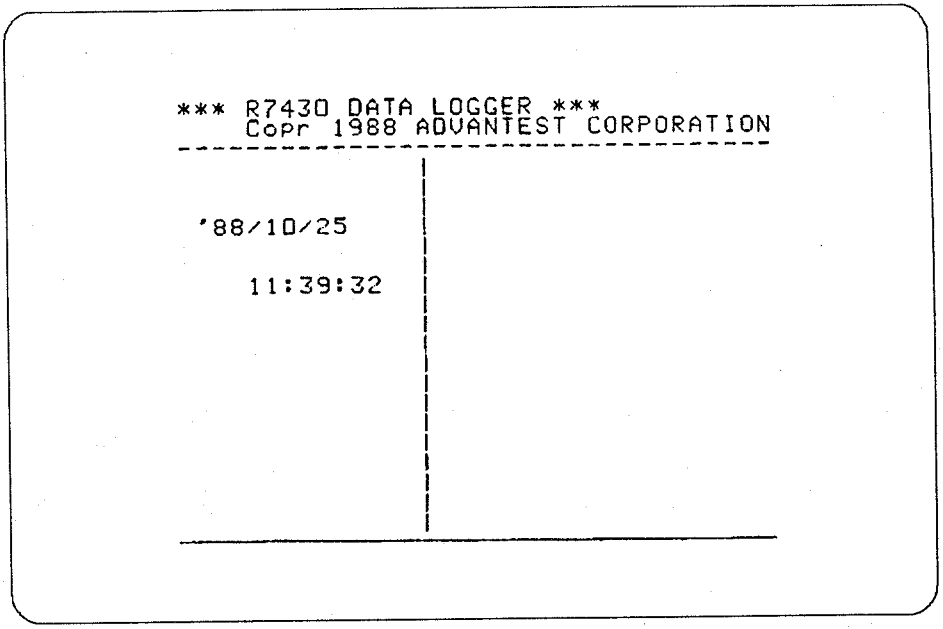
NOTE

1. Group-programming refers to "Function group" and "Alarm group."
2. The measurement screen refers to the screen that displays the time of day. All other screens are referred to as programming screens. Changing between the measurement screen and programming screens is done by the ON/OFF actions of the PROG key.

Operation examples of the screen control keys

① Set the power switch to ON.

↓

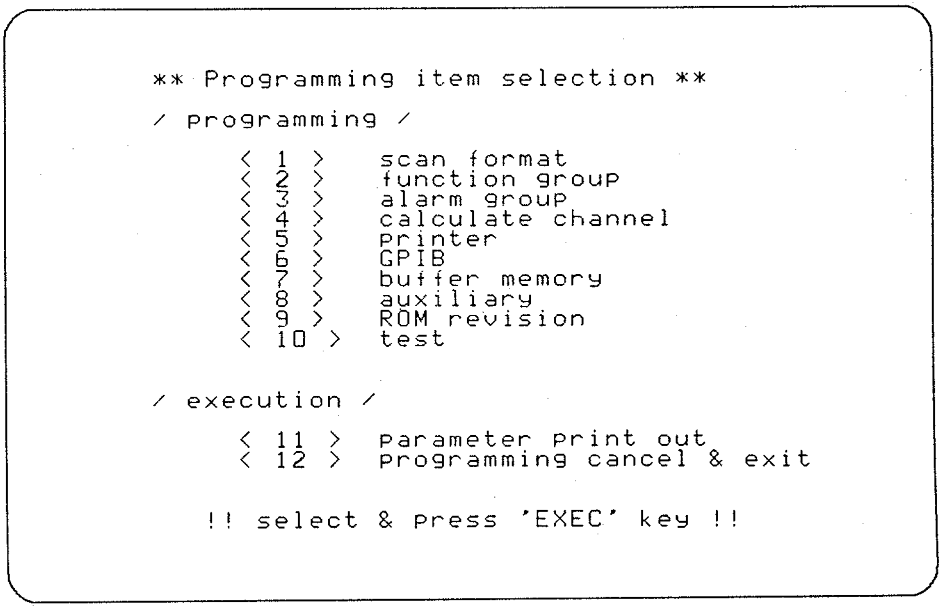


```
*** R7430 DATA LOGGER ***
    Copr 1988 ADVANTEST CORPORATION
-------------------------------------------
                     |
 '88/10/25           |
                     |
    11:39:32         |
                     |
```

Measurement screen after self-diagnosis

② Press the PROG key.

↓

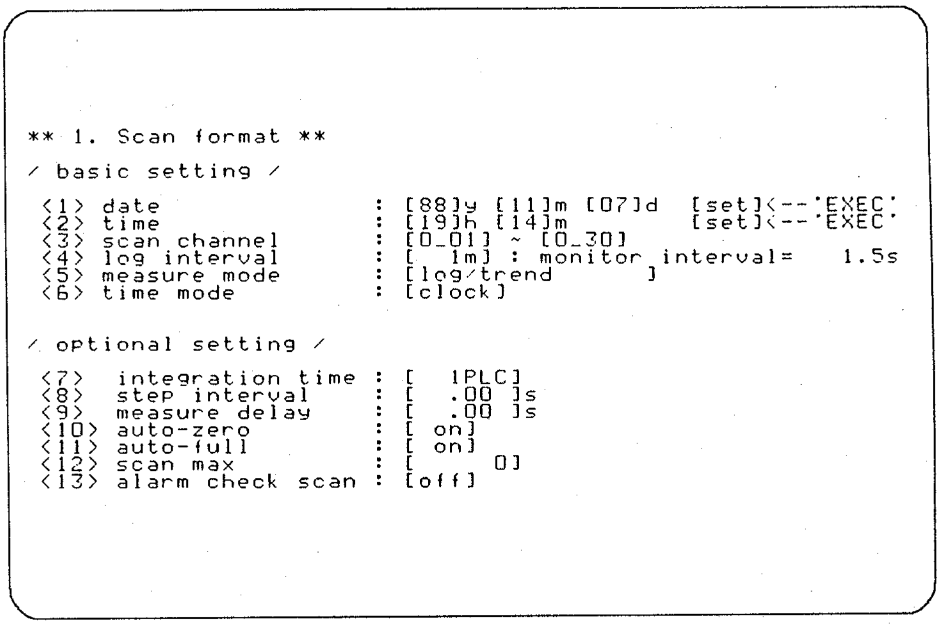


```
** Programming item selection **

/ programming /

      < 1 >    scan format
      < 2 >    function group
      < 3 >    alarm group
      < 4 >    calculate channel
      < 5 >    printer
      < 6 >    GPIB
      < 7 >    buffer memory
      < 8 >    auxiliary
      < 9 >    ROM revision
      < 10 >   test

/ execution /

      < 11 >   parameter print out
      < 12 >   programming cancel & exit

    !! select & press 'EXEC' key !!
```

Programming screen (Menu screen)

③ Press PROG key to return to the screen shown in ① above.
Press NEXT key to proceed to the next item.

↓

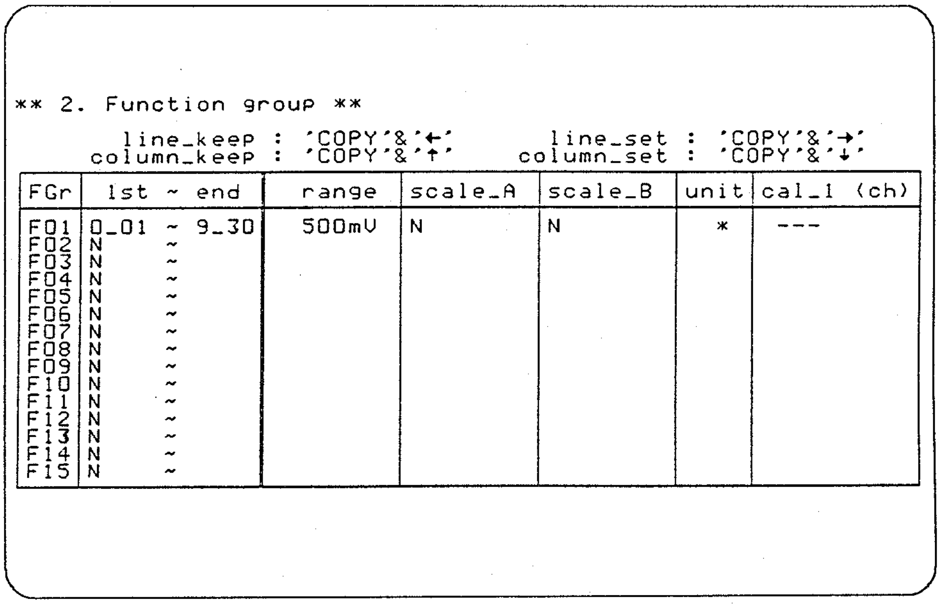


```
** 1. Scan format **

/ basic setting /

 <1> date                : [88]y [11]m [07]d  [set]<--'EXEC'
 <2> time                : [19]h [14]m        [set]<--'EXEC'
 <3> scan channel        : [0_01] ~ [0_30]
 <4> log interval        : [   1m] : monitor interval=   1.5s
 <5> measure mode        : [log/trend         ]
 <6> time mode           : [clock]

/ optional setting /

 <7>  integration time : [   1PLC]
 <8>  step interval    : [   .00 ]s
 <9>  measure delay    : [   .00 ]s
 <10> auto-zero        : [ on]
 <11> auto-full        : [ on]
 <12> scan max         : [       0]
 <13> alarm check scan : [off]
```

Scan format screen

④ Press PROG key to return to the screen shown in ① above.
Press MENU key to return to the screen shown in ② above.
Press NEXT key to proceed to the next item.
(Press PREV key to return to the previous item.)

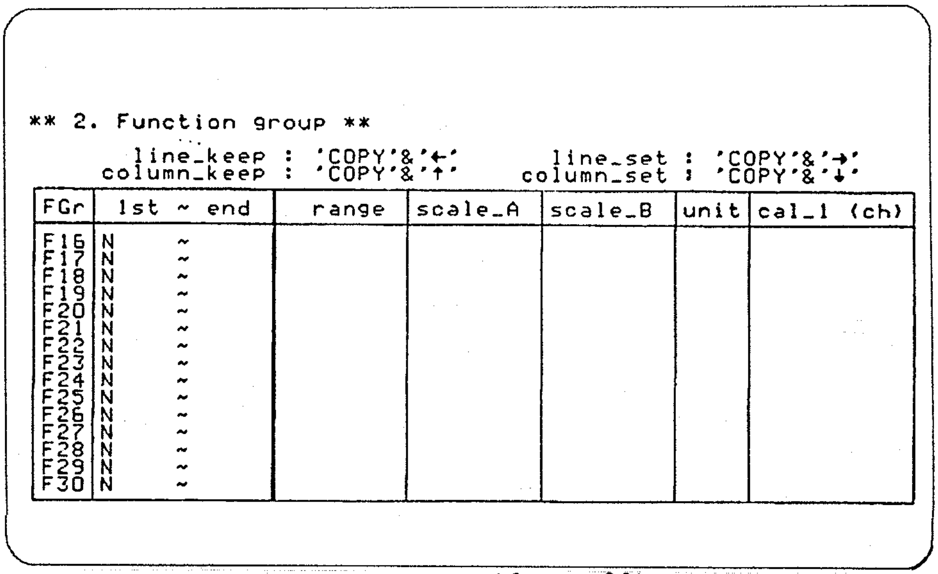
↓



```
** 2. Function group **
       line_keep : 'COPY'&'←'        line_set : 'COPY'&'→'
     column_keep : 'COPY'&'↑'      column_set : 'COPY'&'↓'
 FGr | 1st ~ end   |   range  | scale_A  | scale_B  | unit | cal_1 (ch)
 F01 | 0_01 ~ 9_30 |   500mV  | N        | N        |  *   |  ---
 F02 | N    ~      |          |          |          |      |
 F03 | N    ~      |          |          |          |      |
 F04 | N    ~      |          |          |          |      |
 F05 | N    ~      |          |          |          |      |
 F06 | N    ~      |          |          |          |      |
 F07 | N    ~      |          |          |          |      |
 F08 | N    ~      |          |          |          |      |
 F09 | N    ~      |          |          |          |      |
 F10 | N    ~      |          |          |          |      |
 F11 | N    ~      |          |          |          |      |
 F12 | N    ~      |          |          |          |      |
 F13 | N    ~      |          |          |          |      |
 F14 | N    ~      |          |          |          |      |
 F15 | N    ~      |          |          |          |      |
```

Function group (F01 to F15) screen

⑤ Press PROG key to return to the screen shown in ① above.
Press MENU key to return to the screen shown in ② above.
Press FWD key to proceed to the next group screen.
↓



** 2. Function group **

```
    line_keep : 'COPY'&'←'      line_set : 'COPY'&'→'
  column_keep : 'COPY'&'↑'    column_set : 'COPY'&'↓'
```

FGr	1st ~ end	range	scale_A	scale_B	unit	cal_1 (ch)
F16	N ~					
F17	N ~					
F18	N ~					
F19	N ~					
F20	N ~					
F21	N ~					
F22	N ~					
F23	N ~					
F24	N ~					
F25	N ~					
F26	N ~					
F27	N ~					
F28	N ~					
F29	N ~					
F30	N ~					

Function group (F16 to F30) screen

⑥ Press PROG key to return to the screen shown in ① above.
Press MENU key to return to the screen shown in ② above.
Press BACK key to return to the immediately preceding group screen, that is, the screen shown in ④ above.

4.3.2 Basic Entry Operations for Parameter-setting Data

Using the five keys listed below, enter new parameter-setting data if you want to change the current data after selecting a programming screen using the screen control keys.

① Rotary Key

This key acts as a character data selector key if the DATA LED is on, or as a cursor control key if the CURSOR LED is on.

② MODE Key

Use this key to select the DATA or CURSOR mode for the rotary key.

③ EXEC/COPY Key

This key acts as a program execution key, or for group-programs, as a keep or set mode key that is to be used together with a cursor contol key.

④ Arrow Keys

Use these keys to move the cursor.

⑤ Data Keys

Use these keys to enter numeric data.

The methods of moving the cursor to a parameter-setting item and then changing the cursor-indicated data are described below.

(1) If the data is blinking:

You must enter numeric data. Entering numeric data using the data keys displays the data in sequence with the least significant digit first.

(2) If the data is not blinking:

You must enter character data. First, make sure that the DATA LED is on. (If the CURSOR LED is on instead, turn it off using the MODE key.) Then, select and enter the desired data using the rotary key.

(3) If the message "Press 'EXEC' key" is displayed:

Pressing the $\overset{\text{EXEC}}{\square}$ key under the existing status executes that item.

(4) If the message "[set] <--'EXEC'" is displayed:

Moving the cursor to the position of [set] and then pressing the $\overset{\text{EXEC}}{\square}$ key will execute that item.

(5) If the message "!! select & press 'EXEC' key!!" is displayed:

Moving the cursor to the desired item and then pressing the $\overset{\text{EXEC}}{\square}$ key will execute that item.

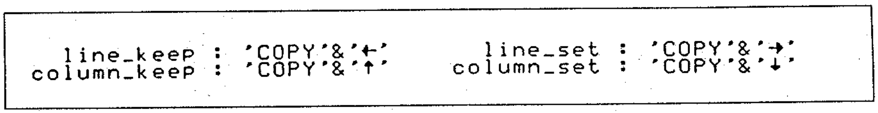
(6) To recall the original data:

New data is automatically set when a programming screen is changed over to the measurement screen. The original (old) data can be recalled on the existing programming screen by moving the cursor to the intended data item and then pressing $\boxed{\text{C}}$, unless you have already changed that screen over to the measurement screen.

NOTE

If the contents of a program cannot be set for some reason during programming screen changeover using the $\boxed{\text{MENU}}$, $\boxed{\text{NEXT}}$, or $\boxed{\text{PREV}}$ key, or during termination of programming with the $\boxed{\text{PROG}}$ key, then an error message will be displayed and the existing screen will remain unchanged.
See Subsection 4.3.15, "programming cancel & exit," to cancel the entire data being programmed and then recall the parameters last set.

(7) If the following screen is displayed:



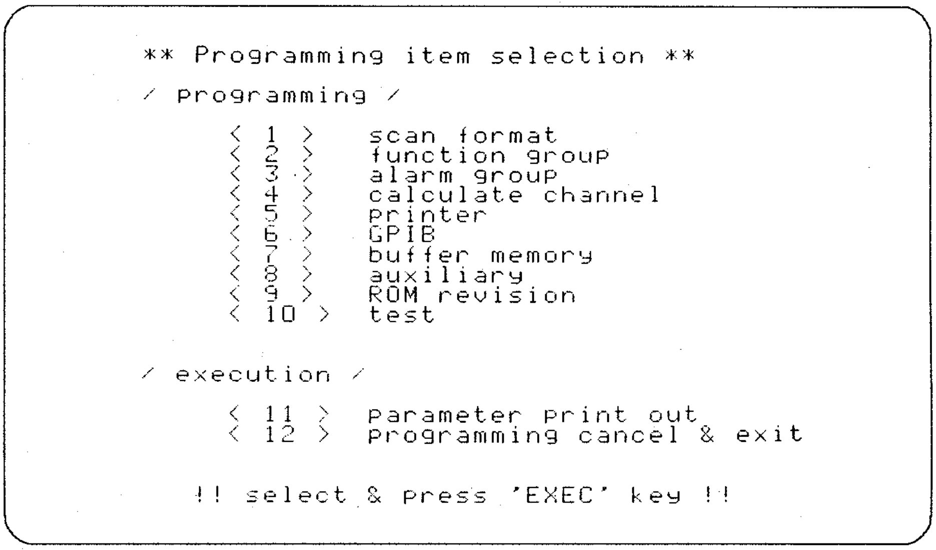
```
    line_keep : 'COPY'&'←'      line_set : 'COPY'&'→'
  column_keep : 'COPY'&'↑'    column_set : 'COPY'&'↓'
```

Press a cursor control key while holding down the COPY key. See Subsection 4.3.5 (1), "Identical-parameter Copy Setting," for a further detailed description of this operation.

4.3.3 Getting Started with Programming

Use the following procedure to start your programming work:

(1) The measurement screen will have appeared on the CRT following the power ON sequence. First, press PROG to change the screen over to the menu screen shown in Figure 4-3.



```
** Programming item selection **

/ programming /

     < 1 >    scan format
     < 2 >    function group
     < 3 >    alarm group
     < 4 >    calculate channel
     < 5 >    printer
     < 6 >    GPIB
     < 7 >    buffer memory
     < 8 >    auxiliary
     < 9 >    ROM revision
     < 10 >   test

/ execution /

     < 11 >   parameter print out
     < 12 >   programming cancel & exit

   !! select & press 'EXEC' key !!
```

Figure 4 - 3 Menu Screen

(2) The desired programming screen can be displayed by moving the cursor to the appropriate one of the 12 items (<1> through <12>) and then pressing EXEC.

(3) Pressing the NEXT key with the menu remaining on the display will display programming screen "1. scan format".

(4) Pressing the PREV key with the menu remaining on the display will display programming screen "10. test".

(5) Pressing the MENU key at any one time during programming will redisplay the menu.

(6) Pressing the PROG key at any one time during programming will redisplay the measurement screen.

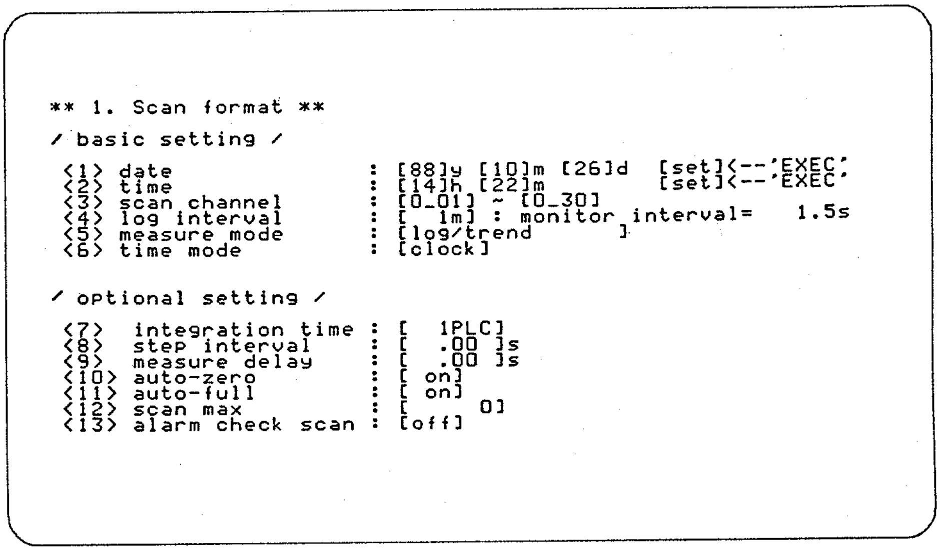
(7) Moving the cursor to item <11> and then pressing EXEC will output a program parameter list onto the printer. Re-pressing EXEC during printing will immediately terminate the list printout operation.

4.3.4 Scan format

The "Scan format" screen allows you to set basic parameters for scan measurement. This screen consists of two sections: basic setting and optional setting.

/basic setting/	This section lists parameter items that must be set for any type of measurement.
/optioanl setting/ ...	This section lists parameter items that can be set to accommodate changes in measured data.

For usual measurement, it is good enough just to set the items listed in /basic setting/.



```
** 1. Scan format **

/ basic setting /

 <1> date               : [88]y [10]m [26]d  [set]<--'EXEC'
 <2> time               : [14]h [22]m        [set]<--'EXEC'
 <3> scan channel       : [0_01] ~ [0_30]
 <4> log interval       : [  1m] : monitor interval=   1.5s
 <5> measure mode       : [log/trend        ]
 <6> time mode          : [clock]

/ optional setting /

 <7>  integration time : [  1PLC]
 <8>  step interval    : [  .00 ]s
 <9>  measure delay    : [  .00 ]s
 <10> auto-zero        : [ on]
 <11> auto-full        : [ on]
 <12> scan max         : [      0]
 <13> alarm check scan : [off]
```

Figure 4 - 4 Scan Format Screen

Description of /basic setting/ (Items <1> through <3>)

<1> date

Set the system clock date (year, month, day).

[Procedure]

① Using the data keys, enter the data within the allowable setting range displayed.

[88]y [10]m [26]d

Day (01 to 31)
Month (01 to 12)
Year (88 to 03)

② Move the cursor to [set], and press $\overset{\text{EXEC}}{\square}$.

<2> time

Set the system clock time (hours, minutes).

[Procedure]

① Using the data keys, enter the data within the allowable setting range displayed.

[14]h [22]m

Minutes (00 to 59)
Hours (00 to 23)

② Move the cursor to [set], and press $\overset{\text{EXEC}}{\square}$.

The time will become 00 seconds when you press $\overset{\text{EXEC}}{\square}$, and then increment in steps of one second.

<3> scan channel

Specify the starting and ending channels required for measurement. If you want to measure data for a single channel only, set the measurement starting channel and the measurement ending channel to the same number.

[Procedure]

① Select and enter data using the rotary key.

[0_01] to [0_30]

↑ Set a measurement unit number for the measurement starting channel. This unit number will then change from 0 to 9, from which the desired value must be selected.

[0_01] to [0_30]

↑ Set a channel number for the measurement unit. The channel number will then change from 01 to 30, from which the desired value must be selected.

② Set a measurement ending channel number using a similar method to that of setting the measurement starting channel number.

NOTE

The measurement starting channel number must be equal to or smaller than the measurement ending channel number.

<4> log interval

Set a log interval time. (Monitor interval time is set automatically.)

[Procedure]

① Select and enter data using the rotary key.

[1m] : monitor interval= 1.5s

↑ Set a log interval time. The interval will then change from 0.1s (seconds) to 24h (hours). Select the desired value. The monitor interval will change with the changing log interval.

The relationship between the log interval and the monitor interval is represented in Table 4-1.

Table 4 - 1 Relationship Between Log Interval and Monitor Interval

Log interval	Monitor interval	Log interval	Monitor interval
0.1s	0.1s	40s	1min
0.2s	0.1s	50s	1min, 15s
0.3s	0.1s	1h	1min, 30s
0.4s	0.1s	2h	3min
0.5s	0.1s	3h	4min, 30s
0.6s	0.1s	4h	6min
0.8s	0.1s	5h	7min, 30s
1s	0.1s	6h	9min
2s	0.1s	7h	10min, 30s
3s	0.1s	8h	12min
4s	0.1s	9h	13min, 30s
5s	0.1s	10h	15min
6s	0.1s	11h	16min, 30s
8s	0.2s	12h	18min
10s	0.2s	13h	19min, 30s
20s	0.5s	14h	21min
30s	0.6s	15h	22min, 30s
40s	1.0s	16h	24min
50s	1.0s	17h	25min, 30s
1min	1.5s	18h	27min
2min	3.0s	19h	28min, 30s
3min	4.5s	20h	30min
4min	6.0s	21h	31min, 30s
5min	7.5s	22h	33min
6min	9.0s	23h	34min, 30s
8min	12.0s	24h	36min
10min	15.0s		
20min	30.0s		
30min	45.0s		

NOTE

Set the log interval once again if the LOG MISSED LED lights during scanning, since this indicates that measurement is not possible with the existing interval.

<5> measure mode

Set a measurement mode (printout type).

[Procedure]

① Select and enter data using the rotary key.

[log/trend]

↑ The mode changes in order of log → trend → log/trend → alarm → log/alarm → trend/alarm → log/trend/alarm. Select the desired mode data.

The printout type differs according to the selected measurement mode.

The relationship between the measurement mode and the printout type is represented in Table 4-2.

Table 4 - 2 Relationship Between Measurement Mode and Printout Type

Measure mode	Measurement input		Printout type			
	Scan mode		Data output		Alarm output	
	Log scan	Monitor scan	Digital printout	Trend printout	Alarm based on log data	Alarm based on monitor data
log	○		○			
trend	○	○		○		
log/trend	○	○	○	○		
alarm	○				○	
log/alarm	○	○	○			○
trend/alarm	○	○		○	○	○
log/trend/alarm	○	○	○	○		○

Note 1: Alarm printing is done in digital form.
Note 2: Under a combination of digital printing and trend printing, a maximum of 30 channels can be selected for digital printing. See Subsection 4.3.8 Printer, for channel selection.

<6> time mode

Set whether you want printing to be done in system clock time (real time) or in actual time elapsed (timer).

[Procedure]

① Select and enter a time printing type using the rotary key.

[clock]

↑ Select either "clock" (printing in system clock time) or "timer" (printing in actural time elapsed).

NOTE

1. If you select "clock" (printing in system clock time), printing will occur in real-time format (yy/mm/dd, hh/mm/ss). If you select "timer" (printing in actual time elapsed), printing will always occur with yy set to 00 and mm set to 30 (one month).
2. For single log scan measurement, the clock time will be printed even if you select "timer."

<7> integration time

Set an integral time appropriate for the particular measurement accuracy, noise rejection factor, and measurement time.

[Procedure]

① Select and enter data using the rotary key.

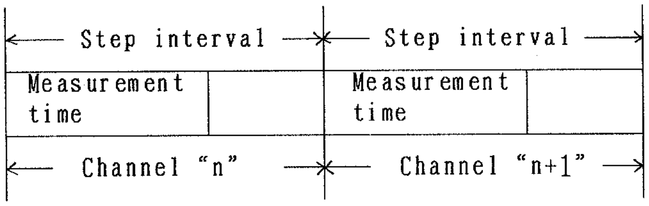
[1PLC]

↑ Data changes in order of 1ms → 5ms → 10ms → 1PLC → 2PLC → 5PLC → 10PLC → 100PLC. Select the desired value.

PLC: Power Line Cycle. It denotes the one-cycle time of the AC Power. For 50Hz, 1PLC = 20ms. For 60Hz, 1PLC ≒ 16.7ms.

< 8 > step interval

Set a scanning step time (step interval).



[Procedure]

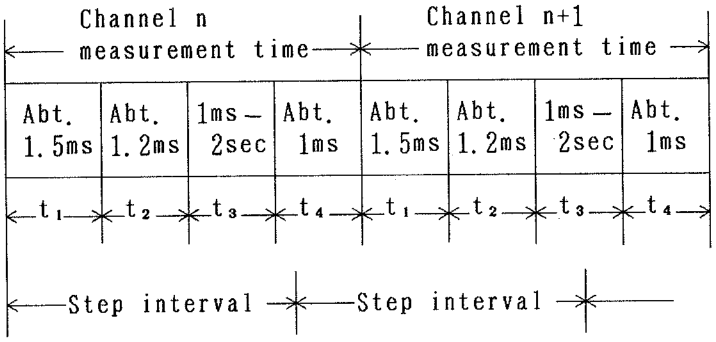
① Using the data keys, set the data within the allowable setting range displayed.

[.00]s

00.00 to 99.99 seconds

NOTE

The measurement time required for one channel is shown below. If the step interval is smaller than the measurement time, continuous measurement will occur with that measurement time.



t_1: Relay switching time
t_2: Settling time
t_3: Integral time (Time that has been set in < 7 > integration time)
t_4: Data processing time

< 9 > measure delay

If an external circuit has been added, the start of measurement can be delayed according to the response time of the external circuit. Set a measurement delay time here. See Section 5.2, "How To Use Scanner Output Terminals," for addition of external circuits.

[Procedure]

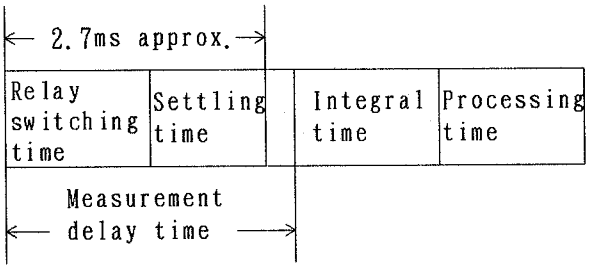
① Using the data keys, enter the data within the allowable setting range displayed.

[.00] s

↑ 0.00 to 9.99 seconds

NOTE

A measurement delay time setting of 0 delays the start of measurement by about 2.7ms.



<10> auto-zero

Set "on" if you want the zero drift of the measurement range to be automatically calibrated.

[Procedure]

① Select and enter data using the rotary key.

[on]

↑ Select and set "on" or "off."

NOTE

Settnig "on" will execute the calibration operation at the start of each scan. See Subsection 9.2.1, "Basic Operation Timing and Execution Time," for information about the execution time requirement.

<11> auto-full

Set "on" if you want the gain drift of the measurement range to be automatically calibrated.

[Procedure]

① Select and enter data using the rotary key.

```
[     on]
      ↑
      └──────────── Select and set "on" or "off."
```

NOTE

Setting "on" will execute the calibration operation at the start of each scan. The time required for execution is about 250ms.

<12> scan max

Set the maximum number of scans to be performed. Unless you press the stop key in the middle of measurement, the measuring operation will continue up to the maximum number of scans you have set, and then come to a stop.

[Procedure]

① Using the data keys, enter the data within the allowable setting range.

```
[       0]
        ↑
        └──────────── 0 to 99999 scans
```

NOTE

If you set the maximum number of scans to zero, measurement will continue until you press the stop key.

<13> alarm check scan

When you need data that will be measured after the occurrence of an alarm, it is possible to prevent output of the data measured before the occurrence of the alarm. This can be done by setting this programming item to "on."
See Section 6.2, "Applications of the Alarm Check Scan Function," for information about measurement examples.

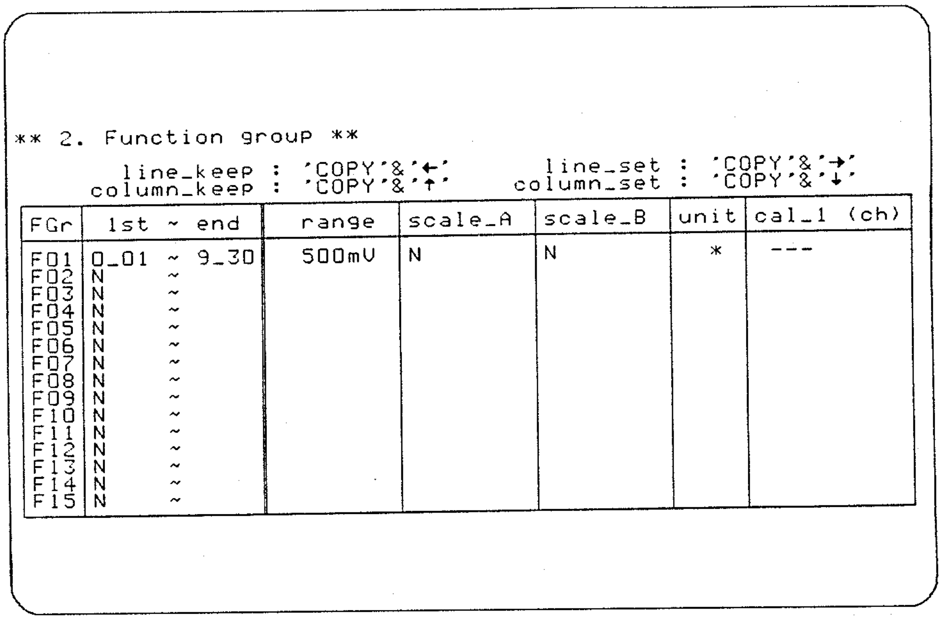
[Procedure]

① Select and enter data using the rotary key.

[off]
↑
└──── Select "off" or "on."

4.3.5 Function group

The "Function group" screen allows you to set the parameters under function groups. First, set specific starting and ending channels (1st ~ end) for each group. If measurement range parameters or scaling calculation parameters are included in the particular group, specify an industrial unit of measurement that is different from the units of the scaling factors (scale-A, scale-B) or measurement range. Also specify the first-order calculation process (cal-1).
You can set a maximum of 60 groups. Display is made for every 15 groups. Press FWD to proceed to the next group, or press BACK to return to a previous group.



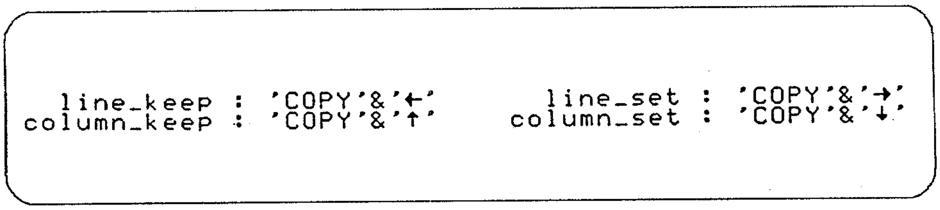
```
** 2. Function group **
     line_keep : 'COPY'&'←'     line_set : 'COPY'&'→'
   column_keep : 'COPY'&'↑'   column_set : 'COPY'&'↓'

FGr  1st ~ end    range    scale_A  scale_B  unit  cal_1 (ch)
F01  0_01 ~ 9_30  500mV    N        N         *    ---
F02  N    ~
F03  N    ~
F04  N    ~
F05  N    ~
F06  N    ~
F07  N    ~
F08  N    ~
F09  N    ~
F10  N    ~
F11  N    ~
F12  N    ~
F13  N    ~
F14  N    ~
F15  N    ~
```

Figure 4 - 5 Function group Screen

(1) Identical-parameter Copy Setting

For simplified group-programming, identical parameters can be copied, and set, by pressing one of the ⇦, ⇨, ⇧, and ⇩ keys while holding down the COPY ▭ key.

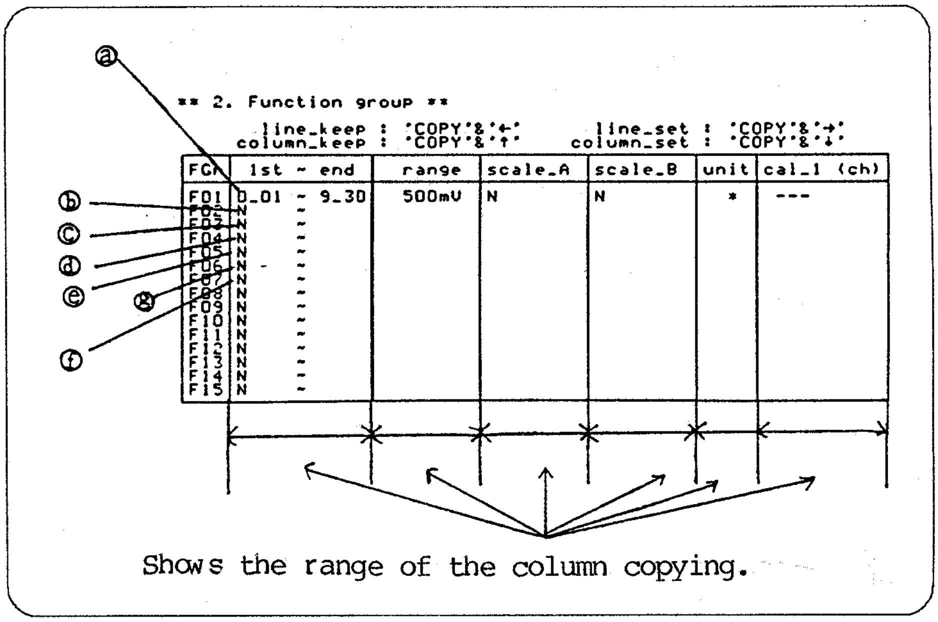
Use this function on the following screen:



```
  line_keep : 'COPY'&'←'       line_set : 'COPY'&'→'
column_keep : 'COPY'&'↑'     column_set : 'COPY'&'↓'
```

The operation of copying each parameter separately is referred to as column copying, and the operation of copying the parameters on the row located to the right of the double line is referred to as line copying.

(1)-1 Column Copying



```
** 2. Function group **
      line_keep : 'COPY'&'←'       line_set : 'COPY'&'→'
    column_keep : 'COPY'&'↑'     column_set : 'COPY'&'↓'
FCN| 1st ~ end | range | scale_A | scale_B | unit | cal_1 (ch)
F01| 0_01 ~ 9_30 | 500mV | N      | N       |  *   | ---
F02| N   ~
F03| N   ~
F04| N   ~
F05| N   ~
F06| N   ~
F07| N   ~
F08| N   ~
F09| N   ~
F10| N   ~
F11| N   ~
F12| N   ~
F13| N   ~
F14| N   ~
F15| N   ~
```

Shows the range of the column copying.

Column copying example

① Move the cursor to the position indicated by ⓐ.

② Press COPY ▭ and ⇧ together.
(The operation of "column-keep: 'COPY' & '↑'" displayed on the screen)

③ The screen shows "Done! column-keep" at its bottom.

④ Move the cursor to the position indicated by ⓑ, and press COPY and ⇩ together.
(The operation of "column-set: 'COPY' & '↓'" displayed on the screen)

⑤ At each of positions ⓒ, ⓓ, and ⓔ, press COPY and ⇩ together. The cursor moves to the next group each time you press these keys.

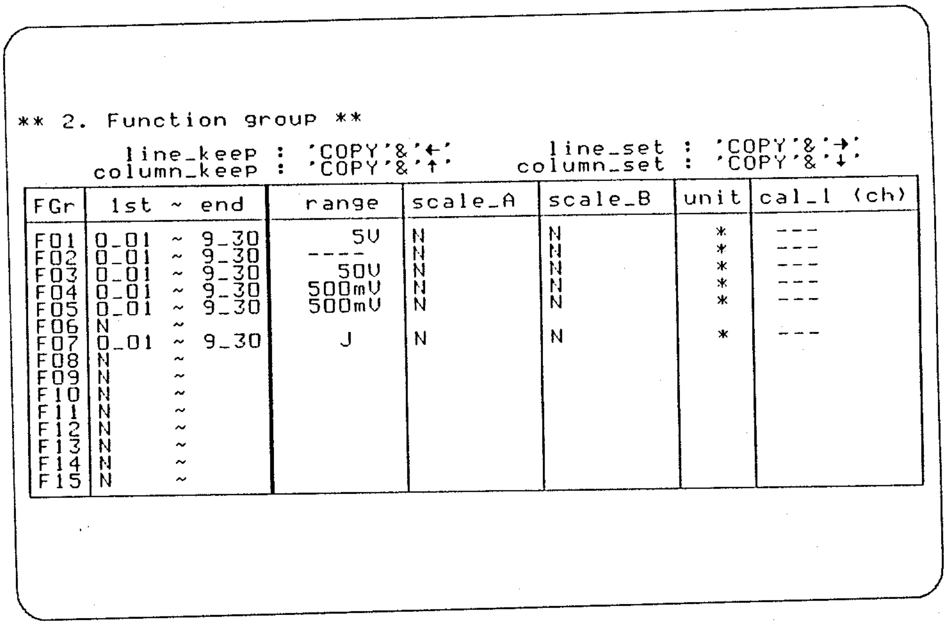
⑥ Move the cursor to position ⓕ.

⑦ Data within the range from "0_01" to "9_30" is set in each of positions ⓐ through ⓕ. "N" remains set in ⓖ.

NOTE

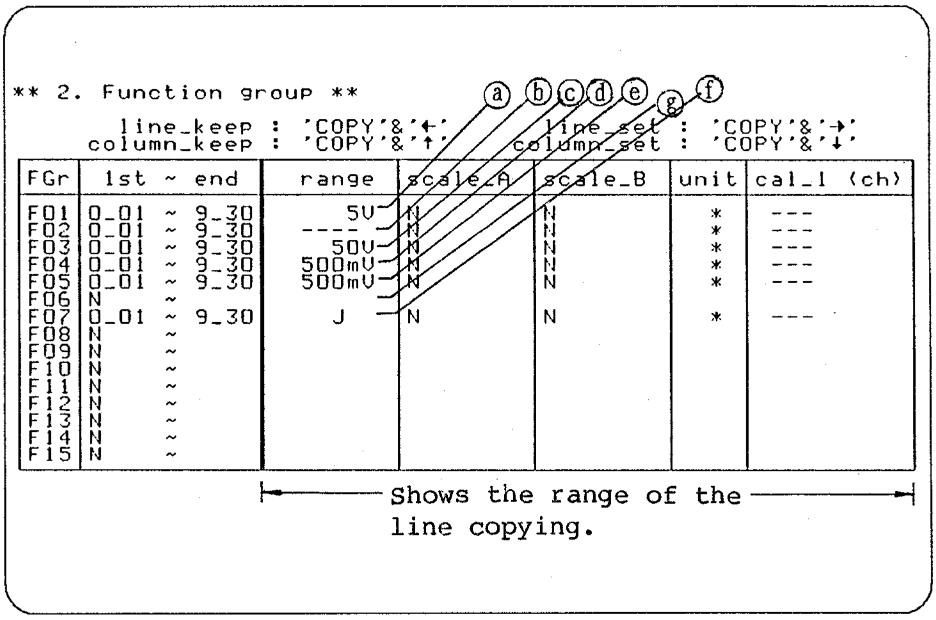
When parameters are set under the column of "1st ~ end", other parameters will be displayed. The latter is the data last set under those groups.

⑧ Display appears as follows:



```
** 2. Function group **
      line_keep : 'COPY'&'←'       line_set : 'COPY'&'→'
    column_keep : 'COPY'&'↑'     column_set : 'COPY'&'↓'
FGr  1st  ~  end    range   scale_A   scale_B   unit  cal_l (ch)
F01  0_01 ~  9_30      5V   N         N          *     ---
F02  0_01 ~  9_30    ----   N         N          *     ---
F03  0_01 ~  9_30     50V   N         N          *     ---
F04  0_01 ~  9_30   500mV   N         N          *     ---
F05  0_01 ~  9_30   500mV   N         N          *     ---
F06  N    ~
F07  0_01 ~  9_30       J   N         N          *     ---
F08  N    ~
F09  N    ~
F10  N    ~
F11  N    ~
F12  N    ~
F13  N    ~
F14  N    ~
F15  N    ~
```

(1)-2 Line Copying



```
** 2. Function group **
       line_keep : 'COPY'&'←'      line_set : 'COPY'&'→'
     column_keep : 'COPY'&'↑'    column_set : 'COPY'&'↓'
```

FGr	1st ~ end	range	scale_A	scale_B	unit	cal_I (ch)
F01	0_01 ~ 9_30	5V	N	N	*	---
F02	0_01 ~ 9_30	----	N	N	*	---
F03	0_01 ~ 9_30	50V	N	N	*	---
F04	0_01 ~ 9_30	500mV	N	N	*	---
F05	0_01 ~ 9_30	500mV	N	N	*	---
F06	N ~					
F07	0_01 ~ 9_30	J	N	N	*	---
F08	N ~					
F09	N ~					
F10	N ~					
F11	N ~					
F12	N ~					
F13	N ~					
F14	N ~					
F15	N ~					

Shows the range of the line copying.

Line copying example

① Move the cursor to the position indicated by ⓐ.

② Press [COPY] and ⇦ together.
(The operation of "line_keep: 'COPY' & '←'" displayed on the screen)

③ The screen shows "Done! line-keep" at its bottom.

④ Move the cursor to the position indicated by ⓑ, and press [COPY] and ⇨ together.
(The operation of "line_set: 'COPY' & '→'" displayed on the screen)

⑤ At each of positions ⓒ, ⓓ, and ⓔ, press [COPY] and ⇨ together. The cursor moves to the next group each time you press these keys.

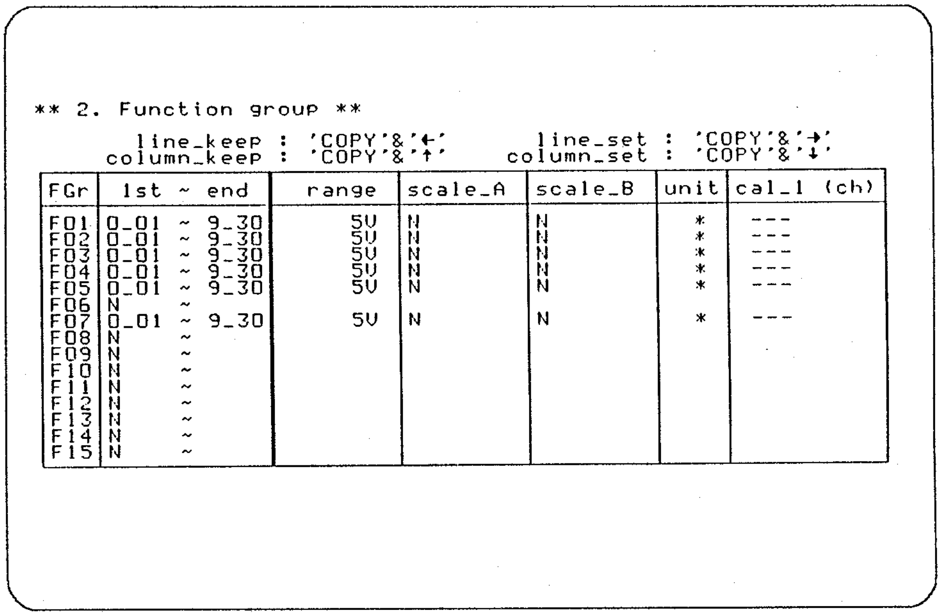
⑥ Move the cursor to position ⓕ. (The cursor does not move to position ⓖ.)

⑦ Data '5V N N * ---' is set in each of positions ⓐ through ⓕ.

NOTE

Groups having the "1st ~ end" parameters set to N cannot be used. Unless you set "1st ~ end" parameters, you cannot set any other parameters.

⑧ Display appears as follows:



```
** 2. Function group **

      line_keep : 'COPY'&'←'       line_set : 'COPY'&'→'
    column_keep : 'COPY'&'↑'     column_set : 'COPY'&'↓'
┌───┬─────────────┬────────┬─────────┬─────────┬────┬─────────┐
│FGr│ 1st ~ end   │ range  │scale_A  │scale_B  │unit│cal_1 (ch)│
├───┼─────────────┼────────┼─────────┼─────────┼────┼─────────┤
│F01│0_01  ~  9_30│     5V │N        │N        │ *  │ ---     │
│F02│0_01  ~  9_30│     5V │N        │N        │ *  │ ---     │
│F03│0_01  ~  9_30│     5V │N        │N        │ *  │ ---     │
│F04│0_01  ~  9_30│     5V │N        │N        │ *  │ ---     │
│F05│0_01  ~  9_30│     5V │N        │N        │ *  │ ---     │
│F06│N     ~      │        │         │         │    │         │
│F07│0_01  ~  9_30│     5V │N        │N        │ *  │ ---     │
│F08│N     ~      │        │         │         │    │         │
│F09│N     ~      │        │         │         │    │         │
│F10│N     ~      │        │         │         │    │         │
│F11│N     ~      │        │         │         │    │         │
│F12│N     ~      │        │         │         │    │         │
│F13│N     ~      │        │         │         │    │         │
│F14│N     ~      │        │         │         │    │         │
│F15│N     ~      │        │         │         │    │         │
└───┴─────────────┴────────┴─────────┴─────────┴────┴─────────┘
```

(2) Individual Parameter Setting

(2)-1 1st ~ end

During operation, measurement channels will be divided into groups according to the measurement range, scaling factor, industrial unit, and calculation type. Here, you are to set the channels to be divided into groups (group channels).

[Procedure]

① Select and enter data using the rotary key.

[0-01~9-30)

Channel number of the group ending channel
: 1 to 30

Measurement unit number of the group ending channel : 0 to 9

Channel number of the group starting channel
: 1 to 30

Measurement unit number of the group starting channel : 0 to 9, and N

NOTE

1. The group starting channel number must be equal to or smaller than the group ending channel number.
2. Within a function group, there must not be the same channel number as that of other function groups.
3. Scaling factors cannot be set for groups not having group channel numbers set. For such groups, group channel numbers must be set before you set scaling factors.

(2)-2 range

Set a measurement range appropriate for the type of input signal.

[Procedure]

① Select and enter data using the rotary key.

[500mV]

Data changes in order of ---(off) → 500mV → 5V → 50V → T → J → E → K → S → R → B → N → W5/W26RE → JPt/3w → JPt/4w → FLAG → Pt/3w → Pt/4w. Select the desired value.

NOTE

If you select ---(off), measurement will not occur for that channel group.

The following Table 4-3 lists "range" settings and actual measurement ranges.

Table 4 - 3 "range" Settings and Actual Measurement Ranges

	range	Measurement range	Remarks
DC voltage	500mV	-500mV to +500mV	
	5V	-5V to +5V	
	50V	-50V to +50V	
Thermocouple	T	-270℃ to +400℃	
	J	-210℃ to +1200℃	
	E	-270℃ to +1000℃	
	K	-270℃ to +1372℃	
	S	-50℃ to +1769℃	
	R	-50℃ to +1769℃	
	B	+100℃ to +1820℃	
	N	0℃ to +1300℃	
	W5/W26RE	0℃ to +2320℃	
Pt *	JPt/3w	-200℃ to +649℃	
	JPt/4w	-200℃ to +649℃	
	Pt/3w	-200℃ to +660℃	
	Pt/4w	-200℃ to +660℃	
Contacts input	FLAG	ON at 2kΩ or less OFF at 2kΩ or more	For ON, data becomes 1. For OFF, data becomes 0.

*: Pt (Platinum resistance thermometer bulb)

(2)-3 scale_A, scale_B

For each group, factor A is subtracted from input measurand X. The results are divided by factor B, and then converted into an industrial unit.

$$Y = \frac{X - A}{B} \quad (B \neq 0)$$

Factors A and B are referred to as scaling factors, which are to be set using "scale_A" and "scale_B", respectively.

[Proceduer]

① Select and enter data using the rotary key.

[N   ]

↑ Data changes in order of + → - → N. Select the desired value.

② If you selected + or -, move the cursor through one character space to the right.

③ Enter allowable data using the data keys.

[+   0.]

↑ Up to seven digits, including the decimal point

NOTE

No scaling factors can be used if you select N.

(2)-4 unit

Measured data can be output (printed out) with a unit added, for each group. Set an output unit to be added.

[Procedure]

① Select and enter data using the rotary key.

[*]

↑ Data changes in order of * → mV → V → °C → % → kg → Ω → --. Select the desired value.

NOTE

1. The unit corresponding to the measurement range is automatically added if * has been selected.

Measurement range	Output unit
500mV	mV
5 V	V
50 V	V
Thermocouple	℃
Pt	℃
Contacts input	None

2. No unit is added if -- has been selected.

(2)-5 cal_1 (First-order calculation)

If the linealize flag is on and scaling factors are set, first-order calculation will occur, based on the data obtained after linearization and scaling calculation. See Subsection 9.3.3, "First-order Calculation," for further details.

[Procedure]

① Select and enter data using the rotary key.

[---]

↑ Data changes in order of --- → MAX → MIN → AVE → ΔI → ΔN → ΔT. Select the desired data.

---: No calculation
MAX: Maximum value
MIN: Minimum value
AVE: Average value
ΔI : Difference from initial data
ΔN : Difference from any input point
ΔT : Difference from the data last measured

② If you selected data [ΔN], a calculate channel number (number of the channel data to be calculated) will be displayed next to the data. Move the cursor correspondingly.

[ΔN 1-01]

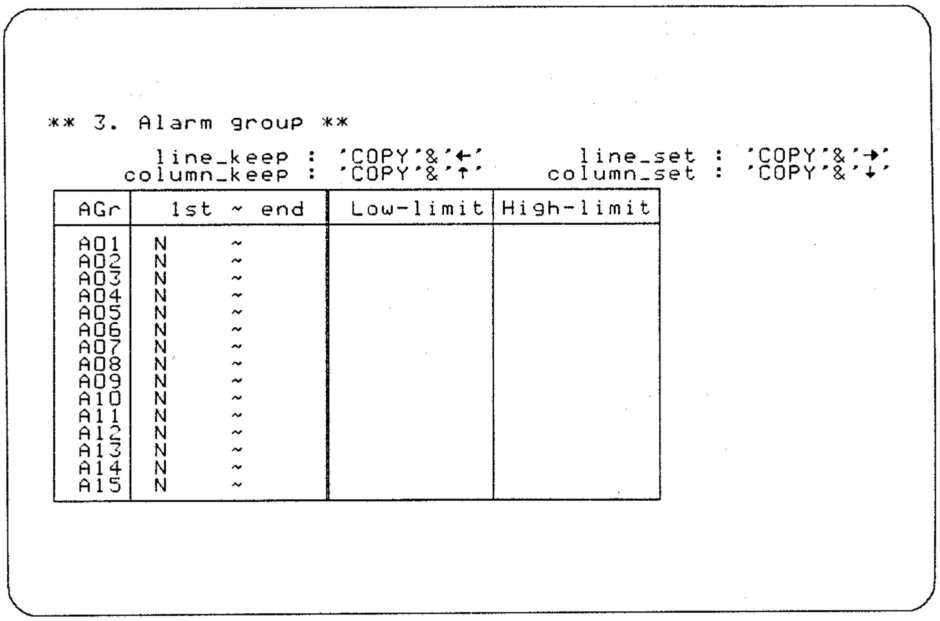
↑ Channel number of the measurement unit: 01 - 30.
↑ The measurement unit number changes from 0 to 9. Select the desired number.

Select calculated channel numbers that come under the same measurement range group.

Measurement range	Same range group
500mV	mV
5V	V
50V	
Thermocouple	°C
Platinum resistance thermometer bulb	
Contacts	FLAG

4.3.6 Alarm group

The Alarm group screen allows you to set alarm groups of parameters. After setting specific starting and ending channels (1st ~ end) for each group, set the low-limit value (Low-limt) and high-limit value (High-limit) of each group.
Alarm group channels are independent of the channels previously described in Subsection 4.3.5, "Function Group." Thus, you can create groups different from the function groups and identify the high- and low-limit values of those groups.
You can set a maximum of 60 alarm groups. Data is displayed for every 15 groups. Press FWD key to proceed to the next group, or press BACK key to return to a previous group.
Identical parameters can be copied, and set, by pressing any of the keys ⇦, ⇧, ⇨, ⇩ while holding down the COPY key.
See Subsection 4.3.5 (1), "Identical-parameter Copy Setting," for information on how to set identical parameters.



```
** 3. Alarm group **
           line_keep : 'COPY'&'←'      line_set : 'COPY'&'→'
         column_keep : 'COPY'&'↑'    column_set : 'COPY'&'↓'
 AGr |  1st ~ end  | Low-limit | High-limit
 A01 | N     ~     |           |
 A02 | N     ~     |           |
 A03 | N     ~     |           |
 A04 | N     ~     |           |
 A05 | N     ~     |           |
 A06 | N     ~     |           |
 A07 | N     ~     |           |
 A08 | N     ~     |           |
 A09 | N     ~     |           |
 A10 | N     ~     |           |
 A11 | N     ~     |           |
 A12 | N     ~     |           |
 A13 | N     ~     |           |
 A14 | N     ~     |           |
 A15 | N     ~     |           |
```

Figure 4 - 6 Alarm group Screen

(1) Individual Parameter Setting

(1)-1 Alarm groups having identical high- and low-limit values are to be handled as a single group. Therefore, set specific starting and ending channels for that group. These channels are referred to as group channels.

[Procedure]

① select and enter data using the rotary key.

[0-01 ~ 9-30]

Channel number of the group ending channel : 1 to 30

Measurement unit number of the group ending channel : 0 to 9
Or, calculate channel number : C or D

Channel number of the group starting channel : 1 to 30

Measurement unit number of the group starting channel : 0 to 9
Or, calculate channel number : C, D, or N

NOTE

1. The group starting channel number must be the same as or smaller than the group ending channel number.
2. Calculate channel numbers are larger in order of 0 to 9 < C < D.
3. Within an alarm group, there must not be identical channel numbers as those of any other group.
4. Neither high- nor low-limit values can be set for the groups having N as the group starting channel number.
   For such groups, change the group starting channel number to a value other than N.

(1)-2 Low-limit, High-limit

Set high- and low-limit values for an alarm group.

[Procedure]

① Select and enter data using the rotary key.

[N]

Data changes in order of + → - → N. Select the desired data.

NOTE

Neither high- nor low-limit values can be set if you select N.

② If you selected + or -, move the cursor through one character space to the right.

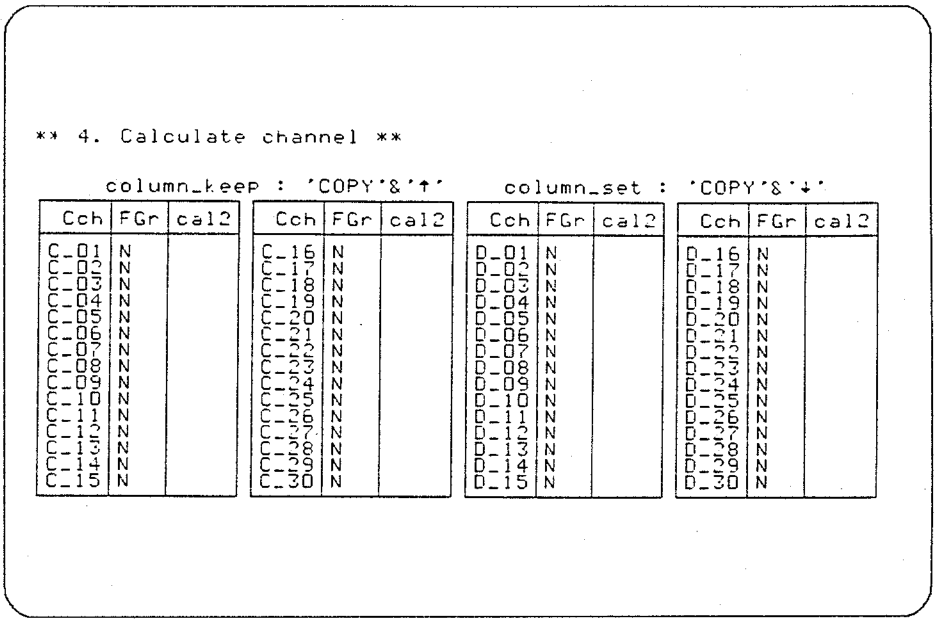
③ Enter allowable data using the data keys.

[+ 0.]

A maximum of seven digits, including the decimal point

4.3.7 Calculate channel

The Calculate channel screen allows you to set second-order calculation parameters coming under the same function group at the same time of day. You can select a maximum of 60 channels: C01 through C30, and D01 through D30.
Identical parameters can be copied, and set, by pressing either the key ⇧ or the key ⇩ while holding down the COPY key. See Subsection 4.3.5 (1), "Identical-parameter Copy Setting," for information on how to set identical parameters.



** 4. Calculate channel **

column_keep : 'COPY'&'↑'   column_set : 'COPY'&'↓'

Cch	FGr	cal2	Cch	FGr	cal2	Cch	FGr	cal2	Cch	FGr	cal2
C_01	N		C_16	N		D_01	N		D_16	N	
C_02	N		C_17	N		D_02	N		D_17	N	
C_03	N		C_18	N		D_03	N		D_18	N	
C_04	N		C_19	N		D_04	N		D_19	N	
C_05	N		C_20	N		D_05	N		D_20	N	
C_06	N		C_21	N		D_06	N		D_21	N	
C_07	N		C_22	N		D_07	N		D_22	N	
C_08	N		C_23	N		D_08	N		D_23	N	
C_09	N		C_24	N		D_09	N		D_24	N	
C_10	N		C_25	N		D_10	N		D_25	N	
C_11	N		C_26	N		D_11	N		D_26	N	
C_12	N		C_27	N		D_12	N		D_27	N	
C_13	N		C_28	N		D_13	N		D_28	N	
C_14	N		C_29	N		D_14	N		D_29	N	
C_15	N		C_30	N		D_15	N		D_30	N	

Figure 4 - 7 Calculate channel Screen

(1) Individual Parameter Setting

(1)-1 FGr

Set a function group.

[Procedure]

① Select and enter data using the rotary key.

```
[N      ]
↑
└──────────── Select N or F.
```

NOTE

1. Parameters for Cal 2 (second-order calculation) cannot be set if you select N.
2. The parameters last set will be displayed if you select F.

② If you selected F, move the cursor through one character space to the right.

③ Enter allowable data using the data keys.

```
[F 01]
   ↑
   └──────────── Data changes from 01 to 60.  Select the desired
                 value.
```

(1)-2 Cal 2 (Second-order calculation)

Data is calculated within the same function group at the same time of day. Second-order calculation occurs, based on the data obtained after scaling and first-order calculation. See Subsection 9.3.4, "Second-order calculation," for further details.

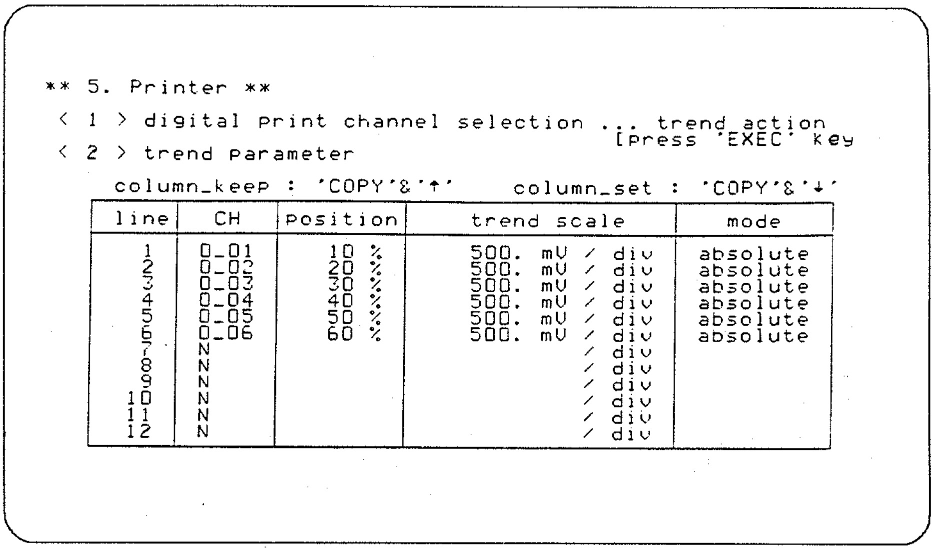
[Procedure]

① Select and enter data using the rotary key.

```
[MAX]
 ↑──────────── Data changes in order of MAX → MIN → AVE.
               Select the desired data.

               MAX:  Maximum value
               MIN:  Minimum value
               AVE:  Average value
```

4.3.8 Printer

The Printer screen allows you to set parameters of the trend format and to select channels for digital/trend combination printing. You must select either digital printing, trend printing, or digital/trend combination printing, as the printout type. Make this selection using data item <5> measure mode of the Scan format screen previously described in Subsection 4.3.4.



** 5. Printer **

< 1 > digital print channel selection ... trend action
[press 'EXEC' key

< 2 > trend parameter

column_keep : 'COPY'&'↑'   column_set : 'COPY'&'↓'

line	CH	position	trend scale	mode
1	0_01	10 %	500. mV / div	absolute
2	0_02	20 %	500. mV / div	absolute
3	0_03	30 %	500. mV / div	absolute
4	0_04	40 %	500. mV / div	absolute
5	0_05	50 %	500. mV / div	absolute
6	0_06	60 %	500. mV / div	absolute
7	N		/ div	
8	N		/ div	
9	N		/ div	
10	N		/ div	
11	N		/ div	
12	N		/ div	

Figure 4 - 8 Printer Screen

Description of Printer screen (<1> and <2>)

< 1 > digital print channel selection

Set channels you want to use for digital/trend combination printing.

[Procedure]

① While the cursor stays at [press 'EXEC' key], press EXEC key to proceed to the next screen.
Press PREV key if you want to return to the "Printer" screen after proceeding to the next screen.

② Select and enter data using the rotary key.

```
[0-01]
 ↑ ↑________ Channel number (01 to 30)
 |__________ Measurement unit number (0 to 9), calculate channel
             number (C, D, or N). Select the desired numbers.
```

NOTE

Printing will not occur if you select N.

< 2 > trend parameter

Set parameters of the trend format.
Such parameters must be set when printing is to be done in trend mode.

(1) CH

Set trend channels, that is, channels whose data is to be printed in trend mode.

[Procedure]

① Select and enter data using the rotary key.

[0-01]

Channel number (01 to 30)

Measurement unit number (0 to 9), calculate channel number (C, D, or N). Select the desired numbers.

NOTE

1. Neither the "position", the "trend scale", nor the "mode" parameters can be set if you select N.
2. No parameters can be set for channels that have not been selected on the "Function group" screen previously described in Subsection 4.3.5. Neither the "position", the "trend scale", nor the "mode" parameters can be set for calculated channels whose FGr values are set to N on the "Calculate channel" screen previously described in Subsection 4.3.7.
3. In all cases other than the above, the parameters last set will be displayed once again.

(2) Position

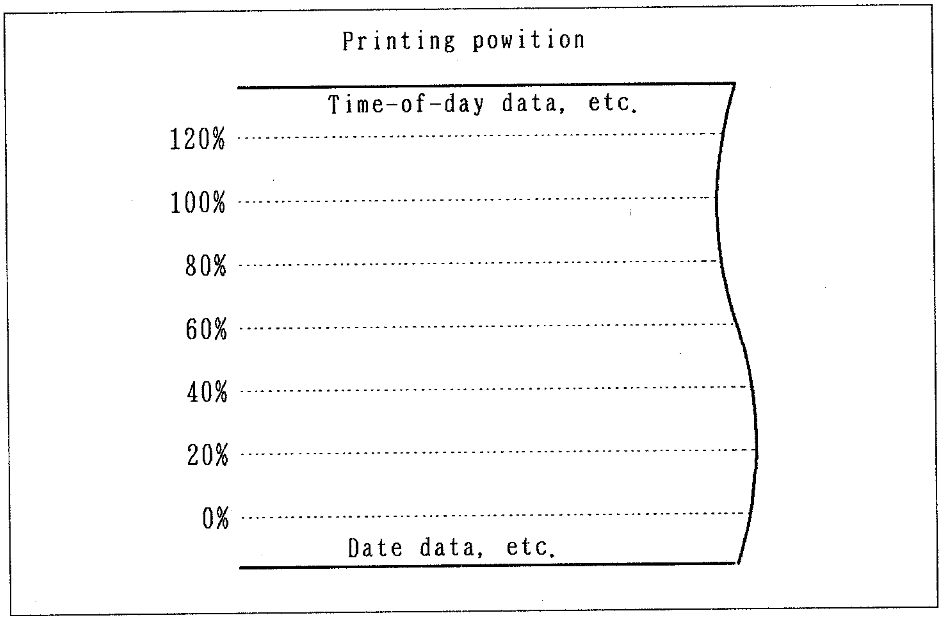
Set position 0 if the "mode" described later is "absolute," or set the first measurement position if the "mode" is "relative."

[Procedure]

① Select and enter data using the rotary key.

[10%]

Data changes in 10% steps from 0% to 120%. Select the desired percentage data.



(3) trend scale

Set a scale value per division.

[Procedure]

① Select and enter data using the rotary key.

[500. mV/div]

Data changes in order of 1 x 10^{nn} → 2 x 10^{nn} → 5 x 10^{nn}. $(-6 \leq nn \leq 5)$
Select the desired data.

NOTE

The unit immediately preceding /div is that which is determined by the measurement range of the selected function group, or that which has been set under "unit."

(4) mode

Set whether the value of "position" previously described is to be set equal to 0 or to the value of the first measurement position.

[Procedure]

① Select and enter data using the rotary key.

[absolute]

Select the "absolute" mode or the "relative" mode.

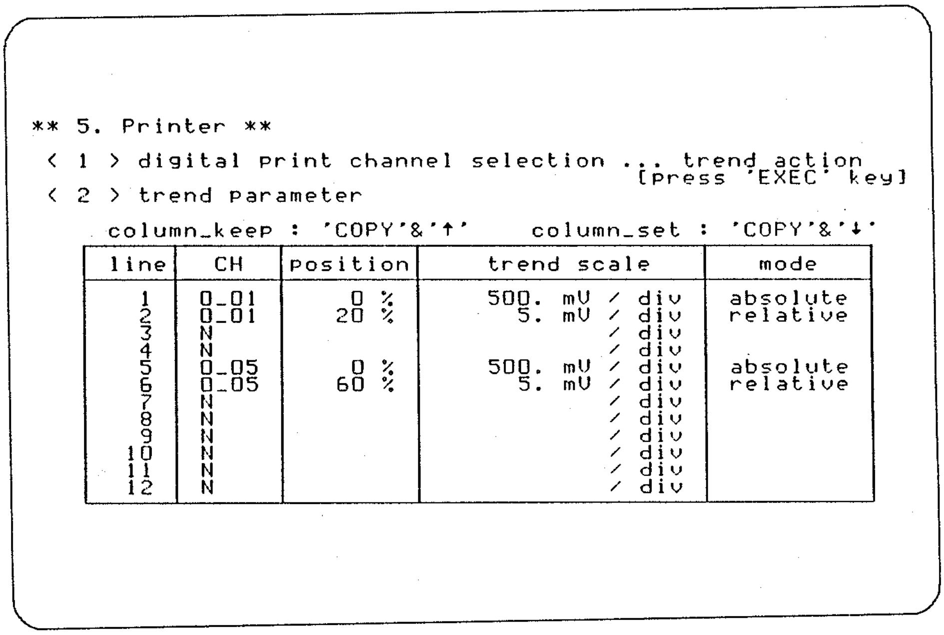
①-1 If you selected "absolute":

The absolute mode becomes valid, and trend printing occurs with the value of "position" as 0. This mode is suited for checking the entire characteristics of the data such as temperature increases or significantly changing measurands.

①-2 If you selected "relative":

The relative mode becomes valid, and trend printing occurs with the value of "position" as the first measurement position. This mode is suited for checking in enlarged form the data dispersion after it has become constant to a certain extent.

Setting the two different modes for one channel enables you to check both the entire data characteristics and the characteristics of enlarged data dispersion. That is, you can set different trend-print parameters for one channel.
The following represents such a screen image:

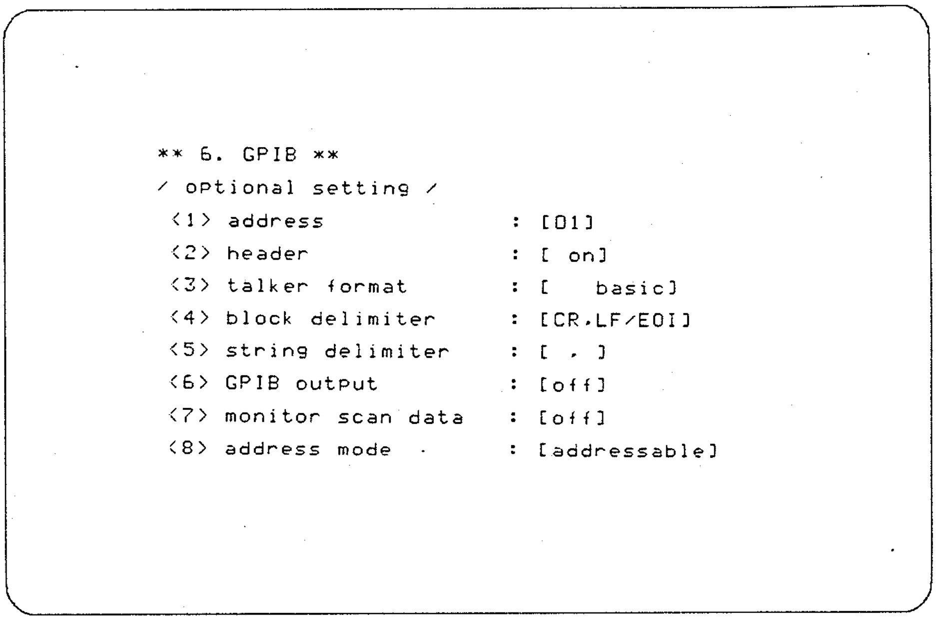


```
** 5. Printer **
 < 1 > digital print channel selection ... trend action
                                          [press 'EXEC' key]
 < 2 > trend parameter
     column_keep : 'COPY'&'↑'     column_set : 'COPY'&'↓'
```

line	CH	position	trend scale	mode
1	0_01	0 %	500. mV / div	absolute
2	0_01	20 %	5. mV / div	relative
3	N		/ div	
4	N		/ div	
5	0_05	0 %	500. mV / div	absolute
6	0_05	60 %	5. mV / div	relative
7	N		/ div	
8	N		/ div	
9	N		/ div	
10	N		/ div	
11	N		/ div	
12	N		/ div	

4.3.9 GPIB

The GPIB screen allows you to set the parameters required for remote-controlled operation using a GPIB interface.



```
** 6. GPIB **
/ optional setting /
 <1> address               : [01]
 <2> header                : [ on]
 <3> talker format         : [   basic]
 <4> block delimiter       : [CR,LF/EOI]
 <5> string delimiter      : [ , ]
 <6> GPIB output           : [off]
 <7> monitor scan data     : [off]
 <8> address mode  .       : [addressable]
```

Figure 4 - 9 GPIB Screen

Description of GPIB screen (<1> to <8>)

<1> address

Set an address for the equipment.

[Procedure]

① Enter allowable data using the rotary key.

[01]
↑
└── 00 to 30

NOTE

If the address mode, data itme <8>, is set to "talk only," the address you have set will become invalid.

<2> header

Set either on or off for the header of a talker format (data output format).

[Procedure]

① Select and enter data using the rotary key.

[on]

↑ Select on or off. The header will be omitted if you select off.

<3> talker format

Set a talker format (data output format).
See Section 8.3, "Talker Formats (Data Output Formats)," for further details.

[Procedure]

① Select and enter data using the rotary key.

[basic]

↑ Data changes in order of basic → omission → binary.
Select the desired data format.
basic : Basic format
omission: Omission format
binary : Binary format

NOTE

After you have selected the binary format, the header cannot be omitted even if you set "header" to "off."

<4> block delimiter

Set a block delimiter.

[Procedure]

① Select and enter data using the rotary key.

[CR, LF/EOI]

↑ Data changes in order of CR, LF/EOI → LF → EOI. Select the desired delimiter type.

<5> string delimiter

Set a string delimiter.

[Procedure]

① Select and enter data using the rotary key.

[,]
↑
└──Select , (comma) or LF.

<6> GPIB output

Set whether you want data output to GPIB to be controlled.

[Procedure]

① Select and enter data using the rotary key.

[off]
↑
└──Select on or off. Measured data will not be output if you select off.

NOTE

Measured data must be read out if you selected "on". If measured data is not read out, measurement will stop.

<7> monitor scan data

Set whether you want monitor scan data output to be controlled.

[Procedure]

① Select and enter data using the rotary key.

[off]
↑
└──Select on or off. Monitor scan measured data will not be output to GPIB if you select on.

<8> address mode

Set whether you want addressing to be controlled.

[Procedure]

① Select and enter data using the rotary key.

[addressable]

↑ Select addressable or talk only.

①-1 If you selected addressable:

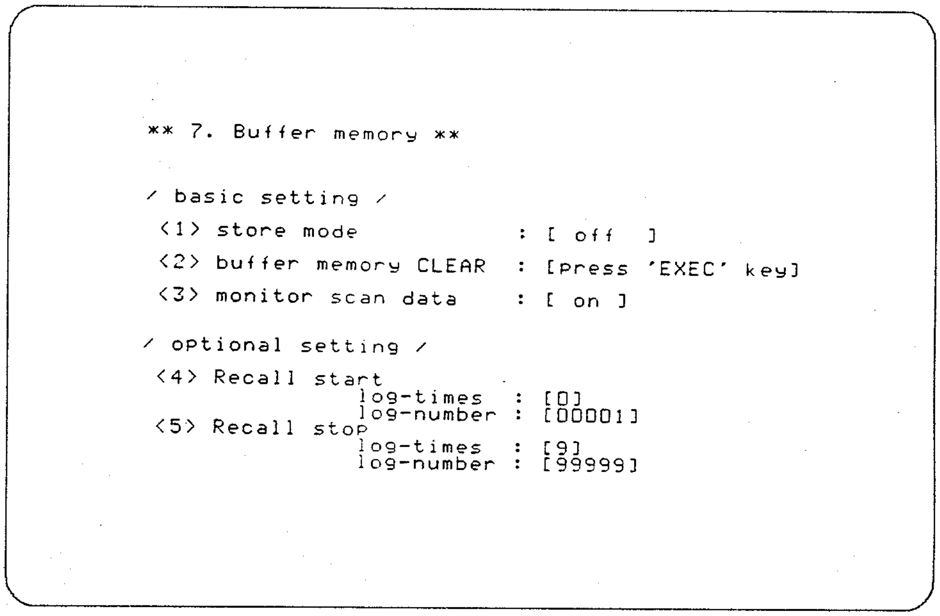
The equipment will reply only when the address assigned from the controller agrees with the address set in <1> address.

①-2 If you selected talk only:

The equipment will be fixed at the talker mode, irrespective of the address set in <1> address.
See Subsection 8.8 (1), "Notes on Use of Only Mode."

4.3.10 Buffer memory Screen

The Buffer memory screen allows you to set the data required for using a data buffer memory (option No. +71).



```
** 7. Buffer memory **

/ basic setting /
 <1> store mode              : [ off  ]
 <2> buffer memory CLEAR     : [press 'EXEC' key]
 <3> monitor scan data       : [ on ]

/ optional setting /
 <4> Recall start
               log-times     : [0]
               log-number    : [00001]
 <5> Recall stop
               log-times     : [9]
               log-number    : [99999]
```

Figure 4 - 10 Buffer memory Screen

Description of Buffer memory screen (<1> to <5>)

<1> store mode

Set the appropriate mode for your requirements when you are to store measured data into an buffer memory (optional).
See Section 9.4, "Data Buffer Memory," for further details.

[Procedure]

① Select and enter data using the rotary key.

[off]
↑
└── Data changes in order of off → fix → ring → fifo. Select the desired mode data.

①-1 off

Measured data will not be stored.

①-2 fix

Measured data will be stored until the memory becomes full. No further store operation will occur.

①-3 ring

The operation until the memory becomes full will be similar to that of "fix" above. After the memory has become full, newly measured data will override the oldest data.

①-4 fifo

Measured data will be buffered.

NOTE

1. If you selected fix or ring, measured data can be stored only while the LED of the MEMORY STORE ▭ key remains on.
2. If you selected fifo, measured data will be buffered, irrespective of the on or off state of the MEMORY STORE ▭ key LED.
3. To change the store mode with data remaining stored in the memory (that is, after measured data has been stored during the fix or ring mode), the buffer memory CLEAR (described below) must be executed beforehand.

<2> buffer memory CLEAR

Clears the data stored within the data buffer memory.

[Procedure]

① Move the cursor to [press 'EXEC' key] on the screen and then press EXEC key. The data buffer memory will then be cleared.

< 3> monitor scan data

Set whether you want storage of monitor scan measured data into the memory to be controlled.

[Procedure]

① Select and enter data using the rotary key.

[on]
↑
└── Select on or off. Monitor scan measured data will be stored into the memory.

< 4> Recall start

Set a recall start number you want to use when reading out the data that was stored into the data buffer memory using the RECALL key. See Subsection 9.4.6, "Recall Control," for further details.

[Procedure]

① Enter allowable data using the data keys.

log-times : [0]
↑── 0 to 9 : Number of log scans

log-number: [00001]
↑── 1 to 99999: Log number

NOTE

1. In the fix mode, the log number existing during measurement becomes the log number for data recall. The setting in "log-times" is valid only for the fix mode.

2. In the ring mode, the oldest data within the memory that has been serially numbered "00001" becomes the log number for data recall.

< 5 > Recall stop

Set a recall stop number you want to use when reading out the data that was stored into the data buffer memory using the RECALL key.

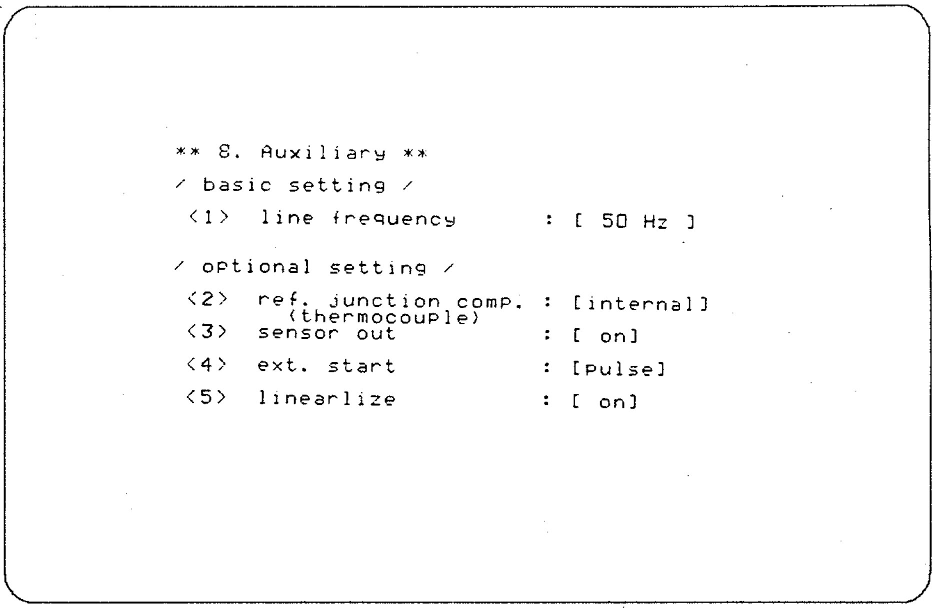
[Procedure]

① Enter allowable data using the data keys.

```
log-times :  [0]
              ↑
              └────── 0 to 9     :  Number of log scans

log-number:  [00001]
               ↑
               └───── 1 to 99999:  Log number
```

4.3.11 Auxiliary (Auxiliary Functions)

The Auxiliary screen provides five types of auxiliary functions, as shown in Figure 4-11.



```
** 8. Auxiliary **
/ basic setting /
 <1>  line frequency        : [ 50 Hz ]

/ optional setting /
 <2>  ref. junction comp.   : [internal]
        (thermocouple)
 <3>  sensor out            : [ on]
 <4>  ext. start            : [pulse]
 <5>  linearlize            : [ on]
```

Figure 4 - 11 Auxiliary Screen

Description of Auxiliary screen (<1> to <5>)

<1> line frequency

Set the frequency of the AC power line you will use.

[Procedure]

① Select and enter data using the rotary key.

```
[50Hz]
  ↑
  └───────────────── Select 50Hz or 60Hz.
```

<2> ref. junction comp.

Set whether you want room temperature compensation during temperature measurement to be controlled internally or externally.

[Procedure]

① Select and enter data using the rotary key.

```
[internal]
    ↑
    └──────────────── Select internal or external.
```

NOTE

If you selected external, externally connect 0°C reference instruments (say, automatic reference cold-contacts temperature compensators) to the equipment.

The measurement accuracy depends on the accuracy of externally connected reference instruments.

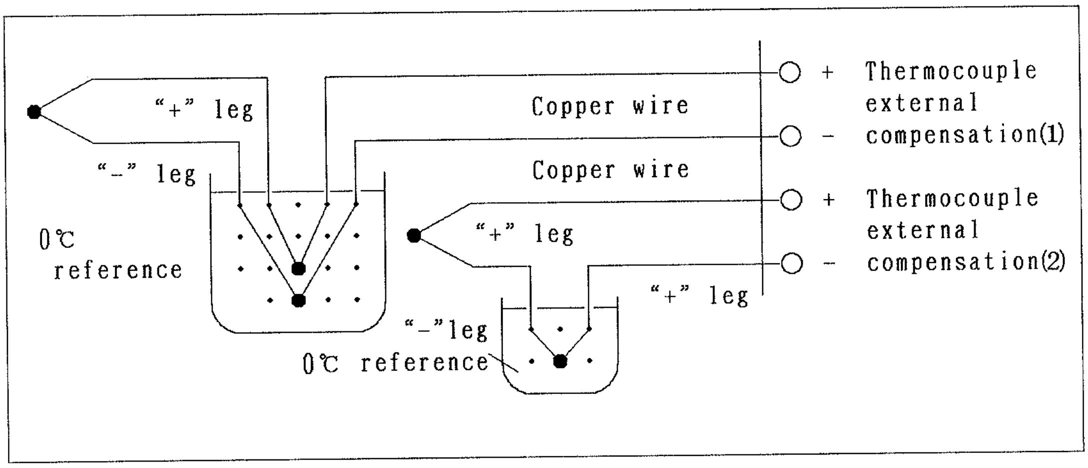


Figure 4 - 12 Connection Example for External Compensation

<3> sensor out

This function generates pulse current and measures the resistance values of sensors to check whether the sensors are active. Set whether you want to activate (on) or deactivate (off) the sensor check function.

[Procedure]

① Select and enter data using the rotary key.

[off]
↑
└── Select on or off. Selection of "on" activates the sensor check function.

<4> ext. start

Set the contacts input mode you want to use for external control of measurement. See Section 7.3, "External Start/Stop (Input Signal)," for further details.

[Procedure]

① Select and enter data using the rotary key.

[pulse]
↑
└── Select pulse or level.

①-1 pulse

Measurement will start when the first contacts signal turns ON, and stop when the next contacts signal turns ON.

①-2 level

Measurement starts while a contacts signal is ON, and stops when the contacts signal turns OFF.

<5> linearize

Making the relationship between temperature and output data linear during temperature measurement with thermocouples is referred to as linearization. Set Whether you want the required computation for linearization to be controlled.

[Procedure]

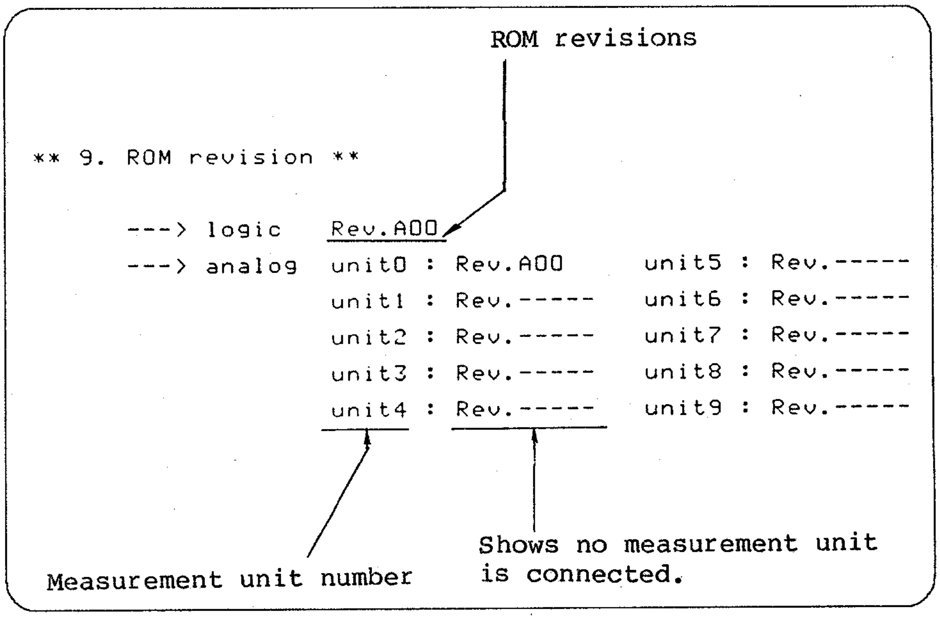
① Select and enter data using the rotary key.

[on]

Select "on" or "off". Selection of "on" executes the computation required for linearizing the temperature-output data relationship.

4.3.12 ROM revision

The ROM revision screen allows you to refer to ROM revisions. No key operations are required.



```
** 9. ROM revision **

    ---> logic   Rev.A00
    ---> analog  unit0 : Rev.A00      unit5 : Rev.-----
                 unit1 : Rev.-----    unit6 : Rev.-----
                 unit2 : Rev.-----    unit7 : Rev.-----
                 unit3 : Rev.-----    unit8 : Rev.-----
                 unit4 : Rev.-----    unit9 : Rev.-----
```

Figure 4 - 13 ROM revision Screen

4.3.13 test

The test function performs operation tests. See Subsection 10.1.3, "How to Perform Usual Operation Tests", and Subsection 10.1.4, "How to Perform Calibrations".

4.3.14 parameter print out

A list of previously set parameters will be printed out when you press the EXEC key following selection of data item <11> parameter print out on the menu screen previously shown in Figure 4-3.

Re-pressing EXEC key during printout terminates the list printout operation.

NOTE

The parameters being programmed will be stored into a special parameter memory for editing use, and all the editing parameters will be checked before you exit from the programming mode using the PROG key. If there are no inconsistencies in the measuring parameters, they will be copied into a special parameter memory for execution use. The parameters listed out will be the contents of the execution parameter memory.
To print out a list of parameters immediately after they have been modified, you must first select the measurement screen by pressing PROG key and then select the menu screen by pressing once again the PROG key.

4.3.15 programming cancel & exit

When you press EXEC key following selection of data item <12> programming cancel & exit on the menu screen previously shown in Figure 4-3, the parameters being programmed will all be canceled and the measurement screen will appear.
Use this function when aborting a programming operation and recalling the parameters last set.

NOTE

You can refer to programming screens during measurement.
If you want to modify existing parameters, first stop the measurement operation temporarily at this time. Next, change the existing programming screen by pressing PROG key and then restart the measurement operation.
If there are no parameters to be modified, select and execute programming cancel & exit to return to the measurement screen.

4.4 MEMORY Section

The MEMORY section becomes valid only if the <1> store mode in Subsection 4.3.10 Buffer memory Screen has been set to either "fix" or "ring" under use of a data buffer memory (option No. +71).

4.4.1 STORE

The STORE function allows you to store data into a data buffer memory.

Pressing the STORE key turns the key LED on to indicate that measured data can be stored. Storage of measured data begins with the start of scan measurement.

Re-pressing the STORE key turns the key LED off and stops the storage operation.

NOTE

1. STORE ON (LED on state) does not occur on programming screens.
2. Call channel measured data cannot be stored into a data buffer memory.
3. Monitor scan measured data can be stored only if <3> mointor scan data in Subsection 4.3.10 Buffer memory Screen has been set to ON.

If the memory becomes full during storage using the fix mode, the STORE key LED will go out and the storage operation will terminate. Measurement itself, however, will be continued.

4.4.2 RECALL

When you press the RECALL key, the key LED will light and the data within the recall area of a data buffer memory will be output onto the printer, or to GPIB, if these units are on.

Re-pressing the RECALL key turns the key LED off and stop the recall operation. See Subsection 9.4.6 Recall Control, for further details.

NOTE

1. The RECALL key is operative only while measurement is not in progress with the sotre mode of a data buffer memory set to "fix" or "ring".
2. If the printer and the GPIB are both turned on, the recall operation will be performed but data will not be output.

4.5 PRINTER Section

The PRINTER section controls the operation of the printer. The function of each key in this section is described below.

4.5.1 FEED Key

Pressing and holding down the $\overset{\text{FEED}}{\square}$ key feeds recording paper.

4.5.2 ON/OFF Key

Pressing the $\overset{\text{ON/OFF}}{\square}$ key turns the key LED on to indicate that the printer has been set ready for printing.

Re-pressing the $\overset{\text{ON/OFF}}{\square}$ key turns the key LED off to indicate that the printer has been released from its ready status for printing.

When scan measurement is started with the $\overset{\text{ON/OFF}}{\square}$ key LED on, the printer will start printing out the data measurements.
While the key LED remains off, the printer will not operate even if scan measurement is started.

If recording paper has run out during printing:

If recording paper has run out during printing, the printing operation stops and a buzzer sounds together with the display of an error message.

At that time, the $\overset{\text{ON/OFF}}{\square}$ key LED goes out automatically.
To resume the printing operation, you must refill the printer with recording paper and then press $\overset{\text{ON/OFF}}{\square}$. The key LED will then light once again and printing will restart.

4.6 GPIB Section

The GPIB section contols data output onto GPIB (general-purpose interface buses).
This section consists of five status indicator LEDs and one panel lock key. The function of each component part of the GPIB section is described below.

4.6.1 Status Indicator LEDs

The status indicator LEDs consist of an SRQ (service request mode) LED, a TLK (talker mode) LED, an LTN (listener mode) LED, an RMT (remote control mode) LED, and an OUT (output mode) LED. These LEDs indicate the operational states of the equipment when it is controlled via GPIB.

SRQ LED:	Lights during issuance of service requests to the GPIB-controller.
TLK LED:	Lights during the talker mode that allows data transmission.
LTN LED:	Lights during the listener mode that allows data reception.
RMT LED:	Lights during the external contol of the equipment.
OUT LED:	Lights during the "on" status of the GPIB output.

Pressing the $\overset{\text{LOCK/LOCACL}}{\square}$ key during remote-controlled operation, that is, with the RMT LED on, will release the equipment from external control, allowing you to carry out panel key operations.

4.6.2 Panel Lock

Pressing the $\overset{\text{LOCK/LOCAL}}{\square}$ key three times in succession turns the key LED on to indicate that a panel lock function has worked. The panel lock function prevents erroneous key operations by deactivating all keys, except those which are to be used to select call channels on the call channel selection screen.

Power-down auto-restart function

Aborted measurement will automatically restart when the power that has been turned off during an active status of the panel lock function is turned back on.
The function that automatically restarts an aborted measurement operation in this way is referred to as the power-down auto-restart function.

5. FOR ACCURATE MEASUREMENT

This section describes the requirements for performing accurate measurements.

5.1 Thermocouple/Voltage Measurement and Input Signal Wiring

The number of input points for thermocouple/voltage measurement is 30 per measurement unit.

(1) Description of the Terminal Board (See Figure 3-2.)

The numerals inscribed between the (+) and (-) markings at the input terminals denote channel numbers.
The (+) and (-) markings signify the polarities of the terminals. For voltage measurement, signals will assume positive polarity (+) when a plus voltage under measurement is applied to the (+) terminal or when a minus voltage under measurement is applied to the (-) terminal. (Polarity display of signals will not be made.)
In an opposite case to the above, negative polarity (-) will be displayed for data. In general, a lead wire that has a lower signal source impedance should be connected to the (-) terminal. When using a thermocouple or a compensating lead, connect the plus leg to the (+) terminal and the minus leg to the (-) terminal. Inverse connection causes incorrect measurements.

(2) How To Connect Input Signal Wires

Connect the plus (red) leg and minus (white or black) leg of each thermocouple or compensating lead to the (+) terminal and (-) terminal, respectively, on the terminal board. Then, lock the legs securely with screws.
Securely screw down the strand of the thermocouple or compensating lead using a small, U-shaped crimp terminal, or twist and curl the strand directly. (See Figure 5-1.) We recommend that at this time, thermocouples of the same type should be connected to serially numbered channels. Channel program parameter setting will then become easy.

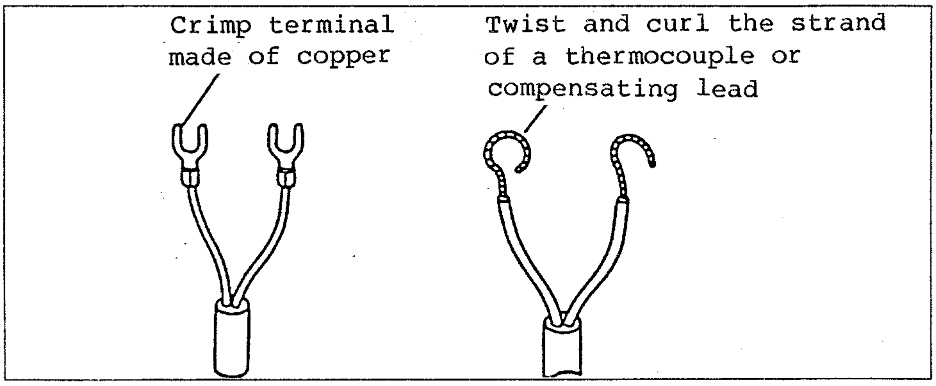


Figure 5 - 1 Termination of the Ends of Input Signal Wires

To ensure accurate measurement, the precautions listed below must be observed for minimum effects of noise. Also see Section 5.4 How To Suppress the Occurrence of Noise.

Precautions

① Using a thick copper wire, securely connect the GND terminal located on the rear panel of the R7430 to ground.

② Using a thick copper wire, connect the frame of the material to be measured to the same grounding point as that of the R7430.

③ With a voltage generated at the GND terminal of the R7430 as a reference value, check using an oscilloscope the potential of the thermocouple or compensating lead that has been connected to the input terminals. In order that this potential (especially, the AC component) is minimized, the material to be measured must be grounded or the thermocouple or compensating lead must be shielded. This potential must stay within the range of ±100V. If this range is overstepped, then this may increase measurement errors and even cause equipment malfunctions or trouble.
If you are to use a DC voltage generator to perform calibration or performance check of the equipment, connect the voltage generator as shown in Figure 5-2 below.

NOTE

Connect a strapping bar between the GUARD terminal and the LO terminal if you are not to use the former terminal.

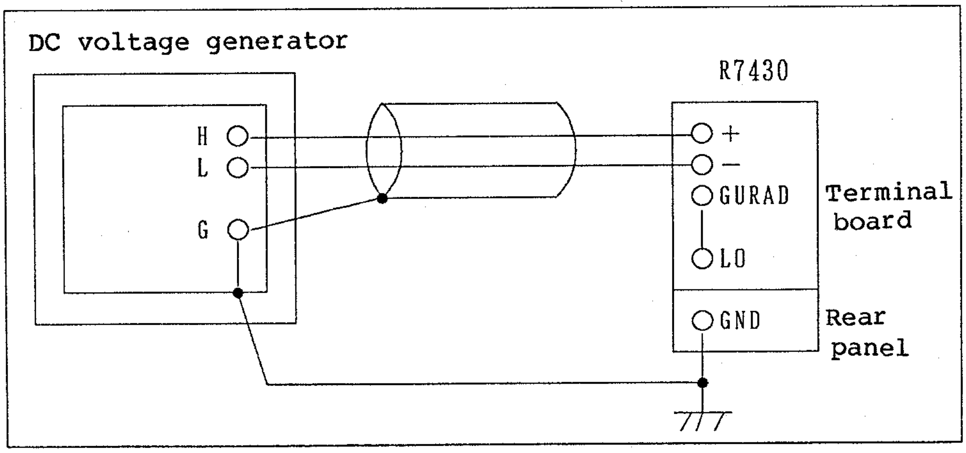


Figure 5 - 2 Connection of a DC Voltage Generator

(3) Connecting Various Sensors to the Terminal Board

Connection examples of various sensors are shown in Figure 5-3 below.

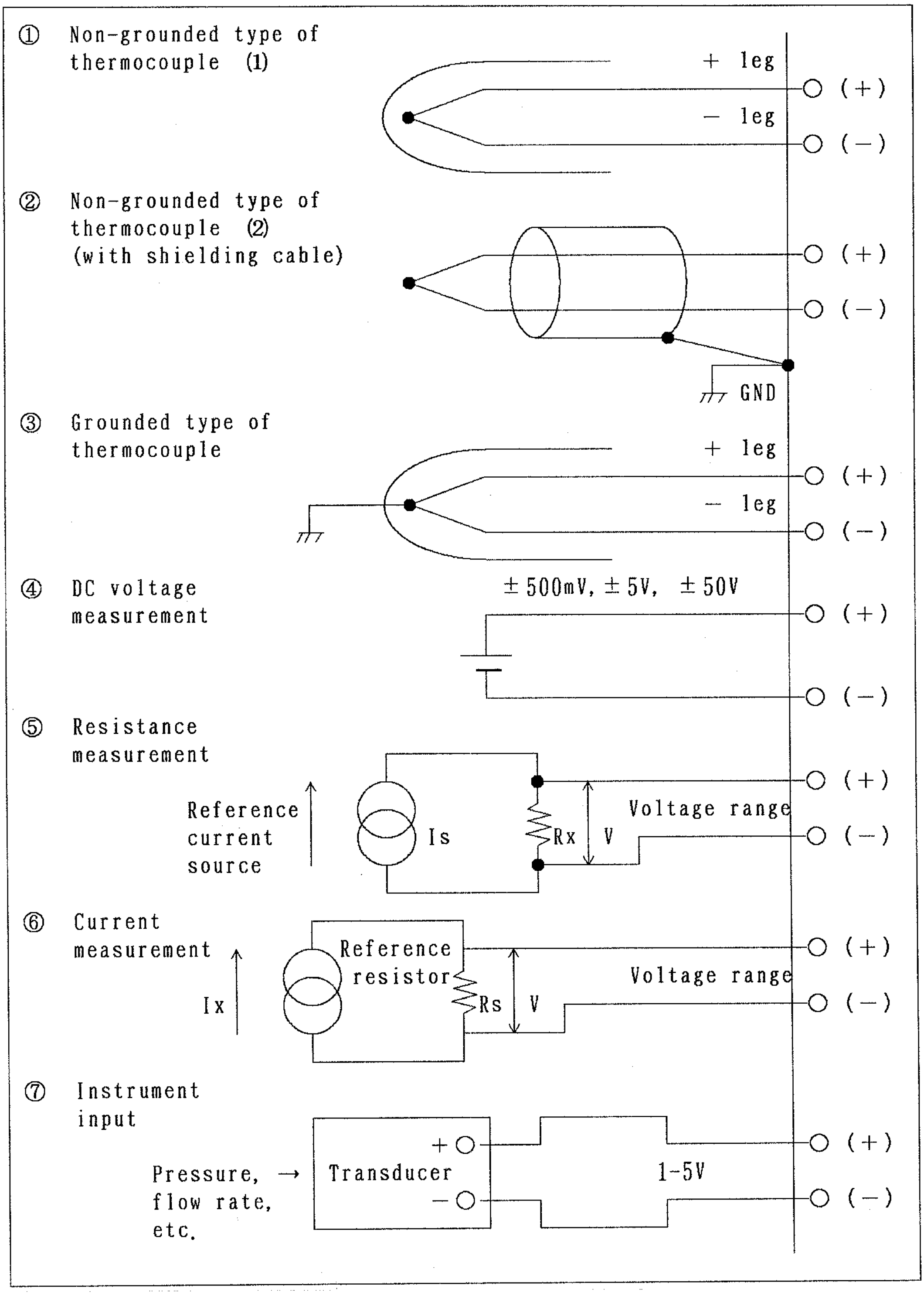


Figure 5 - 3 Connection of Sensors to the Terminal Board

Description of Figure 5-3

① Non-grounded Type of Thermocouple (1)

Use this type of thermocouple to perform general thermometry.

② Non-grounded Type of Thermocouple (2)

Connect the sheathing of the shielding cable to the GND termimal of the frame.

③ Grounded Type of Thermocouple

This type of thermocouple is susceptible to noise.
See Section 5.4 How To Suppress the Occurrence of Noise, to use such thermocouples.

④ DC Voltage Measurement

This DC voltage measurement method is commonly used.

⑤ Resistance Measurement

External use of a reference current source enables resistance measurement.
The maximum measurable resistance value depends on the noise level, induction level, and other ambient conditions. During measurement, current as much as possible should be applied to enable use of a higher voltage range. This will minimize the effects of noise or induction. Note, however, that if you use the 50V range, the input impedance of the R7430 will become about 10MΩ and this value will be coupled in parallel to the resistance being measured.
Use a reference current source whose output accuracy is equal to or higher than the measurement accuracy.

⑥ Current Measurement

External use of a reference resistor enables current measurement.
Calculate the current values as follows:

$$Ix = \frac{V}{Rs}$$

⑦ Instrument Input

Use the 5V range to perform measurements of this type.
Measured data can be converted into percentage terms or other industrial units.

NOTE

1. The wiring of your factory may have high voltages induced due to insufficient insulation of thermocouple wires or compensating leads. Handle input signal wires very carefully.

2. Keep the input terminals free from a direct draft of air, and keep hands away from them. Otherwise, measurement errors may result. If you have inadvertently touched the input terminals, allow them to stand as they are for several minutes before you start your measurement operations.

3. Connect the thermocouple wires or compensating leads correctly to the input terminals, and then lock them securely.

5.2 How To Use the Scanner Output Terminals

Four terminals, ③ through ⑥, are shown in the upper right section of Figure 3-2. These terminals are provided to release to the user the common inputs and outputs that have been switched by the scanner. You can use these teriminals to expand the uses of this measurement unit.

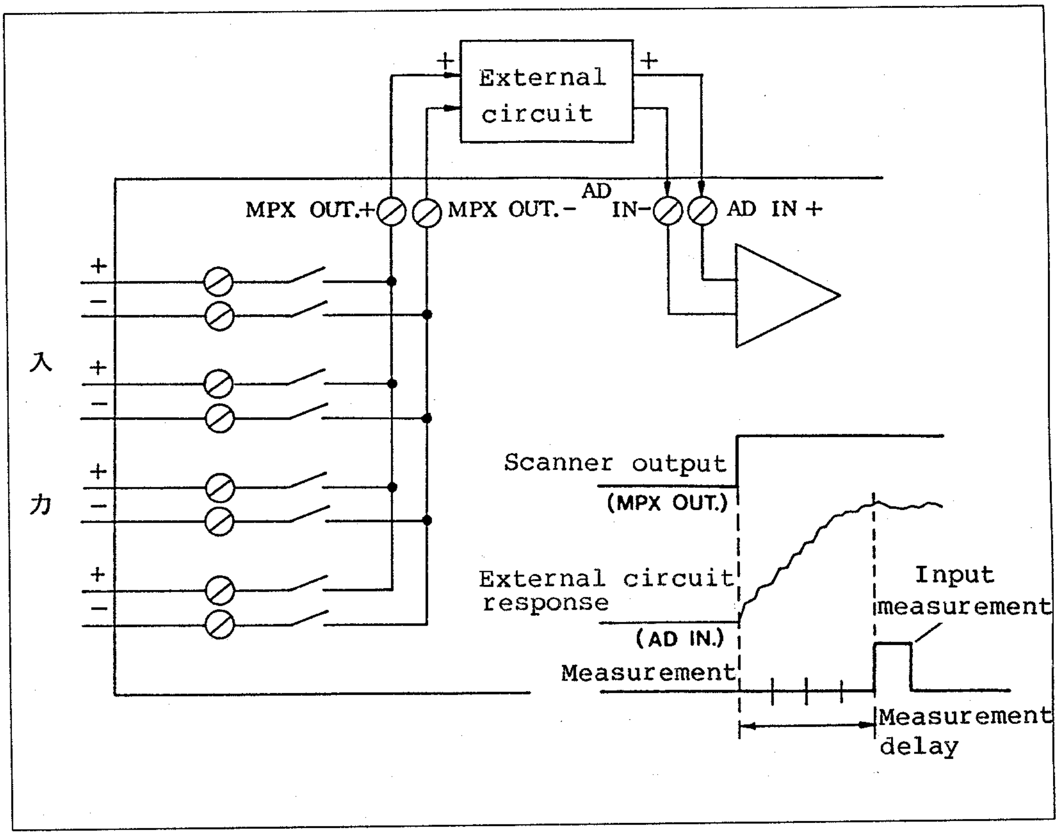


Figure 5 - 4 Usage of the MPX Terminals

Usually, the scanner outputs are strapped to the input side of the measuring system as shown in Figure 5-4. However, any analog circuits can be added using the four terminals (MPX OUT.+, MPX OUT.-, AD IN-, AD IN+). You can add, for example, a linearizing circuit for temperature measurement using a thermistor, an RC filter circuit for random-noise rejection, a reference resistor circuit for current measurement, an AC-DC converter circuit, a voltage attenuator circuit, etc. Since such analog circuits have their own settling time constants, measurement can be delayed by setting a measurement delay time. It is to be noted, however, that use of these circuits may adversely affect all sensor terminals and increase the measurement time.

5.3 Connecting Platinum Resistance Thermometer Bulbs (Pt) and Input Signal Wires

The number of input points for measuring a platinum resistance thermometer bulb is 15 per measurement unit.

(1) Description of the Terminal Board

For the Pt 3-wire or Pt 4-wire type, use four terminals for one input. The connection diagram of the input trminals is shown in Figure 5-5.

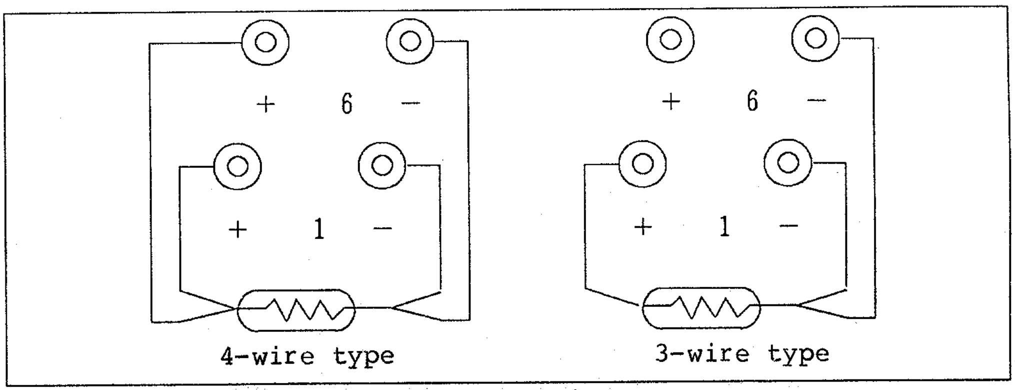


Figure 5 - 5 Input Terminal Connection

(2) Connecting Input Signal Wires

The diagram of connecting platinum resistance thermometer bulbs (in the remainder of this section, referred to as Pt sensors) to the terminal board is shown in Figure 5-6. Remove the strapping bar connected between the CURRENT SOURCE (+, -) terminals, and then connect the terminals as indicated by solid lines.

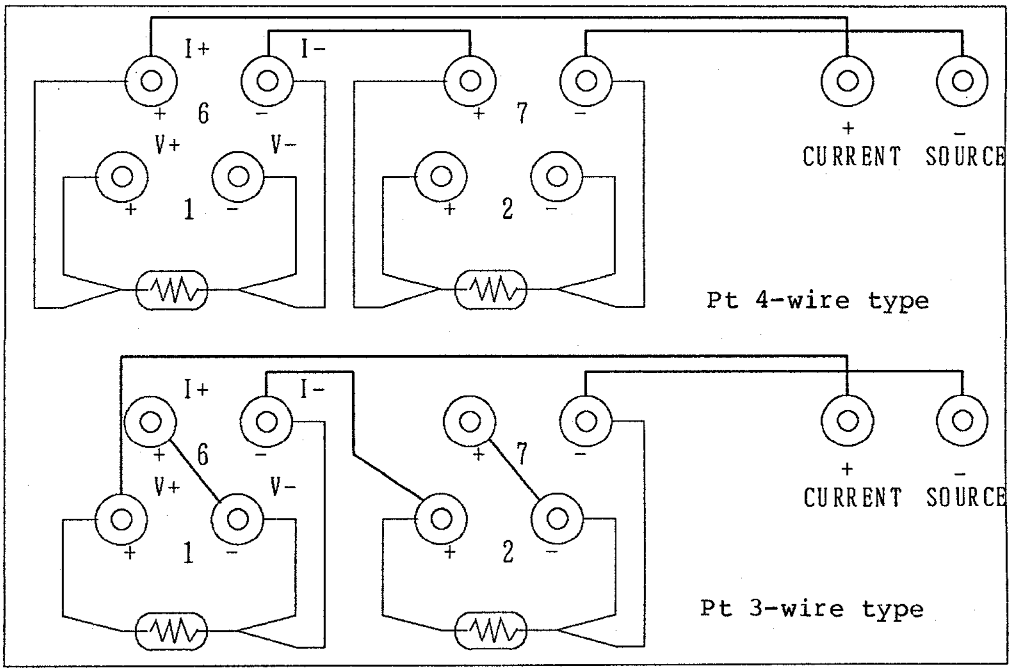


Figure 5 - 6 Connection of Platinum Resistance Thermometer Bulbs

As shown in Figure 5-5 above, compensating channels are required for the Pt 3-wire type or current terminals are required for the Pt 4-wire type. These channels or terminals must be connected to a stage after the input channels.
Only the Pt sensors having a nominal resistance value of 100Ω can be used.
If the Pt senesor has a shielding wire in its connection cable, connect the shielding wire to the V- side and connect all other wires as previously shown in Figure 5-3. If the cable is of independent shielded construction in which it is not connected to any part of the Pt sensor, connect the cable to the GND terminal on the rear panel.
To ensure accurate measurement, the precautions listed below must be observed for minimum effects of noise.

Precautions

① Using a thick copper wire, securely connect the GND terminal located on the rear panel of the R7430 to ground.

② Using a thick copper wire, connect the frame of the material to be measured to the same grounding point as that of the R7430.

③ With a voltage generated at the GND terminal of the R7430 as a referecne value, check using an oscilloscope the potential of the Pt sensor that has been connected to the input terminals. In order that this potential (especially, the AC component) is minimized, the material to be measured must be grounded or the Pt sensor must be shielded. This potential must stay within the range of ±100V. If this range is overstepped, then this may increase measurement errors and even cause equipment malfunctions or trouble.

If you are to use a DC voltage generator to perform calibrtation or performance check of the equipment, connect the voltage generator as previously shown in Figure 5-2.

NOTE

1. The wiring of your factory may have high voltages induced due to insufficient insulation of Pt sensor cables. Handle the sensor cables very carefully.

2. Connect Pt sensor cables correctly to the input terminals, and then lock them securely.

5.4 How To Suppress the Occurrence of Noise

Although the R7430 is designed to provide sufficient shielding against noise, measured data may disperse or significant measurement errors may occur. If such states are likely to occur, take the preventive measures listed below.

(1) For Major Types of Noise

① Normal Mode Voltage

When there is a voltage (V_{NMV}) that causes an electromotive force in series with respect to a signal voltage (Vs), as shown in Figure 5-7 below, the former voltage is referred to as normal mode voltage (NMV), which can cause measurement errors.
A factor that indicates how much this voltage may influence data measurements is referred to as the normal mode noise rejection ratio (NMRR), which is expressed as follows:

$$\text{NMRR} = \left| \frac{V_{NMV}}{(\text{Measured data}) - (V_s)} \right|$$

The NMV is in many cases the AC induction with respect to the signal source and cables, and has a line frequency of 50 or 60Hz. In the expression shown above, the peak value of noise (for sine waves, effective value x $\sqrt{2}$) is assigned to V_{NMV}.

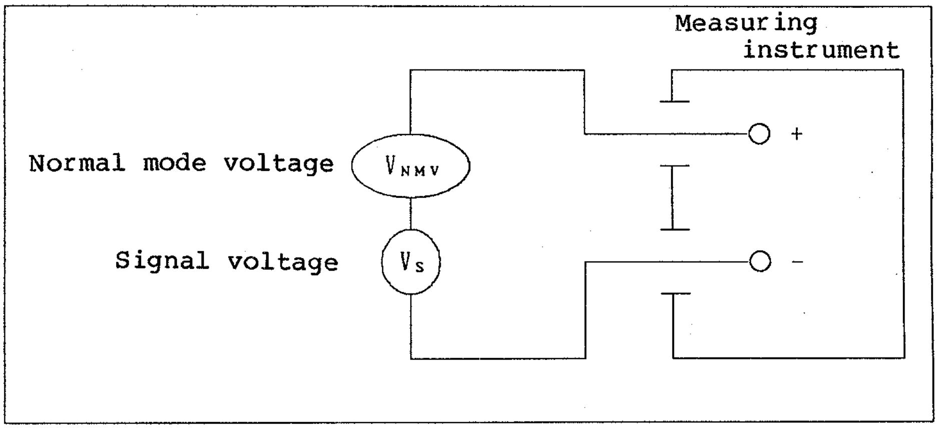


Figure 5 - 7 Normal Mode Voltage

② Common Mode Voltage

As shown in Figure 5-8 below, the same voltage may be induced in the plus (+) and minus (-) signal wires when seen from the grounding point. This voltage is referred to as the common mode voltage (CMV). Connecting a measuring instrument between these signal wires forms an equivalent circuit such as that shown in Figure 5-9, and thus develops an NMV of Ve because of circuit components R and Z. The voltage, Ve, may cause erroneous measurements. A factor that indicates how much this voltage may influence data measurements is referred to as the common mode noise rejection ratio (CMRR), which is expressed as follows:

$$\text{CMRR} = \left| \frac{V_{\text{CMV}}}{(\text{Measured data}) - (\text{Vs})} \right|$$

If the connection cables are too long or if the impedance of the signal source is too large, then the CMV may cause errors because the R (resistance) shown in Figure 5-9 will increase. The major components of the CMV are induced by the ground current flowing across the grounding point of the AC power (supply power). The peak value of noise is assigned to V_{CMV}.
Both the NMV and the CMV consist mainly of AC line frequency components (50 or 60Hz), as described above. If, however, frequency components of several tens of kHz or more are superimposed on the NMV or CMV components, the possible nonlinearity of the amplifier, semiconductor switches, etc. within the measuring instrument may cause a significant error rate compared with low frequencies.

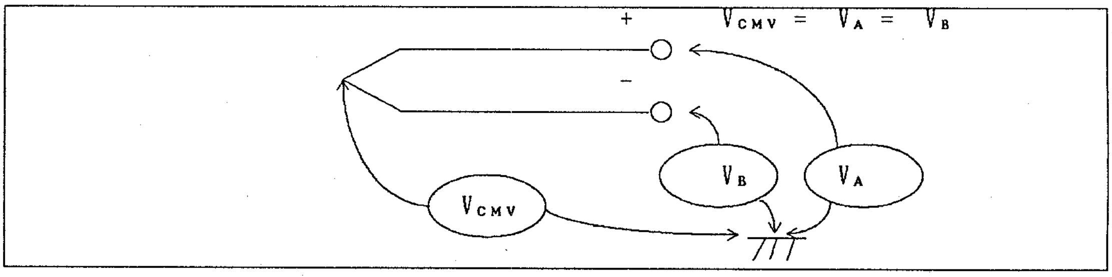
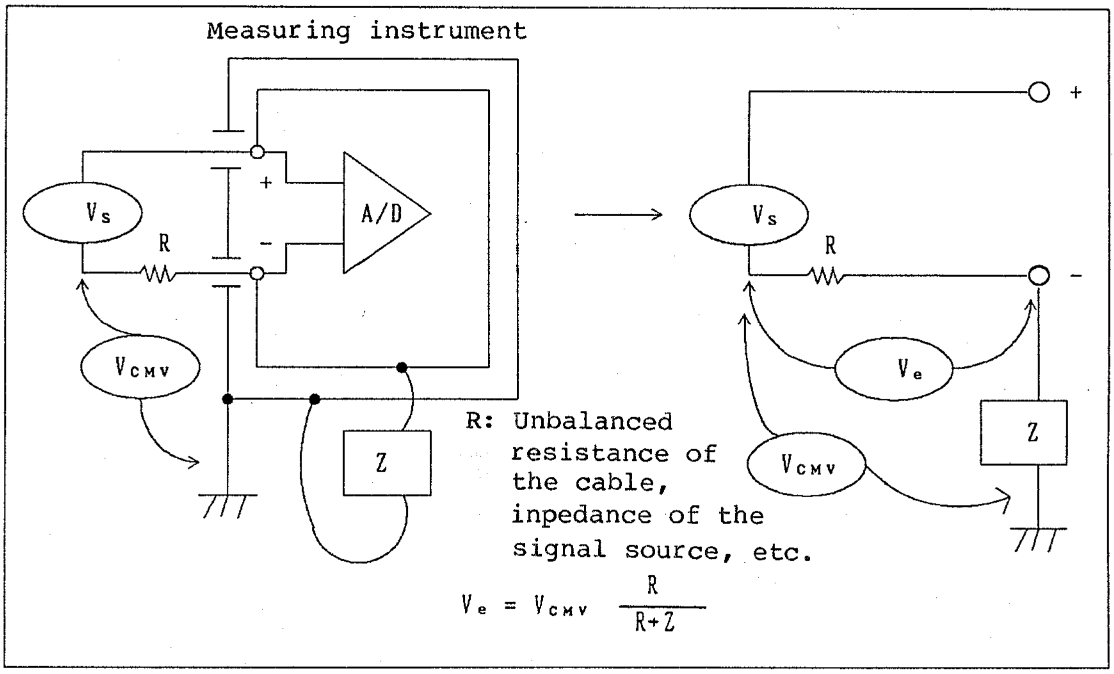


Figure 5 - 8 Common Mode Voltage



$$V_e = V_{CMV} \frac{R}{R+Z}$$

Figure 5 - 9 Effects of the Common Mode Voltage

(2) Precheck for Noise

The followng lists some of the major noise factors that may have great effects on temperature measurements obtained with the equipment:

- High-voltage generator
- Large-current generator
- Radio-frequency or pulse generator

When measuring these units themselves or their ambient temperatures or voltages, prechecks must be made to determine the degree of probable effects and the necessary preventive measures according to the type and level of noise.

① Measuring the CMV

Using an oscilloscope (bandwidth: 10MHz or more, input impedance: 1MΩ or more), check the voltage developed between the (-) leg of a sensor (cable included) and the grounding wire to which the measurement unit is to be connected. (See Figure 5-10.)

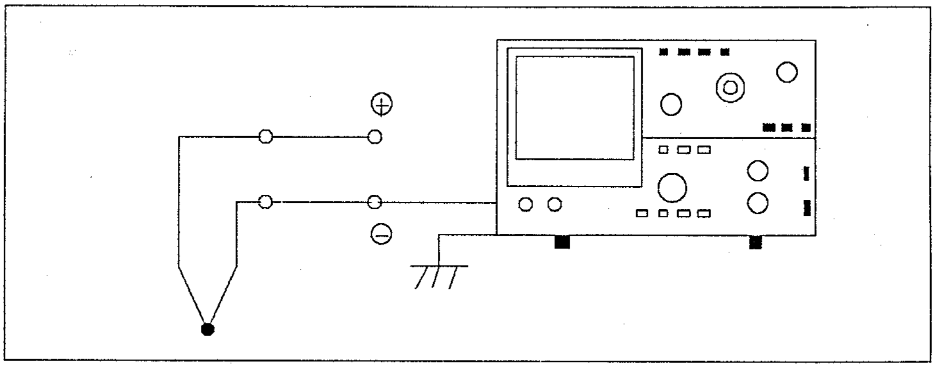


Figure 5 - 10 CMV Measurement

② Measuring the NMV

Using a floating-type oscilloscope, check the voltage developed between the (+) and (-) legs of a sensor (cable included). (See Figure 5-11.)

> Floating-type oscilloscopes refer to battery-powerd oscilloscopes whose input terminals are fully separated from the AC power or ground.

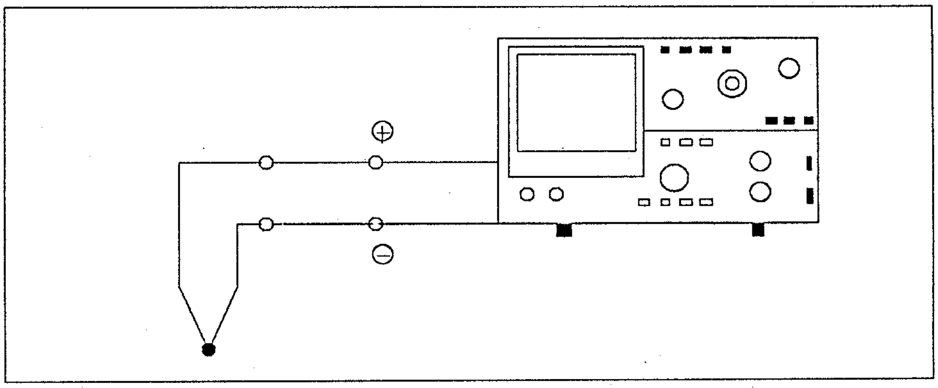


Figure 5 - 11 NMV Measurement

(3) Noise Preventive Measures

The noise rejection characteristics of the equipment may be insufficient for the particular type or level of noise generated in the input of the equipment. Therefore, take the following preventive measures:

① Selection of a Thermocouple Type

Use thermocouples of the non-grounded type that are electrically insulated from ground or the material to be measured.

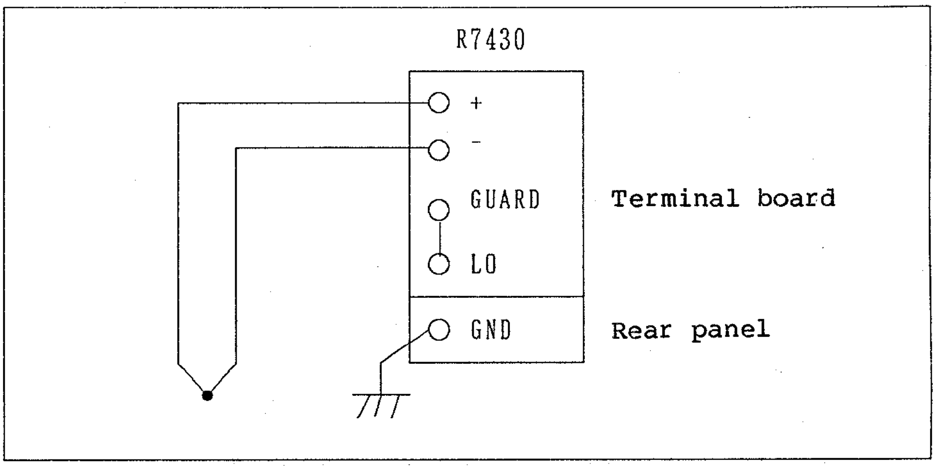


Figure 5 - 12 Cabling a Non-grounded Type of Thermocouple

If it is absolutely necessary to use a grounded-type thermocouple that is not electrically insulated from ground or the material to be measured, minimize the run of the cable from the thermocouple to the equipment.
If a grounded-type thermocouple is to be used that is likely to cause high-frequency CMV noise, connect ceramic capacitors with a capacitance from 0.001 to 0.01μF between the input terminals of each channel and the GND terminal of the equipment.

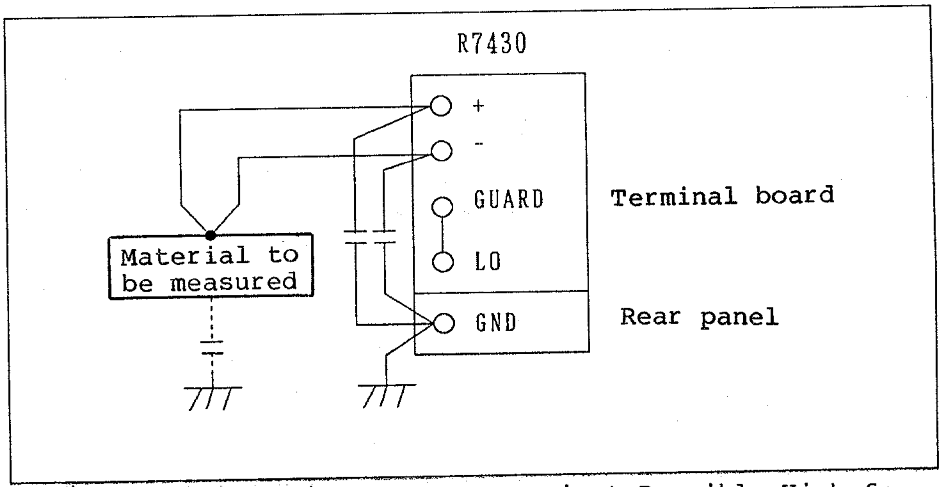


Figure 5 - 13 Preventive Measures Against Possible High-frequency Noise Generated Under Use of a Grounded-type Thermocouple

② Grounding the Material to be Measured

Connect a thick, short wire between the material to be measured and the GND terminal of the equipment so that noise will not be induced from the material to be measured into the thermocouple.

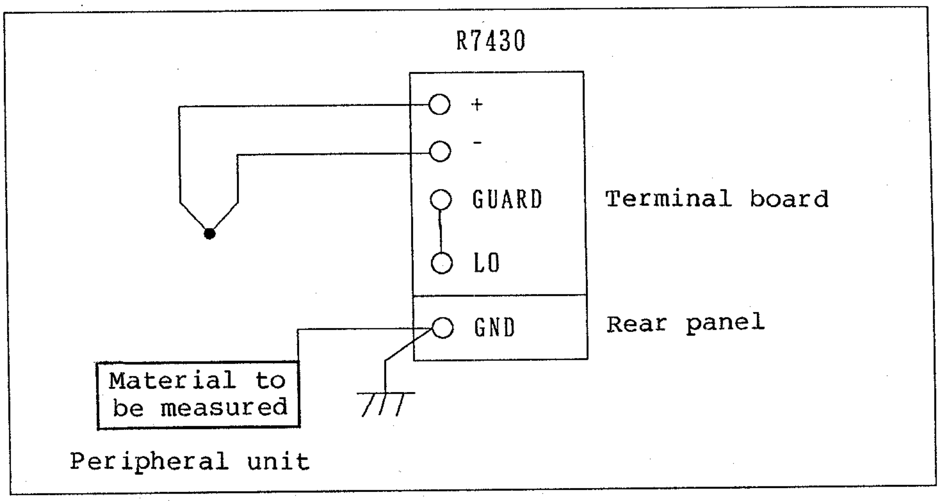


Figure 5 - 14 Grounding the Material to be Measured

③ Using an Electrostatic Shielding Wire

Connect a shielding wire to the GND terminal of the equipment to prevent the input signal wires from becoming electrostatically coupled to the surrounding noise source.

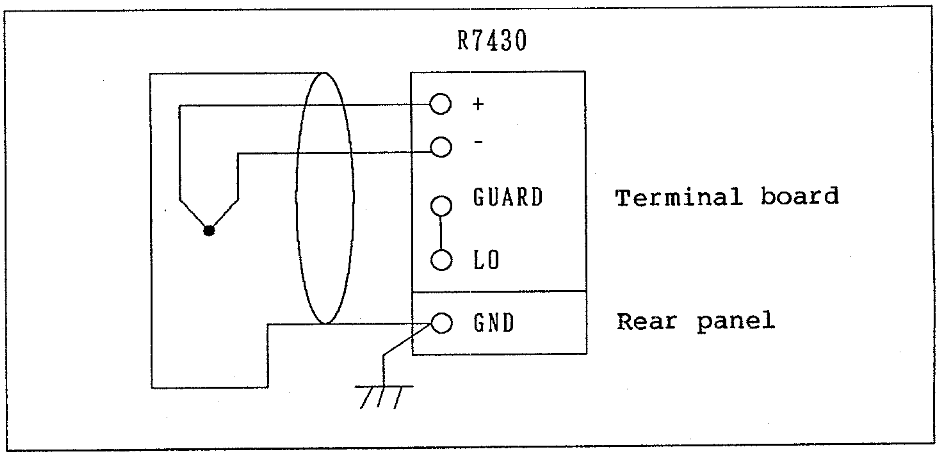


Figure 5 - 15 Electrostatic Shielding

④ Using Twisted-pair Wires

If large-current power transmission lines are laid out near the position where you are to connect input signal wires, use twisted-pair input signal wires to prevent the occurrence of NMV noise due to magnetic coupling.
The occurrence of NMV noise can better be prevented by taking the electrostatic shielding measure previously described in ③ above, since such power lines are also usually high in voltage.

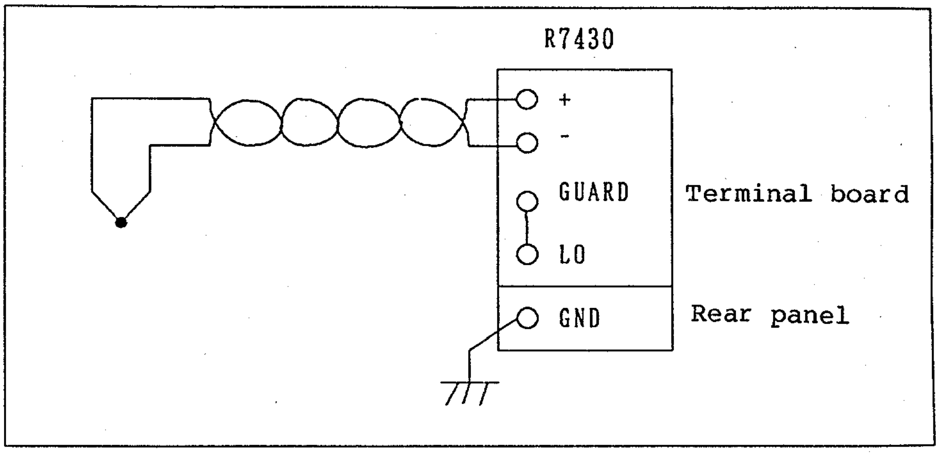


Figure 5 - 16 Using Twisted-pair Wires

⑤ Using a Guard Shielding Wire

The effects of common mode noise can be reduced by connecting a guard shielding wire between the GUARD terminal and the LO terminal after removing the strapping bar connected between these two terminals.

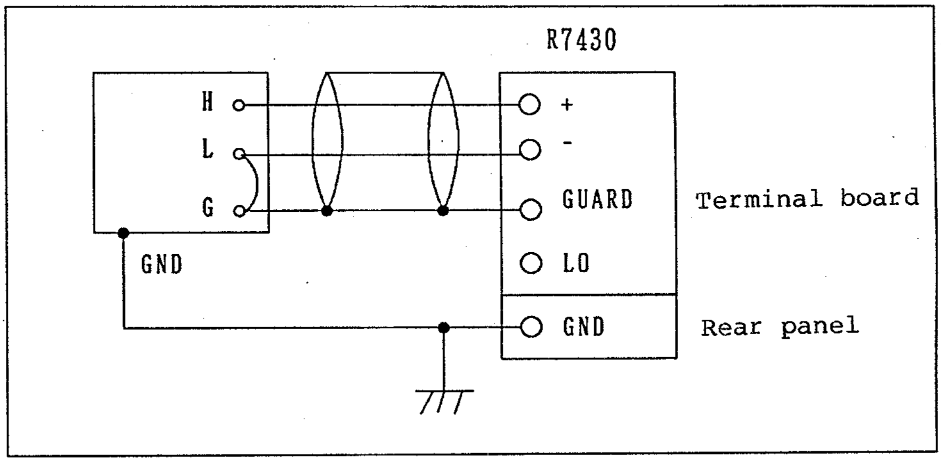


Figure 5 - 17 Using a Guard Shielding Wire

5.5 Voltage-down Alarm Function

The equipment has an automatic voltage check function for the parameter protection Ni-Cd (nickel-cadmium) battery contained within the equipment. When the equipment is turned on, this function will generate an alarm if the battery voltage has decreased below a predetermined level.
See Subsection 1.3.6 for further details.

5.6 Power-down Auto-restart Function

If the power turns off during measurement under a panel lock status (see Subsection 4.6.2 Panel Lock), measurement will automatically restart when the power is restored.

① Data Buffer Memory

In the above case, the fifo mode will be discontinued by restoration of the power since the buffer will be cleared.

② Time Display

During the clock mode, real-time display will be continued as it is. During the timer mode, time display will restart with 0.

6. MEASUREMENT EXAMPLES

This section presents various applications of the equipment for each of its functions so that you can fully utilize them.

6.1 Applications with Arithmetic Functions

6.1.1 Differential Calculation (ΔN) Relative to Other Input Point

During differential calculation (ΔN) relative to other input points, the difference in data between the user-selected input point and a reference input point is calculated. Applications of this arithmetic function include: differential calculation between room temperature and the temperature of a reference point; temperature difference calculation between the entrance and exit of a room; differential detection using heat-flow measurement; correlative recognition; etc. For example, the temperature distribution within a freezing casing can be checked by measuring the differences in temperature between various internal points of the freezing casing and a reference point. This example is shown in Figure 6-1.

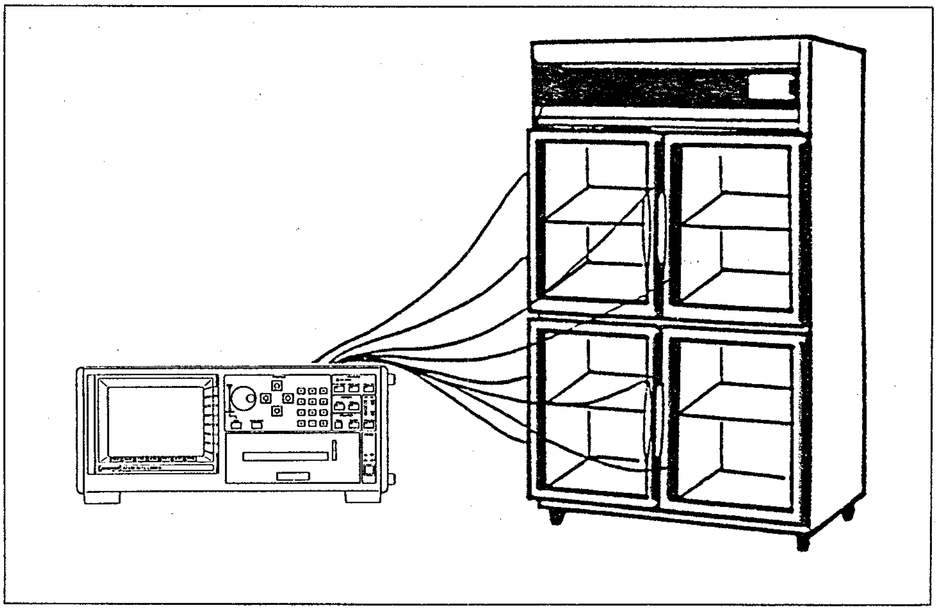


Figure 6 - 1 Measurement of the Internal Temperature Distribution of a Freezing Casing

6.1.2 Differential Calculation (ΔI) Relative to Initial Data

During differential calculation (ΔI) relative to initial data, the first log scan data is stored into a special memory first and then the differences between the first and subsequent scan data are calculated. Applications of this arithmetic function include elimination of offsets, correction for unbalanced errors of an input amplifier, elimination of the background, measurement of temperature differences before and after heating and cooling, etc. This arithmetic function can be used to measure only the changes in data from the measurement starting point.
For temperature increase tests of a motor, for example, you can use this function to record only the temperature increases resulting from driving of the motor after measurement has begun.

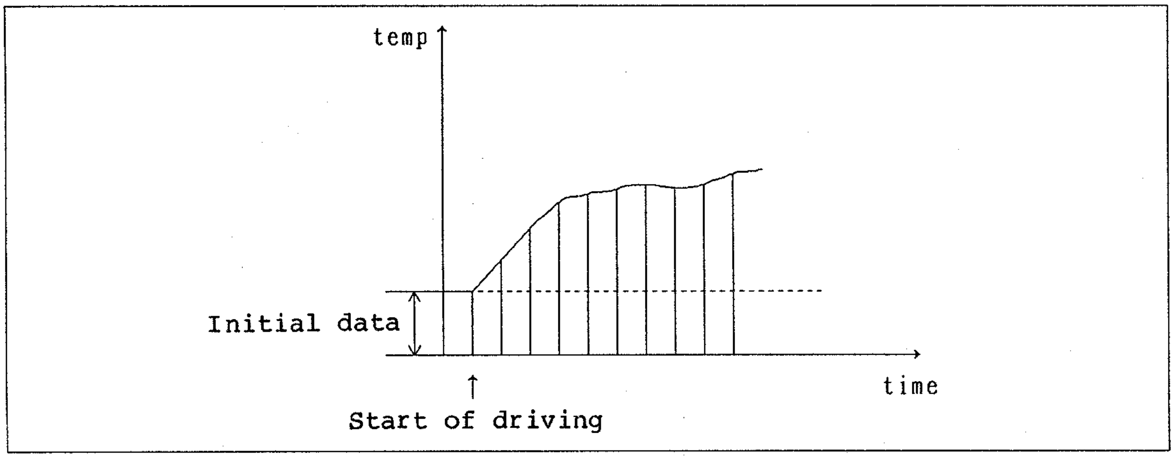


Figure 6 - 2 Temperature Increase Test of a Motor

6.1.3 Example (1) of Calculating the Maximum (MAX), Minimum (MIN), and Average (AVE) Data

This arithmetic function allows calculation of the maximum, minimum and average data of the monitor scans within one data frame for each channel. This function can be applied to analysis of the control characteristics of a temperature controller.

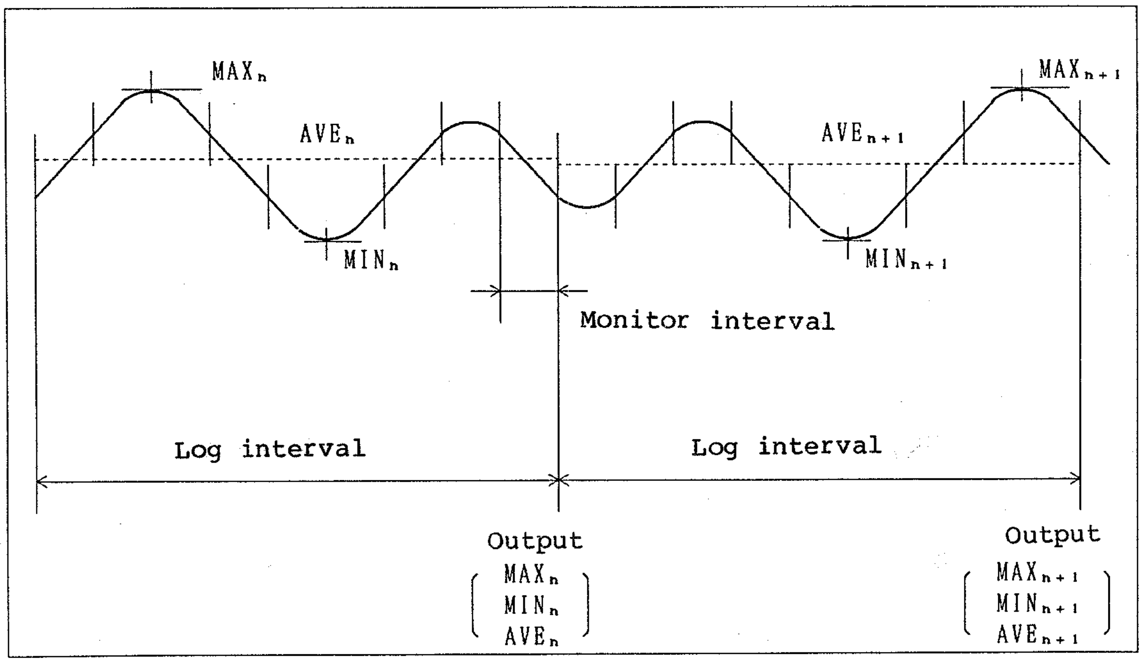


Figure 6 - 3 Explanatory Diagram of Control Characteristics Analysis of a Temperature Controller

During the first-order calculation mode, only one type of scan data can be set for one channel.

6.1.4 Example (2) of Calculating the Maximum (MAX), Minimum (MIN), and Average (AVE) Data

(1) Calculation Between the Individual Channels within One Function Group

This arithmetic function allows maximum, minimum, and average data calculation between the individual channels within one function group. Calculation occurs for any of the three types of scans: log scan, monitor scan, and single log scan.
With this function, you can obtain useful data for measuring temperature irregularities of a thermostatic chamber.

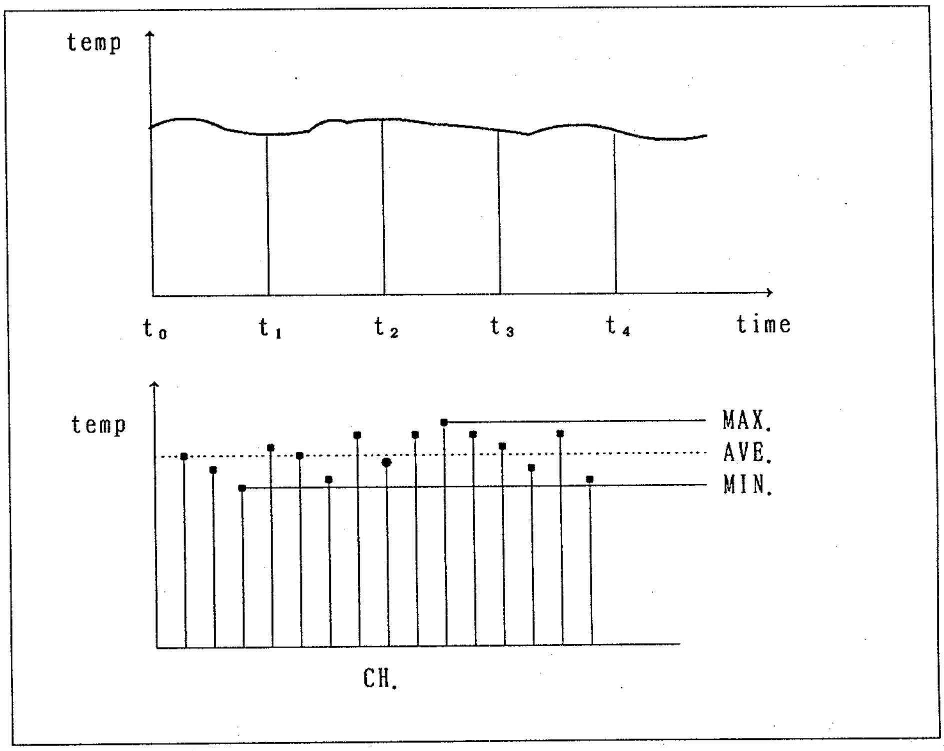
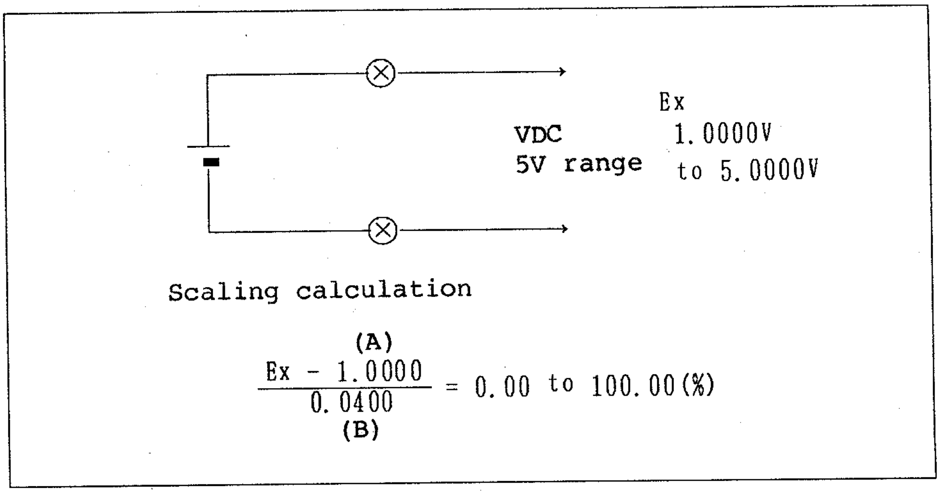


Figure 6 - 4 Explanatory Diagram of Temperature Irregularities Measurement of a Thermostatic Chamber

6.1.5 Linear Scaling Calculation

For collection of data such as physical or chemical quantities, sensors or transducers are generally used to transduce data into standardized voltage or instrument signals. The prime objective of scaling calculation is to express the levels of such signals in terms of data directly read in the original industrial units.
Scaling calculation uses the expression of (X - A)/B, where X is a value that has been measured using the user-selected measurement range, and A and B are user-set offset and span constants, respectively. In this expression, B is taken not to be equal to zero.
To represent instrument signal levels of 1 to 5 volts in percentage terms, for example, set A and B as shown in Figure 6-5 and select % as the unit.
Scaling calculation can also be used to carry out operations based on the four fundamental rules of arithmetics, deletion of offsets, magnification of slight changes, normalizing computation, etc.
For example, dispersion in the characteristics of sensors can be smoothed by first measuring a reference temperature, then analyzing the characteristics of the sensors from the reference value, and finally setting A and B to suitable values. For narrow ranges, linearization characteristics can also be compensated for as shown in Figure 6-6.



$$\frac{Ex - 1.0000}{0.0400} = 0.00 \text{ to } 100.00(\%)$$

Figure 6 - 5 Measurement of Instrument Input Signal Levels by Scaling Calculation

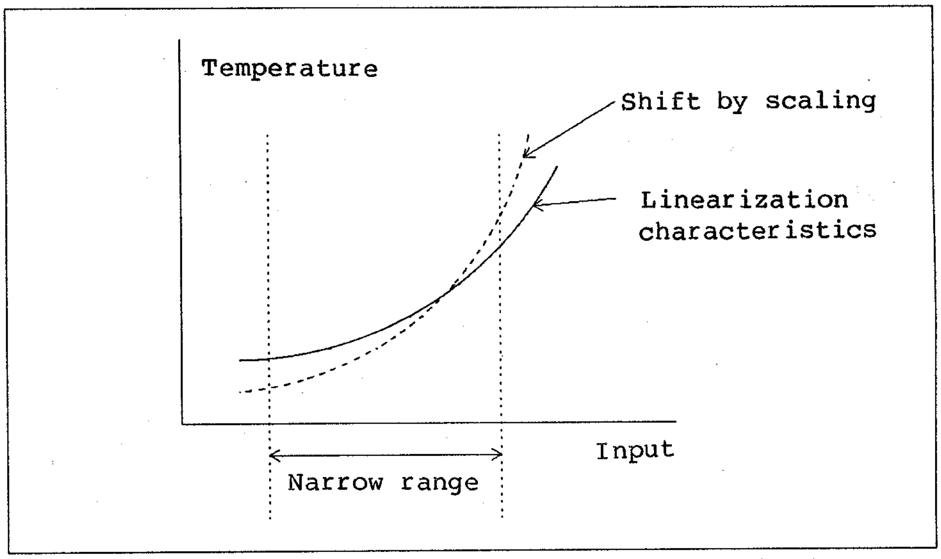


Figure 6 - 6 Narrow-range Characteristics Improvement by Scaling

6.2 Applications of the Alarm Check Scan Function

For the usual log-scan-start function, data is measured at the user-set intervals and then the high- and low-limit values are judged and the results are printed out. The alarm check scan function, however, is valid for cases where you need only the measured data existing after errors have been detected by high-/low-value judgment.

For battery discharge tests, for example, you can use the alarm check scan function to cause data output to be started only after the battery voltage has decreased below a predetermined level. In that case, data is not output while the battery voltage stays above the predetermined level.

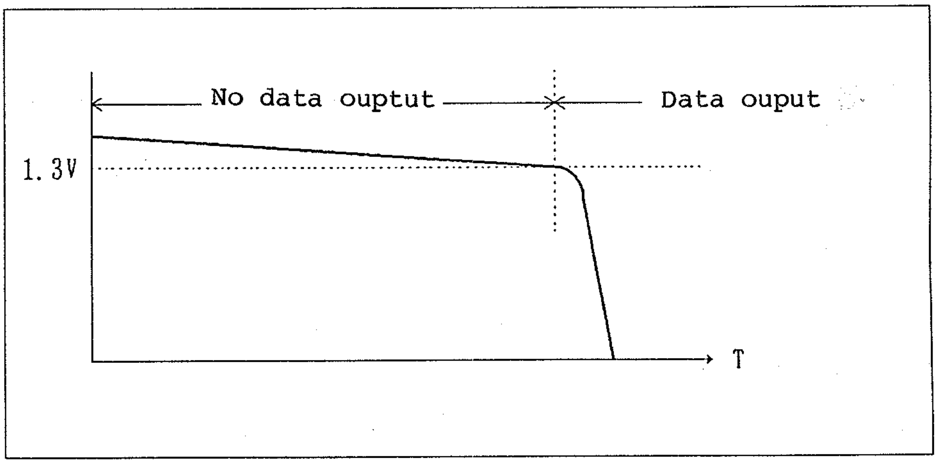


Figure 6 - 7 Battery Discharge Test

6.3 Applications of the Contacts Outputs

6.3.1 Activating the Contacts According to High-/Low-value Judgment Results

It is possible to set separate high-limit values and low-limit values for each input point and thus to activate the contacts according to the results of high-/low-value judgment.
For example, if trouble occurs in a control system during temperature monitoring of a furnace, its relays can be activated when measured data exceeds the preset temperature value. Thus, an alarm can be output to an external unit and the power can be turned off to prevent damaging the furnace.

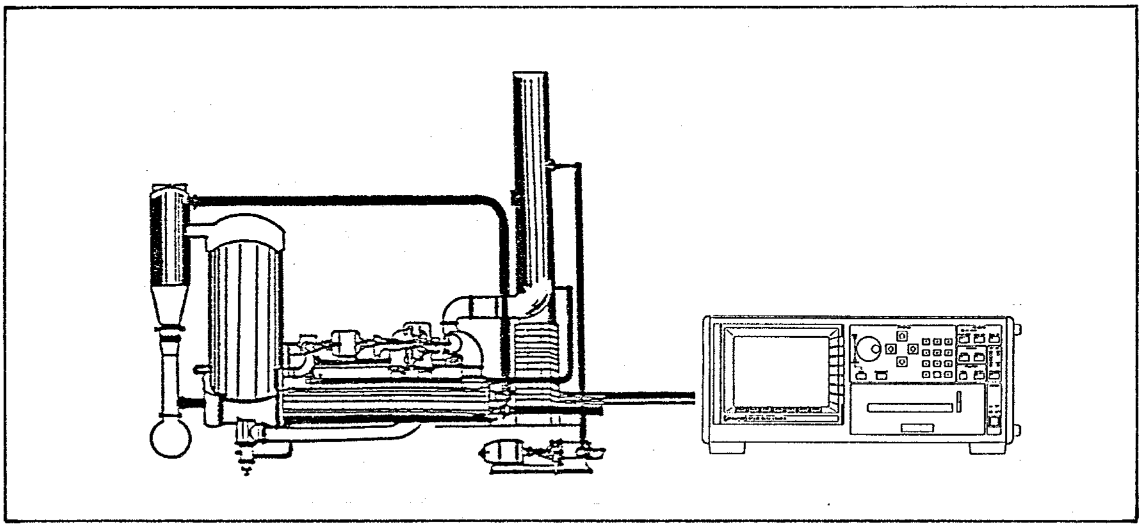


Figure 6 - 8 An Application of the R7430 to Furnace Temperature Monitoring

6.3.2 Activating Contacts via the GPIB

The contacts outputs of the equipment can be activated according to the results of high-/low-value judgment within the equipment.
The contacts can also be turned on or off using the program codes from the GPIB.
This function is effective for sending the control signals from the controller out to an external unit after measured data has been fetched into the controller and then undergone advanced arithmetic processing.

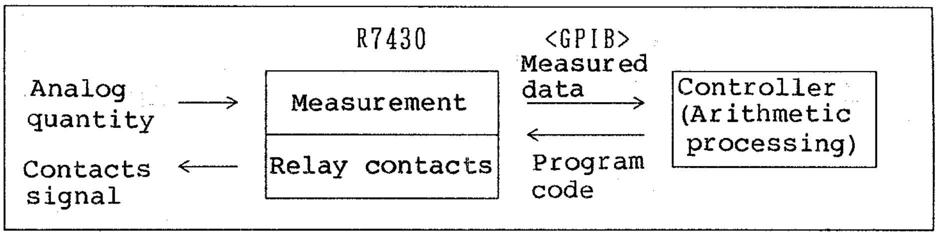


Figure 6 - 9 Example of Contacts Output via the GPIB

6.4 Applications of Linear Scaling and Unit Conversion

During measurement of physical quantities, the appropriate types of transducers for respective quantities are commonly used to convert the measured quantities into DC voltages. In that case, if the voltages and physical quantities are converted at the rate of not 1:1, but 10:1 or 100:1, the easier-to-see results can be obtained by moving the decimal point.
For example, when measuring temperatures using a thermistor sensor, measure DC voltages using the thermistor liearization characteristics and then move the decimal point by linear scaling and convert the unit into °C.
When temperatures from 0°C to 100°C are measured at 100mV DC/°C, the value of 25°C will be expressed as 2.50000V and the data can be output in the format of 25.0000°C. Also, making this value into 1/1000 terms by scaling enables the data to be output using the necessary number of significant digits such as 25.0°C.

7. EXTERNAL CONTROL

This section describes the external control functions of the equipment.

7.1 Concept of External Control

The concept of the external control functions of the equipment is represented in Figure 7-1.

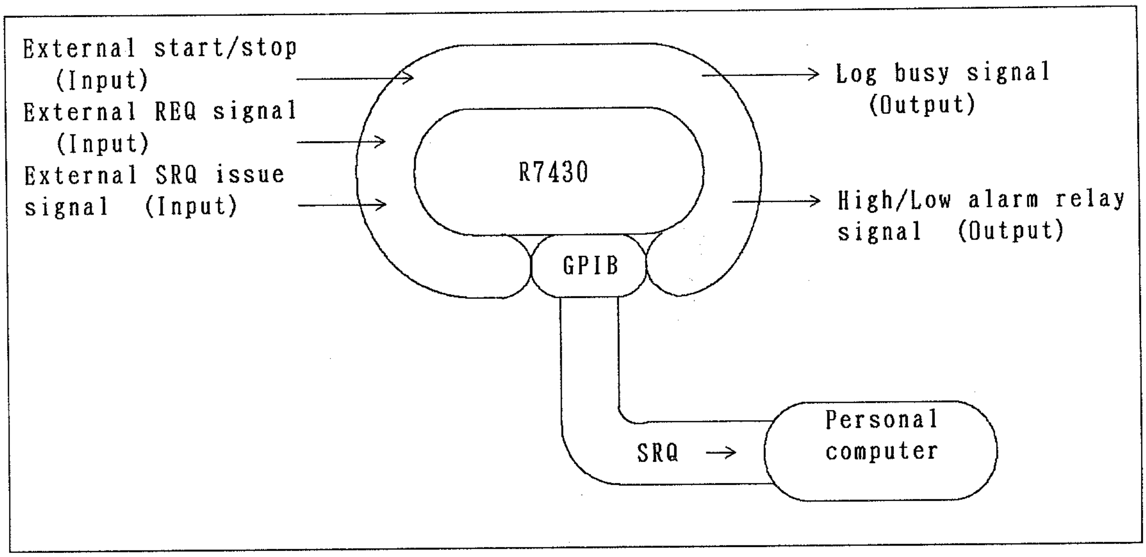


Figure 7 - 1 Conceptual Diagram of the External Control Functions

7.2 External Control Connector

The signal arrangement of the connector used for external control input and output is shown in Figure 7-2.

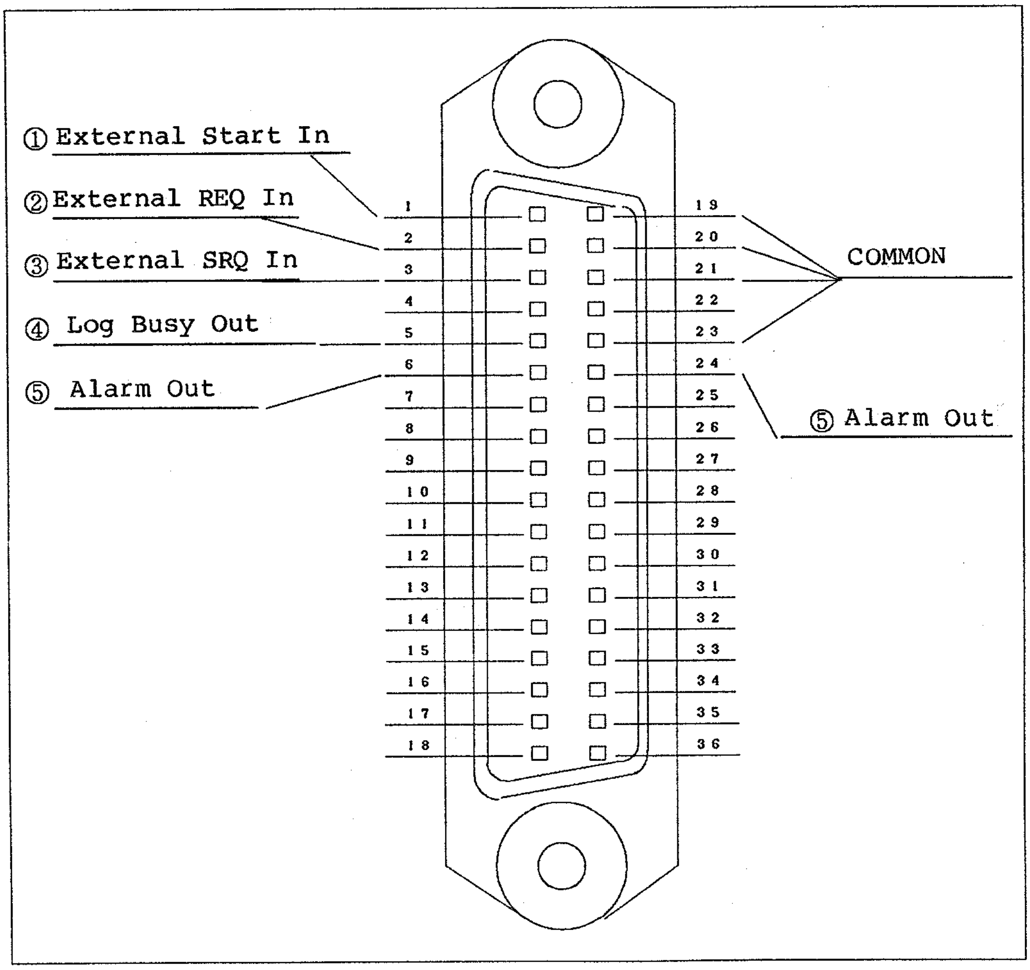


Figure 7 - 2 Signal Arrangement of the External Control Connector

① External Start In

This contacts input terminal controls the start or stop of log scans, depending on the level of an external contacts signal.

② External REQ IN

This contacts input terminal controls the start of signal log scans according to the level of an external contacts signal.

③ External SRQ In

This contacts input terminal issues a service request via the GPIB according to the level of an external contacts signal.

④ Log Busy Out

This terminal outputs a signal at a negative logical voltage level to indicate that a log scan operation is in progress.

⑤ Alarm Out

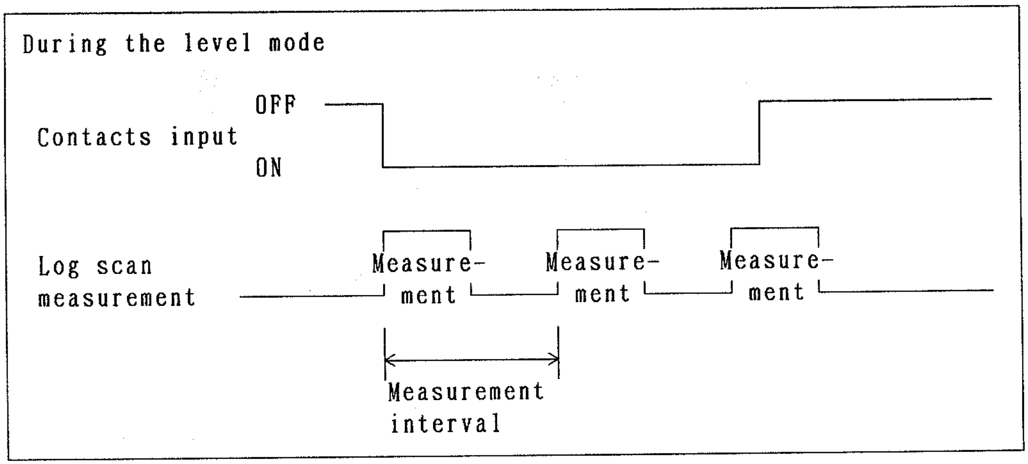
This terminal outputs a signal in contacts format if high- or low-limit values are overstepped.

7.3 External Start/Stop (Input Signal)

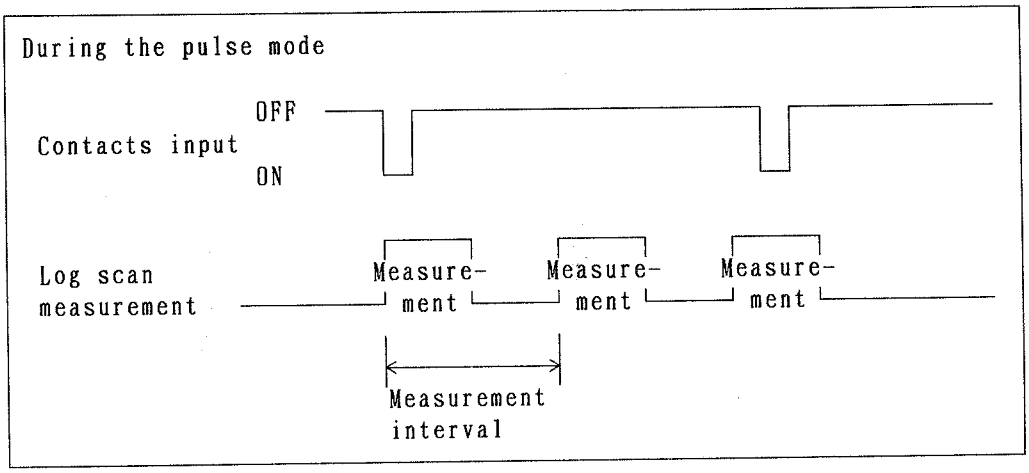
Use the external start/stop signals to direct the equipment to start or stop a log scan measurement operation by issuing a contacts signal from an external unit. During the level mode, however, the external start signal or the external stop signal will be ignored if they are issued with the equipment in operation or with the equipment not in operation, respectively.

(1) Operation Mode

The external start/stop signals can be used for either the level mode or the pulse mode.
During the level mode, measurement occurs while the contacts signal is ON, and stops when the signal turns OFF.



During the pulse mode, measurement starts when the first contacts signal turns ON, and stops when the next contacts signal turns ON.



(2) Contacts Input Specifications

Chattering time: 30ms or less
Pulse width : 100ms or more

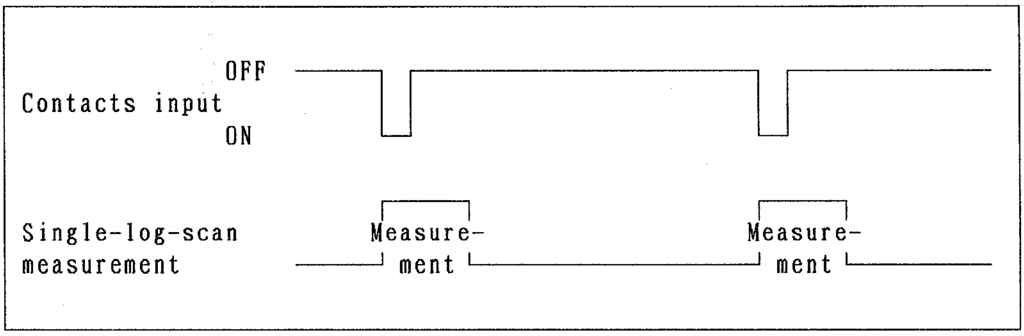
The contacts input terminal for the external start/stop signal is pin No. 1 of the external control connector. Pin No. 19 is for 0V input. The input circuit is shown in Figure 7-3.

7.4 External REQ (Input Signal)

Use the external REQ signal to direct the equipment from an external unit to execute single-log-scan measurement.
While the equipment is performing a log-scan operation, however, this signal will be ignored if it is issued.

(1) Operation Mode

The external REQ signal can be used only for the pulse mode.
Single-log-scan measurement will occur only once when the contacts signal turns ON.



(2) Contacts Input Specifications

Chattering time: 30ms or less
Pulse width : 100 ms or more

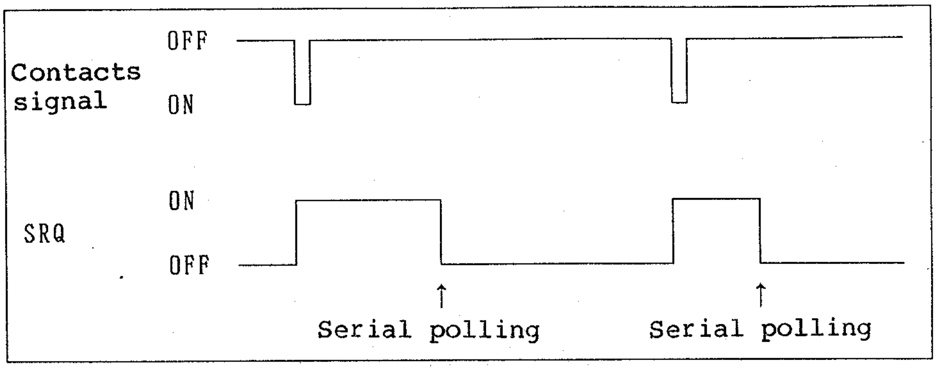
The contacts input terminals for the external REQ signal is pin No. 2 of the external control connector. Pin No. 20 is for 0V input.
The input circuit is shown in Figure 7-3.

7.5 External SRQ (Input Signal)

Use the external SRQ signal to issue an SRQ (service request) from an external unit to the personal computer connected to the equipment. Using this signal requires presetting the equipment to the S0 (SRQ output ON) mode.

(1) Operation Mode

The external SRQ signal can be used only for the pulse mode.
One SRQ is automatically output when the contacts signal turns ON.



(2) Contacts Input Specifications

Chattering time: 30ms or less
Pulse width : 100ms or more

The contacts input terminals for the external SRQ signal is pin No. 3 of the external control connector. Pin No. 21 is for 0V input. The input circuit is shown in Figure 7-3.

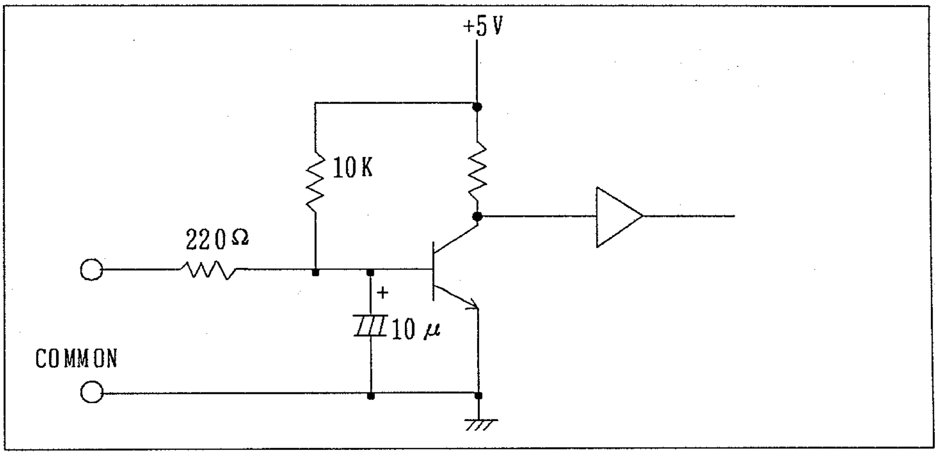
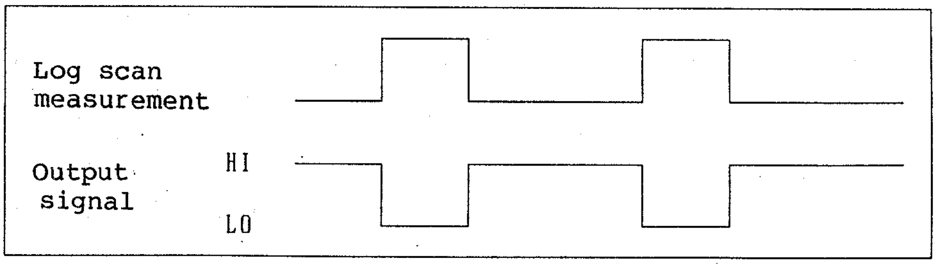


Figure 7 - 3 External Control Input Circuit

7.6 Log Busy Signal (Output Signal)

(1) Operation

During log scan measurement, LO (low) level voltage signals are output. They are not output during single-log-scan measurement.



(2) Output Specifications

Negative logical voltage signal (Transistor output)

HI (high) level: 3V or more (when output at 400μA)
LO (low) level : 0.4V or less (when input at 1.6mA)

The output terminal for the log busy signal is pin No. 5 of the external control connector. Pin No. 23 is for 0V input.
The input circuit is shown in Figure 7-4.

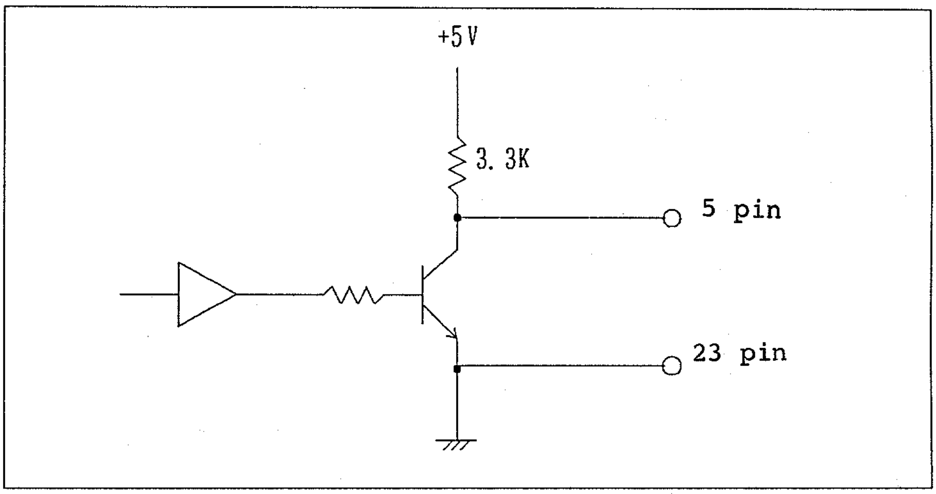


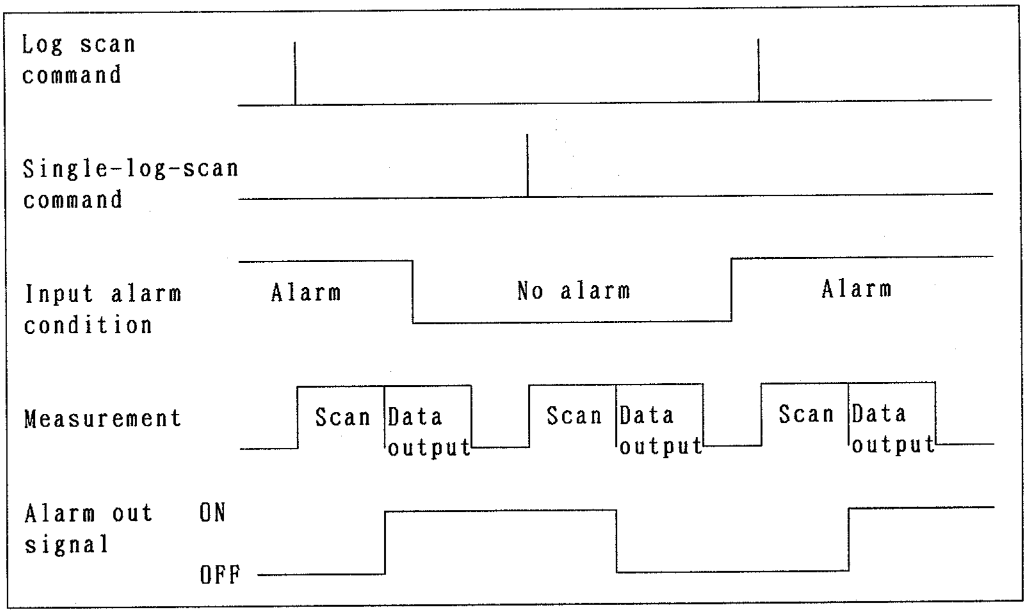
Figure 7 - 4 Log Busy Signal Output Circuit

7.7 Alarm Out Signal (Output Signal)

(1) Operation

During scan measurement with high- and low-limit values set, the alarm out signal will be output in any one of the following cases:

- High-limit value < Measurements calculation results
- High-limit value > Measurements calculation results
- If sensor out is detected
- If excessive input is detected
- If calculation errors occur
- If transfer errors occur



(2) Contacts Output Specifications

Maximum contacts activating voltage: 12VDC
Maximum contacts activating current: 0.3A (at a DC rating of 10VA)
Maximum operating time (bouncing time included): 1ms

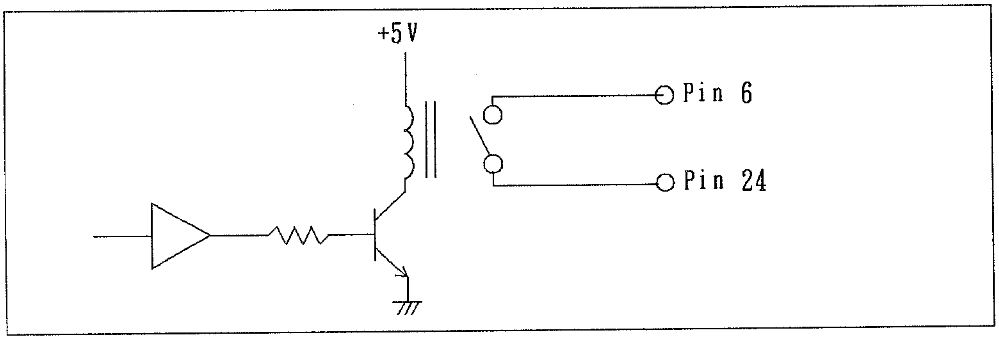


Figure 7 - 5 Alarm Out Signal Output Circuit

8. GPIB

This section describes the GPIB (General-Purpose Interface Bus system) used in the equipment.

8.1 Overview of the GPIB

The GPIB can be connected to a measuring instrument, a GPIB controllr, and peripheral units via simple cables (bus lines).
Compared with conventional interfaces, the GPIB has excellent extendability and is easy to use. It is also electrically, mechanically, and functionally compatible with non-ADVANTEST products. You can therefore build various types of systems, from simple measurement systems to advanced automatic measurement systems, by adding a single bus cable to the GPIB.

To operate the GPIB, you must first set a specific "unit address" for each of the equipment component units connected to the bus lines. These units can each undertake one or more of three functions: controller, talker, and listener.

During the operation of the GPIB, only one "talker" can be send data onto the bus lines and more than one "listener" can receive the data.
The controller specifies the addresses of a "talker" and a "listener(s)" and transfers data from the "talker" to the "lestener(s)". The controller also specifies measuring parameters from itself, or from the "talker", to the "listener(s)"
Data transfer between the units uses eight data lines of the bit-parallel, byte-serial format. The transfer operation is asynchronous, bi-directional. Because of the asynchronous scheme, high-speed units and low-speed units can be freely connected in combined form.

Data (messages) that can be transferred between each unit include measured data, measuring parameters (programs), commands, etc.
Transfer of such data uses the ASCII code.
In addition to the eight data lines mentioned above, the GPIB has three handshaking lines, which control asynchronous data transfer between the units, and five contol lines, which control the flow of information along the buses.

- The handshaking lines use the following signals:

DAV (Data Valid)	:	This signal indicates that the data is valid.
NRFD (Not Ready For Data)	:	This signal indicates that data can be received.
NDAC (Data Not Accepted)	:	This signal indicates that data reception has been completed.

- The control lines use the following signals:

ATN (Attention)	: This signal identifies whether the signal placed on the data line is an address, a command, or some other type of information.
IFC (Interface Clear)	: This signal clears the interface.
EOI (End or Identify)	: This signal is used at the end of information transfer.
SRQ (Service Request)	: This signal requests a unit to perform a service for the controller.
REN (Remote Enable)	: This signal provides remote control of remote-programmable units.

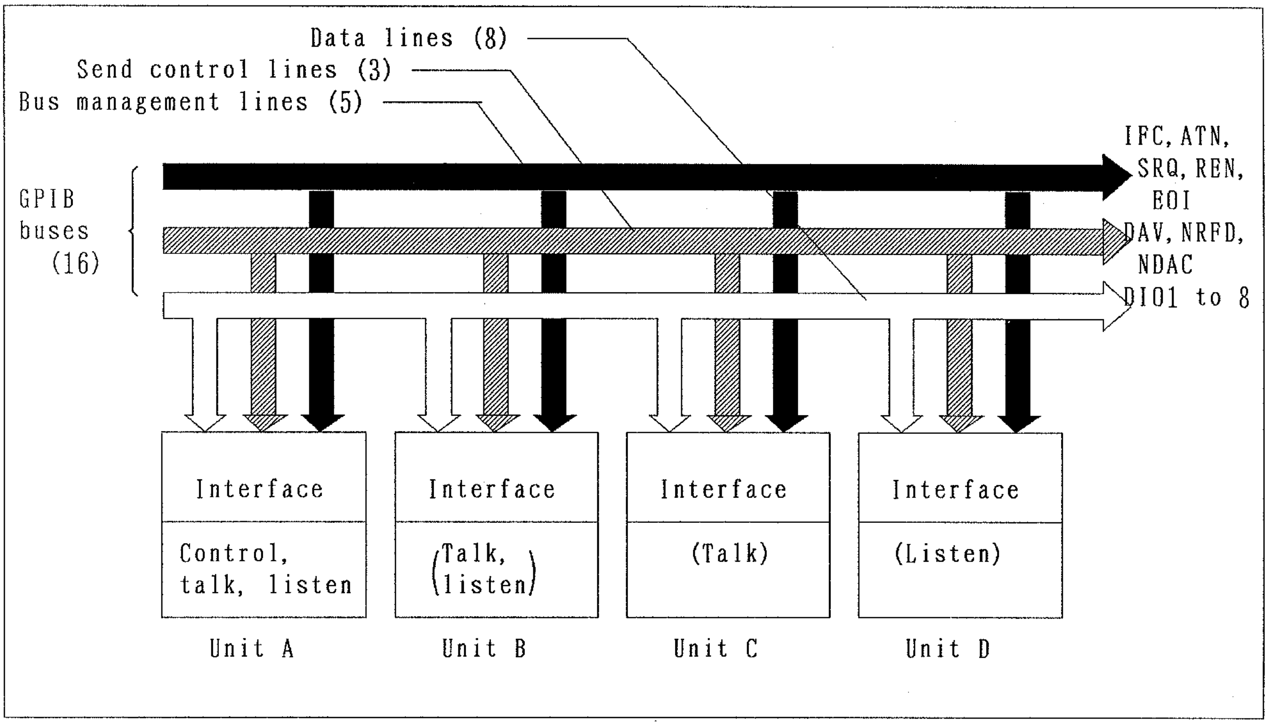


Figure 8 - 1 Block Diagram of the GPIB

8.2 Standards and Specifications

8.2.1 GPIB Specifications

Relevant standard : IEEE Standard, 488-1978

Logical level : Logical 0 (high status) at +2.4V or more
Logical 1 (low status) at +0.4V or less

Bus line termination : 16 bus lines are terminated as follows.

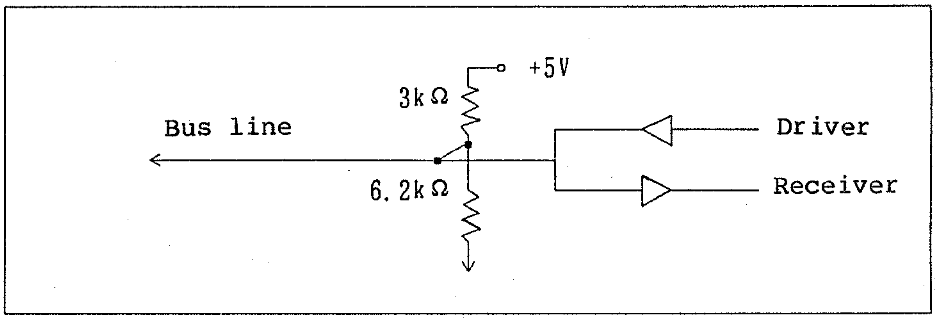


Figure 8 - 2 Bus Line Termination

Driver specifications: Tri-state format
Otuptut voltage in low status:
+0.4V or less, 48mA

Receiver specifications:
Low status at +0.6V or less
High status at +2.0V or more

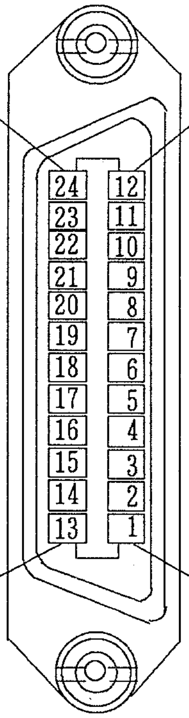
Bus cable length : The total bus cable length must be between [(number of units connected to the buses) x 2m or less] and 20m.

Addressing : 31 types of talker addresses/listener addresses can be freely set under key operations.

Connector : 24-pin GPIB connector
57-20240-D35A (Amphenol product or equivalent)

Signal name	Pin No.
GND LOGIC	24
GND (ATN)	23
GND (SRQ)	22
GND (IFC)	21
GND (NDAC)	20
GND (NRFD)	19
GND (DAV)	18
REN	17
DIO8	16
DIO7	15
DIO6	14
DIO5	13

24-pin GPIB connector



Pin No.	Signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO4
3	DIO3
2	DIO2
1	DIO1

Figure 8 - 3 GPIB Connector Pin Layout

8.2.2 Interface Functions

Table 8 - 1 Interface Functions

Code	Description
SH1	Source handshaking
AH1	Acceptor handshaking
T5	Basic talker function, serial polling, talk-only mode function, talker release by listener specification
L4	Basic listener function, listener release by talker specification
SR1	Service request
RL1	Remote/local selection
PP0	No parallel functions provided
DC1	Device clear (SDC and DCL commands can be used)
DT1	Device trigger (GET commands can be used)
C0	No controller functions provided
E2	Tri-state driver used

8.3 Talker Formats (Data Output Formats)

Three types of talker formats are used: (1) basic, (2) omission, and (3) binary.
For (1) and (2) above, header ON/OFF can be specified.

(1) Basic Talker Format

```
Time , Log scan No. , CH , Data , Mode , Alarm , ······
 ①   ⑧     ②       ⑧  ③  ⑦   ④   ⑦   ⑤   ⑦   ⑥   ⑧

                      CH , Data , Mode , Alarm , ······
                       ⋮
                      CH , Data , Mode , Alarm   CRLF(EOI)
                                                    ⑨
```

① Time

T␣ YYMMddhhmmss
Header

- YY: Year
- MM: Month
- dd: Day
- hh: Hours
- mm: Minutes
- ss: Seconds

② Number of Log Scans

L␣ ℓSSSSS

ℓ : Number of log scans (0 to 9)
SSSSS: Log number (1 to 99999)

Headers
L␣ : Log scan data
M␣ : Monitor scan data
S␣ : Single-log scan data

③ CH

N␣ gnn
Header

g : Measurement unit number
nn : Channel number

④ Data

XX␣ ddd.dddd E±d

- Exponential part (E + polarity + 1 digit)
- Mantissa part (Decimal point + 6 digits)
- Polarity (- or␣)
- Header (2-digit, alphabetic) See Table 8-2.

See Subsection 9.3.2, (4) GPIB Data Output Formats for information about the number of data digits and the position of the decimal point.

Table 8 - 2 Data Headers

Header	Description	Unit
DV	Measurement range for DC voltages	V
TC	Measurement range for thermocouples or platinum resistance thermometer bulbs	°C
BT	Thermocouple sensor out	
OL	Measured data overscaled	
ER	Transfer or calculation errors	
FL	Measurement range for contacts	

NOTE

The 500mV range data is converted into volts as follows.
DV ddd.dddE-3

⑤ Mode

```
MD d
↑  ↑
|  └──────────────── d: Calculation mode (0 to 6)  See Table 8-3.
└─────────────────── Header
```

Table 8 - 3 Calculation Mode

d	First-order calculation	Second-order calculation
0	No calculation	—
1	ΔN (Differences from other channel data)	—
2	ΔI (Differences from initial data)	—
3	Δt (Differences from the previous data)	—
4	MAX (Maximum value)	MAX (Interchannel maximum value)
5	MIN (Minimum value)	MIN (Interchannel minimum value)
6	AVE (Average value)	AVE (Interchannel average value)

⑥ Alarm

```
A␣ d
↑  ↑
|  └──────────────── d: Meaning of the alarm (0 to 6)  See Table 8-4.
└─────────────────── Header
```

Table 8 - 4 Meanings of Alarms

d	Meaning of the alarm
0	Normal
1	Thermocouple sensor out
2	Measured data overscaled
3	Transfer error or calculation error
4	High-limit value exceeded
5	Low-limit value exceeded

⑦ "," String Delimiter

This delimiter is output to denote the end of one string (channel or data).

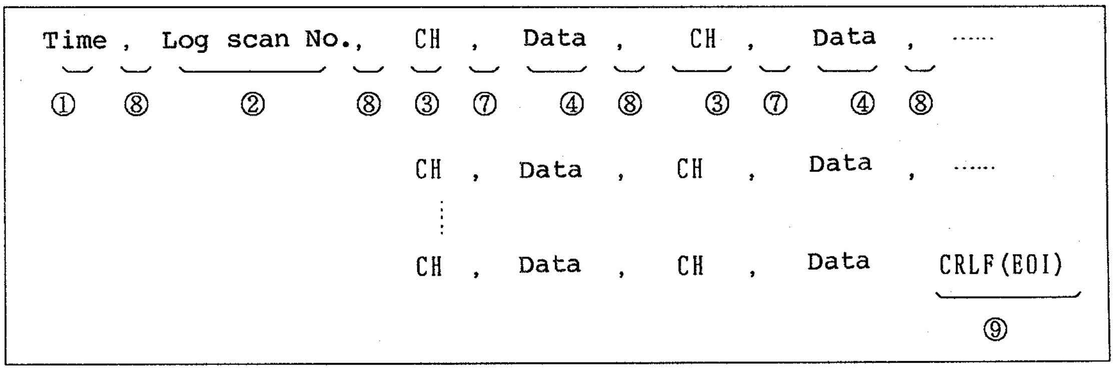
⑧ "," String Delimiter

As with item ⑦ above, this delimiter is output to denote the end of one string (channel or data). This delimiter can be changed to LF if so specified from the GPIB controller.

⑨ CR LF(EOI) Block Delimiter

EOI, together with CR LF and LF, is output as the block delimiter. Only LF or only EOI can be changed into output form if so specified from the GPIB controller.

(2) Omission Format

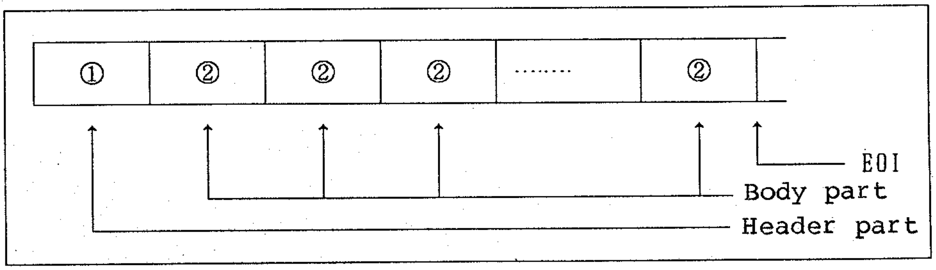


For the omission format, mode ⑤ and alarm ⑥ are not output as shown above.

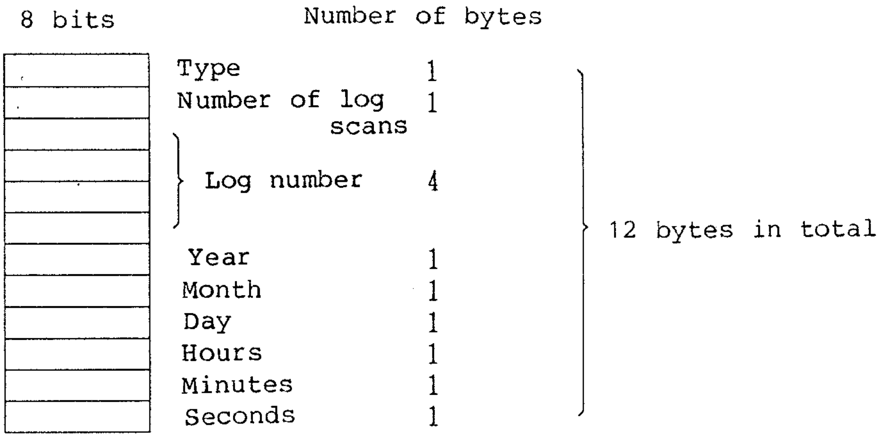
NOTE

For both the basic format and the omission format, the two characters in the header will be output in left-justified form if it is turned OFF.

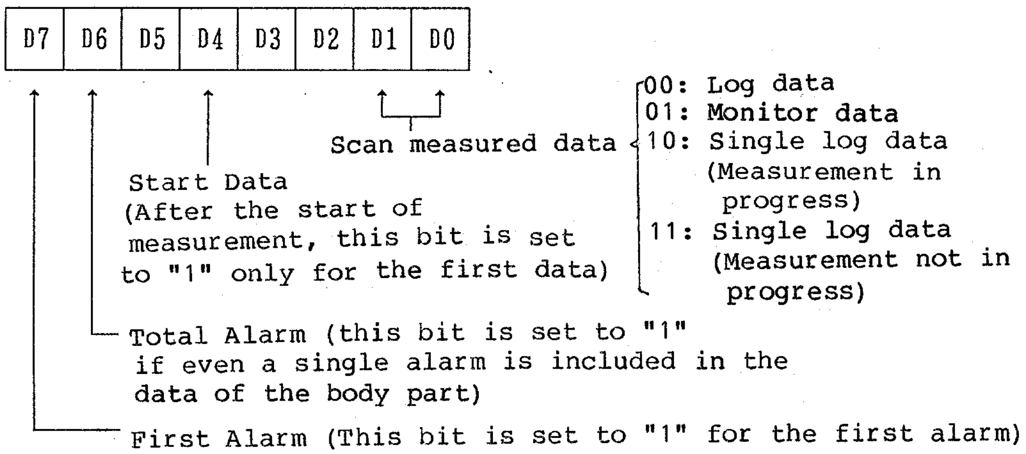
(3) Binary Format



① Header Part

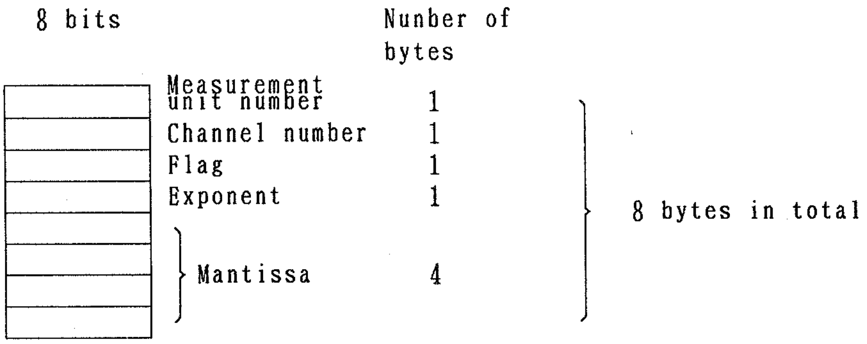


①-1 Bit pattern of Type



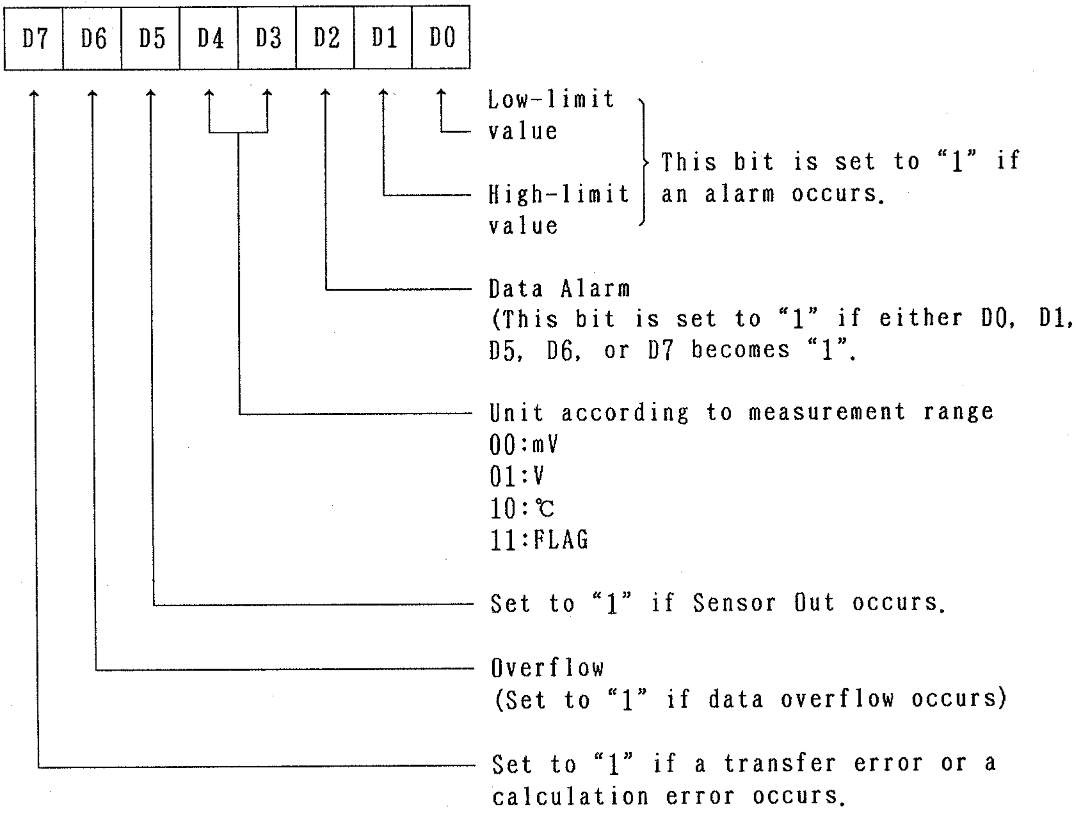
①-2 Data for number of log scans through seconds are binary form.

② Body Part



②-1 Measurement unit numbers and channel numbers are displayed in binary form.

②-2 Bit Pattern of Flag



Low-limit value

High-limit value

This bit is set to "1" if an alarm occurs.

Data Alarm
(This bit is set to "1" if either D0, D1, D5, D6, or D7 becomes "1".

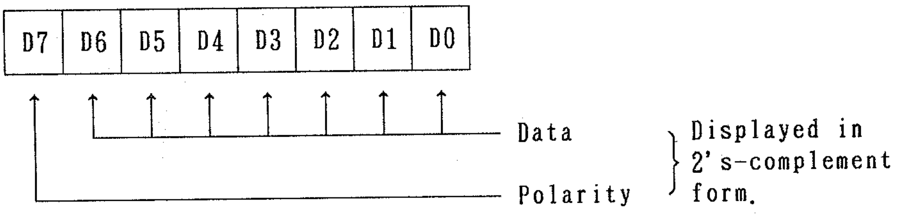
Unit according to measurement range
00:mV
01:V
10:℃
11:FLAG

Set to "1" if Sensor Out occurs.

Overflow
(Set to "1" if data overflow occurs)

Set to "1" if a transfer error or a calculation error occurs.

②-3 Bit Pattern of Exponent

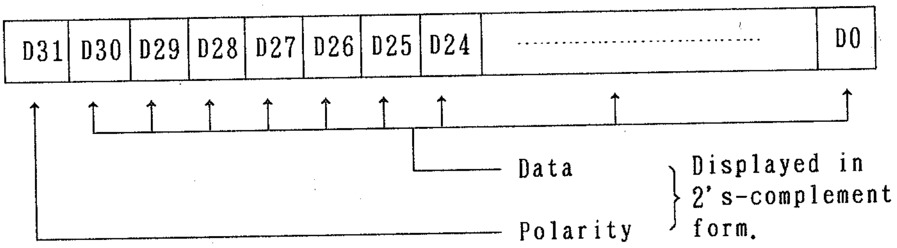


Data

Polarity

Displayed in 2's-complement form.

②-4 Bit Pattern of Mantissa



Data

Polarity

Displayed in 2's-complement form.

8.4 Program Codes

8.4.1 Execution Parameter Setting Command (PM)

The equipment contains an editing parameter memory and an execution parameter memory. Parameters you set using the GPIB will be stored into the editing parameter memory. After all editing parameters have been checked using the PM command, they will be copied into the execution parameter memory if inconsistencies are not included in the measuring conditions.

NOTE

The PM command must be executed before any changes to the parameter settings can become valid.
The PM command is valid only while measurement is not in progress.

8.4.2 Parameter Initialize Command (PI)

The PI command initializes all parameter settings. Executing this command also causes the PM command to be executed.

8.4.3 Group Codes

The equipment has group codes. Use of these codes allows your parameter-setting jobs to be simplified. This function is similar to the identical-parameter copy setting function previously described in Subsection 4.3.5, (1) Identical Parameter Copy Setting.

(1) The available types of group codes, the individual codes belonging to each group code, and the setting range of each group code are listed in Table 8-5.

Table 8 - 5 Group Codes

Group code	Setting range	Individual codes belonging to each group code
FG (Function group)	1 to 60	FC (Starting/ending channel numbers) * FR (Measurement range) FS (Scaling factor) FU (Unit) FM (First-order calculation) FT (Channel data to be calculated)
AG (Alarm group)	1 to 60	AC (Starting/ending channel numbers) * AH (High-limit value) AL (Low-limit value)
TL (Printer group)	1 to 12	TC (Trend channel) * TP (Trend position) TS (Trend scale) TZ (Trend mode)

NOTE: If you set identical parameters for more than one range using the codes marked with an asterisk (*) above, the settings may become erroneous or meaningless during measurement. Use such codes only for 'N' (Note used) setting.

(2) Format of the Group Codes

```
HD mm , nn
↑    ↑
|    └──────────────── Setting range
└───────────────────── Group code
```

Setting range: mm≦nn

Note: If you set nn only or if you set mm equal to nn, then the equipment will interpret that only mm has been set.

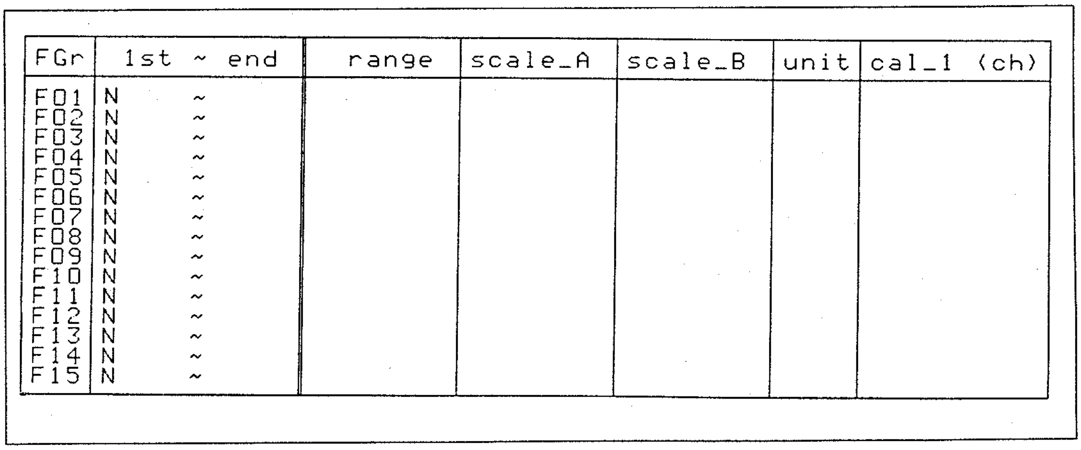
(3) How To Use Group Codes

① Set each individual parameter to within the range previously set for the group code. (The setting is valid even if it does not exist in the same command string.)

Example 1)

```
FG1,15FCN
 ↑    ↑
 |    └────────── Individual parameter
 └─────────────── Group code
```

The following shows a screen image that will be presented when FG1,15FCN, shown in example 1 above, is executed:



FGr	1st ~ end	range	scale_A	scale_B	unit	cal_1 (ch)
F01	N ~					
F02	N ~					
F03	N ~					
F04	N ~					
F05	N ~					
F06	N ~					
F07	N ~					
F08	N ~					
F09	N ~					
F10	N ~					
F11	N ~					
F12	N ~					
F13	N ~					
F14	N ~					
F15	N ~					

② The setting range is stored in memory for each group code. The setting range, therefore, will remain valid until it is set once again for the group code or until ';' is set instead of ','.

(4) Changing the Setting Range by Setting ';'

① If you set ';' immediately after an individual code, the maximum value (nn) within the range which was previously set for the group code corresponding to that individual code will be incremented by +1 and set once again.

Example 2)

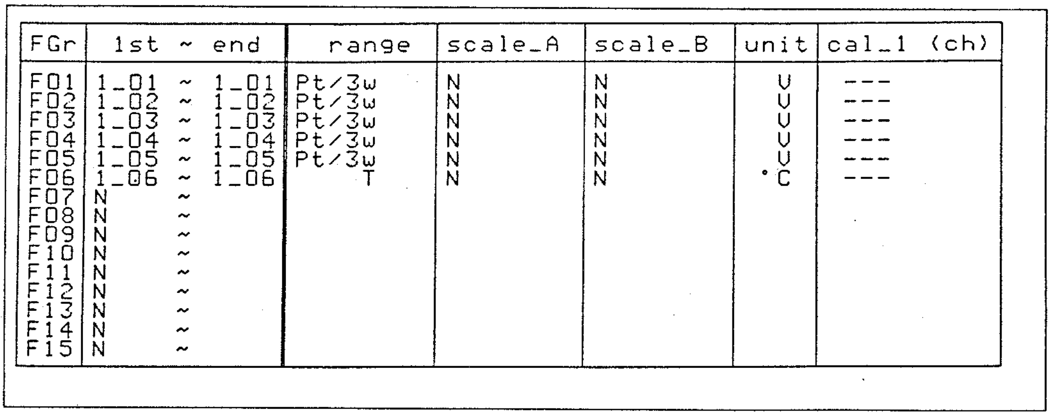
```
FG1,5FR13          FR13 and FU2 are set for FG1,5.
FU2;FR4FU3         FR4 and FU3 are set for FG6.
   ↑
   └────────────── In this cace, ';' means the same as FG6.
```

② If you omit the individual code existing after ';', the setting range will be changed according to the individual code immediately preceding the ';'.

Example 3)

```
FG1FC101;102;103;104;105;106
          ↑   ↑   ↑   ↑   ↑
          |   |   |   |   └──── Same meaninj as FG6FC
          |   |   |   └──────── Same meaning as FG5FC
          |   |   └──────────── Same meaning as FG4FC
          |   └──────────────── Same meaning as FG3FC
          └──────────────────── Same meaning as FG2FC
```

The following shows a screen image that will be presented when the settings shown in examples 2 and 3 above is executed:



FGr	1st ~ end	range	scale_A	scale_B	unit	cal_1 (ch)
F01	1_01 ~ 1_01	Pt/3w	N	N	V	---
F02	1_02 ~ 1_02	Pt/3w	N	N	V	---
F03	1_03 ~ 1_03	Pt/3w	N	N	V	---
F04	1_04 ~ 1_04	Pt/3w	N	N	V	---
F05	1_05 ~ 1_05	Pt/3w	N	N	V	---
F06	1_06 ~ 1_06	T	N	N	°C	---
F07	N ~					
F08	N ~					
F09	N ~					
F10	N ~					
F11	N ~					
F12	N ~					
F13	N ~					
F14	N ~					
F15	N ~					

NOTE

Enen if the setting immediately preceding a ';' is a range setting, this setting will be interpreted as a sole on.

③ Which of the three ranges previously set for the FG, AG, and TL group codes is set once again, depends on the individual code existing immediately before ';'.

Example 4)

```
FG1,5FR13
AG3,6AH+13.3FU3;FR12
            ‾‾‾
            ↑ ↑
            | └──── In this case, ';' means the same as FG6.
            |       For AG, that setting remains unchanged.
            └────── Individual code existing just before ';'
```

8.4.4 Stored-data Reference Command (RN)

The RN command outputs the number of scans of data measurements which were stored into the data buffer memory (option) being used in the "fix" or "ring" mode.
The command will output "0" if the output mode is "off"; however, no data will be output if the mode is "fifo".
The output format is as follows:

```
N␣ddddd      ddddd: 00000 to 99999
```

NOTE

Do not execute this command during log measurement or during recall operations. Abnormal operation may result if the command data overlaps the GPIB output of measured data.
Also, do not use the command during the "fifo" mode.

This command can also be used while the GPIB output mode is "off" (command code G00).

8.5 GPIB Command Code Lists

Note on description in Table 8-6:

In the GPIB command code lists given below, initial values in brackets ([ ]) are those which will be set when you turn the power on. These initial values are not initialized by execution of the PI (Parameter Initialize) command. All other initial values are initialized by execution of the PI command.

8.5.1 Parameter-setting Command Codes

In the command code lists below, "Immediately executed" means that you can execute the command without having to executing the PM command.

① Execution Parameter (The command must be executed immediately after a parameter setting has been changed)

Table 8 - 6 Parameter-setting Command Codes (1 of 20)

Code	Description	Format	Initial value
PM	Same function as that used to terminate a programming operation under key operations.	PM NOTE: Valid only while measurement is not in progress.	—

② Parameter Initialize

(2 of 20)

Code	Description	Format	Initial value
PI	Parameter setting to their initial values. (Immediately executed)	PI	—

③ Scan Format

(3 of 20)

Code	Description	Format	Initial value
CK	Data and time setting. (Immediately executed)	CKYYMMddhhmm ↑ Enter all 10 digits, two for each of YY, MM, dd, hh, and mm. YY:88 to 03 MM:01 to 12 dd:01 to 31 hh:00 to 23 mm:00 to 59	—

Code	Description	Format	Initial value
TM	Time mode	TMd └ 0 or 1 0 : Clock (Clock mode) 1 : Timer (Timer mode)	0
SC	Scan channels	SCddd, ddd └ Measurement ending channel (second ddd) └ Measurement starting channel (first ddd) 001≦ Measurement starting channel ≦ Measurement ending channel ≦930 NOTE: For SCddd, ddd is regarded as the measurement ending channel number and the measurement starting channel is set to 001. That is, SCddd is the same as SC001, ddd.	1, 30
MM	Measure mode	MMd └ 1 to 7 1: log 2: trend 3: log/trend 4: alarm 5: log/alarm 6: trend/alarm 7: log/trend/alarm	3
LI	Log scan interval	LIdd └ 0 to 54 See Table 8-7 for a description of 0 through 54.	19 (1min)
IT	Integral time	ITd └ 0 to 7 0: 1ms 1: 5ms 2: 10ms 3: 1PLC 4: 2PLC 5: 5PLC 6: 10PLC 7: 100PLC	3

(5 of 20)

Code	Description	Format	Initial value
SI	Step interval	SIdd.dd └── 0.00 to 99.99 (seconds)	00.00
MD	Measurement delay	MDd.dd └── 0.00 to 9.99 (seconds)	0.00
AZ	Auto-zero mode	AZd └── 0 or 1 0: Auto-zero OFF 1: Auto-zero ON	1
AF	Auto-full mode	AFd └── 0 or 1 0: Auto-full-calibration OFF 1: Auto-full-calibration ON	1
CN	Number of scans	CNddddd └── 0 to 99999 (times) NOTE: A setting of 0 executes no scans.	0
AS	Alarm check scan	ASd └── 0 or 1 0: Alarm check scan OFF 1: Alarm check scan ON	0

④ Function Group

(6 of 20)

Code	Description	Format	Initial value
FG	Function group	FGmm, nn └──┘── 1 ≦mm≦nn≦60 NOTE: If nn is omitted, then mm = nn.	〔1, 1〕

Code	Description	Format	Initial value
FC	Starting/ending function-channel numbers	FC ddd , ddd Group ending channel Group starting channel 1≤ Group starting channel ≤ Group ending channel ≤930 NOTE: If you set 'N'as the group starting channel number, that group will not be used. If you do not set the group ending channel number, then the group starting channel number becomes equal to the group ending channel number.	* 1,30
FR	Measurement range	FRdd 0 to 17 0: --(off) 9:R 1: 500mV 10:B 2: 5V 11:N 3: 50V 12:W5/W26Re 4: T 13:JPt/3w 5: J 14:JPt/4w 6: E 15:FLAG 7: K 16:Pt/3w 8: S 17:Pt/4w	* 1
FS	Scaling factor	FS scale A, scale B Scaling factor A setting of scale A only is regarded as a comma-less setting ("FS scaling factor") A setting of scale B only is regarded as a with-comma setting ("FS, scaling factor") Scaling factor: Polarity + Decimal point + Number of a maximum of 6 digits (For plus polarity, + can be omitted.) NOTE: A setting of 'N' as the scaling factor will execute no scaling.	* N

(8 of 20)

Code	Description	Format	Initial value
FU	Unit of measurement	FUd ↑ 0 to 7 0: Unit undetermined (Depends on the measurement range) 1: mV 2: V 3: ℃ 4: % 5: kg 6: Ω 7: Blank (No output)	* 0
FM	First-order calculation	FMd ↑ 0 to 6 0: No calculation 1: ΔN (Difference from any input point data) 2: ΔI (Difference from initial data) 3: ΔT (Difference from the previous data) 4: MAX (Maximum value) 5: MIN (Minimum value) 6: AVE (Average value)	* 0
FT	Calculate channel (Channel data to be calculated)	FTddd ↑ 1 to 930 NOTE: The value you set here becomes valid only for an FM5 (ΔN) setting; The setting operation itself, however, can be done at any one time.	001

*: The value applies to F01 only. The codes F02 through F60 are all set to N (Not used) in that case.

⑤ Alarm Group

(9 of 20)

Code	Description	Format	Initial value
AG	Alarm group	AGmm, nn ↑ ↑ 1≦mm≦nn≦60 NOTE: If nn is omitted, then mm = nn.	〔1, 1〕

(10 of 20)

Code	Description	Format	Initial value
AC	Starting/ending alarm-channel numbers	ACddd, ddd ↑ ↑ └Group ending channel number or ending calculate channel number └Group starting channel number or starting calculate channel number Channel number : 1 to 930 Calculate channel number : C1 to C30, or D1 to D30 NOTE: If you set the group start channel number to 'N', that channel line will not be used.)	* N
AH AL	High-limit value Low-limit value	AH limit value AL limit value Limit value: Polarity + Decimal point + Number of a maximum of 6 digits (For plus polarity + can be omitted) NOTE: If you set 'N' as the limit value, it will be regarded as unset.)	*N *N

*: The codes A01 through A60 are all set to N.

⑥ Calculate Channel

(11 of 20)

Code	Description	Format	Initial value
CG	Calculate channle	CGmmm, nnn ↑ ↑ └─┘ C1 to C30, or D1 to D30 NOTE : When nnn is abbreviated, mmm is nnn.	〔C1〕
CF	Function group	CFdd ↑ └── N, or 1 to 60 NOTE: The value will become invalid if set to N.	* N

(12 of 20)

Code	Description	Format	Initial value
CM	Second-order calculation	CMd 0 to 2 0: MAX (Maximum value) 1: MIN (Minimum value) 2: AVE (Average value)	MAX

*: Not only the code C1 but also C2 through C30 and D1 through D30 are all set to N.

⑦ Printer (Trend)

(13 of 20)

Code	Description	Format	Initial value
TL	Trend group	TLmm , nn 1≦mm≦nn≦12 NOTE: If nn is omitted, then mm = nn.	〔1, 1 〕
TC	Trend channel	TCddd Channel number or calculate channel number Channel number : 001 to 930 Calculate channel number : C1 to C30, or D1 to D30 NOTE: If you set the group starting channel number to 'N', that channel line will not be used.	* 001

(14 of 20)

Code	Description	Format	Initial value
TP	Trend position	TPdd └── 0 to12 0: 0% position 1: 10% position 2: 20% position 3: 30% position 4: 40% position 5: 50% position 6: 60% position 7: 70% position 8: 80% position 9: 90% position 10:100% position 11:110% position 12:120% position	* 1
TS	Trend scale	TSd , nn └── Exponent of 10^{nn} (-6≦nn≦+5) └── 1, 2, 5	* 5, 2 (500.)
TZ	Trend mode	TZd └── 0 or 1 0: absolute mode 1: relative mode	* 0

*: The value applies to line 1 only. For lines 2 through 12 the trend scale and the trend mode are set to 500mV and "absolute", respectively, and the trend channel and the trend position are set as follows:

line	Trend channel	Trend position
2	002	20 %
3	003	30 %
4	004	40 %
5	005	50 %
6	006	60 %
7 to 12	N	0 %

⑧ GPIB Control

(15 of 20)

Code	Description	Format	Initial value
GH	Header control	GHd 0 or 1 0: Header OFF 1: Header ON	1
GF	Talker format	GFd 0 to 2 0: Basic format 1: Omission format 2: Binary format	0
DL	Block delimiter	DLd 0 to 2 0: CR, LF/EOI 1: LF 2: EOI	0
SL	String delimiter	SLd 0 or 1 0: , (comma) 1: LF	0
GO	Output controller	GOd 0 or 1 0: GPIB output OFF 1: GPIB output ON	0
GT	Monitor scan data output	GTd 0 or 1 0: Monitor scan data output OFF 1: Monitor scan data output ON	0

⑨ Buffer Memory

(16 of 20)

Code	Description	Format	Initial value
ME	Memory mode	MEd 0 to 3 0: off 1: fix mode 2: ring mode 3: fifo mode	* 0 1 2 0
MC	Buffer memory clear (Immediately executed)	MC NOTE: Execution of this command clears the buffer memory contents.)	—
MS	Monitor scan data storage	MSd 0 or 1 0: Monitor scan data storage OFF 1: Monitor scan data storage ON	1
MT	Recall start position	MTd, ddddd Log number Number of log scans	0, 1
MP	Recall stop position	MPd, ddddd Log number Number of log scans Number of log scans : 0 to 9 Log number : 1 to 99999	9, 99999

* : The initial value depends on the mode.

⑩ Others

(17 of 20)

Code	Description	Format	Initial value
LF	Line frequency	LFd └──── 0 or 1 0: 50Hz 1: 60Hz	—
RJ	Reference contacts compensation	RJd └──── 0 or 1 0: Internal 1: External	0
SO	Sensor out	SOd └──── 0 or 1 0: Sensor out OFF 1: Sensor out ON	1
EP	External start signal	EPd └──── 0 or 1 0: Pulse signal 1: Level signal	0
LZ	Linearize	LZd └──── 0 or 1 0: Linearize OFF 1: Linearize ON	1

⑪ Digital Print Channel

(18 of 20)

Code	Description	Format	Initial value
DC	Digital channel	DCddd └── Channel number or calculate channel number Channel number : 1 to 930 Calculate channel number: C1 to C30, or D1 to D30 NOTE: If you set the channel number to 'N', the corresponding printout will be blank.	N*
DN	Digital group	DNmm, nn └── 1≦mm≦nn≦30 NOTE: If you omit nn, then mm = nn.	[1, 30]

* : Print channels 1 to 10 are set to 001 to 010.

⑫ Calibration

(19 of 20)

Code	Description	Format	Initial value
CU	Calibration unit	CUd └── Measurement unit number Measurement unit number: 0 to 9	0
CR	Calibration (Immediately executed)	CRd └── 0 to 6 0: ZERO 1: +50mV FULL 2: +500mV FULL 3: +5V FULL 4: +50V FULL 5: Pt 6: Tc	—
CP	Pt calibration data (100Ω reference resistance data for Pt resistance thermometer bulb) (Immediately executed)	CPddd.ddd └── Pt calibration data Pt calibration data: 90.000 to 110.000	100.000

Code	Description	Format	Initial value
CT	Tc calibration data (Temperature of reference cold contacts) (Immediately executed)	CT±d.d ↑ └── Tc calibration data Tc calibration data: Polarity +0.0 to 0.9 (For plus polarity + can be omitted)	0.0

Table 8 - 7 Log Scan Interval Code (LIdd) List

Code	Log interval	Monitor interval	Code	Log interval	Monitor interval
0	0.1 sec	0.1 sec	29	40 min	1 min
1	0.2 sec	0.1 sec	30	50 min	1 min, 15 sec
2	0.3 sec	0.1 sec	31	1 h	1 min, 30 sec
3	0.4 sec	0.1 sec	32	2 h	3 min
4	0.5 sec	0.1 sec	33	3 h	4 min, 30 sec
5	0.6 sec	0.1 sec	34	4 h	6 min
6	0.8 sec	0.1 sec	35	5 h	7 min, 30 sec
7	1 sec	0.1 sec	36	6 h	9 min
8	2 sec	0.1 sec	37	7 h	10 min, 30 sec
9	3 sec	0.1 sec	38	8 h	12 min
10	4 sec	0.1 sec	39	9 h	13 min, 30 sec
11	5 sec	0.1 sec	40	10 h	15 min
12	6 sec	0.1 sec	41	11 h	16 min, 30 sec
13	8 sec	0.2 sec	42	12 h	18 min
14	10 sec	0.2 sec	43	13 h	19 min, 30 sec
15	20 sec	0.5 sec	44	14 h	21 min
16	30 sec	0.6 sec	45	15 h	22 min, 30 sec
17	40 sec	1.0 sec	46	16 h	24 min
18	50 sec	1.0 sec	47	17 h	25 min, 30 sec
19	1 min	1.5 sec	48	18 h	27 min
20	2 min	3.0 sec	49	19 h	28 min, 30 sec
21	3 min	4.5 sec	50	20 h	30 min
22	4 min	6.0 sec	51	21 h	31 min, 30 sec
23	5 min	7.5 sec	52	22 h	33 min
24	6 min	9.0 sec	53	23 h	34 min, 30 sec
25	8 min	12.0 sec	54	24 h	36 min
26	10 min	15.0 sec			
27	20 min	30.0 sec			
28	30 min	45.0 sec			

8.5.2 Measurement Control Command Code and Other Command Codes

① Measurement Control

Table 8 - 8 Measurement Control Command Code and Other Command Codes (1 of 8)

Code	Description	Format	Initial value
T	Log scan	Td 0 to 2 0: Log scan stop 1: Log scan start 2: Single log scan	〔0 〕

② Printer Control

(2 of 8)

Code	Description	Format	Initial value
W	Printing	Wd 0 or 1 0: Printing OFF 1: Printing ON	—
FD	Paper feed	FD	—

③ Memory Control

(3 of 8)

Code	Description	Format	Initial value
RE	Recall	REd 0 or 1 0: Recall OFF 1: Recall ON	〔0 〕
SE	Store	SEd 0 or 1 0: Store OFF 1: Store ON	—

(4 of 8)

Code	Description	Format	Initial value
RN	Reference to the number of sets of stored data	RN Execution of this command outputs the number of sets of stored data in the following format: N␣ddddd ↑ Number of sets of stored data: 00000 to 99999	—

④ SRQ Control

(5 of 8)

Code	Description	Format	Initial value
S	Service request	Sd ↑ 0 to 3 0: Issues an SRQ. 1: Does not issue an SRQ. 2: Issues an SRQ as so does S0. External SRQ's, however, are ignored, and bit D5 in the status byte remains cleared and is not set. 3: Does not issee an SRQ as so does not S1. External SRQ's, however, are ignored, and bit D5 in the status byte remains cleared and is not set.	[1]

⑤ Alarm Relay External Control

(6 of 8)

Code	Description	Format	Initial value
AR	Alarm relay external control	ARd ↑ 0 or 1 0: Relay OFF 1: Relay ON	[0]

⑥ Initialize

(7 of 8)

Code	Description	Format	Initial value
C0	R7430 initialize	C0 This command resets the GPIB to its initial status. This command is operated like the DCL/SDL command.	—

⑦ Call channel Control

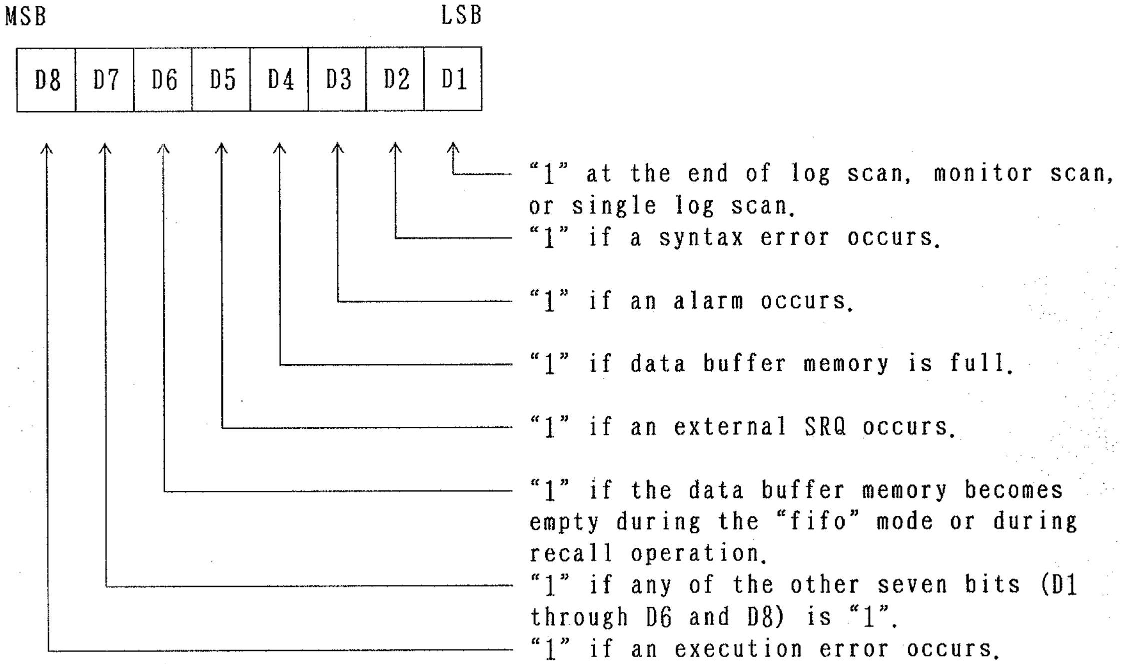
(8 of 8)

Code	Description	Format	Initial value
CH	Call channel measurement	CHd 0 or 1 0: Stop of the call channel measurement 1: Start of the call channel measurement	—
CC	Channel specification for the call channel measurement	CCddd, dd Display position Channel No. Display position : 1 to 10 Channel No. : 1 to 930, N If the display position is not specified, it is regarded as 01.	001 to 010

8.6 Service Requests

During the S0 or S2 mode, a service request will be issued to the controller when the equipment receives either an end-of-measurement code or an undefined code.
The meaning of the issued service request can be identified by status byte. Status bytes are read out by execution of serial polling from the controller.

8.6.1 Status Byte



"1" at the end of log scan, monitor scan, or single log scan.
"1" if a syntax error occurs.
"1" if an alarm occurs.
"1" if data buffer memory is full.
"1" if an external SRQ occurs.
"1" if the data buffer memory becomes empty during the "fifo" mode or during recall operation.
"1" if any of the other seven bits (D1 through D6 and D8) is "1".
"1" if an execution error occurs.

8.6.2 Description of Status Byte Causes

(1) D1 (End of scan)

When either log scan, monitor scan, or single log scan ends, this bit becomes "1" and a service request is issued to the controller.
This bit is cleared by either the end of sending of measured data or the start of log measurement.

(2) D2 (Syntax error)

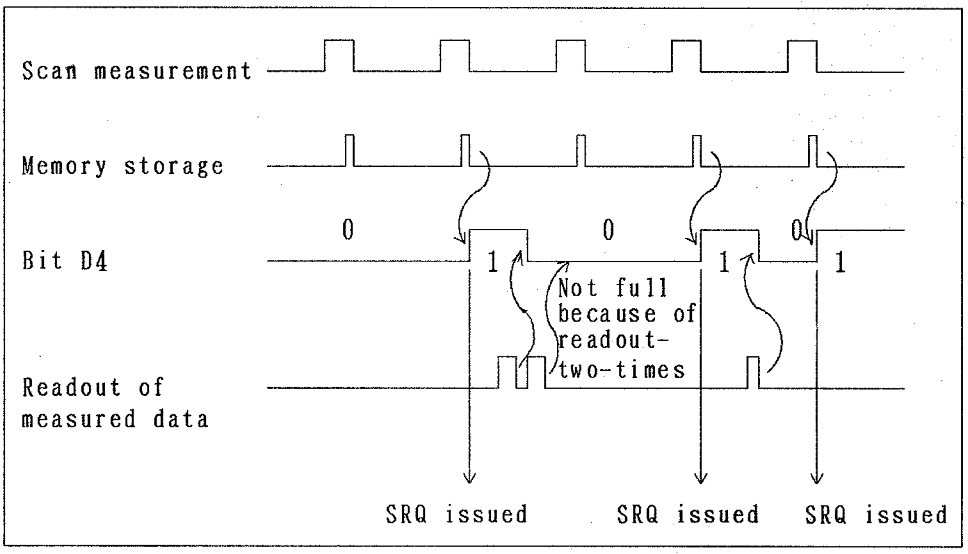
During remote programming, when an undefined program code or a setting error is detected, this bit becomes "1" and a service request is issued to the controller.
This bit is cleared by execution of correct remote programming.

(3) D3 (Alram)

During log scan, monitor scan, or single log scan measurement, if an alarm is detected by high-/low-limit judgment, this bit becomes "1" and a service request is issued to the controller.
This bit is cleared by removal of the cause of the alarm.

(4) D4 (Data buffer memory full)

If the data buffer memory becomes full during its use in the fix, ring, or fifo mode, this bit becomes "1" and a service request is issued to the controller.
For the fix or ring mode, this bit is cleared by execution of Memory Clear.
For the fifo mode, this bit is cleared by readout of measured data because a free area is generated in the memory.
During the fifo mode, bit D4 changes as follows:



(5) D5 (External SRQ)

When the contacts signal or external SRQ turns ON, this bit becomes "1" and a service request is issued to the controller.
This bit is cleared by execution of serial polling.

(6) D6 (Data buffer memory empty)

For fix or ring mode:

During recall of measured data, when the final data is output and the recall operation ends, this bit becomes "1" and a service request is issued to the controller.
This bit is cleared by either the start of the next recall operation, execution of serial polling, or execution of Memory Clear.

For fifo mode:

If the data buffer memory runs out of measured data, bit D6 becomes "1" and a service request is issued.
This bit is cleared by writing of measured data into the data buffer memory or by execution of Memory Clear.

(7) D7 (RQS)

This bit is set to "1" if any of the other seven bits (D1 through D6 and D8) becomes "1", and is set to "0" if all causes become "0".

(8) D8 (Execution error)

For commands of the "immediately executed" type, if an error occurs during operation, this bit becomes "1" and a service request is issued. This bit is cleared by serial polling.

8.6.3 Status Byte Readout

The controller can read out the status byte by executing serial polling operations.

For a GPIB address of 1, the status byte is read out into variable S by the following commands:

- For PC-9801 .... POLL 1,S
- For HP-9816 .... S=SPOLL (701)
- For HP-9845B ... STATUS 701; S

8.7 Other Functions

8.7.1 Device Trigger Function

Log measurement can be started using a GET command.
This function is the same as command code T1.

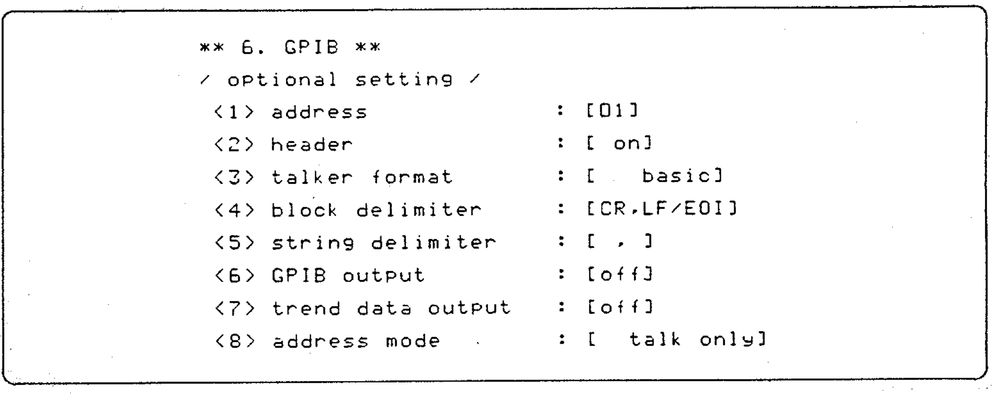
8.7.2 Device Clear Function

External devices previously connected to the equipment can be reset to their initial states using SDC or DCL commands.
This function is the same as command code C0.

8.8 General Precautions on Operation

(1) Notes on Use of Only Modes

To use only modes, set the address mode to talk only on the GPIB setting screen and also set the address mode for the GPIB-connected unit to an only mode.
At this time, do not operate the controller together with the unit. Otherwise, commands from the controller will be ignored and abnormal operation may result.
During only modes, address settings are ignored but all other settings are valid.



```
** 6. GPIB **
/ optional setting /
 <1> address              : [01]
 <2> header               : [ on]
 <3> talker format        : [   basic]
 <4> block delimiter      : [CR,LF/EOI]
 <5> string delimiter     : [ , ]
 <6> GPIB output          : [off]
 <7> trend data output    : [off]
 <8> address mode         : [  talk only]
```

Figure 8 - 4 Only Mode Setting Screen

(2) Power Failures During Operation

If a power failure (whether it be sustained or momentary) occurs during the operation of the entire equipment (GPIB system included), its subsequent normal operation cannot be guaranteed. This also applies to all component units of the GPIB system.

(3) Controller Interrupts During Data Transfer Between Units

For the GPIB system, data can be transferred between units other than the controller. During data transfer between units (that is, in the middle of handshaking), if the controller is switched over to the serial polling mode or if a controller interrupt is generated for addition of listeners or other purposes, then the data transfer operation will be interrupted and priority will be given to the controller interrupt. Data transfer will resume after processing of the interrupt.
In general, programming should be done so that prior to the start of data transfer between units, the controller can recognize the status of the data transfer operation.

(4) Notes on GPIB Programming

① Log measurement starts within one second of recognition of the measurement start command.

② Single-log-scan requests will be ignored if they are issued during scan measurement, that is, during the time from the start of scan measurement to the end of data output onto the printer.
To execute continuous measurement using the single-log-scan mode, therefore, the status bit of the end of scan must be checked before executing the next measurement start command.

③ Execute recall commands with measurement not in progress. If a recall command is executed during log measurement, an execution error will occur and the command will be ignored.

④ Clear the data buffer memory before changing the memory mode. If an attempt is made to change the memory mode with data remaining stored within the memory, an execution error will occur and the memory mode will not be changed.

⑤ A maximum of 250 characters are recognized during one transfer operation of program codes. Program codes containing more than 250 characters are handled as erroneous codes.

(5) Abortion of GPIB Data Tranfer Handshaking

Log measurement will stop in its on-going status if you abort handshaking (by turning off the controller, for example) during output of measured data. In that case, no further measurements can be performed, unless you change the GPIB output setting to [off] under key operations or by executing a GPIB command. The log measurement mode will then be canceled.

8.9 Program Examples

(1) If SRQ is not reuired (Programming with HP-9816)

A program used to measure/print out one to thirty channels of data under the following conditions and then fetch the data into the controller:

Mode : Log/Trend
Log interval: 1 minute

```
10     DIM A$[13].B$[6].C(30.2)
20     CLEAR 7
30     Gpa=701
40     !
50     OUTPUT Gpa;"PIMM3LI19CN5"
60     OUTPUT Gpa;"FG01,01FC001,010FR3"
70     OUTPUT Gpa;"FG02,02FC011,030FR4"
80     OUTPUT Gpa;"SC001,030"
90     OUTPUT Gpa;"TL1,6TS1.-1TZ1"
100    OUTPUT Gpa;"WOS1GHOGF1G01GT1"
110    OUTPUT Gpa;"PMT1"
120    !
130 Data_get:  ENTER Gpa USING "#.K":A$
140            PRINT A$
150            ENTER Gpa USING "#.K":B$
160            PRINT B$
170            !
180            FOR N=1 TO 30
190            ENTER Gpa USING "#.K.K":C(N.1).C(N.2)
200            PRINT C(N.1).C(N.2)
210            NEXT N
220            !
230            ENTER Gpa USING "1A":A$
240            SEND 7:CMD UNT
250    GOTO Data_get
260    END
```

[Description of the program]

10: Definition of the data area

20: Device Clear Command
(It turns on the power to clear the state before measurement)

30: Definiton of the listener address as Gpa

50: PI (Parameter initialization)
MM3 (log/trend mode)
LI19 (Log interval = 1min, Monitor interval = 1.5sec)
CN5 (Number of scans to be performed = 5)

60: FG01,01FC001,010FR3
(Channels 1 through 10 are set to the 50V range as function group 1.)

70: FG02,02FC011,030FR4
(Channels 11 through 30 are set to the T range as function group 2.)

80: SC001,030 (Scan channels 1 through 30)

90: TL1,6 (Trend print, lines 1 through 6)
TS1,-1 (Trend scale = 1 x 10^{-1})
TZ1 (relative mode)

100: W0 (Printing OFF)
S1 (SRQ not to be issued)
GH0 (Header OFF)
GF1 (Omission format)
GO1 (GPIB output ON)
GT1 (Monitor scan data output ON)

110: PM (Parameter setting command)
T1 (Log scan start)

130: Clock data read (Delimiter must not be numerics.)

150: Log scan number read (Delimiter must not be numerics.)

180: to 210: Reading of channels No. 1 through No. 30 and their measured data
(Delimiter must not be numerics.)

230: Reads one character of the last LF

240: UNTALK selection

(2) If SRQ is required (Programming with HP-9816)

A program used to measure data under the same conditions as those shown in item (1) above, and then fetch the data into the controller.

```
10     DIM A$[13],B$[6],C(30,2)
20     CLEAR 7
30     Gpa=701
40     Mask=2
50     !
60     ON INTR 7 GOSUB Data_get
70     !
80     OUTPUT Gpa;"TOPIMM3LI19CN5"
90     OUTPUT Gpa;"FG01,01FC001,010FR3"
100    OUTPUT Gpa;"FG02,02FC011,030FR4"
110    OUTPUT Gpa;"SC001,030"
120    OUTPUT Gpa;"TL1,6TS1,-1TZ1"
130    OUTPUT Gpa;"W1SOGHOGF1GO1GT1"
140    OUTPUT Gpa;"PMT1"
150    ENABLE INTR 7;Mask
160    !
170 Loop: !
180         GOTO Loop
190    !
200 Data_get: !
210              S=SPOLL(Gpa)
220              IF S<>65 THEN GOTO Get_end
230              ENTER Gpa USING "#,K";A$
240              PRINT A$
250              ENTER Gpa USING "#,K";B$
260              PRINT B$
270              FOR N=1 TO 30
280                     ENTER Gpa USING "#,K,K";C(N,1),C(N,2)
290                     PRINT C(N,1),C(N,2)
300              NEXT N
310              ENTER Gpa USING "1A";A$
320              SEND 7;CMD UNT
330 Get_end:     !
340              ENABLE INTR 7;Mask
350              RETURN
360    END
```

[Description of the program]

10: Definition of the data area

20: Device Clear Command
(It turns on the power to clear the state before measurement)

30: Definition of the listener address as Gpa

40: Setting of the GPIB interrupt masking

60: Definition of the starting address of an interrupt processing routine

150: Interrupt enable

170: Waiting for an interrupt
to
180:

210: Execution of serial polling

220: Confirmation of scan end

230: Reading of clock data

250: Log scan number reading

270: Reading of channels No. 1 through No. 30 and their measured data
to
300:

310: Reads one character of the last LF

320: UNTALK selection

340: Interrupt enable

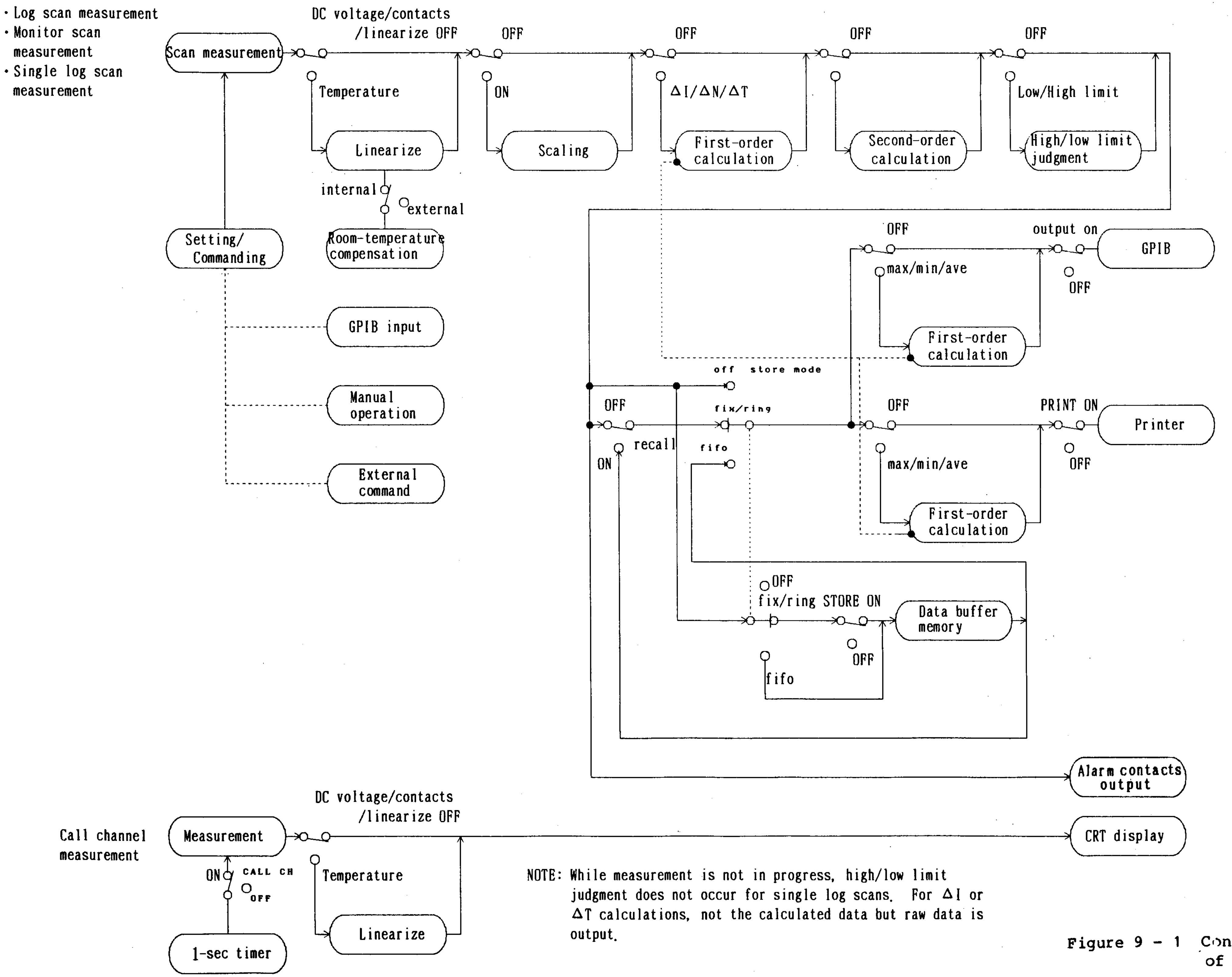
9. OPERATION DESCRIPTION

This section describes the operation of the R7430.

9.1 Operation Overview

The R7430/74301 measures data while scanning each channel using the internal microprocessor (μP) or the equipment. After measured data has been undergone appropriate room-temperature compensation and linearization according to the measurement range, the data is output to the printer, the GPIB system, the data buffer memory, and the CRT display unit. Channel data that has been preselected as calculate channel data is operated on, and if high and low alarm levels are preset, alarm judgment is also performed.
The flow of data is shown in Figure 9-1, and the internal configuration of the equipment is shown in Figure 9-2.

9.1 Operation Overview



NOTE: While measurement is not in progress, high/low limit judgment does not occur for single log scans. For ΔI or ΔT calculations, not the calculated data but raw data is output.

Figure 9 - 1 Conceptual Diagram of Data Flow

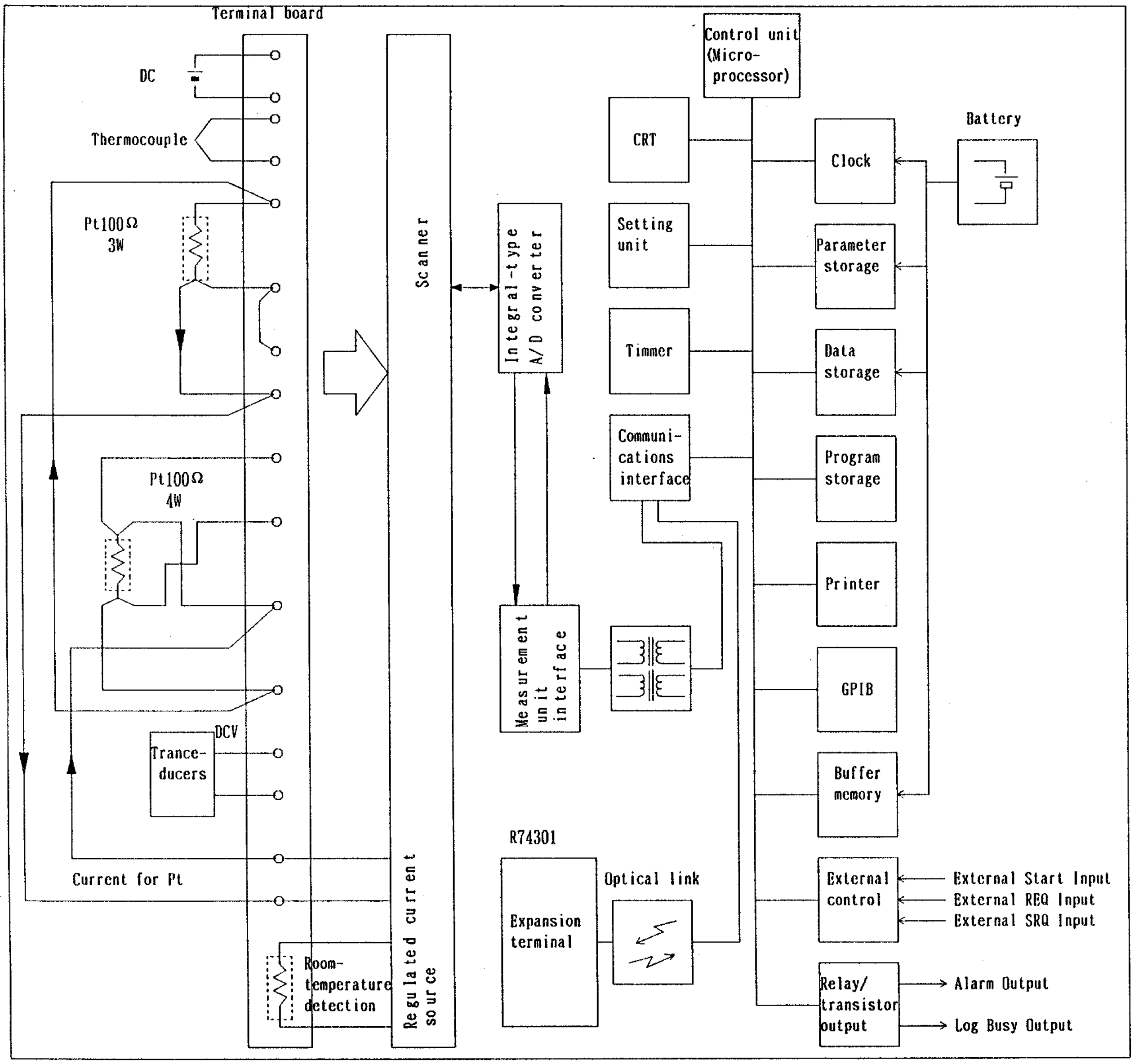
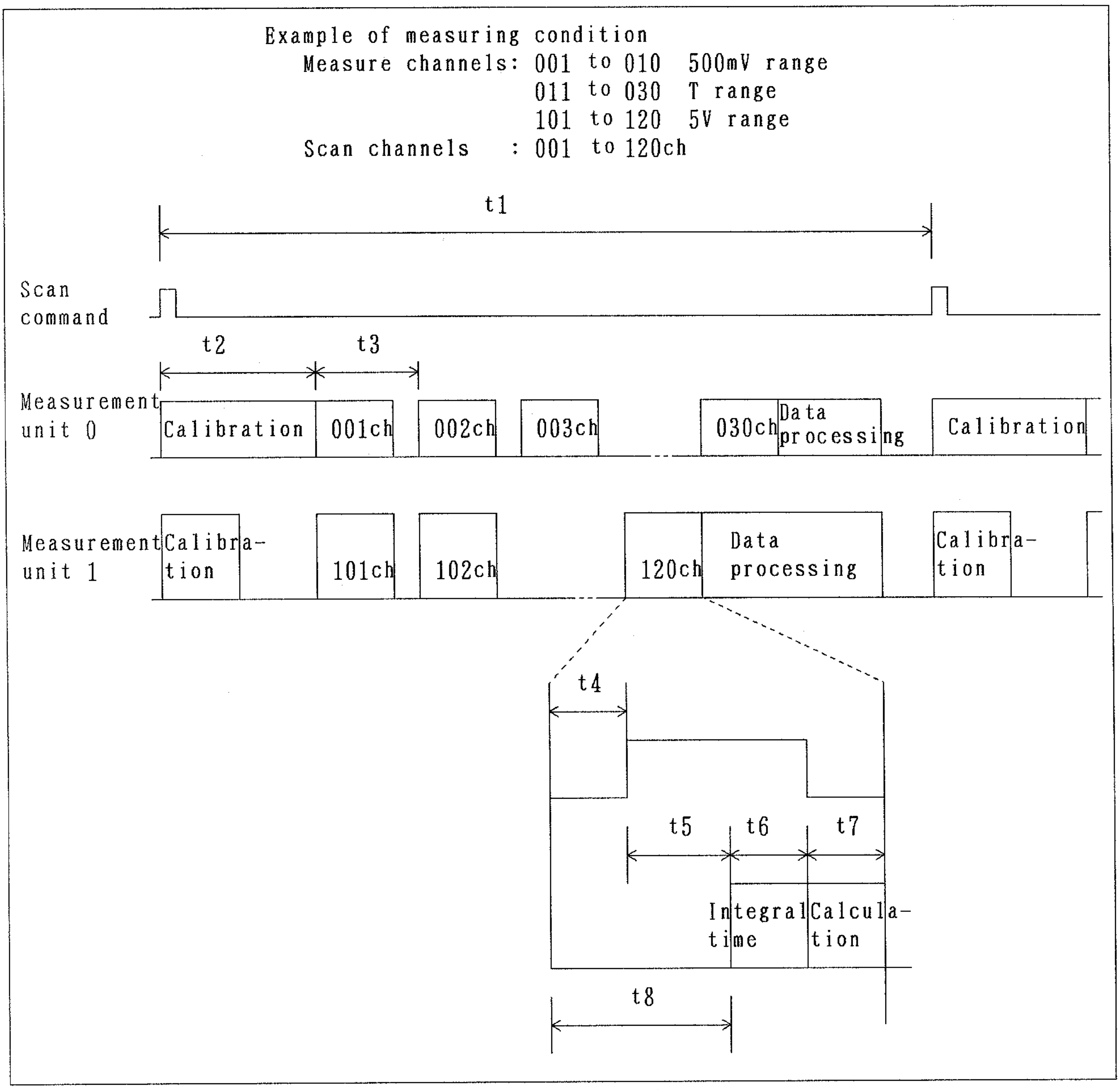


Figure 9 - 2 R7430 Block Diagram

9.2 Measurement Operation

9.2.1 Basic Operation Timing and Execution Time



Example of measuring condition
Measure channels: 001 to 010 500mV range
011 to 030 T range
101 to 120 5V range
Scan channels : 001 to 120ch

Figure 9 - 3 Basic Operation Timing and Execution Time

t1: Log interval time or monitor interval time.
Determined by the measuring mode or the log interval time, respectively.

t2: Calibration time (Auto-zero/auto-full-calibration)
If the setting for calibration is ON, calibration will be performed for the measurement range(s) being used within the measurement unit.

Auto-zero calibration time t_Z
$t_Z \fallingdotseq$ (Integral time) + (1.2ms x Number of execution ranges*) + 1ms

Example)
Integral time : 1PLC (for 50Hz)
Number of execution ranges: 2

$t_Z \fallingdotseq 20ms + 1.2ms \times 2 + 1ms = 23.4ms$

Auto-full-calibration time t_F
$t_F \fallingdotseq 250ms$

t3: Step interval time (0.00 to 9.99 sec)
If this value < measuring time, then continuous measurement.

t4: Relay switching time
$t4 \fallingdotseq 1.5ms$

t5: Settling time
$t5 \fallingdotseq 1.2ms$

t6: Integral time
$t6 \fallingdotseq 1ms$ to 2sec

t7: Data arithmetic processing time
$t7 \fallingdotseq 1ms$

t8: Measurement delay time
$t8 \fallingdotseq 0$ to 9.99sec (If $t8 = 0$, then $t8 = t4 + t5 \fallingdotseq 2.7ms$)

*: The number of execution ranges refers to the number of types of ranges being used within one measurement unit.
The total number of points listed in the table below becomes the number of execution ranges.

Type of range	Points
500mV	1
5V	1
50V	1
Tc (Thermocouple)	1
Pt (Platinum resistance thermometer bulb)	1
Contacts (FLAG)	0

NOTE: The number of points becomes 1 for use of both 500mV and Pt.
If 500mV, Pt, T (Thermocouple), and J (Thermocouple) are used, then:

$$\underset{\uparrow\ \text{500mV + Pt}}{\underline{1}} + \underset{\uparrow\ \text{T + J}}{\underline{1}} = 2 \text{ (points)}$$

9.2.2 Measurement Modes and Scan Modes

The following seven measurement modes are available:

① log mode
② alarm mode
③ log/alarm mode
④ trend mode
⑤ trend/alarm mode
⑥ log/trend mode
⑦ log/trend/alarm mode

The following four scan modes are available:

① log scan
② monitor scan
③ single log scan
④ call channel

Table 9-1 represents the relationship between each measurement mode and scan mode.

Table 9 - 1 Relationship Between Each Measurement Mode and Scan Mode

	Measurement mode	Scan mode			
		log	monitor	single log	call channel
During log measurement	log	✓		✓	✓
	alarm	✓		✓	✓
	log/alarm	✓	✓	✓	✓
	trend	✓	✓	✓	✓
	trend/alarm	✓	✓	✓	✓
	log/trend	✓	✓	✓	✓
	log/trend/alaram	✓	✓	✓	✓
Not during log measurement	——			✓	✓

✓ : Available
(Blank) : Not available

It depends on the selected measurement mode whether the log scan mode and the monitor scan mode are available, and measurement occurs at fixed intervals.
Single log scan measurement can be executed at any clock time.
Call channel measurement occurs at intervals of about one second.
Log scan measurement occurs at the intervals specified by the log interval time.

Monitor scan measurement occurs at the intervals specified by the monitor interval time which is automatically determined by the log interval time.

During the log/alarm mode, only log scan data is output but alarm detection uses both log scan data and monitor scan data.

Log scan data and alarm data can be printed out in digital form.

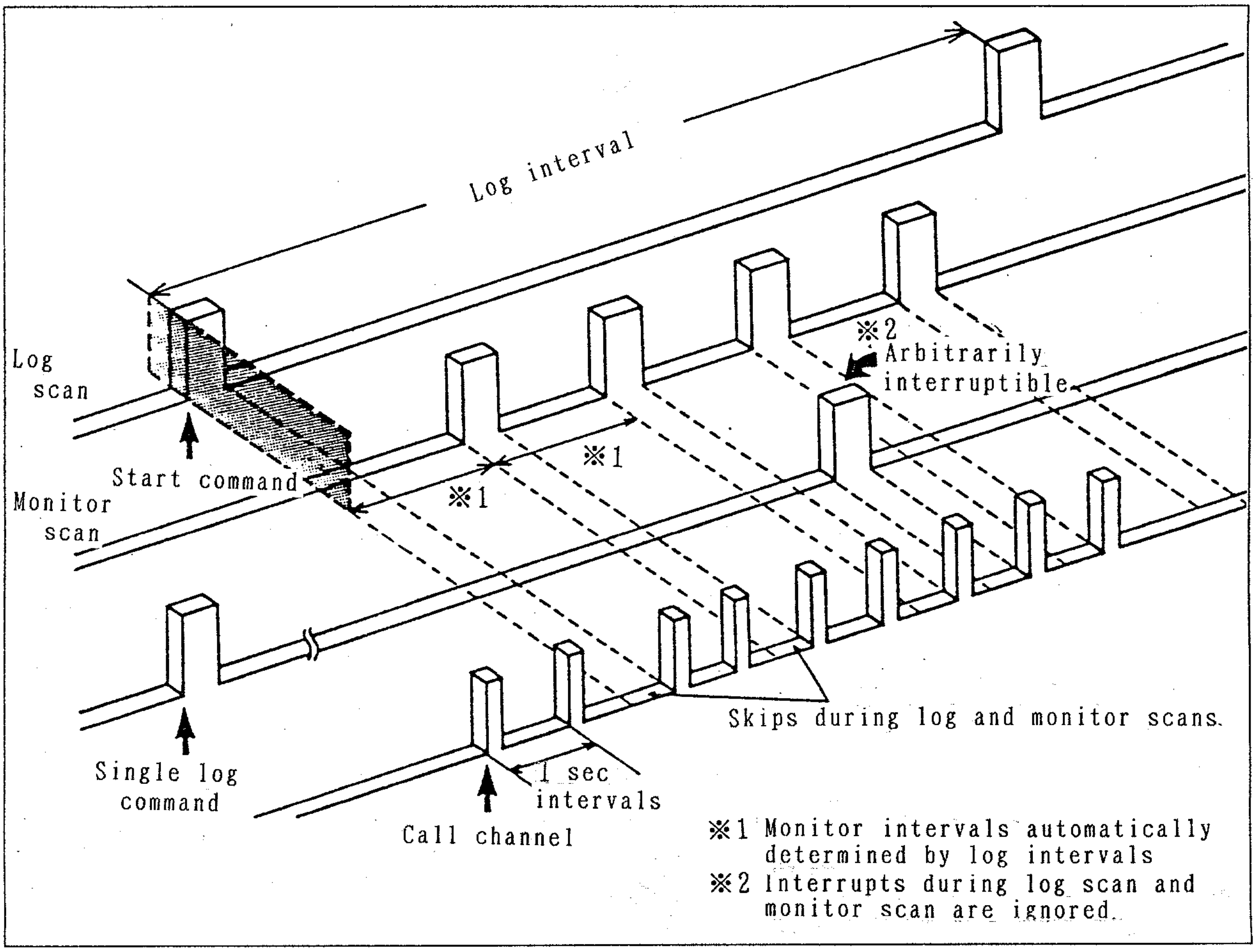
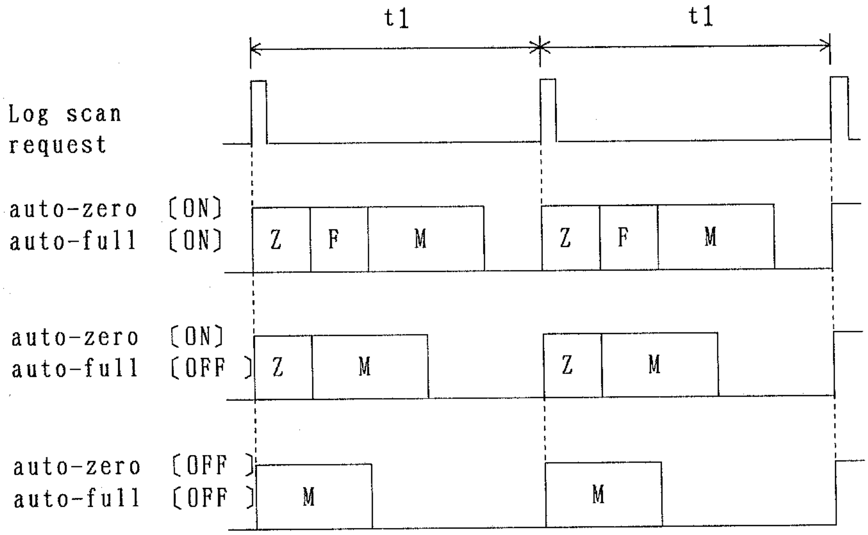


Figure 9 - 4 Conceptual Diagram of Scan Mode Operation

9.2.3 Measurement Modes and Calibration Timing

(1) For the log or alarm modes

Only log scan measurement is performed. Monitor scan measurement is not performed.
Both zero-calibration and full-calibration are performed at the start of log scan measurement.
Although auto-zero [OFF] and auto-full [ON] can be set, respectively, auto-full calibration will offer no merits in accuracy unless auto-zero calibration is performed at the same time.

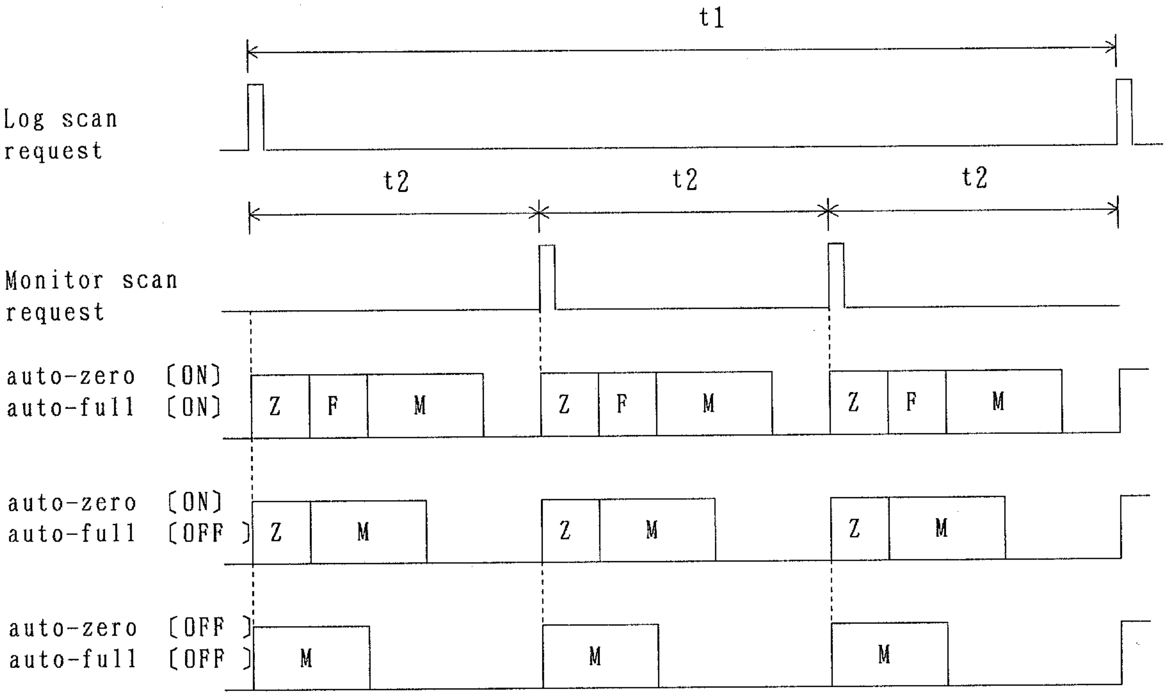


t1: Log interval time
Z : Zero-calibration (Calibration of zero-drift)
F: Full-calibration (Calibration of fullscale drift)
M: Measurement/data processing

(2) For the log/alarm, trend, trend/alarm, log/trend, and log/trend/alarm modes

Zero-calibration and full-calibration are performed at the start of each scan measurement.

Although auto-zero [OFF] and auto-full [ON] can be set, respectively, auto-full calibration will offer no merits in accuracy unless auto-zero calibration is performed at the same time.



t1: Log interval time
t2: Monitor interval time
Z : Zero-calibration (Calibration of zero-drift)
F: Full-calibration (Calibration of fullscale drift)
M: Measurement/data processing

9.2.4 Measuring Instruction and Calibration

The following table lists conditions for calibrating auto-zero and auto-full which are determined by measuring instruction and parameter set condition.

Measuring instruction / Parameter set		Log scan	Monitor scan	Single log scan	Call channel
auto-zero	ON	o	o	o	o
	OFF	X	X	o	X
auto-full	ON	o	o	o	X
	OFF	X	X	o	X

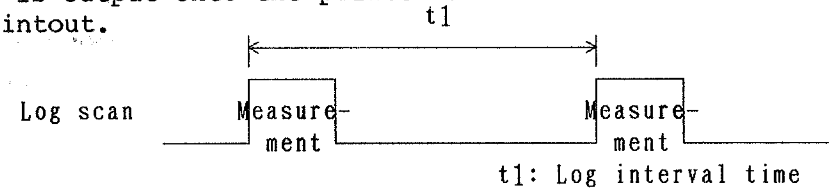
o ; Enables calibration.
X ; Disables calibration.

As shown above, the single log scan is calibrated although the parameter is off. In measurement of call channel, no auto-full is always calibrated.

9.2.5 Measurement Modes and Scan Timing

(1) For the log mode

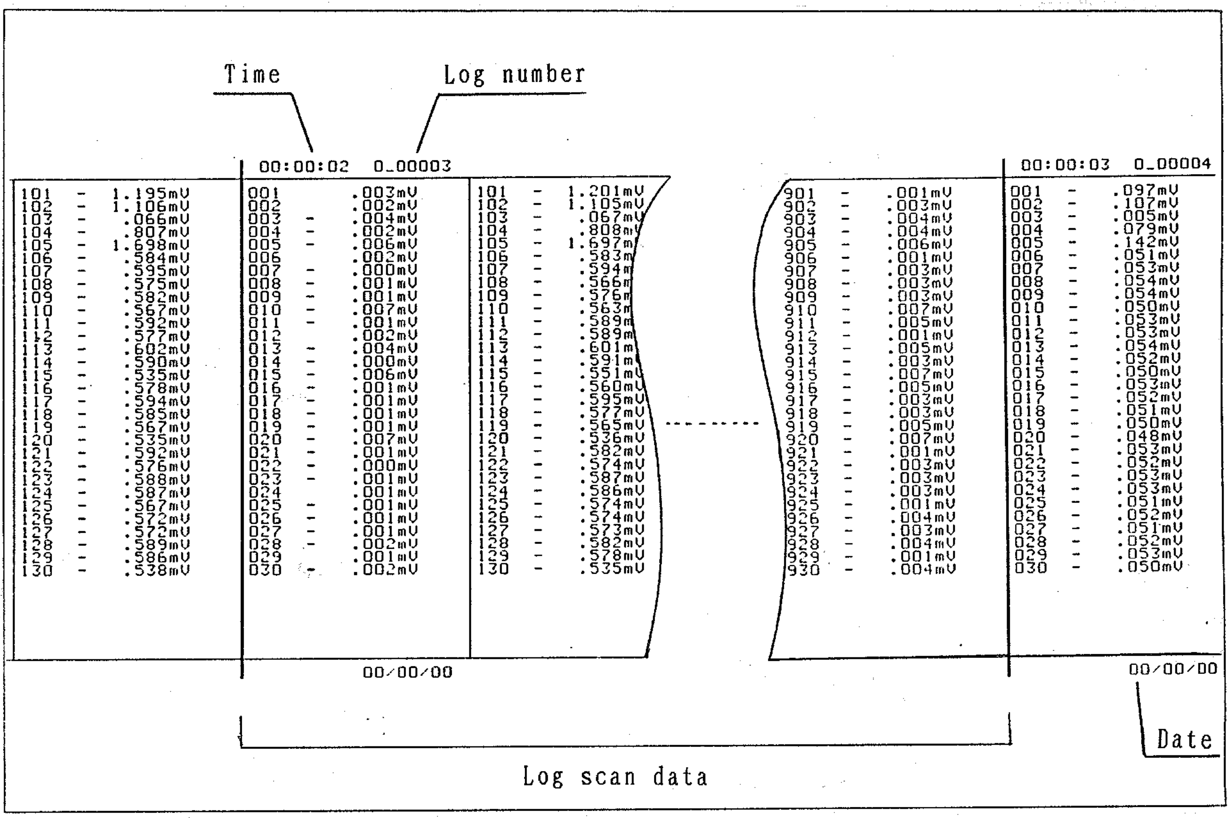
Only log scan measurement is performed. Monitor scan measurement is not performed.
Measured data is output onto the printer as a maximum of 300 channels of digital printout.



Output / Scan measurement	Printer		GPIB
	Digital print	Trend print	
Log scan	✓ ※1		✓ ※1

✓ : Continually output
(Blank): Not output

※1 : 300CH max.
(During use of calculate channels, 360CH max.)



```
101   -   1.195mV
102   -   1.106mV
103   -    .066mV
104   -    .807mV
105   -   1.698mV
106   -    .584mV
107   -    .595mV
108   -    .575mV
109   -    .582mV
110   -    .567mV
111   -    .592mV
112   -    .577mV
113   -    .602mV
114   -    .590mV
115   -    .535mV
116   -    .578mV
117   -    .594mV
118   -    .585mV
119   -    .567mV
120   -    .535mV
121   -    .592mV
122   -    .576mV
123   -    .588mV
124   -    .587mV
125   -    .567mV
126   -    .572mV
127   -    .572mV
128   -    .589mV
129   -    .586mV
130   -    .538mV
```

```
00:00:02  0_00003
001            .003mV
002            .002mV
003   -        .004mV
004   -        .002mV
005   -        .006mV
006            .002mV
007   -        .000mV
008   -        .001mV
009   -        .001mV
010   -        .007mV
011   -        .001mV
012            .002mV
013   -        .004mV
014   -        .000mV
015   -        .006mV
016   -        .001mV
017   -        .001mV
018   -        .001mV
019   -        .001mV
020   -        .007mV
021   -        .001mV
022   -        .000mV
023   -        .001mV
024   -        .001mV
025   -        .001mV
026   -        .001mV
027   -        .001mV
028   -        .002mV
029   -        .001mV
030   -        .002mV
101   -   1.201mV
102   -   1.105mV
103   -    .067mV
104   -    .808m
105   -   1.697m
106   -    .583m
107   -    .594m
108   -    .566m
109   -    .576m
110   -    .563m
111   -    .589m
112   -    .589m
113   -    .601m
114   -    .591m
115   -    .551mV
116   -    .560mV
117   -    .595mV
118   -    .577mV
119   -    .565mV
120   -    .536mV
121   -    .582mV
122   -    .574mV
123   -    .587mV
124   -    .586mV
125   -    .574mV
126   -    .574mV
127   -    .573mV
128   -    .582mV
129   -    .578mV
130   -    .535mV
                00/00/00
```

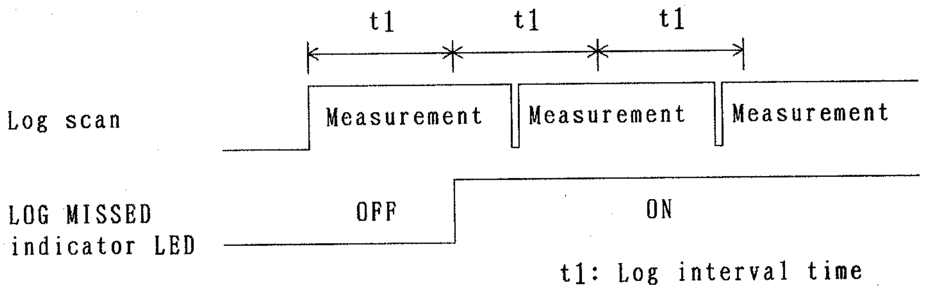
```
901   -    .001mV
902   -    .003mV
903   -    .004mV
904   -    .004mV
905   -    .006mV
906   -    .001mV
907   -    .003mV
908   -    .003mV
909   -    .003mV
910   -    .007mV
911   -    .005mV
912   -    .001mV
913   -    .005mV
914   -    .003mV
915   -    .007mV
916   -    .005mV
917   -    .003mV
918   -    .003mV
919   -    .005mV
920   -    .007mV
921   -    .001mV
922   -    .003mV
923   -    .003mV
924   -    .003mV
925   -    .001mV
926   -    .004mV
927   -    .003mV
928   -    .004mV
929   -    .001mV
930   -    .004mV
```

```
00:00:03  0_00004
001   -    .097mV
002   -    .107mV
003   -    .005mV
004   -    .079mV
005   -    .142mV
006   -    .051mV
007   -    .053mV
008   -    .054mV
009   -    .054mV
010   -    .050mV
011   -    .053mV
012   -    .053mV
013   -    .054mV
014   -    .052mV
015   -    .050mV
016   -    .053mV
017   -    .052mV
018   -    .051mV
019   -    .050mV
020   -    .048mV
021   -    .053mV
022   -    .052mV
023   -    .053mV
024   -    .053mV
025   -    .051mV
026   -    .052mV
027   -    .051mV
028   -    .052mV
029   -    .053mV
030   -    .050mV
          00/00/00
```

Figure 9 - 5 Example of log Scan Data Printout (Digital)

(1)-1 If measurement time > log interval time

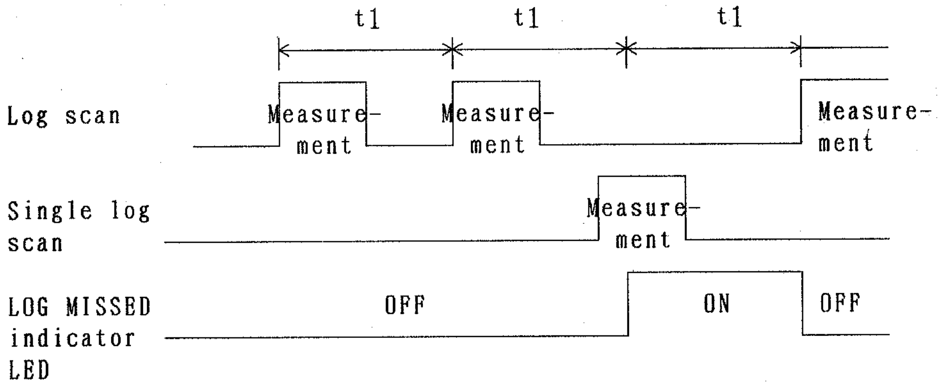
If the measurement time is too long for measurement to terminate within the log interval time, the measurement operation will be interpreted as continuous scan and the LOG MISSED indicator LED will light.



t1: Log interval time

(1)-2 If the log time has come during single log scan

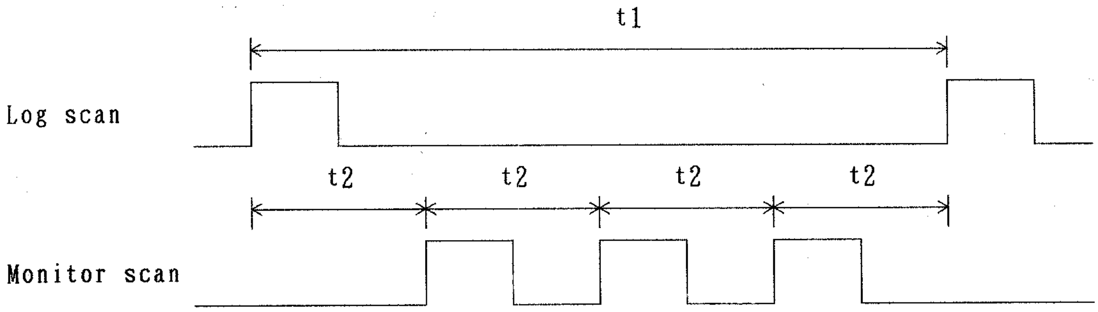
If log scan measurement has not become executable because of single log scan measurement going on, then the former is postphoned until the next log time comes, and the LOG MISSED indicator LED lights during that time.



t1: Log interval time

(2) For the trend mode

Both log scan measurement and monitor scan measurement are performed. Both these two types of scan data are printed out as trend data.



t1: Log interval time
t2: Monitor interval time

Scan measurement \ Output	Printer		GPIB	
	Digital print	Trend print	Monitor output ON	Monitor output OFF
Log scan		✓	✓ ※1	
Monitor scan			✓ ※1	

✓ : Continually output
(Blank): Not output

※1 : 300CH max.
(During use of calculate channels, 360CH max.)

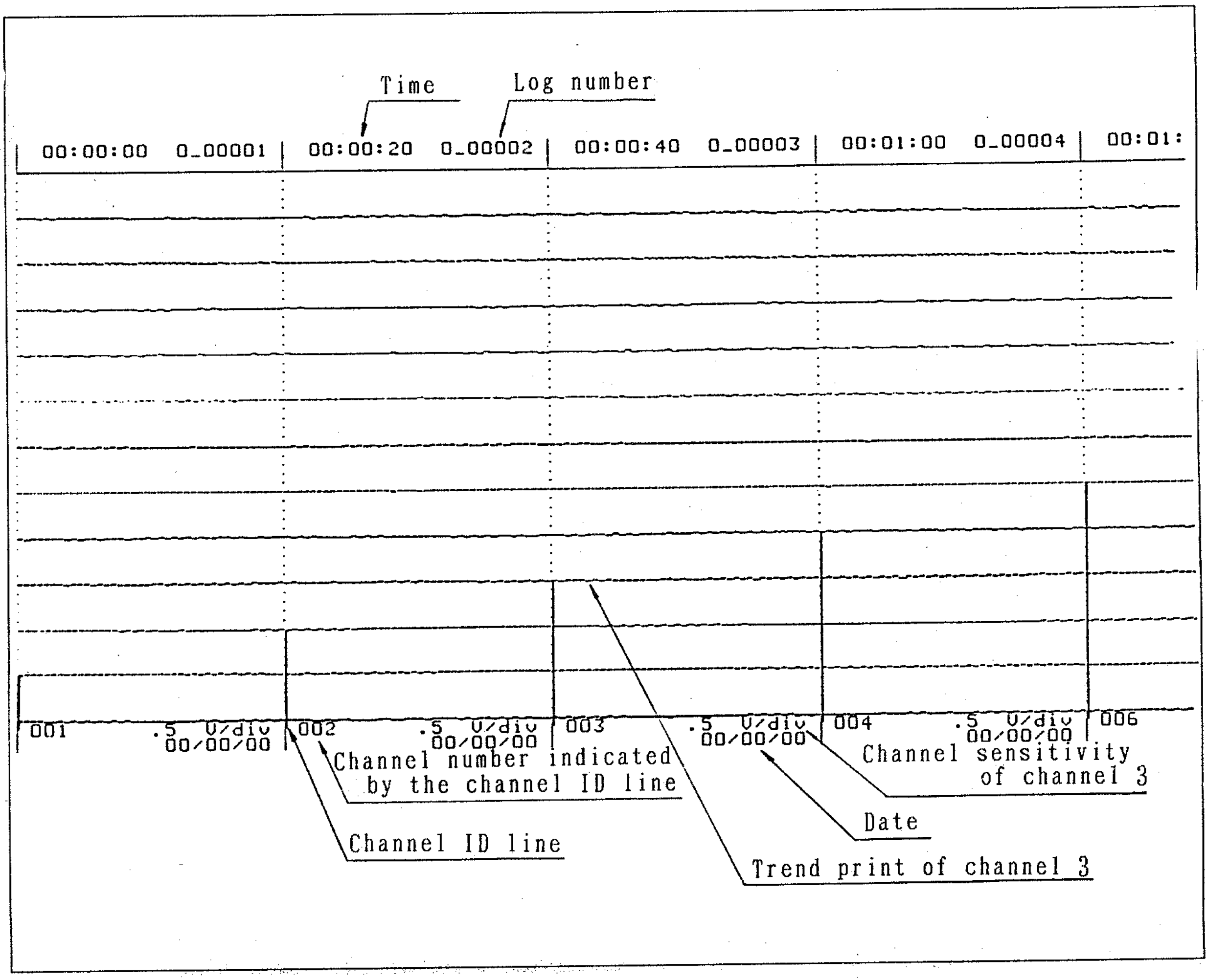
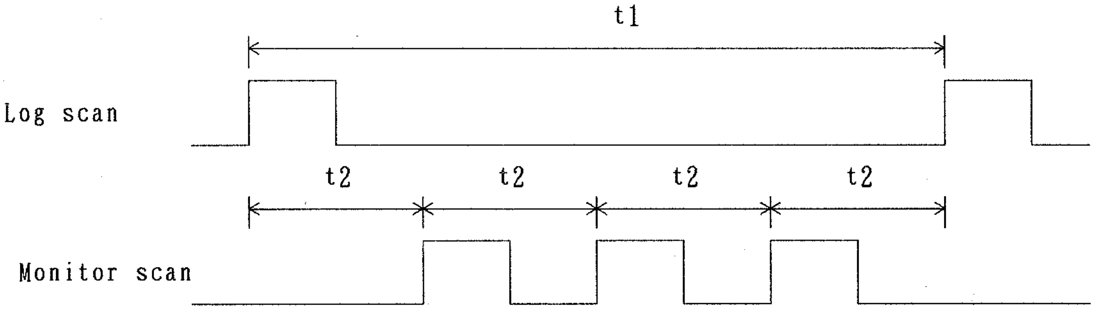


Figure 9 - 6 Example of trend Mode Scan Data (Trend Print)

(3) For the log/trend mode

Both log scan measurement and monitor scan measurement are performed. Log scan data is printed out as digital data, and monitor scan data is printed out as trend data.

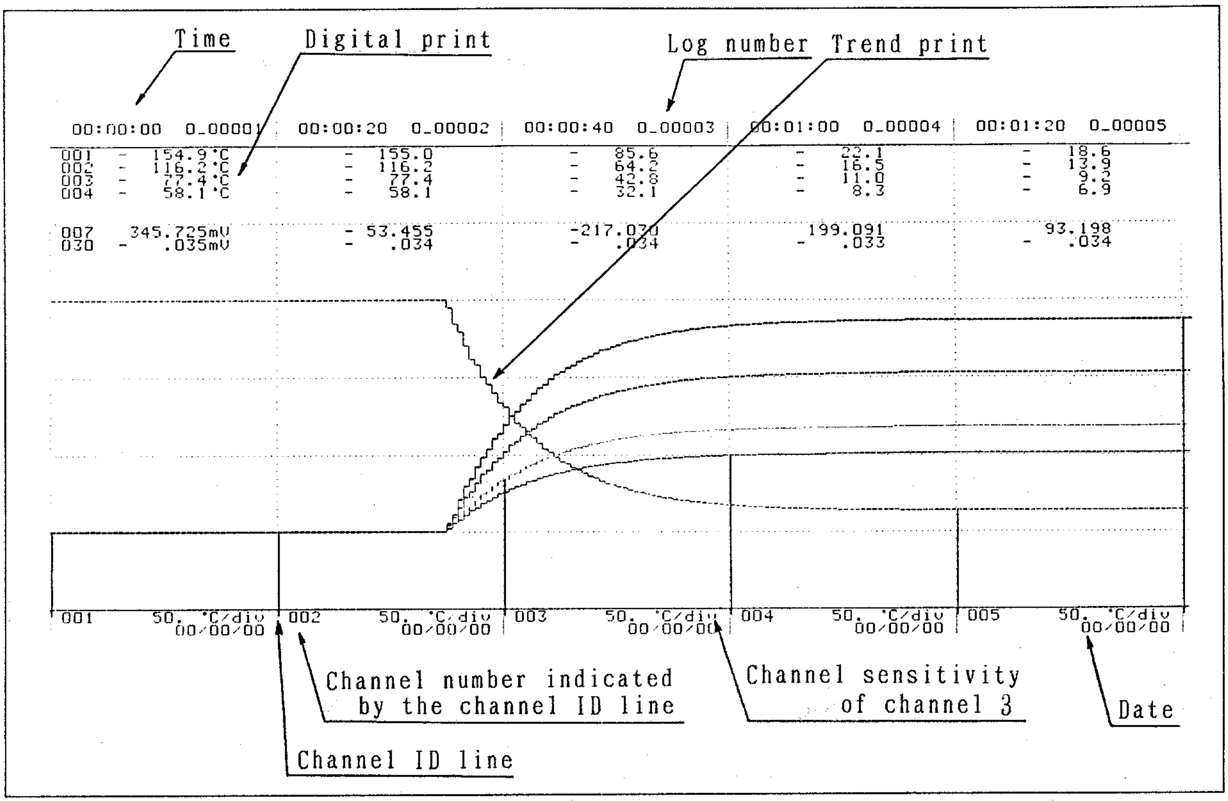


t1: Log interval time
t2: Monitor interval time

Output Scan measurement	Printer		GPIB	
	Digital print	Trend print	Monitor output ON	Monitor output OFF
Log scan	✓	✓	✓ ※1	
Monitor scan			✓ ※1	

✓ : Continually output
(Blank) : Not output

※1 : 300CH max.
(During use of calculate channels, 360CH max.)
※2 : 30CH max. (including calculate channels)

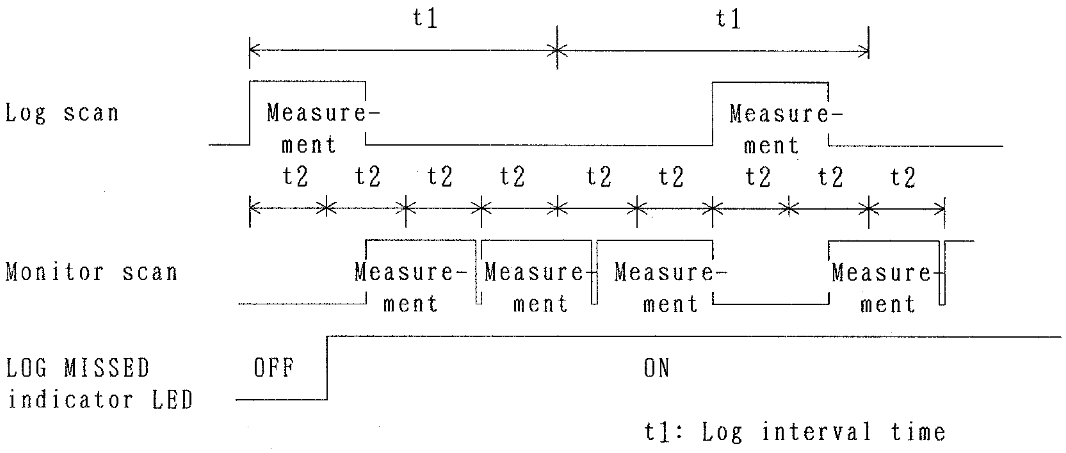


```
00:00:00  0_00001    00:00:20  0_00002    00:00:40  0_00003    00:01:00  0_00004    00:01:20  0_00005
001  -  154.9°C          -  155.0            -  85.6             -  22.1             -  18.6
002  -  116.2°C          -  116.2            -  64.2             -  16.5             -  13.9
003  -   77.4°C          -   77.4            -  42.8             -  11.0             -   9.2
004  -   58.1°C          -   58.1            -  32.1             -   8.3             -   6.9

007   345.725mV          - 53.455          -217.030             199.091              93.198
030  -   .035mV          -   .034            - .034             -  .033             -  .034
```

Figure 9 -7 Example of trend/log Mode Scan Data
(Digital/trend combined printout)

(3)-1 If measurement time > monitor interval time

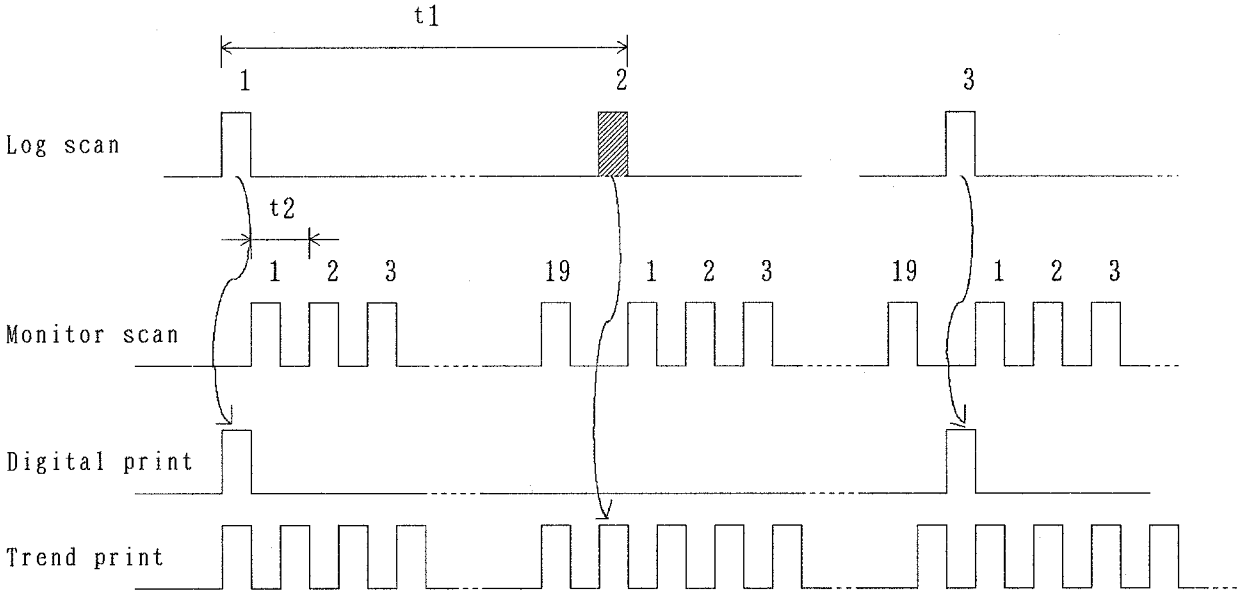
If the measurement time is too long for measurement to terminate within the monitor interval time, the measurement operation will be interpreted as continuous scan and the LOG MISSED indicator LED will light.
For measurement with the LOG MISSED indicator LED off, if the log interval time is set to one minute, the monitor interval time will become 1.5 seconds and monitor scan measurement will occur 39 times during the log interval.
If a continuous scan status is detected, monitor scan measurement will also occur 39 times during the log scan interval.



t1: Log interval time
t2: Monitor interval time

(3)-2 If only monitor scan data is printed out and thus the amount of printed-out trend data per frame is insufficient

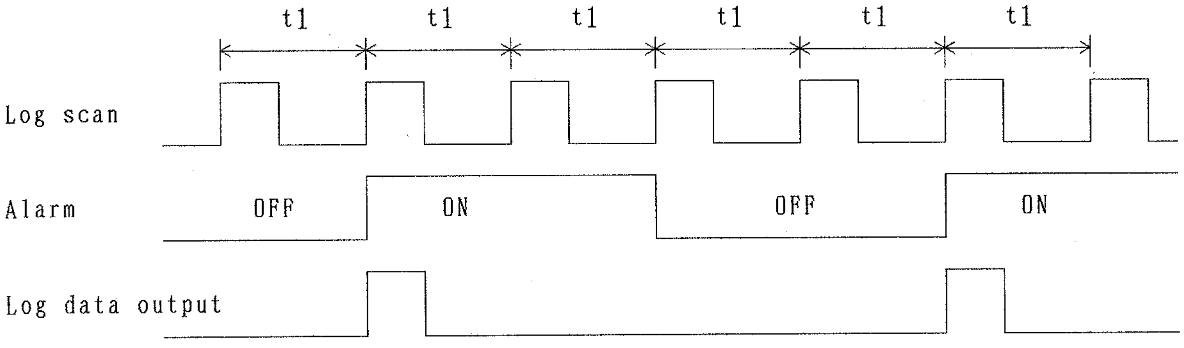
For example, if you set the log interval time to two seconds, the monitor interval time will become 0.1 seconds and monitor scan measurement will occur 19 times for one log scan. Since one frame of digital printout must contain a minimum of 40 scans of trend data, log scan data measured before one digital frame scan is completed will be regarded as trend printout.



t1: Log interval time (2 sec)
t2: Monitor interval time (0.1 sec)

(4) For the alarm mode

Only log scan measurement is performed. Monitor scan measurement is not performed.
Only the log scan data associated with the first alarm is printed out in digital form.



t1: Log interval time

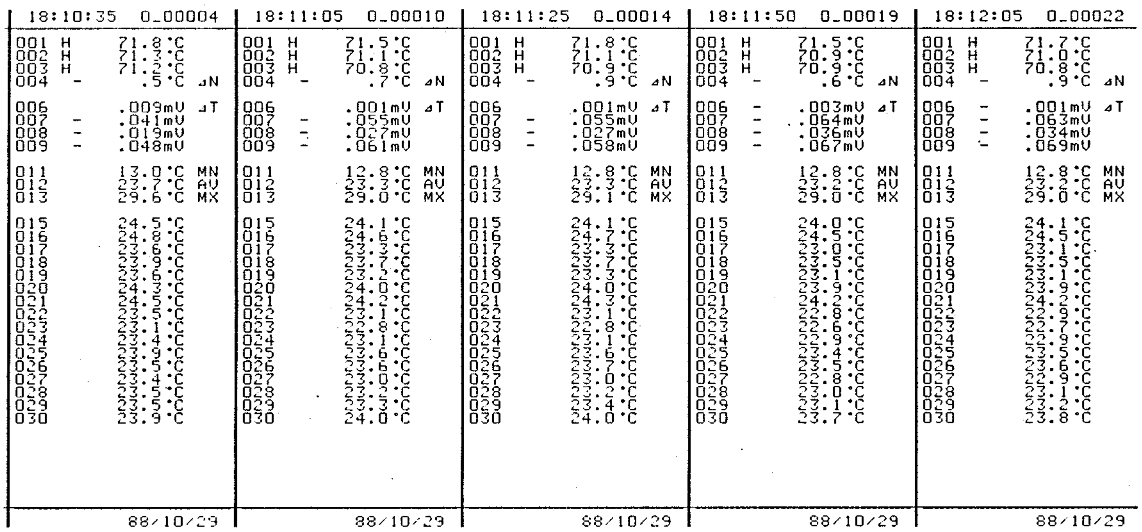
Output / Scan Measurement	Printer		GPIB
	Digital print	Trend print	
Log scan	✓ ※1		✓ ※1

✓ : Only the first-alarm-encountered data is output.
(Blank) : No data is output.
※1 : 300CH max.
(During use of calculate channels, 360CH max.)

Causes of alarms

With regard to the channel data for which high- or low-limit data has been set, an alarm is output in the following cases:

① High- or low-limit overstepped
② Scale over
③ Sensor out
④ Calculation error
⑤ A/D conversion error



```
18:10:35  0_00004
001 H    71.8°C
002 H    71.3°C
003 H    71.2°C
004  -     .5°C  ⊿N

006      .009mV  ⊿T
007  -   .041mV
008  -   .019mV
009  -   .048mV

011      13.0°C  MN
012      23.7°C  AV
013      29.6°C  MX

015      24.5°C
016      24.8°C
017      23.6°C
018      23.9°C
019      23.6°C
020      24.3°C
021      24.5°C
022      23.5°C
023      23.1°C
024      23.4°C
025      23.9°C
026      23.5°C
027      23.4°C
028      23.5°C
029      23.5°C
030      23.9°C

             88/10/29
```

```
18:11:05  0_00010
001 H    71.5°C
002 H    71.1°C
003 H    70.8°C
004  -     .7°C  ⊿N

006      .001mV  ⊿T
007  -   .055mV
008  -   .027mV
009  -   .061mV

011      12.8°C  MN
012      23.3°C  AV
013      29.0°C  MX

015      24.1°C
016      24.6°C
017      23.3°C
018      23.7°C
019      23.2°C
020      24.0°C
021      24.2°C
022      23.1°C
023      22.8°C
024      23.1°C
025      23.6°C
026      23.6°C
027      23.0°C
028      23.2°C
029      23.3°C
030      24.0°C

             88/10/29
```

```
18:11:25  0_00014
001 H    71.8°C
002 H    71.1°C
003 H    70.9°C
004  -     .9°C  ⊿N

006      .001mV  ⊿T
007  -   .055mV
008  -   .027mV
009  -   .058mV

011      12.8°C  MN
012      23.3°C  AV
013      29.1°C  MX

015      24.1°C
016      24.7°C
017      23.3°C
018      23.7°C
019      23.3°C
020      24.0°C
021      24.3°C
022      23.1°C
023      22.8°C
024      23.1°C
025      23.6°C
026      23.7°C
027      23.0°C
028      23.2°C
029      23.4°C
030      24.0°C

             88/10/29
```

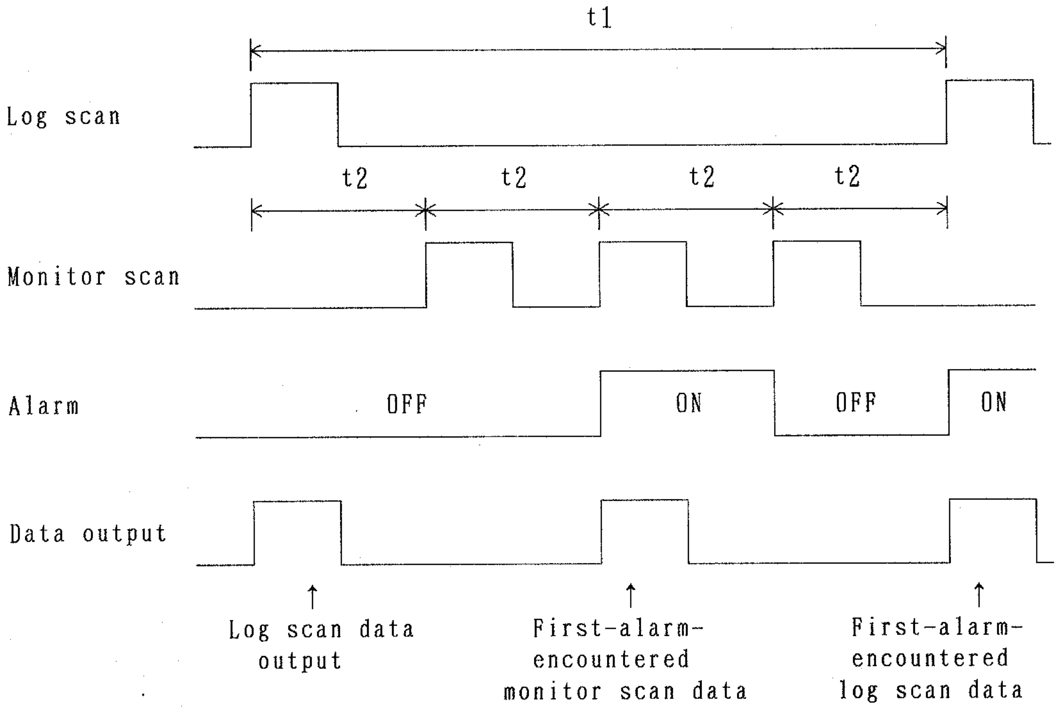
```
18:11:50  0_00019
001 H    71.5°C
002 H    70.9°C
003 H    70.9°C
004  -     .6°C  ⊿N

006  -   .003mV  ⊿T
007  -   .064mV
008  -   .036mV
009  -   .067mV

011      12.8°C  MN
012      23.2°C  AV
013      29.0°C  MX

015      24.0°C
016      24.5°C
017      23.0°C
018      23.5°C
019      23.1°C
020      23.9°C
021      24.2°C
022      22.8°C
023      22.6°C
024      22.9°C
025      23.4°C
026      23.5°C
027      22.8°C
028      23.0°C
029      23.1°C
030      23.7°C

             88/10/29
```

```
18:12:05  0_00022
001 H    71.7°C
002 H    71.0°C
003 H    70.8°C
004  -     .9°C  ⊿N

006  -   .001mV  ⊿T
007  -   .063mV
008  -   .034mV
009  -   .069mV

011      12.8°C  MN
012      23.2°C  AV
013      29.0°C  MX

015      24.1°C
016      24.5°C
017      23.1°C
018      23.5°C
019      23.1°C
020      23.9°C
021      24.2°C
022      22.9°C
023      22.7°C
024      22.9°C
025      23.5°C
026      23.6°C
027      22.9°C
028      23.1°C
029      23.2°C
030      23.8°C

             88/10/29
```

Figure 9 - 8 Example of alarm Mode Scan Data Printout
(Digital Printing)

(5) For the log/alarm mode

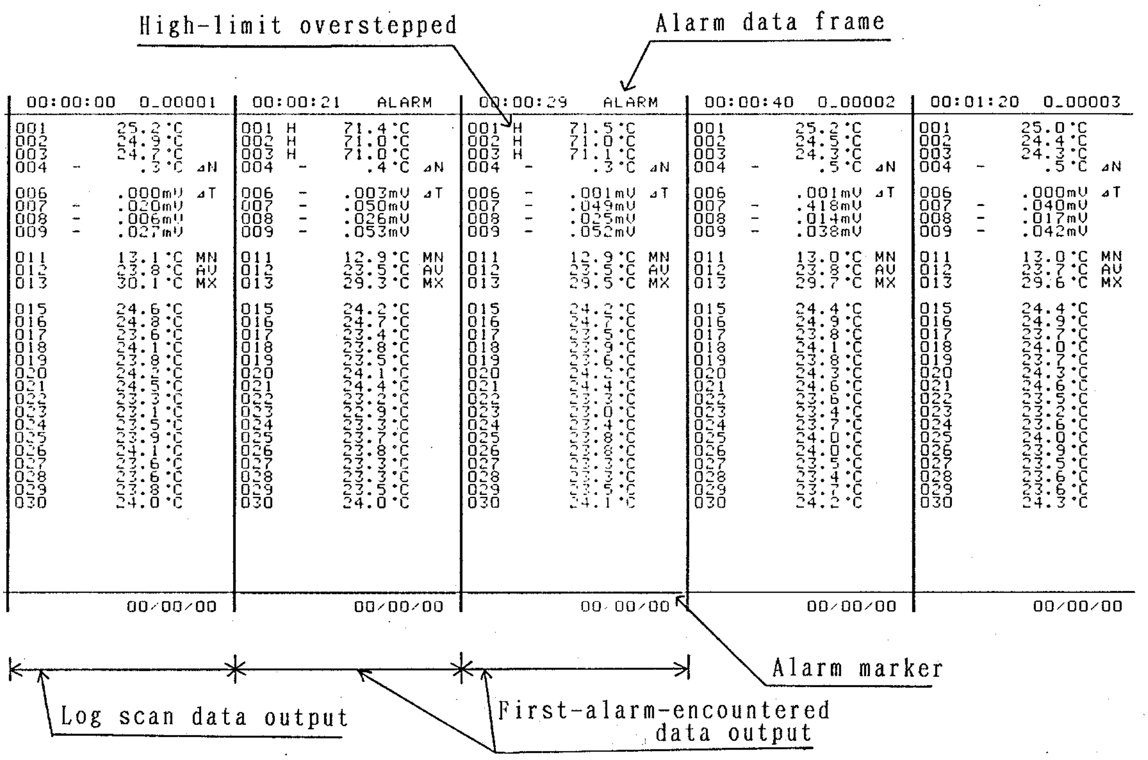
Both log scan measurement and monitor scan measurement are performed. The entire log scan data and the first-alarm-encountered data are printed out in digital form.



Output / Scan Measurement	Printer		GPIB	
	Digital print	Trend print	Monitor output ON	Monitor output OFF
Log scan	✓✓ ※1		✓✓ ※1	
Monitor scan	✓ ※1		✓ ※1	

✓✓ : The entire data is output.
✓ : Only the first-alarm-encountered data is output.
(Blank) : No data is output.

※1 : 300CH max.
(During use of calculate channels, 360CH max.)



```
00:00:00   0_00001
001          25.2°C
002          24.9°C
003          24.7°C
004   -        .3°C  ⊿N

006         .000mV  ⊿T
007   -     .020mV
008   -     .006mV
009   -     .027mV

011          13.1°C  MN
012          23.8°C  AV
013          30.1°C  MX

015          24.6°C
016          24.8°C
017          23.6°C
018          24.1°C
019          23.8°C
020          24.2°C
021          24.5°C
022          23.3°C
023          23.1°C
024          23.5°C
025          23.9°C
026          24.1°C
027          23.6°C
028          23.6°C
029          23.8°C
030          24.0°C

            00/00/00
```

```
00:00:21     ALARM
001 H        71.4°C
002 H        71.0°C
003 H        71.0°C
004   -        .4°C  ⊿N

006   -     .003mV  ⊿T
007   -     .050mV
008   -     .026mV
009   -     .053mV

011          12.9°C  MN
012          23.5°C  AV
013          29.3°C  MX

015          24.2°C
016          24.7°C
017          23.4°C
018          23.8°C
019          23.5°C
020          24.1°C
021          24.4°C
022          23.2°C
023          22.9°C
024          23.3°C
025          23.7°C
026          23.8°C
027          23.3°C
028          23.3°C
029          23.5°C
030          24.0°C

            00/00/00
```

```
00:00:29     ALARM
001 H        71.5°C
002 H        71.0°C
003 H        71.1°C
004   -        .3°C  ⊿N

006   -     .001mV  ⊿T
007   -     .049mV
008   -     .025mV
009   -     .052mV

011          12.9°C  MN
012          23.5°C  AV
013          29.5°C  MX

015          24.2°C
016          24.7°C
017          23.5°C
018          23.9°C
019          23.6°C
020          24.2°C
021          24.4°C
022          23.3°C
023          23.0°C
024          23.4°C
025          23.8°C
026          23.8°C
027          23.3°C
028          23.3°C
029          23.5°C
030          24.1°C

            00/00/00
```

```
00:00:40   0_00002
001          25.2°C
002          24.5°C
003          24.3°C
004   -        .5°C  ⊿N

006         .001mV  ⊿T
007   -     .418mV
008   -     .014mV
009   -     .038mV

011          13.0°C  MN
012          23.8°C  AV
013          29.7°C  MX

015          24.4°C
016          24.9°C
017          23.8°C
018          24.1°C
019          23.8°C
020          24.3°C
021          24.6°C
022          23.6°C
023          23.4°C
024          23.7°C
025          24.0°C
026          24.0°C
027          23.5°C
028          23.4°C
029          23.7°C
030          24.2°C

            00/00/00
```

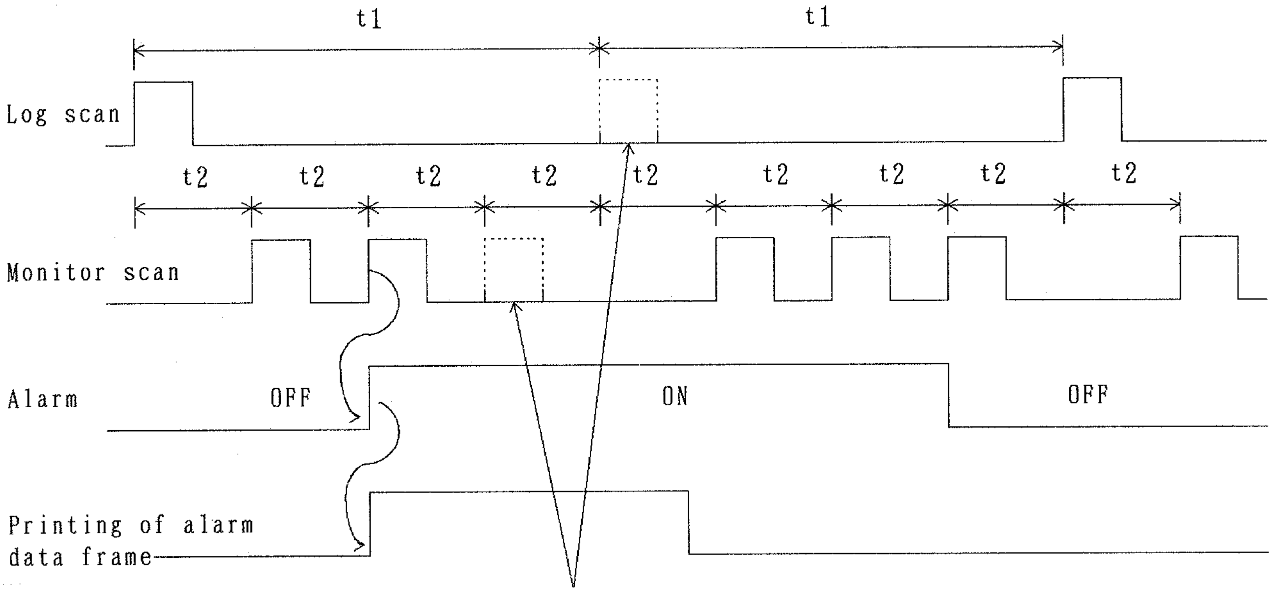
```
00:01:20   0_00003
001          25.0°C
002          24.4°C
003          24.3°C
004   -        .5°C  ⊿N

006         .000mV  ⊿T
007   -     .040mV
008   -     .017mV
009   -     .042mV

011          13.0°C  MN
012          23.7°C  AV
013          29.6°C  MX

015          24.4°C
016          24.9°C
017          23.7°C
018          24.0°C
019          23.7°C
020          24.3°C
021          24.6°C
022          23.5°C
023          23.2°C
024          23.6°C
025          24.0°C
026          23.9°C
027          23.5°C
028          23.6°C
029          23.6°C
030          24.3°C

            00/00/00
```

Figure 9 - 9 Example (1) of log/alarm Mode Scan Data Printout (Digital Printing)

(5)-1 If measurement time > monitor interval time

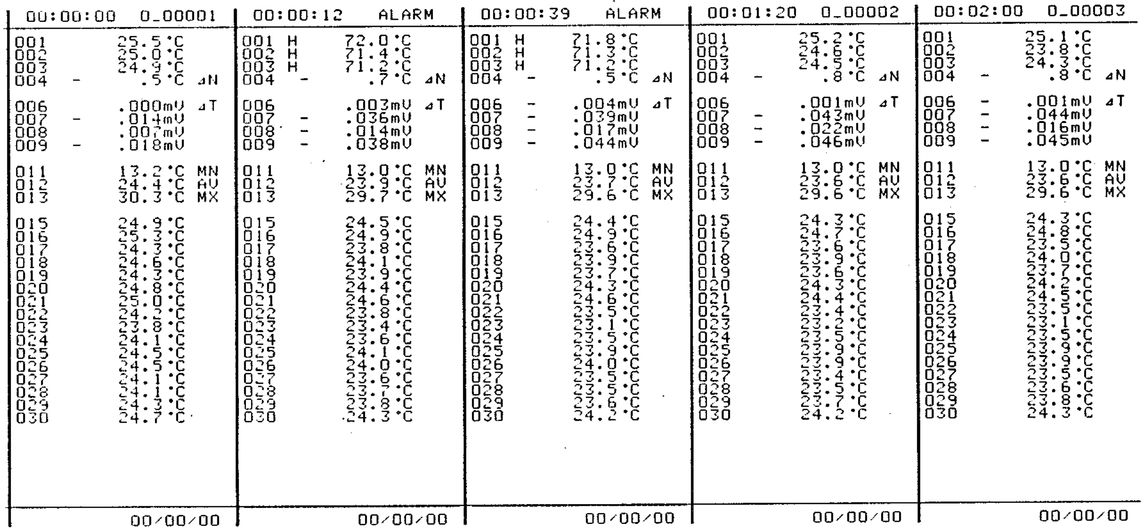
The equipment operates in a similar manner to that of the log/trend mode operation previously described in item (3) above.
For the log/trend measurement mode, both log scan measurement and monitor scan measurement are performed.
Log scan data and monitor scan data are printed out in digital form and trend form, respectively.

(5)-2 If the log time has come during printing of alarm data frames



Measurement does not occur because of output of alarm data frames.

(Log interval time = 40 sec)



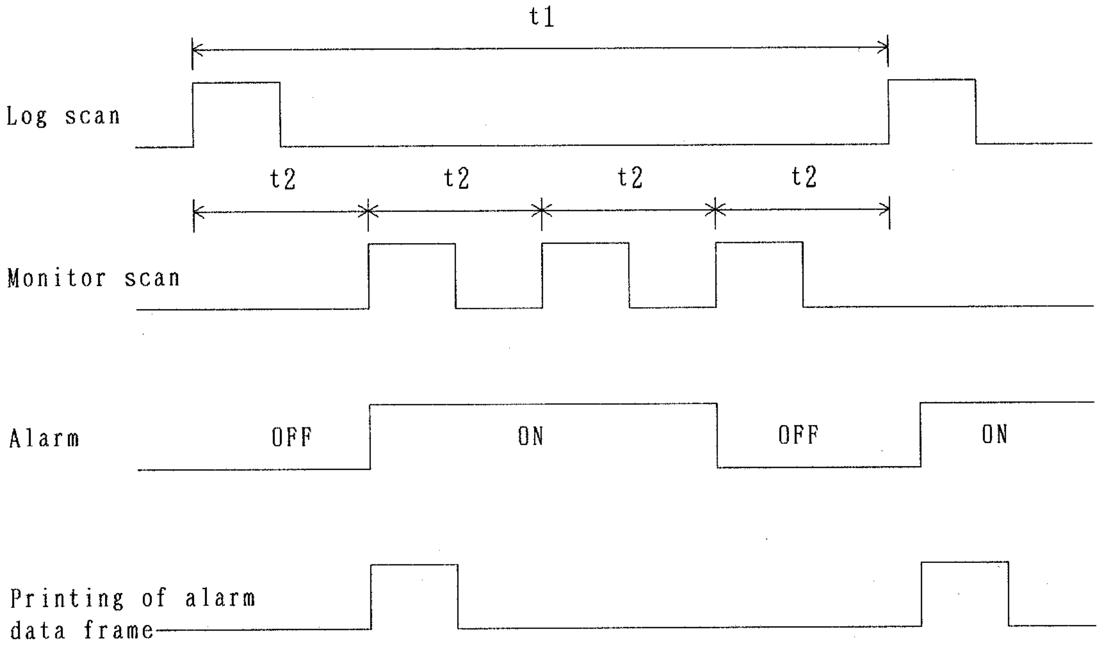
```
| 00:00:00  0_00001 | 00:00:12    ALARM | 00:00:39    ALARM | 00:01:20  0_00002 | 00:02:00  0_00003
|-------------------|-------------------|-------------------|-------------------|------------------
| 001     25.5°C    | 001 H   72.0°C    | 001 H   71.8°C    | 001     25.2°C    | 001     25.1°C
| 002     25.0°C    | 002 H   71.4°C    | 002 H   71.3°C    | 002     24.6°C    | 002     23.8°C
| 003     24.9°C    | 003 H   71.2°C    | 003 H   71.2°C    | 003     24.5°C    | 003     24.3°C
| 004 -     .5°C ⊿N | 004 -     .7°C ⊿N | 004 -     .5°C ⊿N | 004 -     .8°C ⊿N | 004 -     .8°C ⊿N
|                   |                   |                   |                   |
| 006     .000mV ⊿T | 006     .003mV ⊿T | 006 -   .004mV ⊿T | 006     .001mV ⊿T | 006 -   .001mV ⊿T
| 007 -   .014mV    | 007 -   .036mV    | 007 -   .039mV    | 007 -   .043mV    | 007 -   .044mV
| 008     .007mV    | 008 -   .014mV    | 008 -   .017mV    | 008 -   .022mV    | 008 -   .016mV
| 009 -   .018mV    | 009 -   .038mV    | 009 -   .044mV    | 009 -   .046mV    | 009 -   .045mV
|                   |                   |                   |                   |
| 011     13.2°C MN | 011     13.0°C MN | 011     13.0°C MN | 011     13.0°C MN | 011     13.0°C MN
| 012     24.4°C AV | 012     23.9°C AV | 012     23.7°C AV | 012     23.6°C AV | 012     23.6°C AV
| 013     30.3°C MX | 013     29.7°C MX | 013     29.6°C MX | 013     29.6°C MX | 013     29.6°C MX
|                   |                   |                   |                   |
| 015     24.9°C    | 015     24.5°C    | 015     24.4°C    | 015     24.3°C    | 015     24.3°C
| 016     25.3°C    | 016     24.9°C    | 016     24.9°C    | 016     24.7°C    | 016     24.8°C
| 017     24.3°C    | 017     23.8°C    | 017     23.6°C    | 017     23.6°C    | 017     23.5°C
| 018     24.6°C    | 018     24.1°C    | 018     23.9°C    | 018     23.9°C    | 018     24.0°C
| 019     24.3°C    | 019     23.9°C    | 019     23.7°C    | 019     23.6°C    | 019     23.7°C
| 020     24.8°C    | 020     24.4°C    | 020     24.3°C    | 020     24.3°C    | 020     24.2°C
| 021     25.0°C    | 021     24.6°C    | 021     24.6°C    | 021     24.4°C    | 021     24.5°C
| 022     24.2°C    | 022     23.8°C    | 022     23.5°C    | 022     23.4°C    | 022     23.5°C
| 023     23.8°C    | 023     23.4°C    | 023     23.1°C    | 023     23.2°C    | 023     23.1°C
| 024     24.1°C    | 024     23.6°C    | 024     23.5°C    | 024     23.5°C    | 024     23.5°C
| 025     24.5°C    | 025     24.1°C    | 025     23.9°C    | 025     23.9°C    | 025     23.9°C
| 026     24.5°C    | 026     24.0°C    | 026     24.0°C    | 026     23.9°C    | 026     23.9°C
| 027     24.1°C    | 027     23.6°C    | 027     23.5°C    | 027     23.4°C    | 027     23.5°C
| 028     24.1°C    | 028     23.7°C    | 028     23.5°C    | 028     23.5°C    | 028     23.6°C
| 029     24.3°C    | 029     23.8°C    | 029     23.6°C    | 029     23.7°C    | 029     23.8°C
| 030     24.7°C    | 030     24.3°C    | 030     24.2°C    | 030     24.2°C    | 030     24.3°C
|                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|------------------
|          00/00/00 |          00/00/00 |          00/00/00 |          00/00/00 |          00/00/00
```

This indicates that the log scan preprogrammed to occur after the elapse of 40 seconds has been skipped because of printing of the alarm data frame which occurred one second before that scan.

Figure 9 - 10 Example (2) of log/alarm Mode Scan Data Printout (Digital Printing)

(6) For the trend/alarm mode

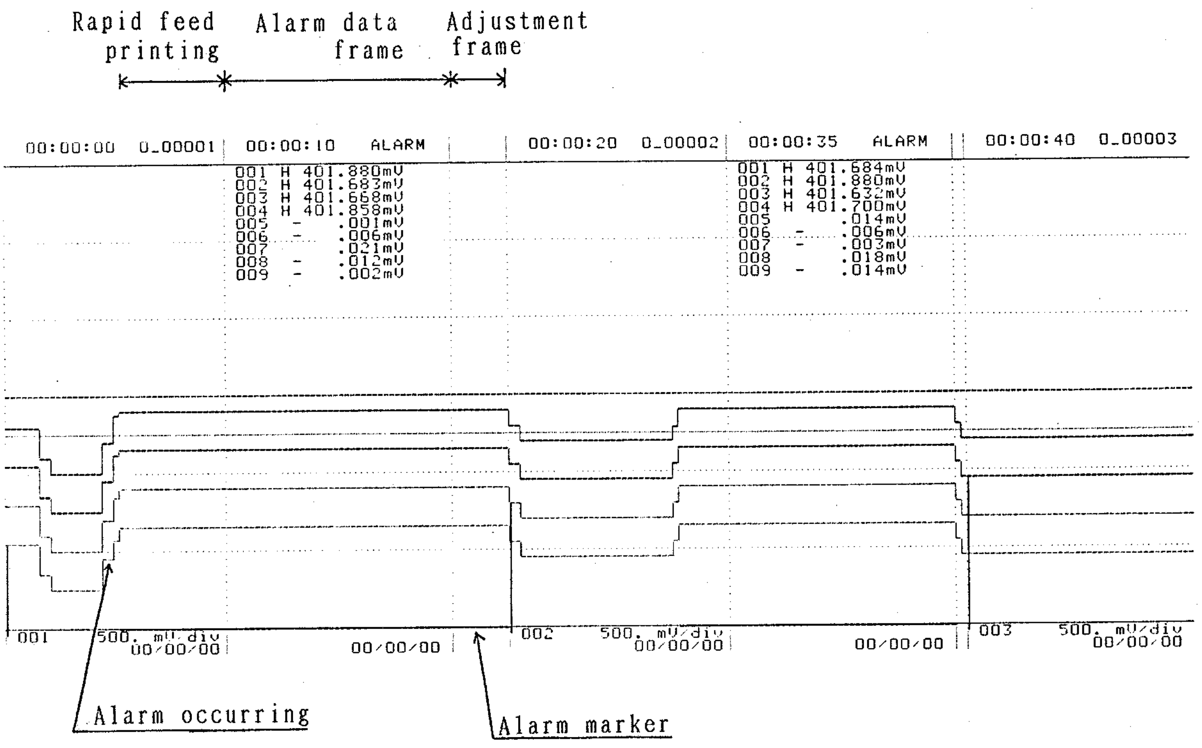
Both log scan measurement and monitor scan measurement are performed. Both these two types of scan data are printed out as trend data. If an alarm occurs, 30 channels of data will be printed out in digital form as the first alarm data frame.



t1: Log interval time
t2: Monitor interval time

Output / Scan Measurement	Printer		GPIB	
	Digital print	Trend print	Monitor output ON	Monitor output OFF
Log scan	✓ ※2	✓✓	✓✓ ※1	✓ ※1
Monitor scan	✓ ※2		✓✓ ※1	✓ ※1

✓✓ : The entire data is output.
✓ : Only the first-alarm encountered data is output.
(Blank) : No data is output.
※1 : 300CH max.
(During use of calculate channels, 360CH max)
※2 : 30CH max.
(including calculate channels)

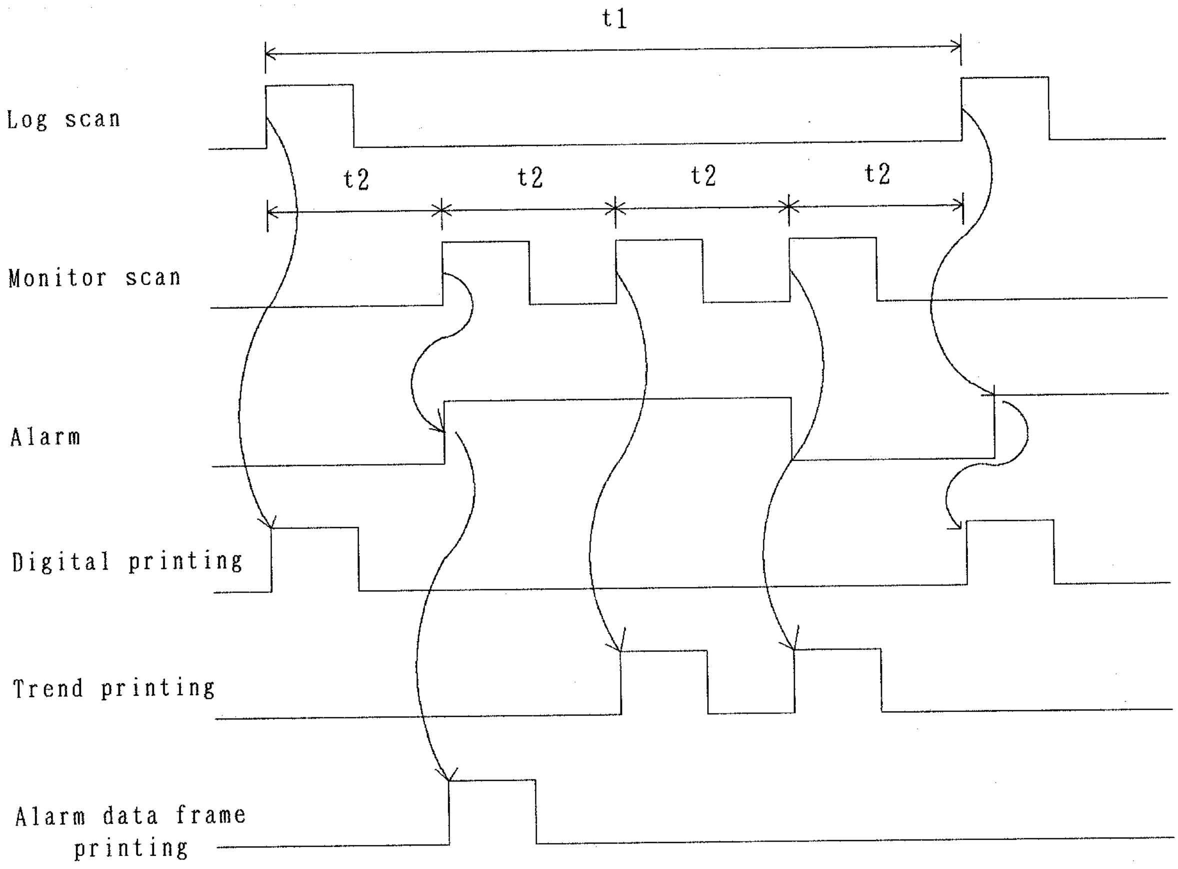


```
00:00:00  0_00001 | 00:00:10     ALARM    |  00:00:20  0_00002 | 00:00:35     ALARM    || 00:00:40  0_00003
                    001 H 401.880mV                           001 H 401.684mV
                    002 H 401.683mV                           002 H 401.880mV
                    003 H 401.668mV                           003 H 401.632mV
                    004 H 401.858mV                           004 H 401.700mV
                    005 -    .001mV                           005      .014mV
                    006 -    .006mV                           006 -    .006mV
                    007      .021mV                           007 -    .003mV
                    008 -    .012mV                           008      .018mV
                    009 -    .002mV                           009 -    .014mV

001    500. mV/div                              002    500. mV/div                              003    500. mV/div
         00/00/00         00/00/00                       00/00/00         00/00/00                       00/00/00
```

Figure 9 - 11 Example of trend/alarm Mode Scan Data Printout (Trend Printing)

(7) For the log/trend/alarm mode

Both log scan measurement and monitor scan measurement are performed. Log scan data is printed out in digital form, and monitor scan data is printed out in trend form.
If an alarm occurs during monitor scan measurement, the corresponding alarm data frame will be printed out.
If an alarm occurs during log scan measurement, an alarm marker and the corresponding alarm data will be printed out. ALARM will not be printed out in that case.

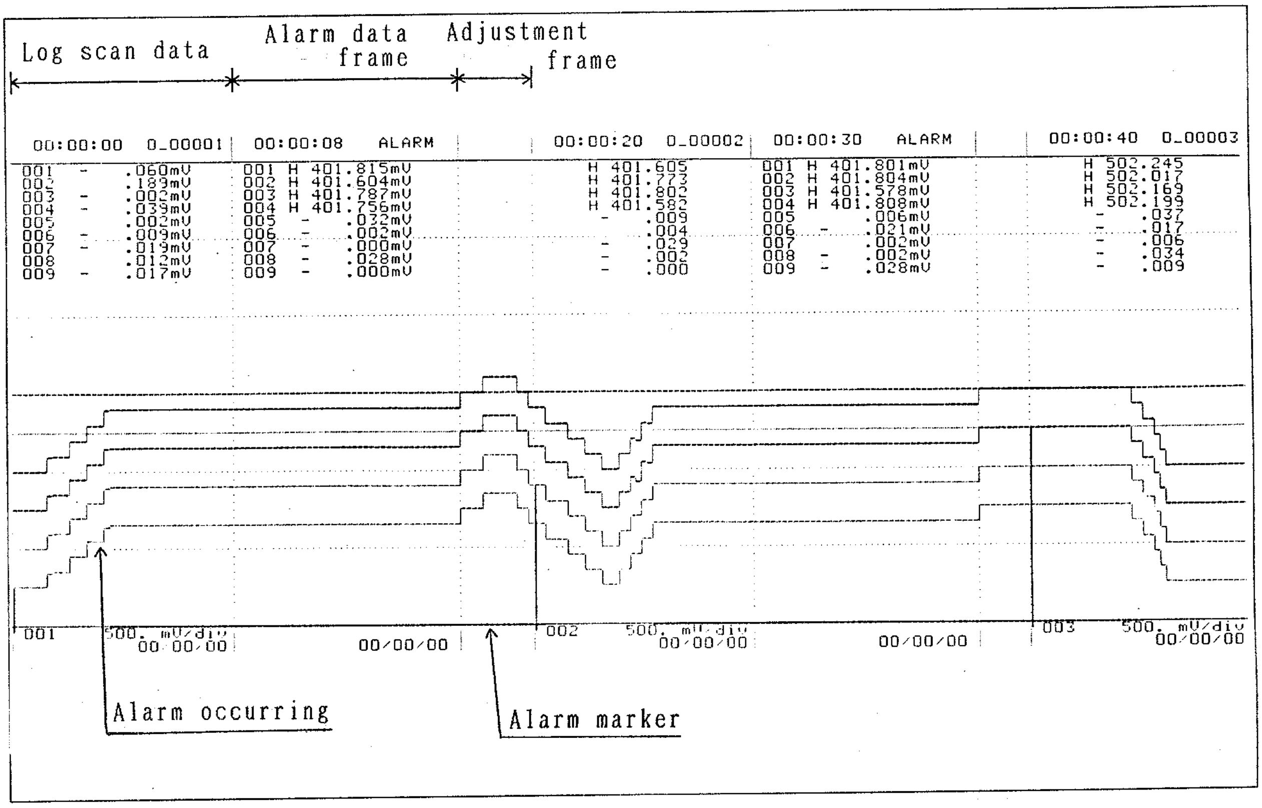


t1: Log interval time
t2: Monitor interval time

Output / Scan measurement	Printer		GPIB	
	Digital print	Trend print	Monitor output ON	Monitor output OFF
Log scan	✓✓ ※2	✓✓	✓✓ ※1	
Monitor scan	✓ ※2		✓✓ ※1	✓ ※1

✓✓ : The entire data is output.
✓ : Only the first-alarm encountered data is output.

※1 : 300CH max
(During use of calculate channels, 360CH max.)
※2 : 30CH max
(Including calculate channels)

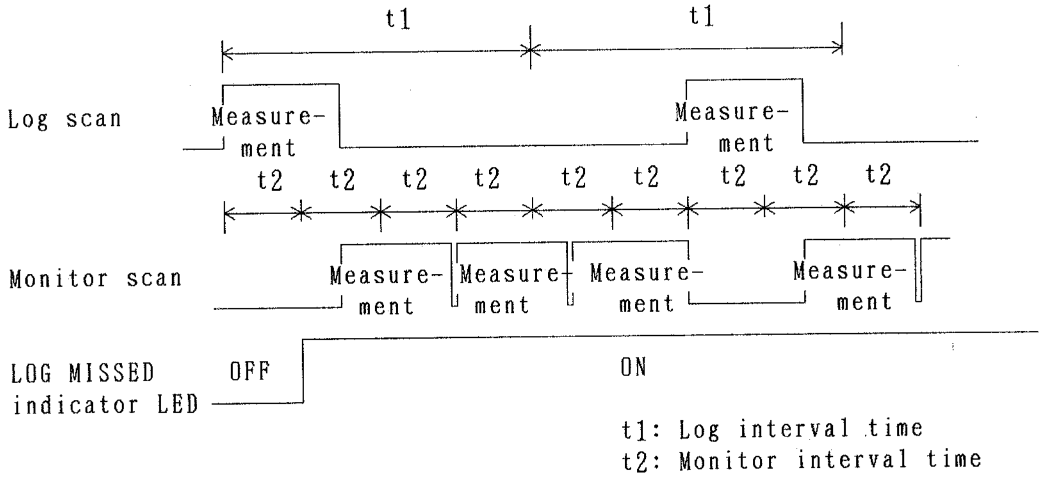


```
00:00:00  0_00001 | 00:00:08    ALARM  |  | 00:00:20  0_00002 | 00:00:30    ALARM  |  | 00:00:40  0_00003
001  -   .060mV   | 001 H 401.815mV    |  |    H 401.605      | 001 H 401.801mV    |  |    H 502.245
002      .189mV   | 002 H 401.604mV    |  |    H 401.773      | 002 H 401.804mV    |  |    H 502.017
003  -   .002mV   | 003 H 401.787mV    |  |    H 401.802      | 003 H 401.578mV    |  |    H 502.169
004  -   .039mV   | 004 H 401.756mV    |  |    H 401.582      | 004 H 401.808mV    |  |    H 502.199
005      .002mV   | 005  -    .032mV   |  |     -    .009      | 005       .006mV   |  |     -    .037
006  -   .009mV   | 006  -    .002mV   |  |          .004      | 006  -    .021mV   |  |     -    .017
007  -   .019mV   | 007  -    .000mV   |  |     -    .029      | 007       .002mV   |  |     -    .006
008      .012mV   | 008  -    .028mV   |  |     -    .002      | 008  -    .002mV   |  |     -    .034
009  -   .017mV   | 009  -    .000mV   |  |     -    .000      | 009  -    .028mV   |  |     -    .009
```

Figure 9 - 12 Example of log/trend/alarm Mode Scan Data Output (Digital/Trend Combined Printing)

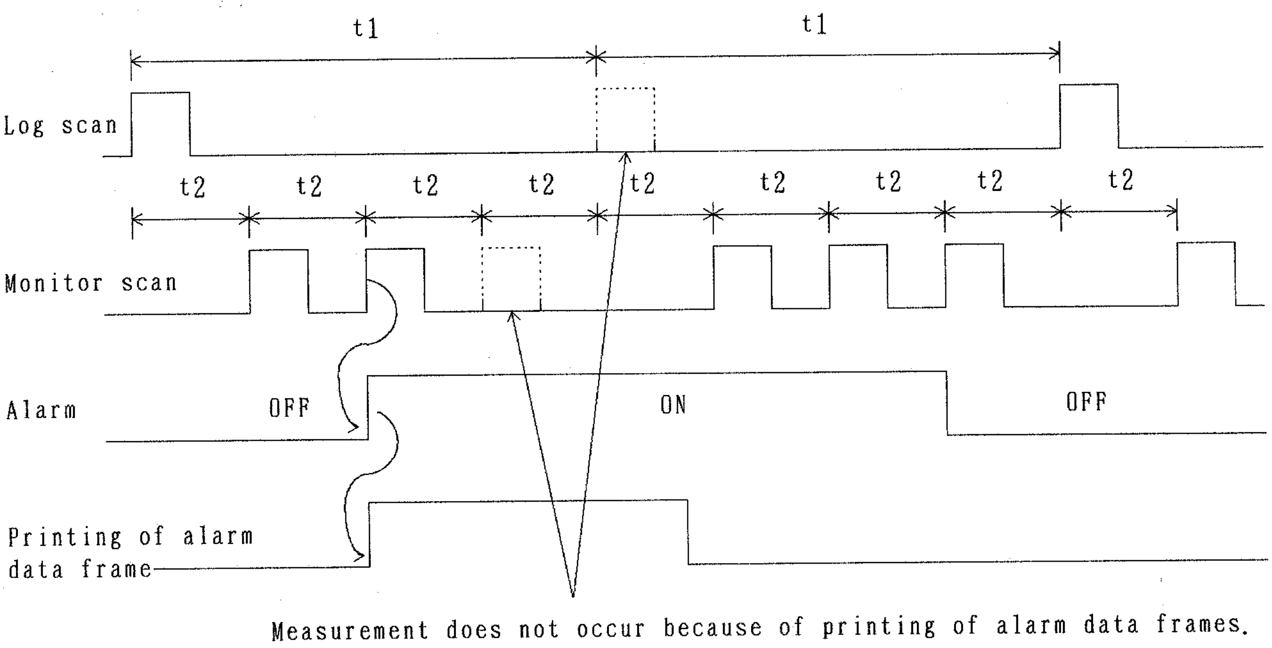
(7)-1 If measurement time > monitor interval time

The equipment operates in a similar manner to that of the log/trend mode operation previously described in item (3) above.
If the measurement time is too long for measurement to terminate within the monitor interval time, the measurement operation will be interpreted as continuous scan and the LOG MISSED indicator LED will light.
For measurement with the LOG MISSED indicator LED off, if the log interval time is set to one minute, the monitor interval time will become 1.5 seconds and monitor scan measurement will occur 39 times during the log interval.
If a continuous scan status is detected, monitor scan measurement will also occur 39 times during the log scan interval.



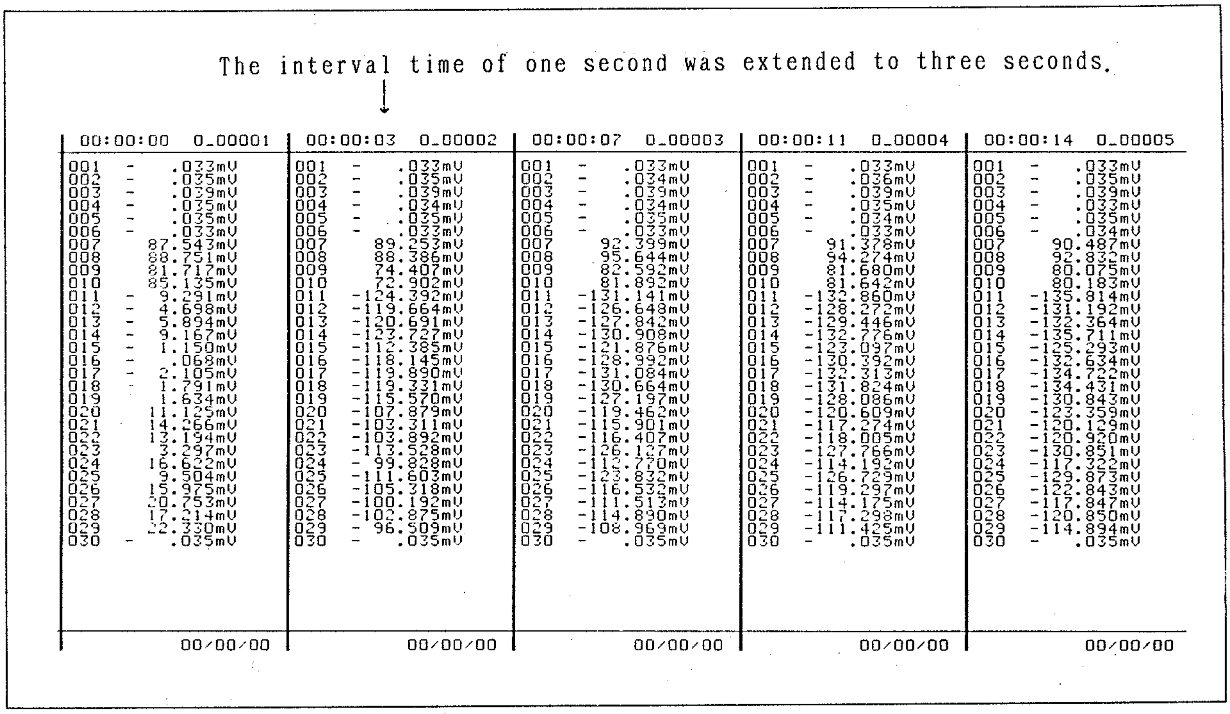
(7)-2 If the log time has come during printing of alarm data frames:

The equipment operates in a similar manner to that of the log/alarm mode operation previously described in item (5) above.



(7)-3 About the interval time

① The LOG MISSED indicator LED lights if the log scan or monitor scan interval time is shorter than the measurement time. In that case, the measurement operation will be interpreted as continuous scan measurement and the log time will shift by the measurement delay time.
An example in which data measured at log intervals of one second was printed out is shown in Figure 9-3. This example shows that depending on the printing time, the interval time is extended to three to four seconds.



The interval time of one second was extended to three seconds.

```
 00:00:00   0_00001
001   -     .033mV
002   -     .035mV
003   -     .039mV
004   -     .035mV
005   -     .035mV
006   -     .033mV
007       87.543mV
008       88.751mV
009       81.717mV
010       85.135mV
011   -    9.291mV
012   -    4.698mV
013   -    5.894mV
014   -    9.167mV
015   -    1.150mV
016   -     .068mV
017   -    2.105mV
018   -    1.791mV
019        1.634mV
020       11.125mV
021       14.266mV
022       13.194mV
023        3.297mV
024       16.622mV
025        9.504mV
026       15.975mV
027       20.753mV
028       17.214mV
029       22.330mV
030   -     .035mV

                00/00/00
```

```
 00:00:03   0_00002
001   -     .033mV
002   -     .035mV
003   -     .039mV
004   -     .034mV
005   -     .035mV
006   -     .033mV
007       89.253mV
008       88.386mV
009       74.407mV
010       72.902mV
011   -124.392mV
012   -119.664mV
013   -120.691mV
014   -123.727mV
015   -112.385mV
016   -118.145mV
017   -119.890mV
018   -119.331mV
019   -115.570mV
020   -107.879mV
021   -103.311mV
022   -103.892mV
023   -113.528mV
024   -  99.828mV
025   -111.603mV
026   -105.318mV
027   -100.192mV
028   -102.875mV
029   -  96.509mV
030   -     .035mV

                00/00/00
```

```
 00:00:07   0_00003
001   -     .033mV
002   -     .034mV
003   -     .039mV
004   -     .034mV
005   -     .035mV
006   -     .033mV
007       92.399mV
008       95.644mV
009       82.592mV
010       81.892mV
011   -131.141mV
012   -126.648mV
013   -127.842mV
014   -130.908mV
015   -121.876mV
016   -128.992mV
017   -131.084mV
018   -130.664mV
019   -127.197mV
020   -119.462mV
021   -115.901mV
022   -116.407mV
023   -126.127mV
024   -112.770mV
025   -123.832mV
026   -116.532mV
027   -111.513mV
028   -114.890mV
029   -108.969mV
030   -     .035mV

                00/00/00
```

```
 00:00:11   0_00004
001   -     .033mV
002   -     .036mV
003   -     .039mV
004   -     .035mV
005   -     .034mV
006   -     .033mV
007       91.378mV
008       94.274mV
009       81.680mV
010       81.642mV
011   -132.860mV
012   -128.272mV
013   -129.446mV
014   -132.776mV
015   -123.097mV
016   -130.392mV
017   -132.313mV
018   -131.824mV
019   -128.086mV
020   -120.609mV
021   -117.274mV
022   -118.005mV
023   -127.766mV
024   -114.192mV
025   -126.729mV
026   -119.297mV
027   -114.175mV
028   -117.298mV
029   -111.425mV
030   -     .035mV

                00/00/00
```

```
 00:00:14   0_00005
001   -     .033mV
002   -     .035mV
003   -     .039mV
004   -     .033mV
005   -     .035mV
006   -     .034mV
007       90.487mV
008       92.832mV
009       80.075mV
010       80.183mV
011   -135.814mV
012   -131.192mV
013   -132.364mV
014   -135.711mV
015   -125.293mV
016   -132.634mV
017   -134.722mV
018   -134.431mV
019   -130.843mV
020   -123.359mV
021   -120.129mV
022   -120.920mV
023   -130.851mV
024   -117.322mV
025   -129.873mV
026   -122.843mV
027   -117.847mV
028   -120.850mV
029   -114.894mV
030   -     .035mV

                00/00/00
```

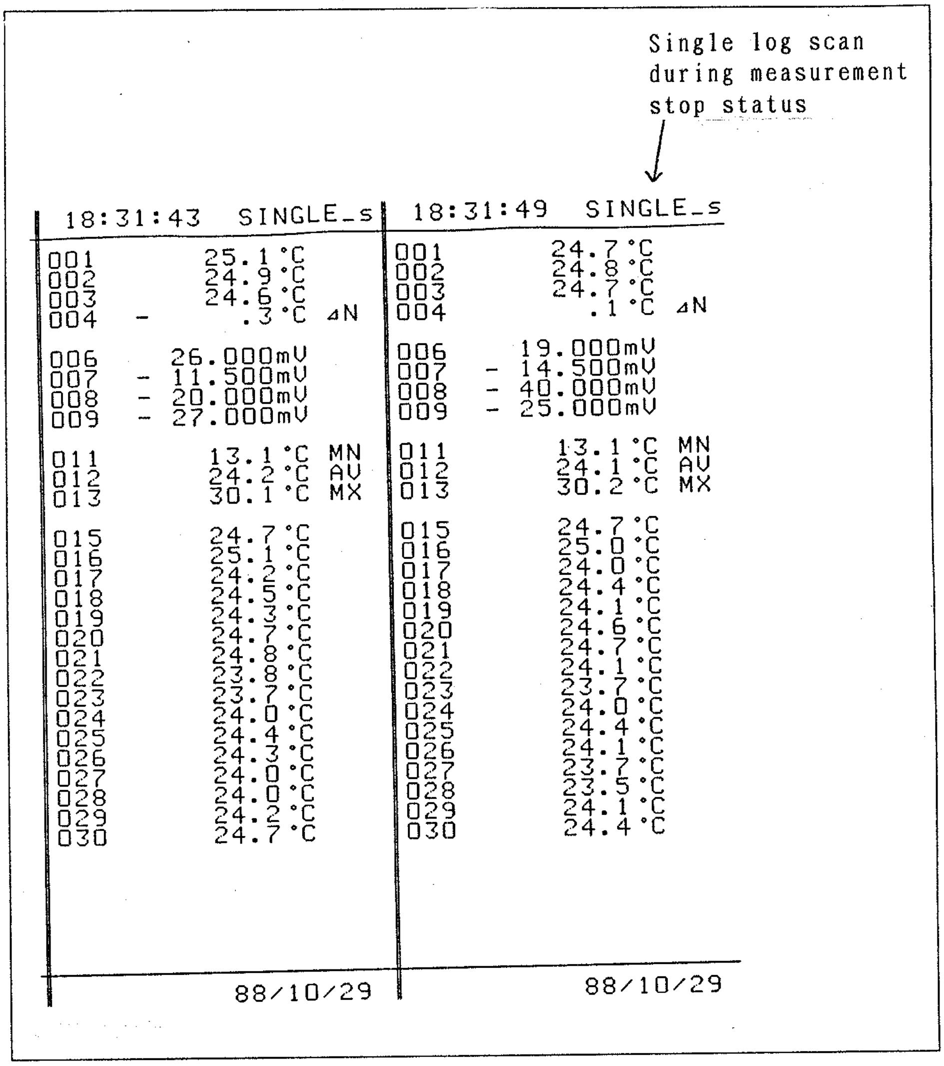
Figure 9 - 13 Example of Continuous Log Scan Data (Digital Printing)

② If the log time has come during printing of single log scan data or during printing of alarm data:
The corresponding log scan is skipped and printing of log scan data starts from the next log time. The interval time does not therefore shift.
An example of alarm data printout is shown in Figure 9-10, and an example of single log scan data printout is shown in Figure 9-16.

9.2.6 Single Log Scan Measurement

Single log scan measurement refers to an operation in which all channels from the scan starting channel to the scan ending channel are scanned and measured only once.
During digital printing, a maximum of 360 channels of data (including second-order calculate channel data) are printed in digital form.
During trend printing or trend/digital combined printing, a maximum of preselected 30 channels of data are printed in digital form.

(1) Printing during measurement stop status (log mode)



Single log scan
during measurement
stop status

```
 18:31:43  SINGLE_s      18:31:49  SINGLE_s
001          25.1 °C      001          24.7 °C
002          24.9 °C      002          24.8 °C
003          24.6 °C      003          24.7 °C
004   -        .3 °C  ⊿N  004            .1 °C  ⊿N

006        26.000mV       006        19.000mV
007   -    11.500mV       007   -    14.500mV
008   -    20.000mV       008   -    40.000mV
009   -    27.000mV       009   -    25.000mV

011          13.1 °C  MN  011          13.1 °C  MN
012          24.2 °C  AV  012          24.1 °C  AV
013          30.1 °C  MX  013          30.2 °C  MX

015          24.7 °C      015          24.7 °C
016          25.1 °C      016          25.0 °C
017          24.2 °C      017          24.0 °C
018          24.5 °C      018          24.4 °C
019          24.3 °C      019          24.1 °C
020          24.7 °C      020          24.6 °C
021          24.8 °C      021          24.7 °C
022          23.8 °C      022          24.1 °C
023          23.7 °C      023          23.7 °C
024          24.0 °C      024          24.0 °C
025          24.4 °C      025          24.4 °C
026          24.3 °C      026          24.1 °C
027          24.0 °C      027          23.7 °C
028          24.0 °C      028          23.5 °C
029          24.2 °C      029          24.1 °C
030          24.7 °C      030          24.4 °C

             88/10/29                  88/10/29
```

Figure 9 - 14 Example of Digital Printing During Stop Status of Single Log Scan Measurement (log mode)

The characters of SINGLE-s are printed out at the position of the log number.
During the stop status of single log scan measurement, high-/low-limit judgment is not performed and for calculation of ΔI and ΔT, not the calculated data but raw data is printed out.
Even if the time mode is timer, not the actual time elapsed but the clock time is printed out.

(2) Printing during measurement (log/trend mode)

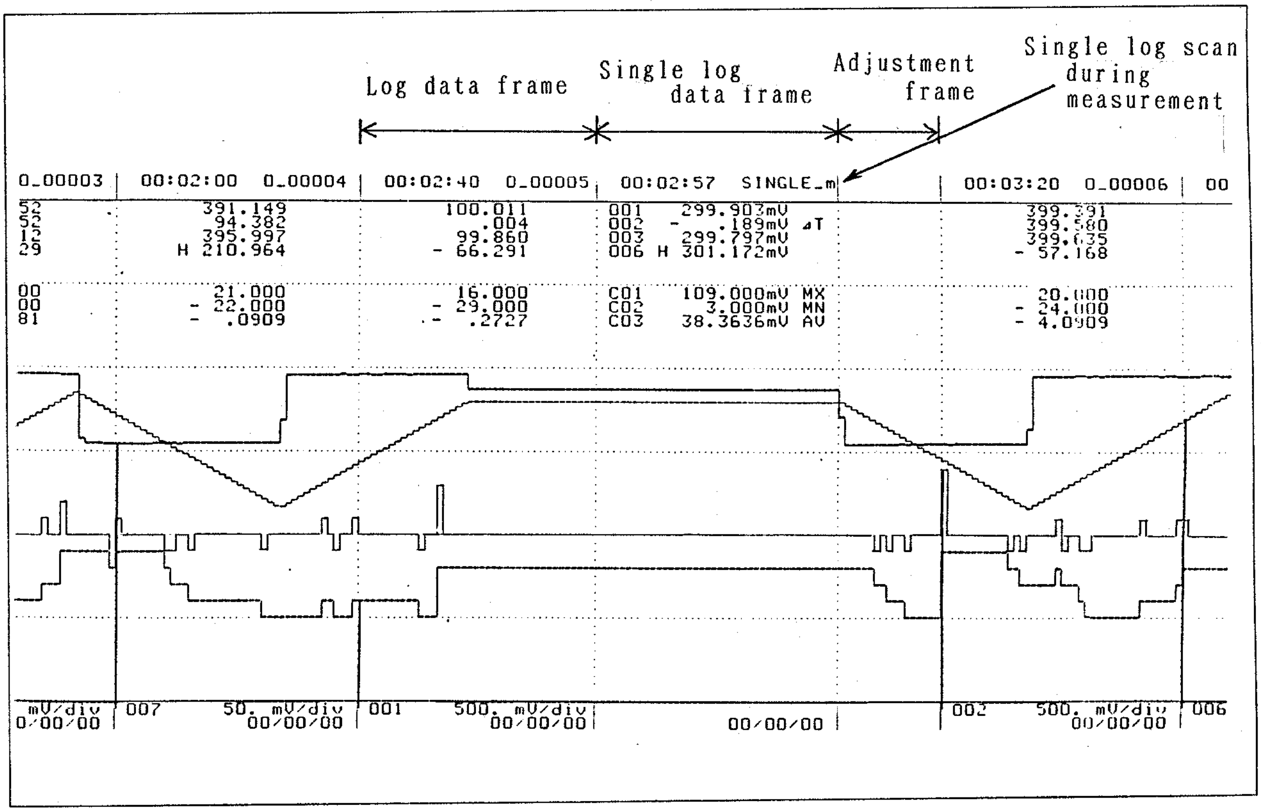
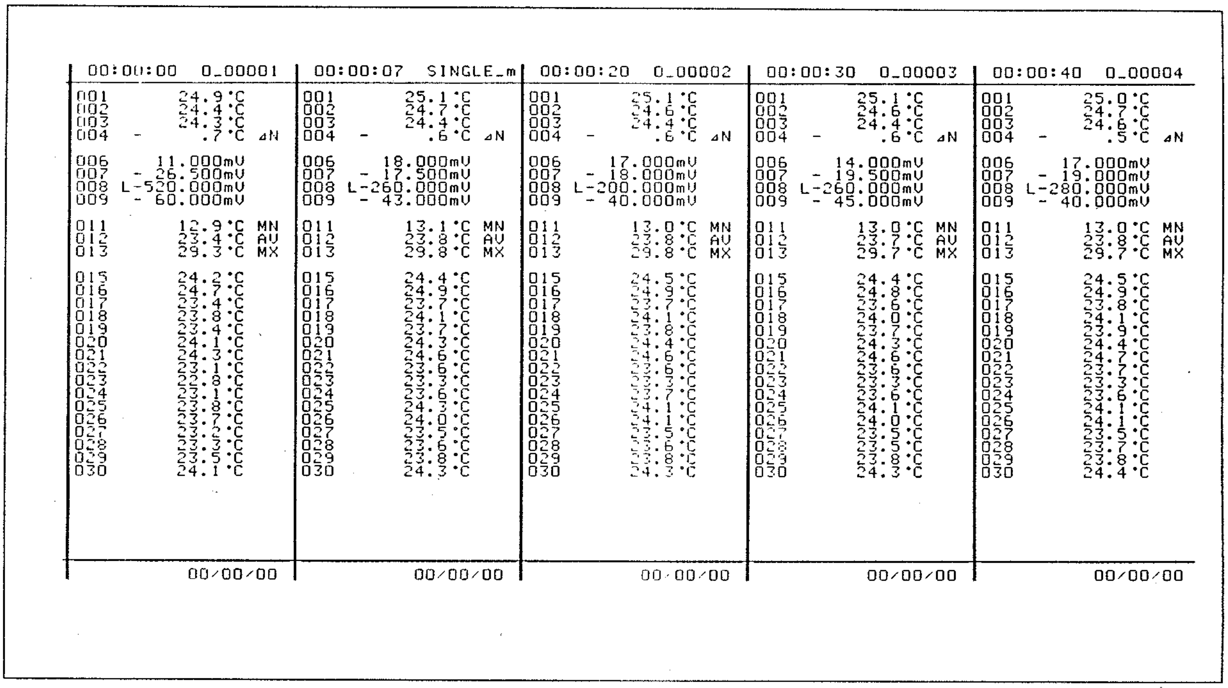


Figure 9 - 15 Example of Digital/Trend Combined Printing During Single Log Scan Measurement (log/trend mode)

The characters of SINGLE-s are printed out at the position of the log number.
First-order/second-order calculations and high-/low-limit judgments are performed.

(3) Skipping of log scan measurement due to single log scan

An example of data that was measured with a log interval time of 10 seconds is shown in Figure 9-16.
In this example, since the single log scan started seven seconds after the start of measurement and ended after ten seconds, the log scan measurement operation pre-scheduled for the tenth second was skipped.



```
 00:00:00   0_00001
001          24.9°C
002          24.4°C
003          24.3°C
004   -        .7°C  ⊿N

006       11.000mV
007   -   26.500mV
008 L-520.000mV
009   -   60.000mV

011          12.9°C  MN
012          23.4°C  AV
013          29.3°C  MX

015          24.2°C
016          24.7°C
017          23.4°C
018          23.8°C
019          23.4°C
020          24.1°C
021          24.3°C
022          23.1°C
023          22.8°C
024          23.1°C
025          23.8°C
026          23.7°C
027          23.2°C
028          23.3°C
029          23.5°C
030          24.1°C

           00/00/00
```

```
 00:00:07   SINGLE_m
001          25.1°C
002          24.7°C
003          24.4°C
004   -        .6°C  ⊿N

006       18.000mV
007   -   17.500mV
008 L-260.000mV
009   -   43.000mV

011          13.1°C  MN
012          23.8°C  AV
013          29.8°C  MX

015          24.4°C
016          24.9°C
017          23.7°C
018          24.1°C
019          23.7°C
020          24.3°C
021          24.6°C
022          23.6°C
023          23.3°C
024          23.6°C
025          24.3°C
026          24.0°C
027          23.5°C
028          23.6°C
029          23.8°C
030          24.3°C

           00/00/00
```

```
 00:00:20   0_00002
001          25.1°C
002          24.6°C
003          24.4°C
004   -        .6°C  ⊿N

006       17.000mV
007   -   18.000mV
008 L-200.000mV
009   -   40.000mV

011          13.0°C  MN
012          23.8°C  AV
013          29.8°C  MX

015          24.5°C
016          24.9°C
017          23.7°C
018          24.1°C
019          23.8°C
020          24.4°C
021          24.6°C
022          23.6°C
023          23.3°C
024          23.7°C
025          24.1°C
026          24.1°C
027          23.5°C
028          23.6°C
029          23.8°C
030          24.3°C

           00/00/00
```

```
 00:00:30   0_00003
001          25.1°C
002          24.6°C
003          24.4°C
004   -        .6°C  ⊿N

006       14.000mV
007   -   19.500mV
008 L-260.000mV
009   -   45.000mV

011          13.0°C  MN
012          23.7°C  AV
013          29.7°C  MX

015          24.4°C
016          24.8°C
017          23.6°C
018          24.0°C
019          23.7°C
020          24.3°C
021          24.6°C
022          23.6°C
023          23.3°C
024          23.6°C
025          24.1°C
026          24.0°C
027          23.5°C
028          23.5°C
029          23.8°C
030          24.3°C

           00/00/00
```

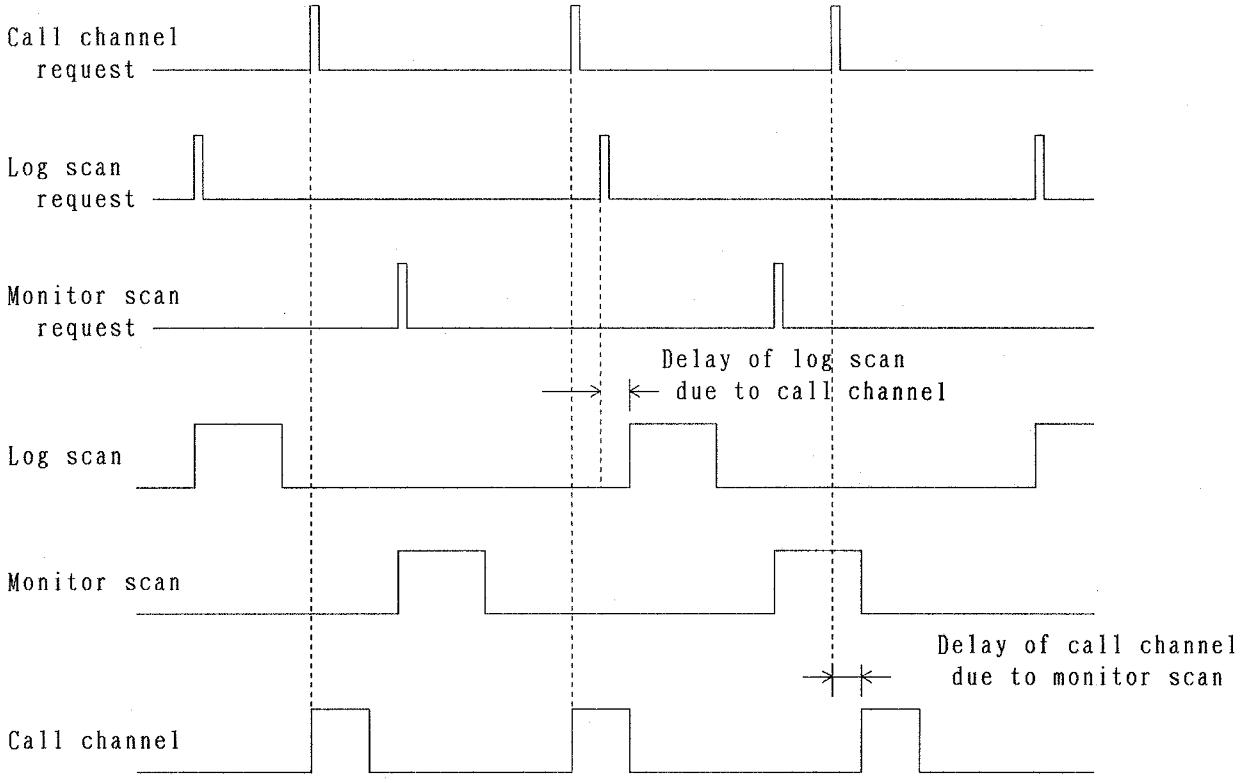
```
 00:00:40   0_00004
001          25.0°C
002          24.7°C
003          24.6°C
004   -        .5°C  ⊿N

006       17.000mV
007   -   19.000mV
008 L-280.000mV
009   -   40.000mV

011          13.0°C  MN
012          23.8°C  AV
013          29.7°C  MX

015          24.5°C
016          24.9°C
017          23.8°C
018          24.1°C
019          23.9°C
020          24.4°C
021          24.7°C
022          23.7°C
023          23.3°C
024          23.6°C
025          24.1°C
026          24.1°C
027          23.5°C
028          23.7°C
029          23.8°C
030          24.4°C

           00/00/00
```

Figure 9 - 16 Example of Skipping of Log Scan Measurement due to Single Log Scan

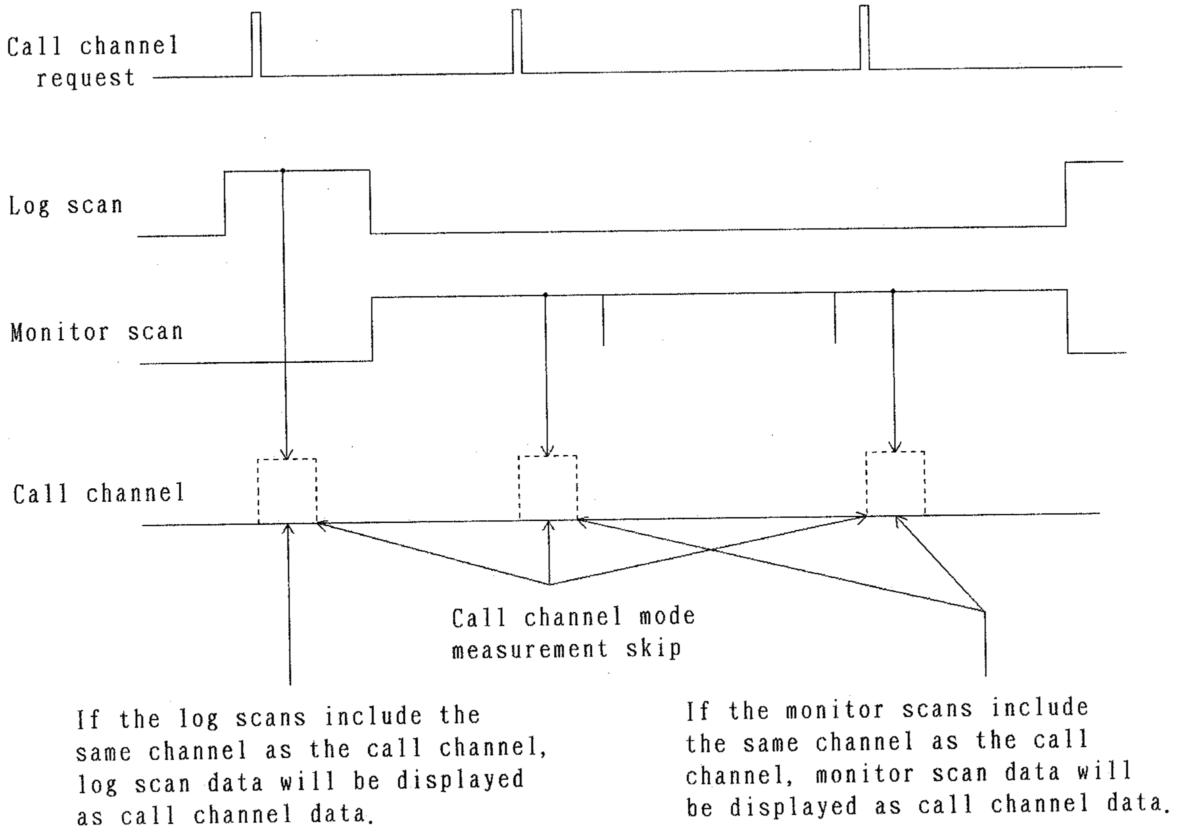
9.2.7 Call Channel Mode

During the call channel mode, ten any points of data are measured at intervals of about one second and then displayed on the CRT. Data thus measured will be output onto the CRT, not onto the printer or the GPIB.
Neither scaling, first-order/second-order calculations, nor high-/low-limit judgments are performed; raw data is output.
If log scan measurement or monitor scan measurement is already in progress, call channel mode measurement is executed after completion of that measurement operation. If, however, execution channels for call channel mode measurement are included in the scan channels, log scan or monitor scan measured data will be displayed as call channel data.

(1) Usual Call Channel Mode Measurement



(2) Call Channel Mode Measurement for Continuous Scanning



If the log scans include the same channel as the call channel, log scan data will be displayed as call channel data.

If the monitor scans include the same channel as the call channel, monitor scan data will be displayed as call channel data.

9.2.8 Alarm Check Scan Mode

During this mode, data is measured according to the monitor interval time. Measured data, however, is not output unless an alarm occurs. If an alarm occurs, measurement will restart --- but this time, according to the preselected measuring mode --- and the results will be output.
This function is effective for starting measurement operations from the time the intended measuring conditions are achieved.

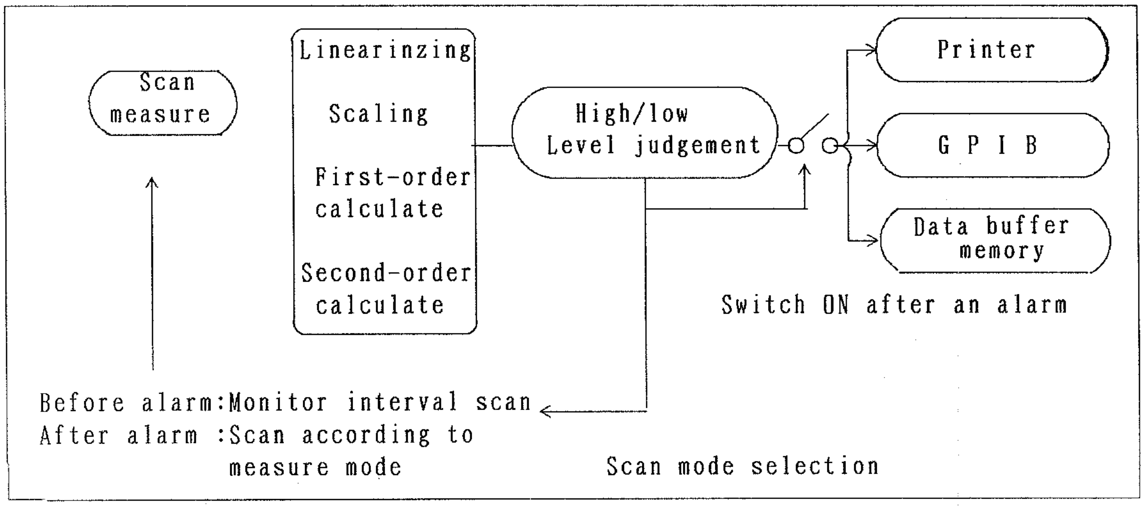
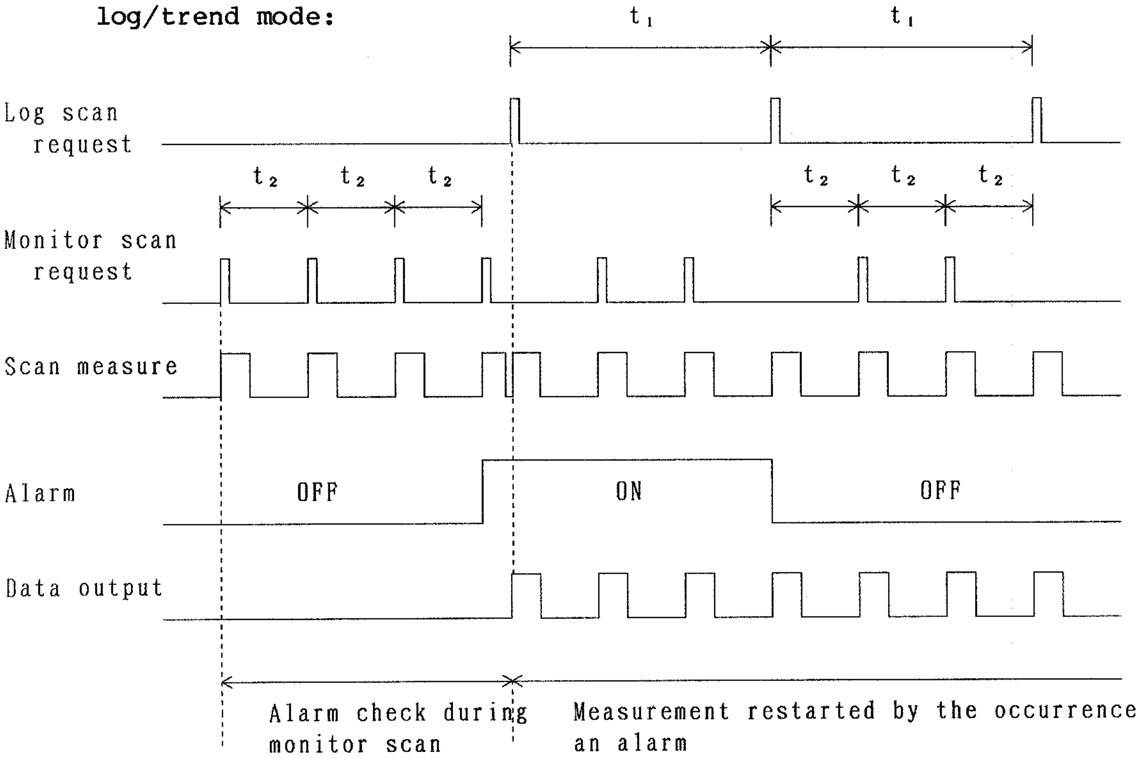


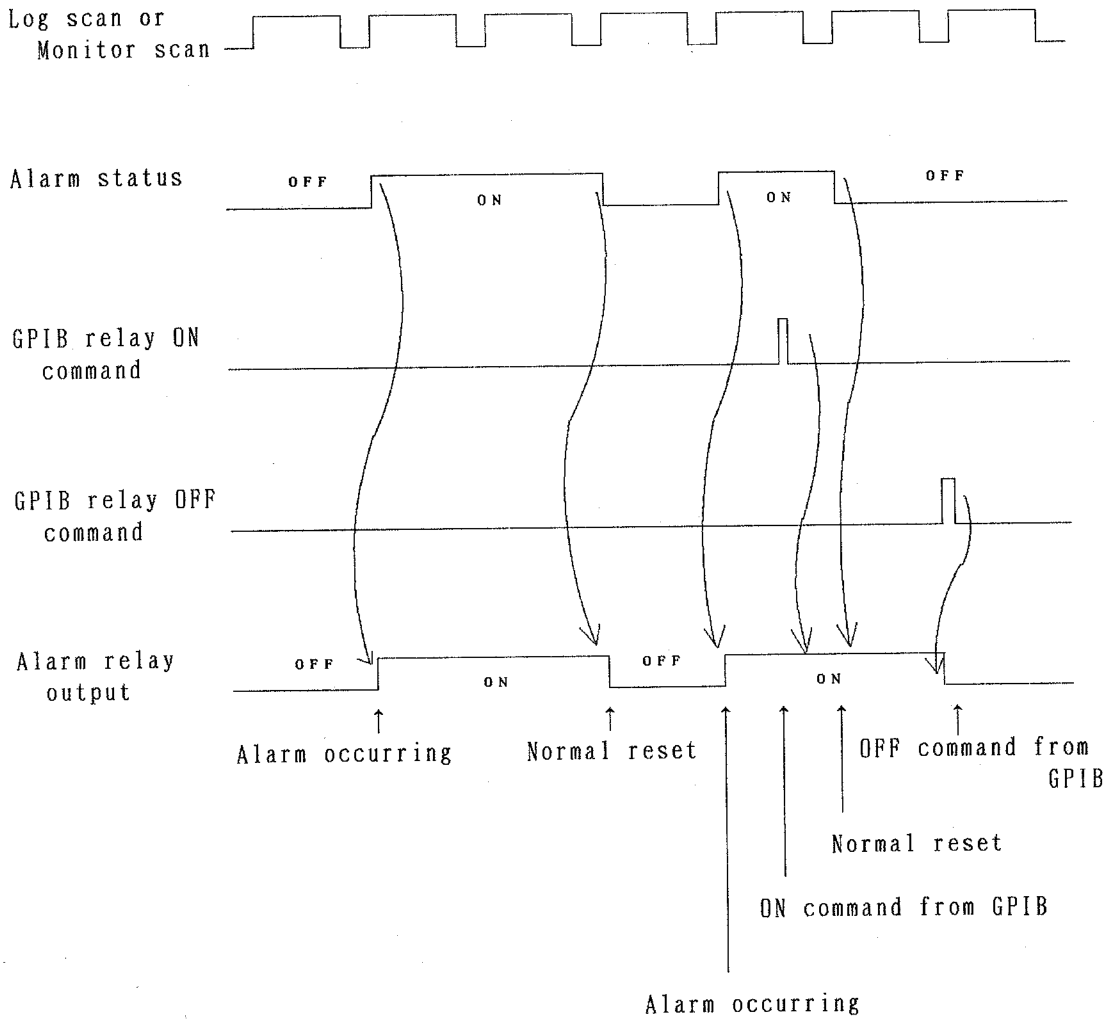
Figure 9 - 17 Conceptual Diagram of Alarm Check Scan

The following represents an example of alarm check scan using the log/trend mode:



9.2.9 Alarm Output Relay

The occurrence of an alarm turns the alarm output relay on, and clearing of the alarm turns the relay off. Relay ON or OFF commands from the GPIB also turn this relay on or off. Thus, the relay turns on when the alarm status is ON (alarm is occurring) or when a GPIB relay ON command is issued.



9.2.10 Error Data Output Formats

Measured data is output onto the call channel display area, the printer, and the GPIB. If, however, errors occur in measured data, the erroneous data will be output in the following formats:

Type of error	Call channel	Printout	GPIB
Thermocouple sensor out	sensor out	*---------	BT 9999999E+9
Measured data scale over	over	*	OL 9999999E+9
Calculation error		*-	ER 9999999E+9
Transfer error	----------	*-	ER 9999999E+9

9.2.11 Scanning Measurement Time

Time required for a single scanning measurement can be roughly calculated from formulas shown below. The scanning measurement time thus calculated can be used as reference in setting a log interval or monitor interval time.

(1) Major Calculation Formula

Scanning measurement time
= UMmax + (UT x Number of measuring units) .... ①

UMmax : Maximum measuring time spent by each measuring unit (Calculated from the formula ② below.)
UT : Processing time spent by each measuring unit = Approx. 22ms

$$UM = INIT + FT + ZT + \left(\sum_{n=1}^{m} CHTn \right) + CMP \; ...②$$

m : Number of scanned channels
INIT : Initial processing time = Approx. 90ms
FT : Full calibration time = Approx. 220ms
ZT : Zero calibration time (Calculated from the formula shown in (2))
CHTn : n channel measuring time (Calculated from the formula shown in (2))
CMP : Room temperature compensation time = (CHT x 2) + 10ms

[Simplified UM Calculation Formula]

The UM can be calculated from an simplified formula ③ shown below under the following standard conditions :

(Standard conditions)

Inategration time : 1PLC
Calibration : Auto-full/auto-zero/room temperature compensation is on
Range : Common to all channels

UM ≑ k0 + (k1 x number of channels) .... ③

Source frequency	Measuring range	K0	K1
50Hz	DC voltage	405	23
	Thermocouple	430	25
	Resistance thermometer bulb	405	25
60Hz	DC voltage	400	20
	Thermocouple	415	22
	Resistance thermometer bulb	400	22

(Unit : ms)

(2) Minor Calculation Formula

(a) Zero Calibration Time (ZT)

ZT = Number of measuring ranges x (IT + 4ms) + 10ms .... ④

Number of measuring ranges : Number of measuring ranges in use in one measuring unit. For a thermocouple, two measuring ranges of 50mV and 500mV are available. For a resistance thermometer bulb, a measuring range of 500mV is available.
IT : Integration time

(b) Channel Measuring Time (CHT)

CHT = IT + ST + CM .... ⑤

IT : Integration time
ST : Setting time = Approx. 3ms (Or major delay time, if set)
CM : Operation time
Approx. 2ms for temperature measurement
Approx. 0.7ms for Scale A operation
Approx. 2.2ms for Scale B operation

When a step interval is set to any value larger than a calculated CHT value, the CHT should be considered equal to the step interval value.

(3) Outline Procedure of Calculating Scanning Measurement Time

① Calculate a UM value for each measuring unit from the following formula :

$$
\begin{aligned}
UM \fallingdotseq\ & 90ms \\
&+ 220ms \quad \text{: When the auto-full calibration is on} \\
&+ (IT + 4ms) \times \text{number of measuring ranges} + 10ms \\
&\quad \text{: When the auto-zero calibration is on} \\
&+ \sum_{n=1}^{m} (IT + 3ms + CM) \\
&+ (IT + 5ms) \times 2 + 10ms \\
&\quad \text{: When room temperature compensation is on}
\end{aligned}
$$

m : Number of scanned channels

② Find the maximum value of the calculated UM and substitute the value for UMmax in the formula below to calculate a scanning measurement time.

Scanning measurement time
$\fallingdotseq$ UMmax + (22ms x number of measuring units)

(4) Examples of Calculation of Scanning Measurement Time

Example 1 : Full calibration, zero calibration : On
Measuring range : 50V
Integration time : 1PLC (50Hz)
Number of channels : 15 channels x 1 unit
Room temperature compensation : Off

UM ≒ 90ms + 220ms + (24ms + 10ms) + (23ms x 15 channels) = 689ms

* Thus, a scanning interval time can be judged to be 700ms or more.

Example 2 : Full calibration, zero calibration : Off
Measuring range : 500mV
Integration time : 1ms
Number of channels : 20 channels x 1 unit
Room temperature compensation : Off

UM ≒ 90ms + (4ms x 20 channels) = 170ms

* Thus, a scanning interval time can be judged to be 200ms or more.

Example 3 : Full calibration : Off
Zero calibration : On
Measuring range : 500mV (10 channels),
T (10 channels),
K (10 channels)
Integration time : 1PLC (50Hz)
Number of channels : 30 channels x 10 units
Room temperature compensation : On

UM ≒ 90ms + (24ms x 2 + 10ms) + (23ms x 10 channels)
+ (25ms + 20 channels) + (25ms x 2 + 10ms) = 938ms

Scanning execution time = 938ms + 22ms x 10 units = 1158ms

* Thus, a scanning interval time can be judged to be 1.2 seconds or more.

9.3 Arithmetic Operations

9.3.1 Operation Overview

The equipment can perform ten types of arithmetic operations: seven types that can be specified for function groups, and three types that require use of calculate channels.

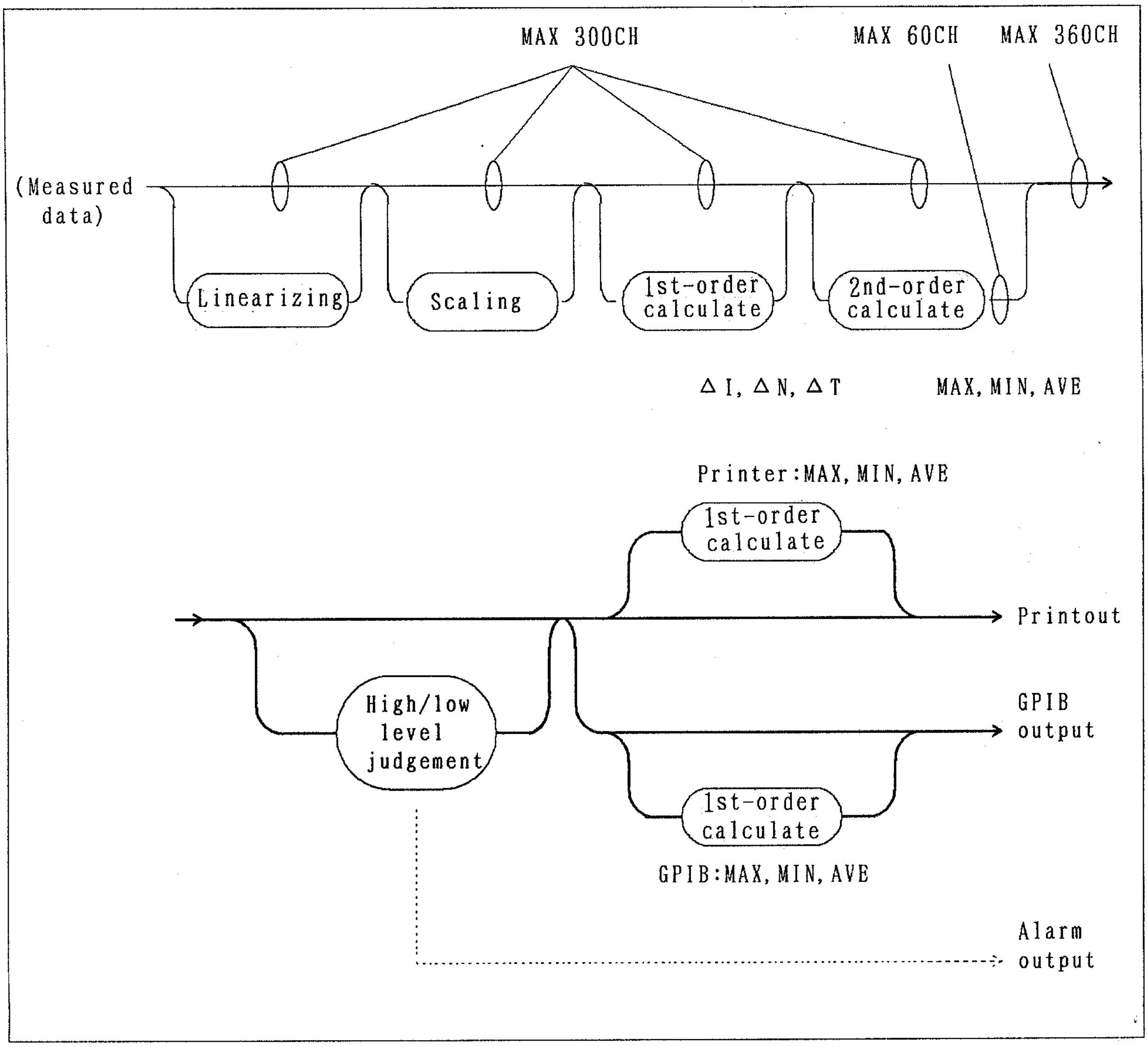


Figure 9 - 18 Conceptual Diagram of Arithmetic Processing

(1) Linearizing

Linearizing is executed during temperature measurement with a thermocouple.
Setting "linearize" to OFF enables linearizing calculation to be skipped. Consequently, DC voltage measurement using the 100mV fullscale range becomes possible, with both the position of the decimal point and the type of unit remaining unchanged.
If the value of 80mV is input for the T range with "linearize" OFF and room-temperature compensation OFF, the data measurement obtained will be:

80000.0°C

This value can be output as follows if the unit of measurement is changed to mV and the value is scaled down into 1/1000 units:

80.0000mV

Detailed description of linearizing

As shown in Figure 9-19 below, the temperature-thermoelectromotive force characteristics of a thermocouple usually become nonlinear when plotted on a graph. Therefore, even dividing the voltage data into constant widths and then assigning a specific value to each such width will not make the widths constant with respect to temperature. If, in the middle of converting voltage into an output data form suitable for display, one gives an opposite voltage-output data characteristics to the temperature-voltage characteristics of the thermocouple, then the temperature-output data relationship will become linear as shown in Figure 9-20.
The operation of making the voltage-output data relationship linear is referred to as linearizing.
The R7430 uses a microcomputer-based, high-accuracy digital linearize method to perform the linearizing operation.

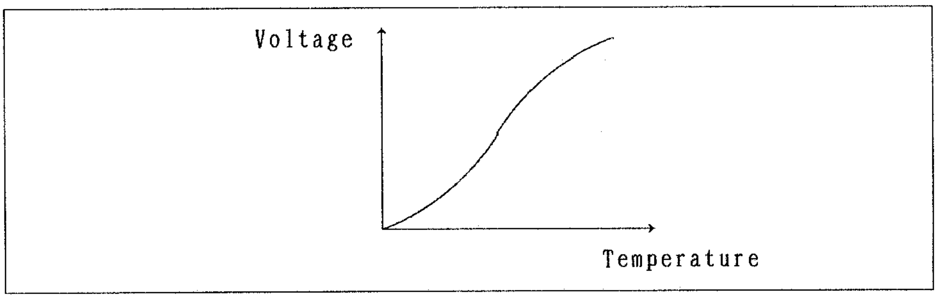


Figure 9 - 19 Temperature-thermoelectromotive Force Characteristics of a Thermocouple

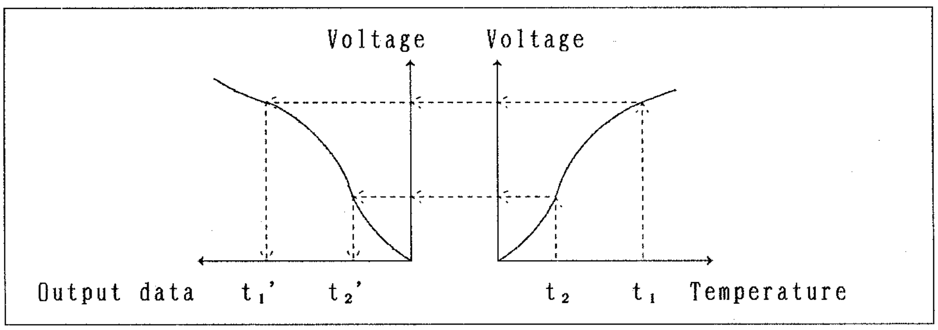


Figure 9 - 20 Conceptual Diagram of Linearizing

(2) During call channel measurement, no calculations are performed and raw data is only output. Nor are performed high-/low-level judgments. Linearizing during temperature measurement, however, is performed.

(3) During single log scan measurement, the equipment operates differently according to whether log measurement is in progress.
If log measurement is in progress, the equipment performs calculations other than first-order MAX, MIN, and AVE calculations.
If log measurement is not in progress, the equipment only outputs raw data used for first-order calculations other than ΔN calculation, and does not perform high-/low-level judgments.

(4) During log scan measurement, although all types of calculations are perfomed, the results of the first ΔI and ΔN calculations always become 0 and high-/low-level judgment does not occur.

Table 9 - 2 List of Calculating Operations

Measurement mode	1st-order calculation				2nd-order calculation MAX/MIN /AVE	High/low level judgement
	ΔI	ΔT	ΔN	MAX/MIN /AVE		
Call channel	No	No	No	No	No	No
Single log scan during log measure stop	No	No	Yes	No	Yes	No
Single log scan during log measure	Yes	Yes	Yes	No	Yes	Yes
First log scan data	Output data =0	Output data =0	Yes	Output data =0	Yes	Not done for 1st -order calculations other than N data
Second/subsequent log scan data	Yes	Yes	Yes	Yes	Yes	Yes

Yes : Calculation done
No : Calculation not done

9.3.2 Scaling Calculation

Scaling calculation is perfomed as follows:

Output data = (X - A)/B
X: Measured data
A: Offset constant (.000000 to ±999999)
B: Span constant (.000000 to ±999999, where B $\neq 0$)

You can select any desired offset channel using the offset constant of A, and any desired range of fullscale using the span constant of B.

The scaling calculation results are output as shown below.

(1) Offset Constant A

① The position of the decimal point becomes the same as in the measured data.

Example)	Measured data	50.0000
	A	4.00000
	Calculation results	46.0000

② If the product of the results and A is likely to exceed the measured data, the decimal point will move correspondingly.

Example)	Measured data	50.0000
	A	400.000
	Calculation results	-350.000

(2) Span Constant B

① For $1 \leqq B$, the number of digits below the decimal point increases by the [(number of integral digits) - 1] of the value of B.

Example)	Measured data	50.0000
	B	100.000
	Calculation results	.500000

② For $1 < B$, the number of digits below the decimal point decreases by the [(number of 0's below the decimal point) + 1] of the value of B.

Example)	Measured data	50.0000
	B	.001000
	Calculation results	50000.0

(3) Data Printout Formats

① For up to six integral digits

.dddddd to dddddd.

② For more than seven integral digits

ddddddd (Upper seven digits only, without decimal point)

Example)	Calculation results	12345678.9
	Output data	1234567

(4) GPIB Data Output Formats

① Basic output fomats

Range	Format
50V	dd.ddddE+0
5V	d.dddddE+0
500mV	ddd.dddE-3
Thermocouple	ddddd.dE+0
Pt	dddd.ddE+0
FLAG	dddddd.E+0

② If the data cannot be expressed in the basic output format:

(a) The position of the decimal point changes within the range from .dddddd to dddddd.

(b) The exponential part changes within the range from -9 to +9.

③ If the value of the exponential part is in excess of +9, only the upper seven digits are output without a decimal point.

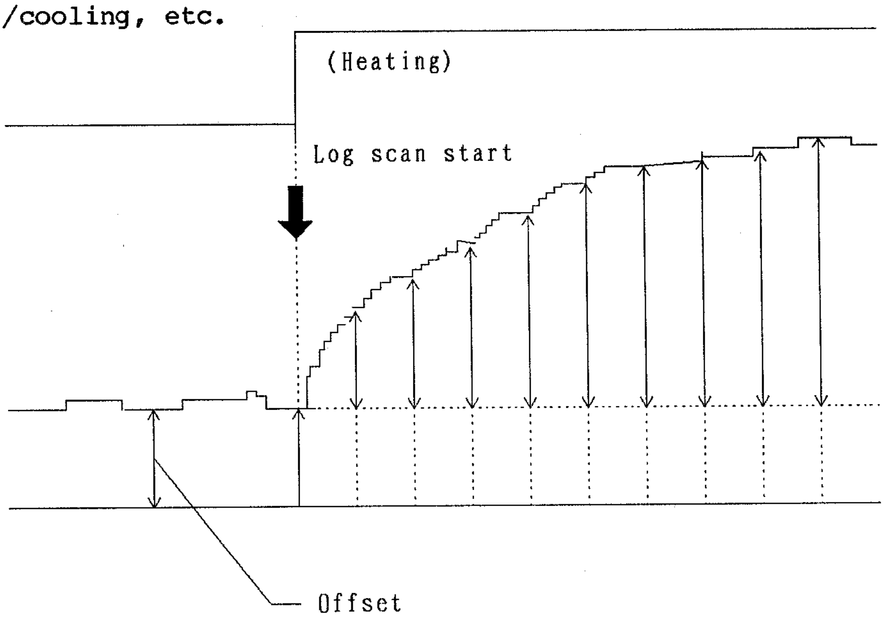
Example)	Calculation results	12345678.9E+9
	Output data	1234567E+9

9.3.3 First-order Calculation

Three types of data are obtained by first-order calculation. They are: (1) ΔI, which denotes the differences from initial data; (2) ΔT, which denotes the differences from the previous data, and; (3) ΔN, which denotes the differences from other channel data.

(1) ΔI (Differences from initial data)

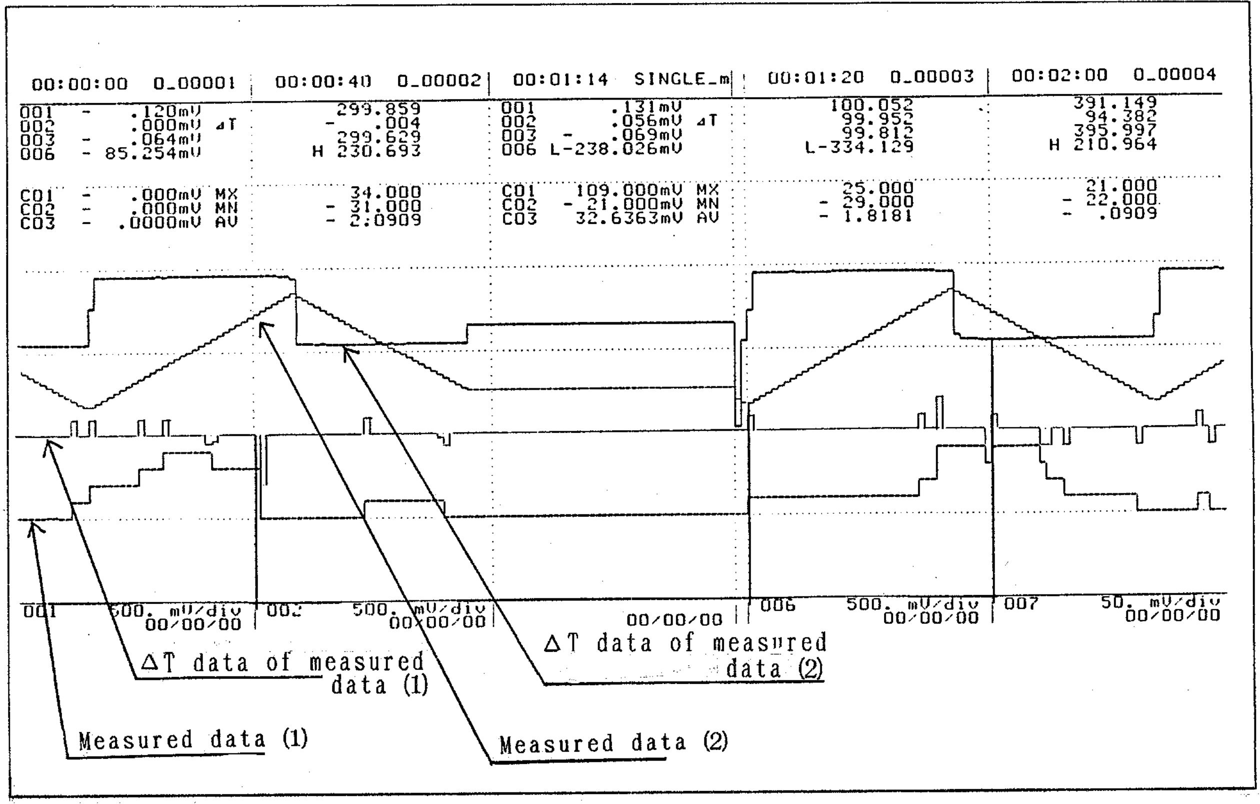
Calculation of ΔI refers to an operation in which the first log scan data is stored into a special memory first and then the differences between the data and second and subsequent log scan data are output as measurement results.
For the initial, "0" is always output and high-/low-level judgment does not occur.
If the initial is scale over, sensor out, or any other such abnormal data, the data will be handled as erroneous data (calculation error).
This function is effective for measuring only the data changes from the measurement starting point, such as removeal of offsets, measurement of temperature differences between before and after heating/cooling, etc.



(2) ΔT (Differences from the previous data)

Calculation of ΔT refers to an operation in which the differences from the previous data are output as measurement results.
Therefore, changes from each previous set of data become measurement results.
For initial data, "0" is always output and high-/low-level judgment does not occur.
If the data last measured or the particular measured data is scale over, sensor out, or any other such abnormal data, the data will be handled as erroneous data (calculation error).

This function is effective for measuring temperature changes per unit time, recognition of differential characteristics or temperature gradients, evaluation of heating/cooling characteristics, evaluation of the control characteristics of a temperature controller, etc.



ΔT data of measured data (1)

ΔT data of measured data (2)

Measured data (1)

Measured data (2)

Figure 9 - 21 ΔT Measurement Examples

(3) ΔN (Differences from other channel data)

Calculation of ΔN refers to an operation in which the differences from the user-selected channel data are output as measurement results. This function can be used to check the differences in data from a specific reference point, to measure the temperature differences between the entrance and exit of a room, or to detect differential data (or to recognize the correlationship of two sets of data) during heat-flow measurement.
Channels belonging to the same range group* can only be selected as calculate channels.
If the calculate channel data or the particular channel data is scale over, sensor out, or any other such abnormal data, the data will be handled as erroneous data (calculation error).

*: The same range group refers to ranges that use the same unit of measurement at all times.

DC voltage group ---- 500mV, 5V, 50V
Temperature group --- T, J, E, K, S, R, B, N, W5/W26Re, JPt/3w, JPt/4w, Pt/3w, Pt/4w
Contacts group ------ FLAG

(4) MAX, MIN, AVE (Maximum, minimum, and average data within one particular frame)

Calculation of MAX, MIN, AVE refers to an operation in which the maximim and minimum (or average) data within one particular frame is calculated and then output as the log data of the next frame. High-/low-limit judgment uses measured raw data.

(4)-1 Output of Data

The type of data which is output depends on the measurement mode being used.

① If the mode is log/trend, log/trend/alarm, or log/alarm:

Calculated data is output instead of log data. Measured raw data is output as trend data or alarm data.

② If the mode is trend/alarm or trend:

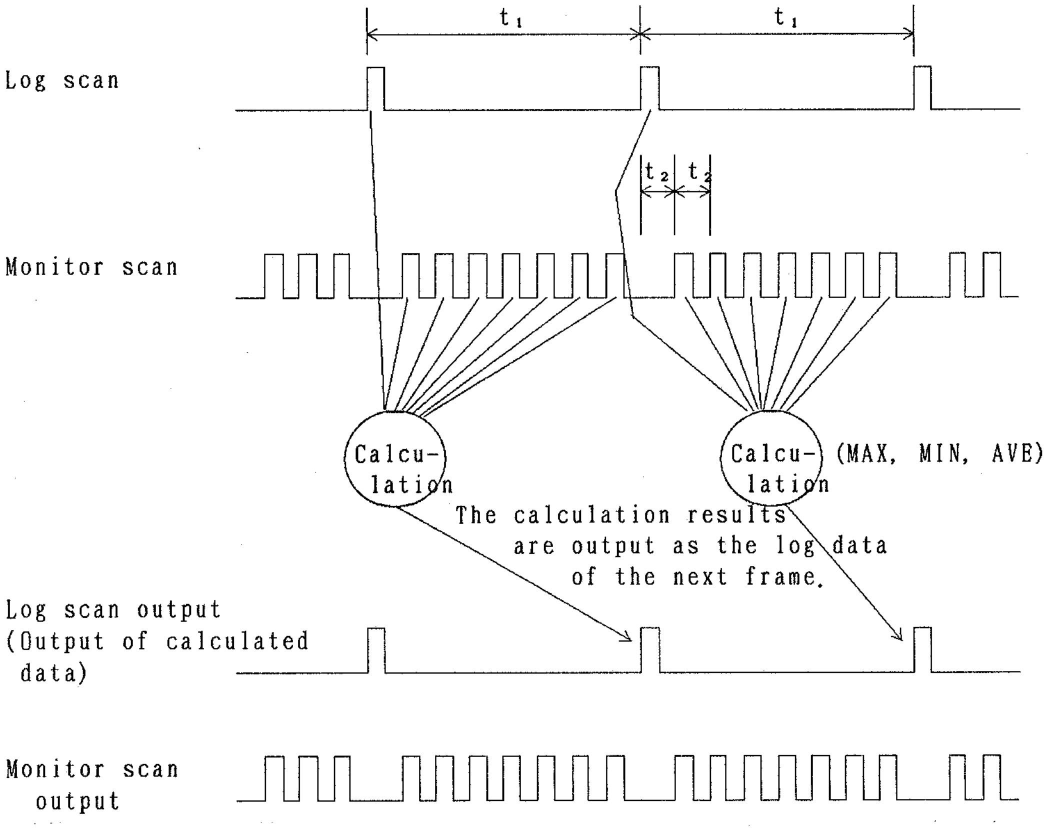
No data is printed out since digital printing has not been selected. The calculation results of the preceding frame are output onto the GPIB during each log interval.

③ If the mode is log or alarm:

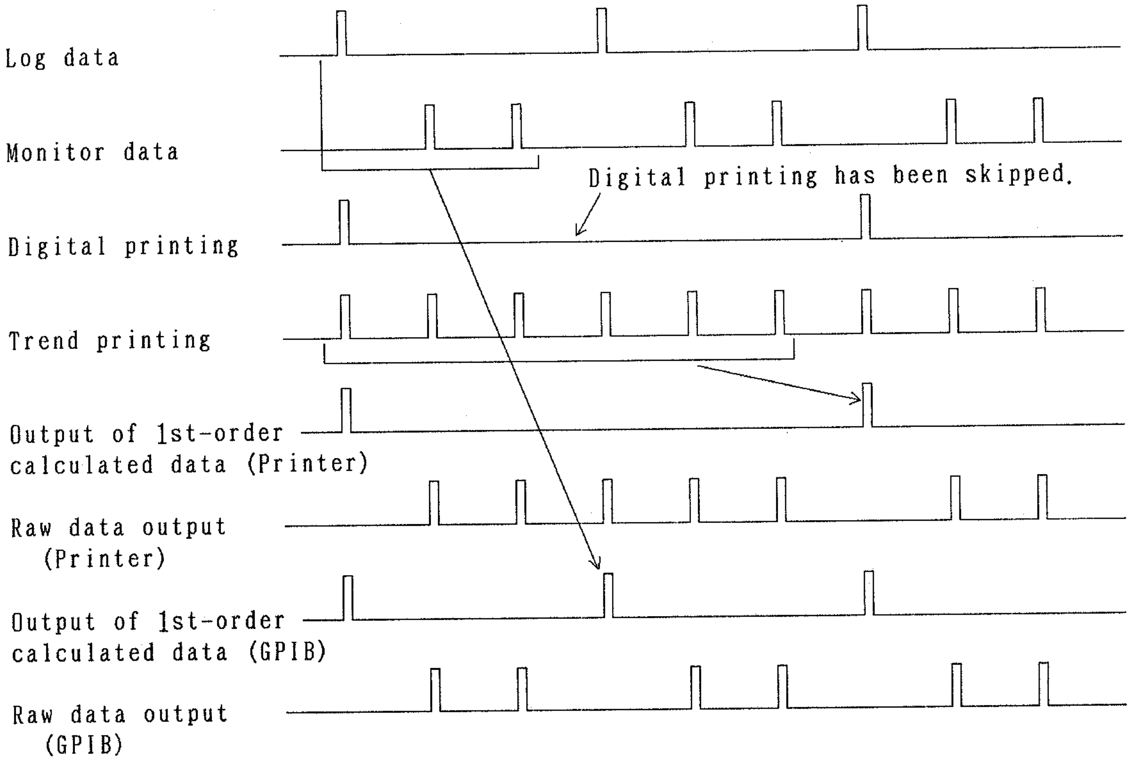
Since there is only one set of data within one frame, measured data becomes the output of the next frame automatically.

(4)-2 Calculation Using the log/trend Mode

The following shows the operation timing of calculation using the log/trend mode:

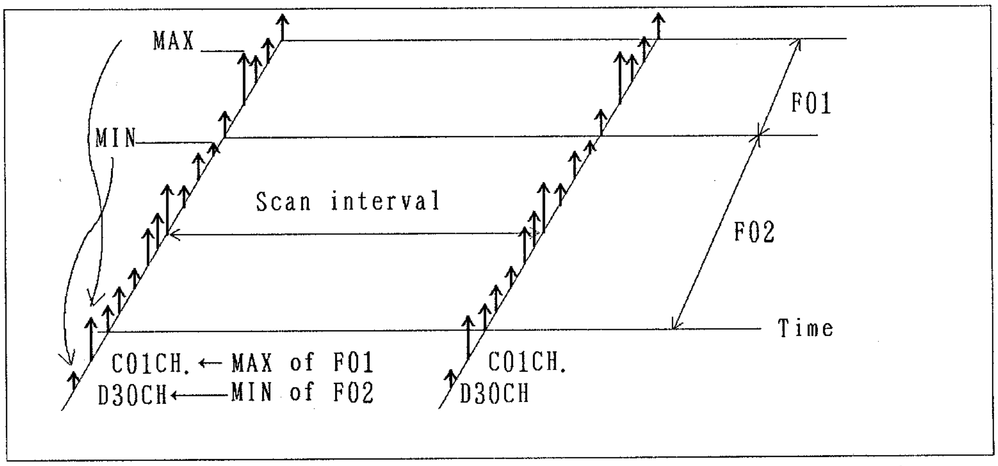


If the calculated data includes scale over, sensor out, or any other such data errors, "999999" will be output to indicate that calculation errors have occurred.
Calculation is not performed on single log scan data.
If digital printing of log scan data has been skipped, the type of data which will be calculated differs between the GPIB and the printer. The operation timing for such types of data is shown as follows.



9.3.4 Second-order Calculation

Second-order calculation refers to an operation in which the maximum and minimum (or average) data within one particular function group existing at one particular clock time is calculated using up to 60 calculate channels.
Second-order calculation is performed on the execution results of scaling and first-order calculation (escept for MAX, MIN, AVE), and the results are output onto calculate channels C01 through C30 and D01 through D30. Calculated data can be handled in a similar manner to that of usual data measurements, and trend printing and high-/low-limit judgment are also possible.



Figuer 9 - 22 Conceptual Diagram of Second-order Calculation

9.3.5 High-/Low-limit Judgment

Separate high-/low-limit data of six digits can be set for each of the measure channels within up to 60 alarm groups, or for each of the calculate channels within up to 60 groups.

See Table 9-2 for the listing of measured data types for which high-/low-limit judgment can be performed.
High-/low-limit judgment of measured data is performed under the following conditions:

High-limit value < Measured data ... Alarm of high-limit overstepped
Measured data < Low-limit value ... Alarm of low-limit overstepped
Low-limit value ≤ Measured data ≤ High-limit value ... No alarm

Position of the decimal point in measured raw data

Range	Output format
500mV	000.000
5V	0.00000
50V	00.0000
TC (Thermocouple)	00000.0
Pt (Platinum resistance thermometer bulb)	0000.00
FLAG	000000.

Note: Execution of scaling may change the position of the decimal point

Causes of alarms

With regard to the channel data for which high- or low-limit data has been set, an alarm is output in the following cases:

① High- or low-limit overstepped
② Scale Over
③ Sensor Out
④ Calculation error
⑤ Transfer error or hardware error

9.3.6 Arithmetic Processing of Contacts Input Data

Printer output will become "ON" or "OFF" if the measurement range is set to "FLAG" and the contacts input data is fetched in. For measured data, the meanings of printer ouptut "ON" and "OFF" are as follows:

ON : 1
OFF: 0

These values can be handled in a similar manner to that of usual data measurements.

Here, if scaling factors A and B are both set equal to 1, then:

ON = 0 ⟶ Printer output "OFF"
OFF = -1 ⟶ Printer output "-ON"

The character 0 is printed out as "OFF", and all other numerics are printed out as "ON".

9.4 Data Buffer Memory

This section describes the data buffer memory, an optional component of the equipment.

9.4.1 Overview

The data buffer memory can contain all types of measured data, except for call channels. This memory operates in either the fix, the ring, or the fifo (first-in, first-out) mode, and one of these three modes is freely selectable.
The contents of the memory are backed up by the internal Ni-Cd (nickel-cadmium) battery of the equipment. Unless an alarm occurs, therefore, the memory contents are retained at all times even after the power has been turned off.

(1) fix Mode

In this mode, data storage can be continued until the memory has become full. If the memory has become full, no more data can be stored into the memory. The data once stored into the memory is not overriden with any other data unless you carry out a memory clear operation.

(2) ring Mode

In this mode, the memory operates in a similar manner to that of the fix mode operation. After the memory has become full, newly measured data overrides the oldest data.
This mode is useful for applications in which data is to be output in sequence with the latest data first.

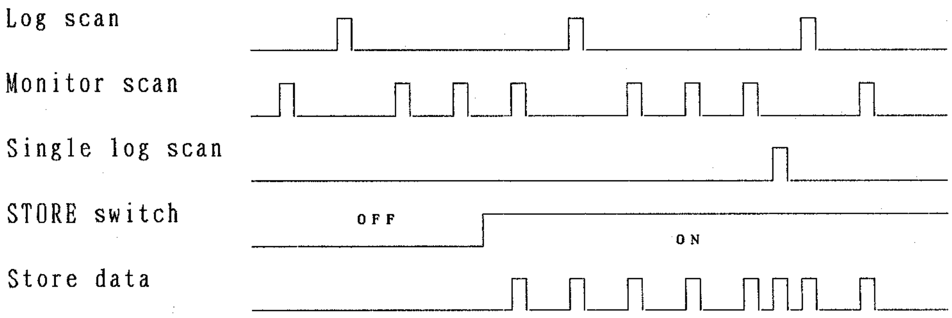
(3) fifo Mode

In this mode, the data buffer memory works as a fifo memory to buffer measred data.

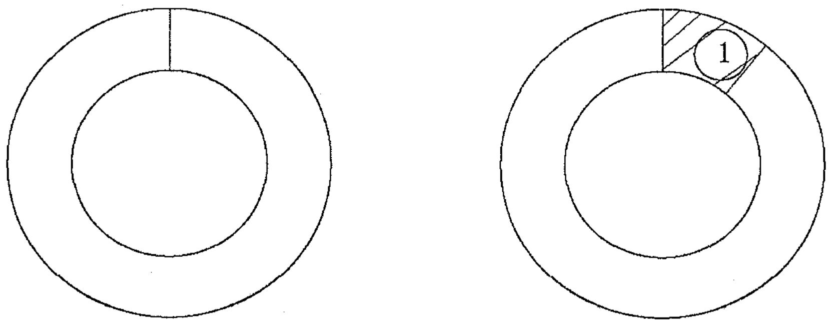
9.4.2 Data Storage Using the fix Mode

In the fix mode, log scan, monitor scan, and/or single log scan data is stored into the memory while the STORE key LED remains ON.

If the memory becomes full during a store operation, the STORE key LED will go out and the store operation will terminate.
In this status, although measurement can be continued, the store operation will no longer occur.

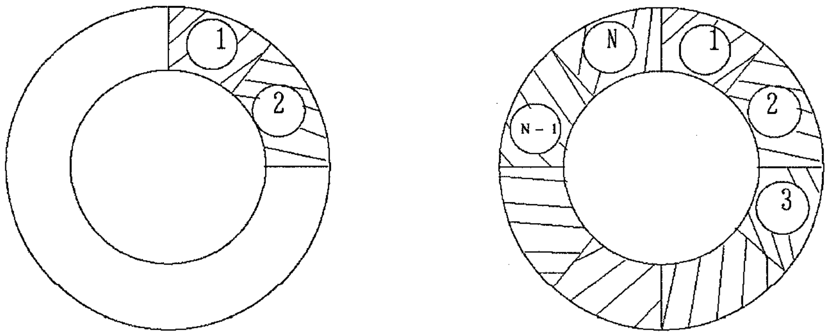


The conceptual diagram of the fix mode is shown in Figure 9-23.



a. Cleared status of
the memory

b. Stored status of
the first scan data



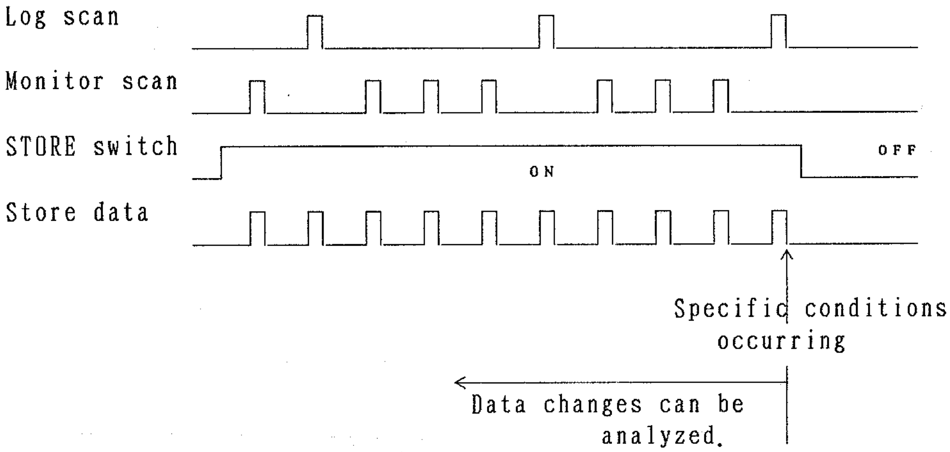
c. Stored status of
the next scan data

d. Status in which the memory
has become full due to
storage of the Nth scan
data

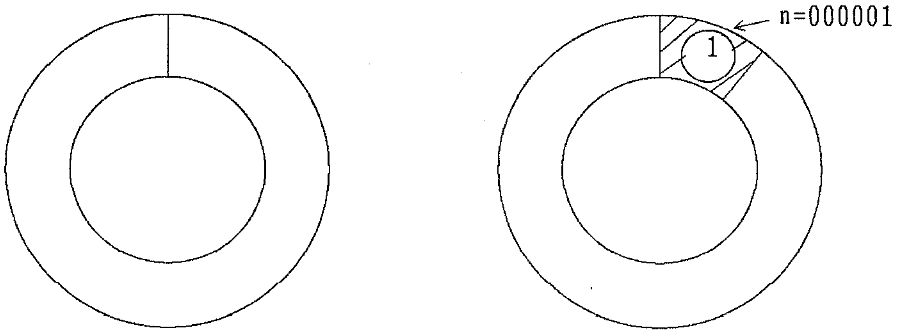
Figure 9 - 23 Conceptual Diagram of the fix Mode

9.4.3 Data Storage Using the ring Mode

Data storage using the ring mode uses the same method as that of the fix mode.
The only one difference from the fix mode is in that if the memory has become full, old data is overriden with new data. With the ring mode, therefore, you can store measured data into the memory without having to limiting the maximum number of scans which can be performed. This in turn allows you to stop log measurement operations when specific conditions hold, and then to analyze changes in the entire preceding data.

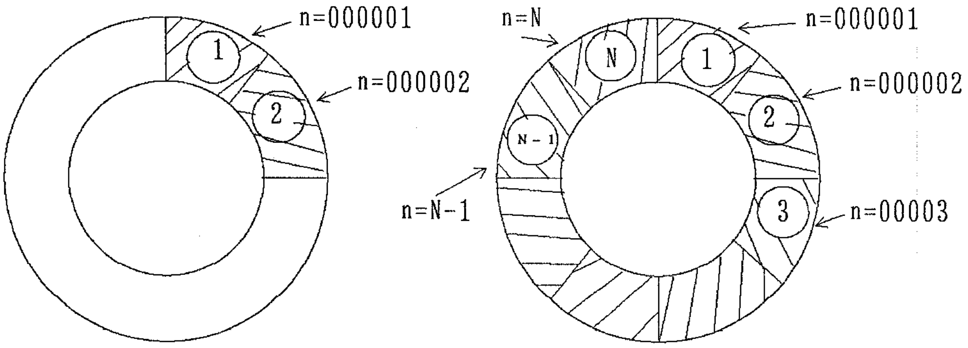


The conceptual diagram of the ring mode is shown in Figrue 9-24.



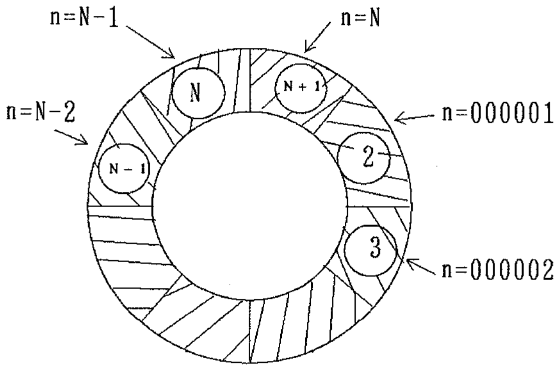
a. Cleared status of the memory

b. Stored status of the first scan data



c. Stored status of the next scan data

d. Status in which the memory has become full due to storage of the Nth scan data

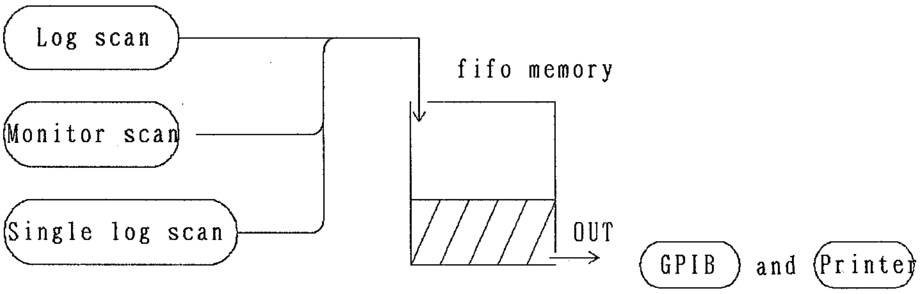


e. Status in which the oldest data has been overriden with the (N+1)th scan data

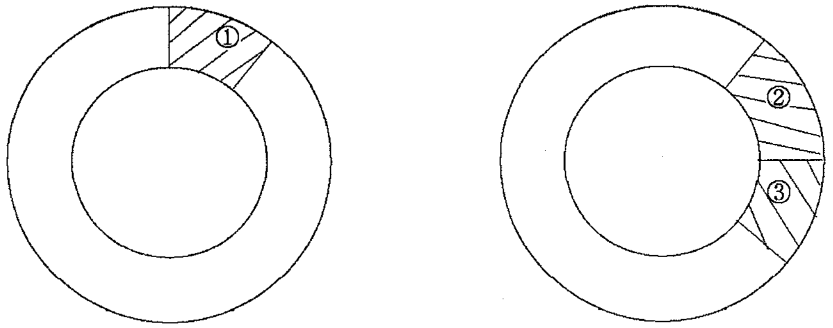
Figure 9 - 24 Conceptual Diagram of the ring Mode

9.4.4 Data Storage Using the fifo Mode

In the fifo mode, the data buffer memory operates as a first-in, first-out buffer memory.
This mode stores log scan, monitor scan, and/or single log scan data into the memory, and then outputs the data onto the GPIB and the printer.

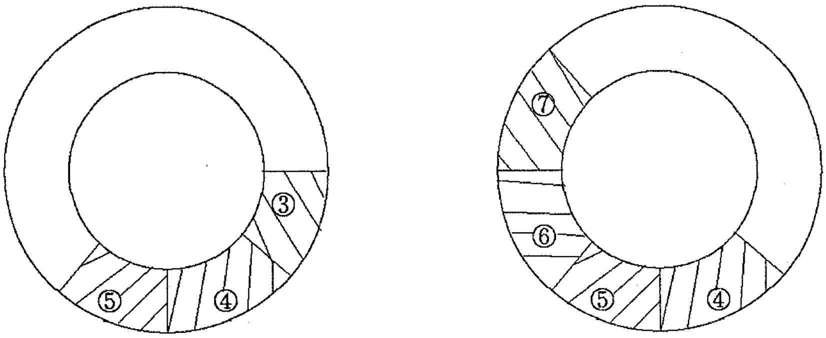


If data output onto the GPIB or onto the printer is likely to delay behind the measuring cycle, using this mode allows measurement to be executed without being restricted by the output time.
If the memory becomes full, measurement will stop until a free area is generated in the memory by output of data from the memory.
The conceptual diagram of the fifo mode is shown in Figure 9-25.



a. Stored status of first scan data

b. Status in which ② and ③ have been stored during output of ①

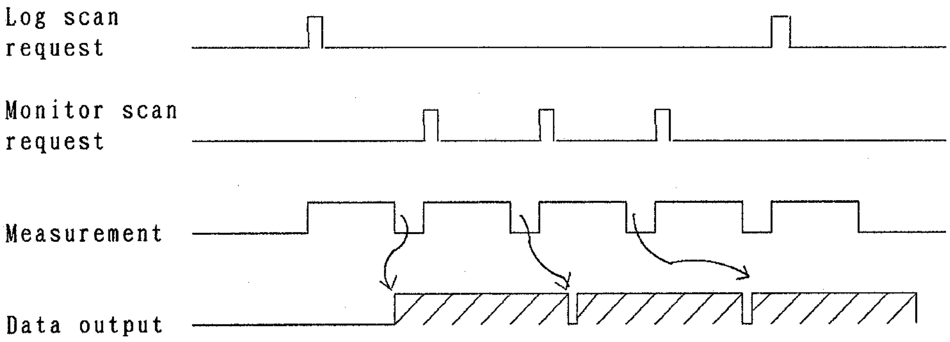


c. Status in which ④ and ⑤ have been stored during output of ②

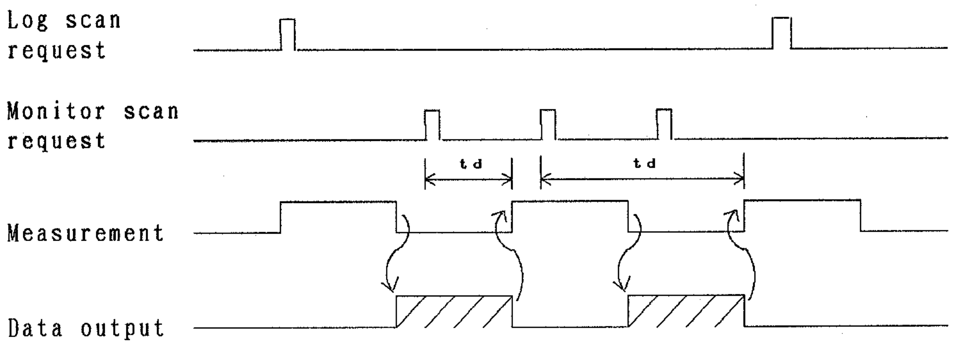
d. Status in which ⑥ and ⑦ have been stored during output of③

Figure 9 - 25 Conceptual Diagram of the fifo Mode

(1) If the fifo mode is used



(2) If the fifo mode is not used



td : Scan start delay time

9.4.5 Data Storage Control

The STORE key is operative only while the data buffer memory remains in the fix or ring storage mode.

Pressing the STORE key turns the key LED on to indicate that the memory can accept log scan data, monitor scan data, and/or single log scan data.
If "monitor scan store" has been set to [off], monitor scan data is not stored into the memory.

NOTE

> If the memory has become full during data storage using the fix mode, the STORE key LED goes out automatically and the storage operation stops. Measurement itself is continued.

Maximum number of sets of data that can be stored:

Channels Mode	1 channel scan	300 channles scan
fix, ring	Approx. 22790 data	Approx. 73500 data
fifo	Approx. 20000 data	Approx. 43000 data

To calculate the maximum number of sets of data that can be stored, first do this calculation:

fix or ring mode ... $\{N \times 7 + 16\} \times (M + 2) = 524288$
fifo mode .... $\{N \times 12 + 13\} \times (M + 1) = 524288$

Where N: Number of scan channels
M: Number of times of scanning

Next, calculate M from the above expression. Finally, calculate the number of sets of data, D, using the following expression:

$D = M \times N$

NOTE: To use second-order calculate channels, the number of such channels to be used must be added to the value obtained above.

9.4.6 Recall Control

The RECALL key is operative only while log measurement is not in progress with the operation mode of the data buffer memory set to "fix" or "ring".

Pressing RECALL key turns the key LED on, and the data within the recall (regeneration) area of the data buffer memory is ouptut onto the printer and the GPIB (if these two units are turned on).

Re-pressing the RECALL key during recall turns the key LED off and terminates the recall operation.

NOTE

1. The data within the recall area refers to the data that exists in the area staritng with the "Buffer memory" programmed recall start log number and ending with the "Buffer memory"programmed recall stop log number.

2. Log numbers are handled differently according to the data storage mode being used.

   - If the mode is fix
     The log numbers during measurement becomes the log numbers for recall.

   - If the mode is ring
     Serial numbers staring with "000001" assigned to the oldest data within the buffer memory become the log numbers for recall.

Use log-times and log-number to set the log numbers for recall start and stop.

(1) log-times

Use log-times when measuring data with the fix mode.
The value of log-times is cleared by "buffer memory CLEAR". Each time you turn the START/STOP ☐ key on, all other values are automatically incremented by 1 until 9 is reached. These values, however, do not change if the STORE ☐ key LED is off.
With this function, you can recall each of several sets of measured data separately by prestoring them into the memory.
There may be more than one set of data for which the log-times value has become "9". If this is the case, those individual sets of data can be recalled by:

Setting the data of recall start to log-times = 9, log-number = 1, and
setting the data of recall stop to log-times = 9, log-number = 99999.

(2) log-number

The log-number begins with "00001", and increments by 1 each time a log scan is performed. This value does not change during monitor scans.

	If "buffer memory CLEAR" executed	Measurement starts on pressing of START/STOP ☐	
		If STORE LED is ON	If STORE LED is OFF
log-times	0	※ Increments by 1 (until 9 is reached)	Does not change
log-number		00001	

※ After 9 is reached, the value does not change any further.
Can only be cleared to 0 by "buffer memory CLEAR".

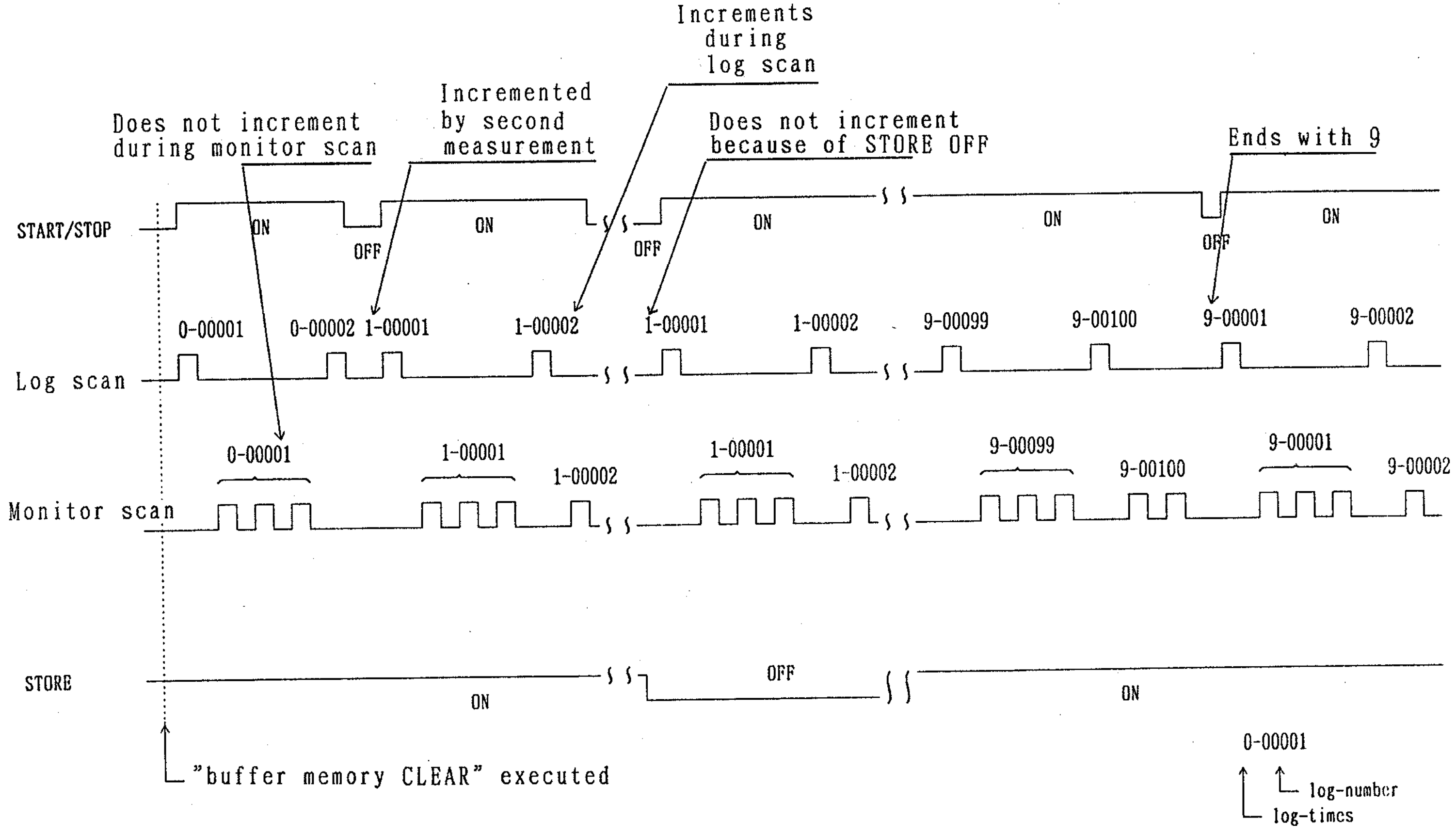
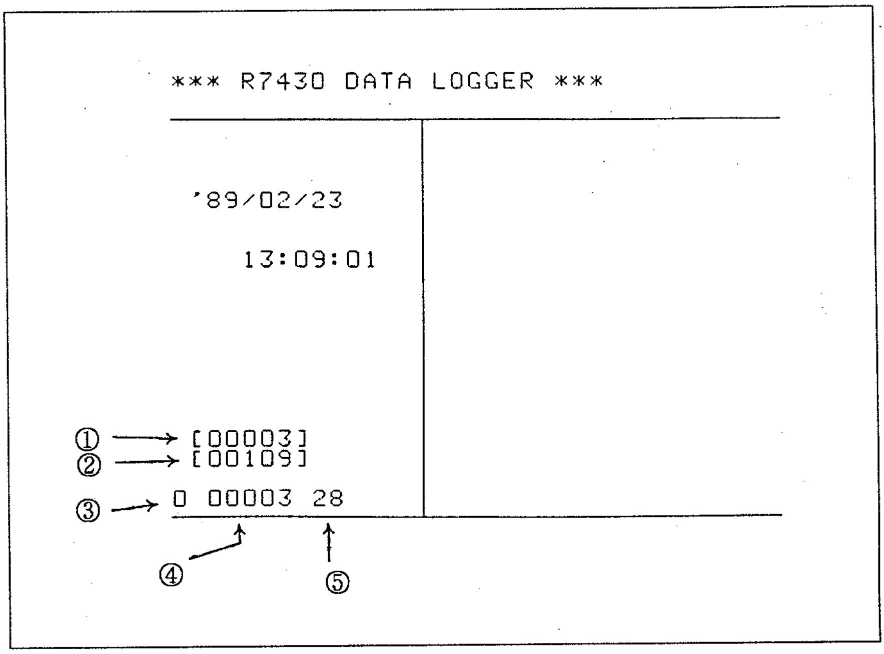


Figure 9 - 26 Changes in Log-times and Log-number

(3) Screen Display During Storage into the Buffer Memory



```
*** R7430 DATA LOGGER ***

'89/02/23
   13:09:01

[00003]
[00109]
0 00003 28
```

Figure 9 - 27 Screen Display During Storage into the Buffer Memory

[Description of the screen display]

① The number of log scans that has been stored into the memory

② Sum of the numbers of log scans and monitor scans that have been stored into the memory

③ The number of times of logging that denotes as what number data the data under measurement is being stored into the memory during the fix mode

④ Log number

⑤ Number of monitor scans

NOTE: Values ① and ② above are displayed only when STORE is on.
Values ③ through ⑤ above are displayed on start of measurement.

(4) Flowchart of Buffer Memory Data Recall

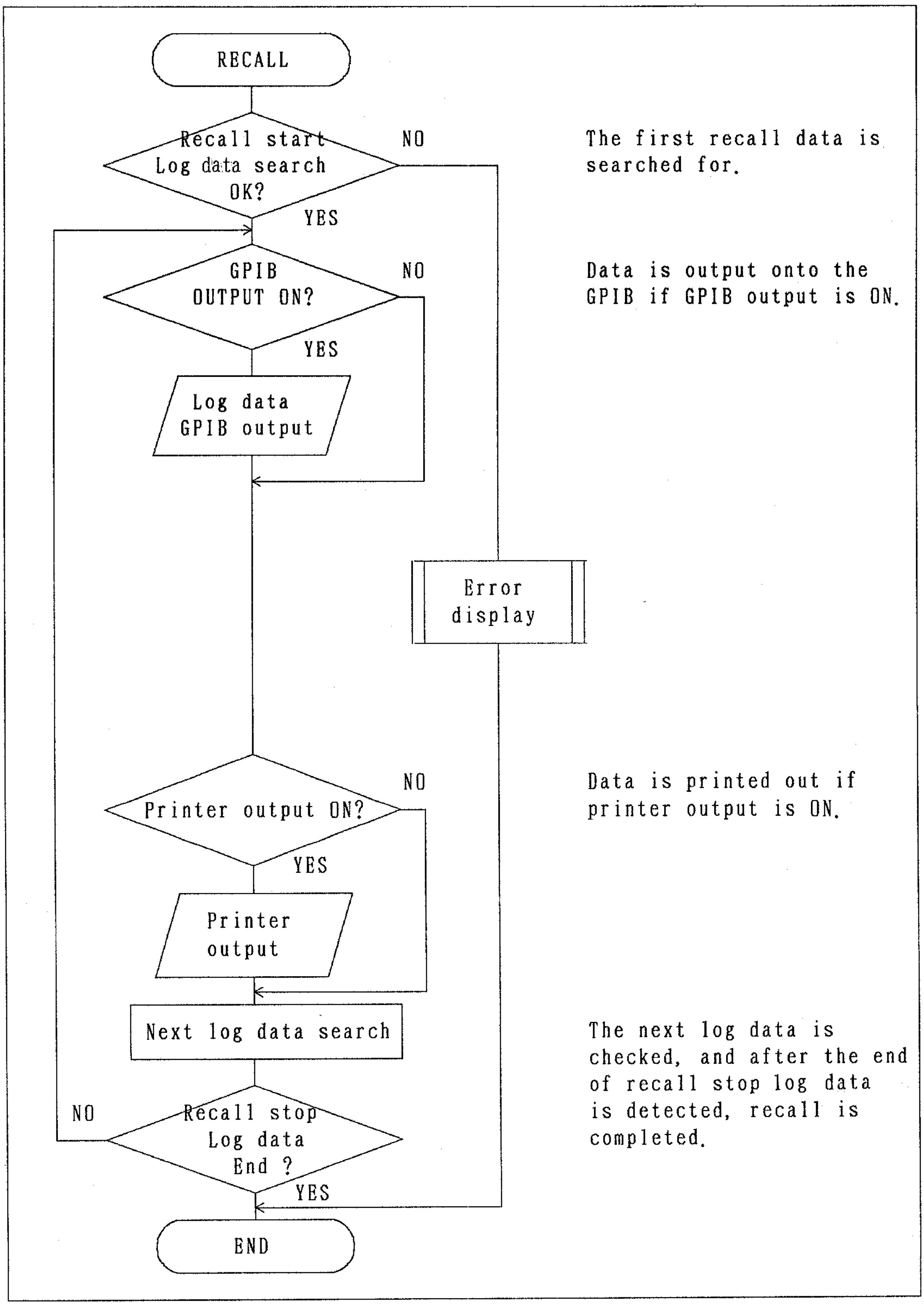


Figure 9 - 28 Flowchart of Buffer Memory Data Recall

10. MAINTENANCE AND INSPECTION

This section describes precautions to be observed during basic operation checks and during maintenance inspection jobs.
Error messages that may be displayed during these operations are also described.
After making any repairs to the equipment, perform the basic operation checks described in this section.

10.1 Operation Checks

10.1.1 Precautions on Maintenance and Repair

To ensure safe maintenance, inspection, and repair jobs, strictly observe the following precautions before uncasing the equipment:

① Reset the power switch of the R7430 to the OFF position, and disconnect the power cable from the outlet.

② Reset the power switch of the R74301 to the OFF position.

WARNING

1. After operations ① and ② above, the voltage will remain applied to the equipment for a while. Take extra care during handling.

2. Turning off the R7430 activates the remote control function to turn off the R74301 and place it in a STANDBY status. The logic circuits, however, will remain energized. After turning off the R7430, reset the power switch of the R74301 to OFF to deenergize the logic circuits also.

10.1.2 Self-diagnostics

Turning on the R7430 runs the self-diagnostics automatically.
The self-diagnostics within the R74301 will also run if it is connected to the R7430. If running of the self-diagnostics comes to a normal end, clock time will be displayed. If errors occur during running, the corresponding error messages will be displayed.

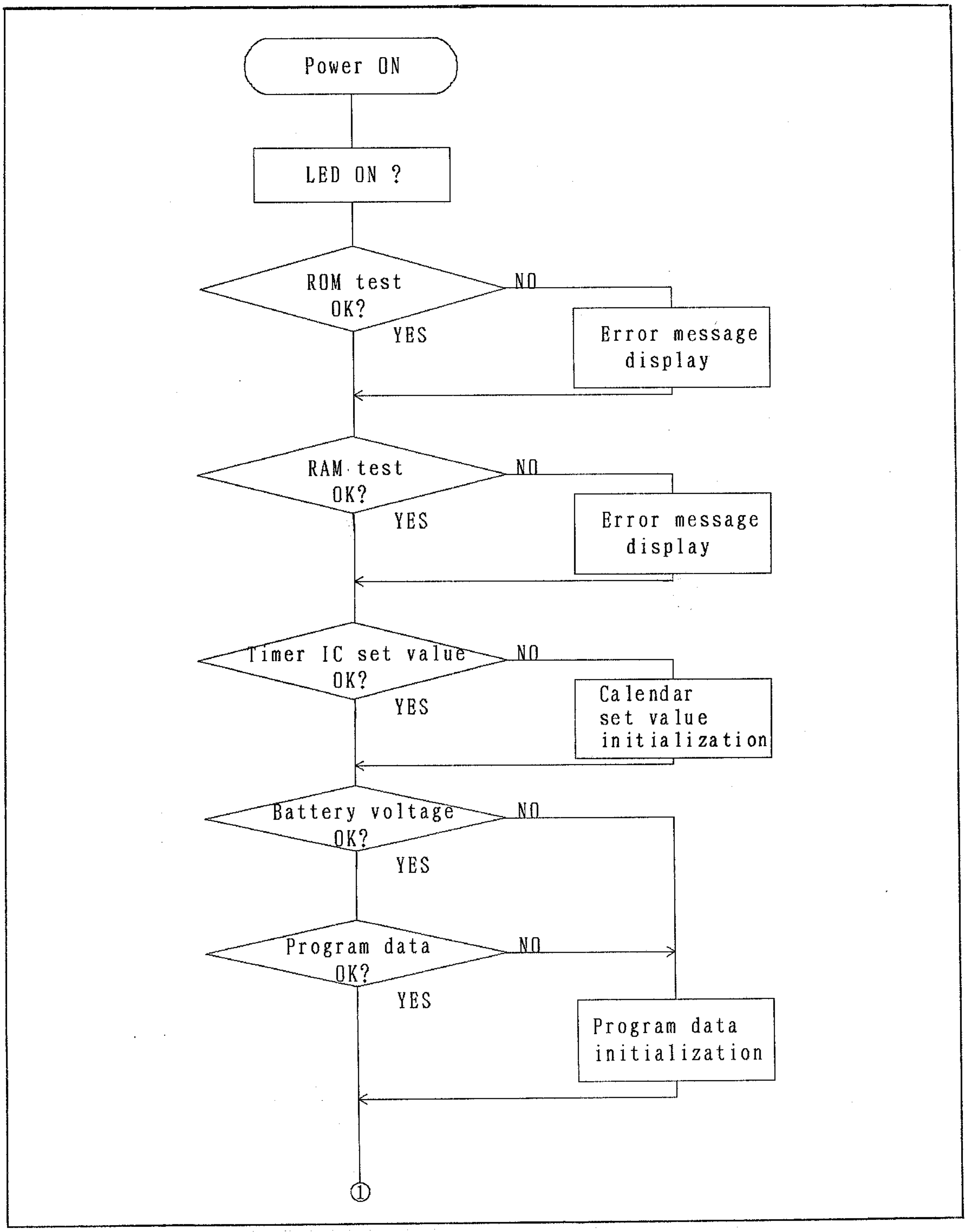


Figure 10 - 1 R7430 Power-on Operation Flowchart (1 of 2)

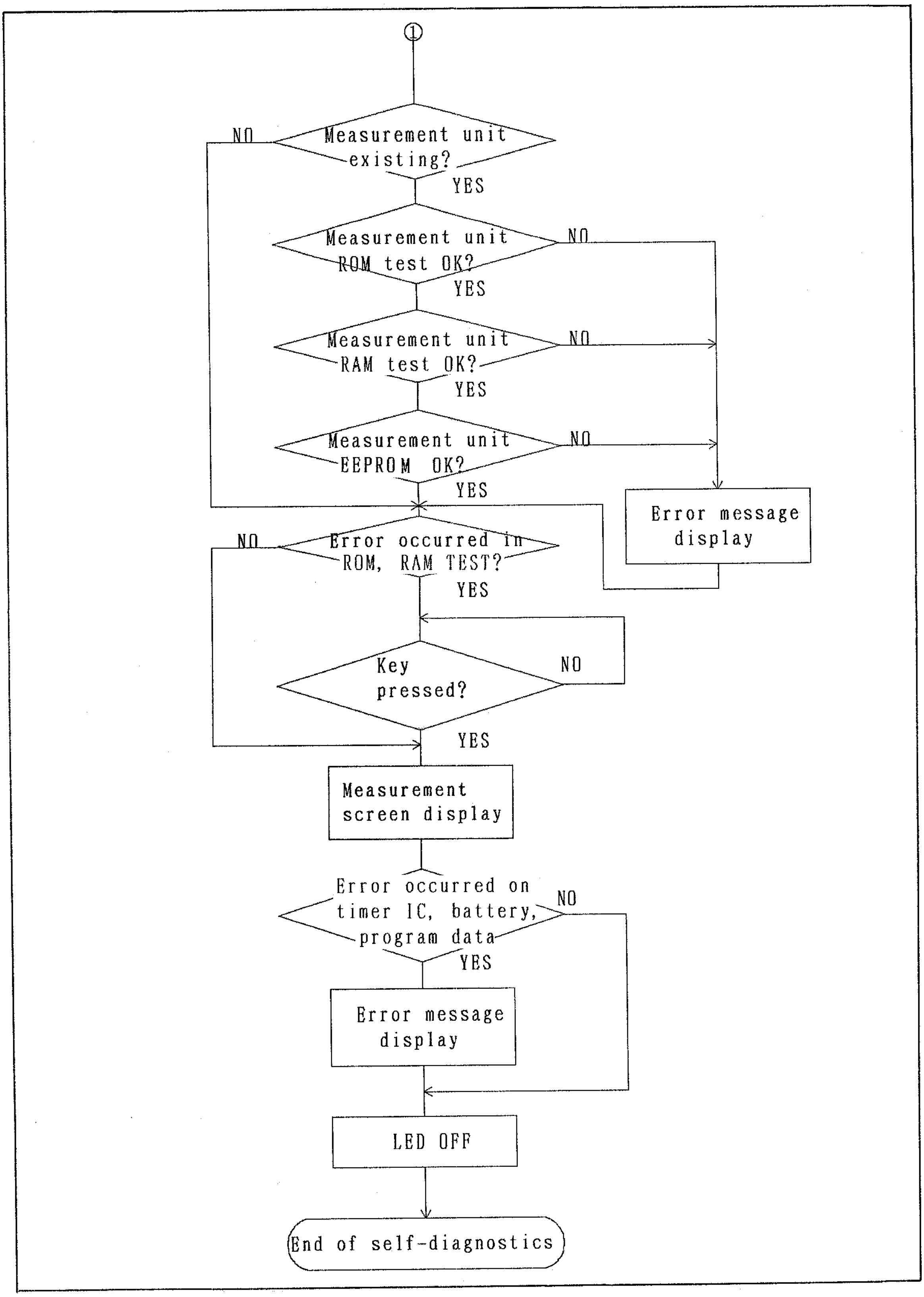


Figure 10 - 1 R7430 Power-on Operation Flowchart (2 of 2)

(1) LED Test

After turning the power on, immediately perform visual checks to see that all LEDs light.

(2) ROM Test

Program memory read operations are performed to check the memory data against the check sum. If an error is detected, the following message will be displayed:

```
"Fail !!! $00008C48, $00008C49"
             ↑           ↑
        Check data   Expected data
```

(3) RAM Test

Data memory read/write operations are performed to check for data errors. If an error is detected, the following message will be displayed:

```
"Fail !!! address: $00080000"
                      ↑
              Error-encountered address
```

NOTE

When an error is generated and an error message is displayed in ROM test or RAM test, press any key on the panel. Measurement screen appears.

(4) Timer IC Set Value Check

This check is performed to see if the set value of the timer IC is between the upper limit value and the lower limit value. If not within the range, the set value is initialized as "Jan 1st, 1989, 01:01", then the following message is displayed.

```
"506:clock was corrected!"
```

(5) Voltage-low Alarm

The voltage of the built-in Ni-Cd battery for data protection is measured.
If the voltage is below the required level, the following message will be displayed:

```
"500:Battery low & default program!!!"
```

This message may also be displayed when the equipment is turned on for the first time or when the equipment, after having been kept turned off for a long time, is turned back on. In such cases, the internal program data will be initialized automatically.
If the voltage-low alarm occurs, leave the power switch turned on for eight hours or more to recharge the battery.
All or part of the program data may be lost if you turn off the power switch without sufficient recharging.
If the alarm message shown above occurs in spite of the fact that you use the equipment each day or that you have recharged the battery for eight hours or more (for full recharging, 48 hours or more), then the battery must be replaced because the life is likely to have expired.
Please contact the nesrest dealer or the sales and support offices.

(6) Program Data Check

This check is performed to see if the set data exceeds the upper or lower limit value in the program. If exceeded, the data is initialized, then the following message is displayed.

```
"502:parameter error!  Default set! "
```

(7) Measurement Unit Configuration Check and Self-diagnostic Operation Check

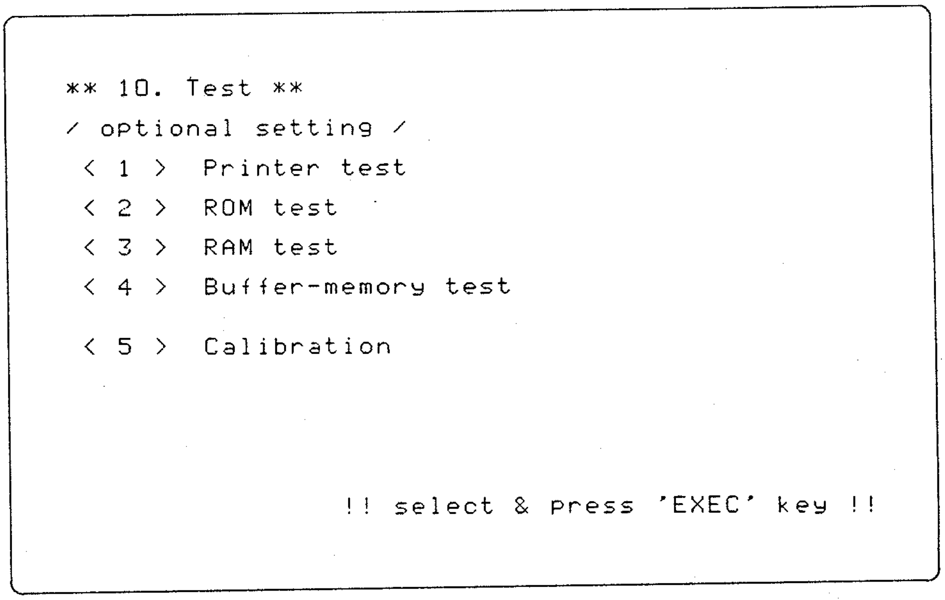
These checks are performed to see if the ROM and RAM tests on the measurement units have come to a normal end. If errors are detected, the following message will be displayed:

```
915:terminal [0]; ROM/RAM error!
916:terminal [0]; EEROM error!
              ↑
```

Measurement unit number

10.1.3 How To Perform Usual Operation Tests

The test menu is shown in Figure 10-2 below. You can execute an operation test by first selecting a test item using the cursor and then pressing the EXEC key.



```
** 10. Test **
/ optional setting /
 < 1 >  Printer test
 < 2 >  ROM test
 < 3 >  RAM test
 < 4 >  Buffer-memory test

 < 5 >  Calibration



                !! select & press 'EXEC' key !!
```

Figure 10 - 2 Test Menu

<1> Printer test

Select this test item to test the printer for normal printing. Selecting the test item displays the following message and starts the printer printing out the data shown in Figure 10-3.

```
"testing print ......"
```

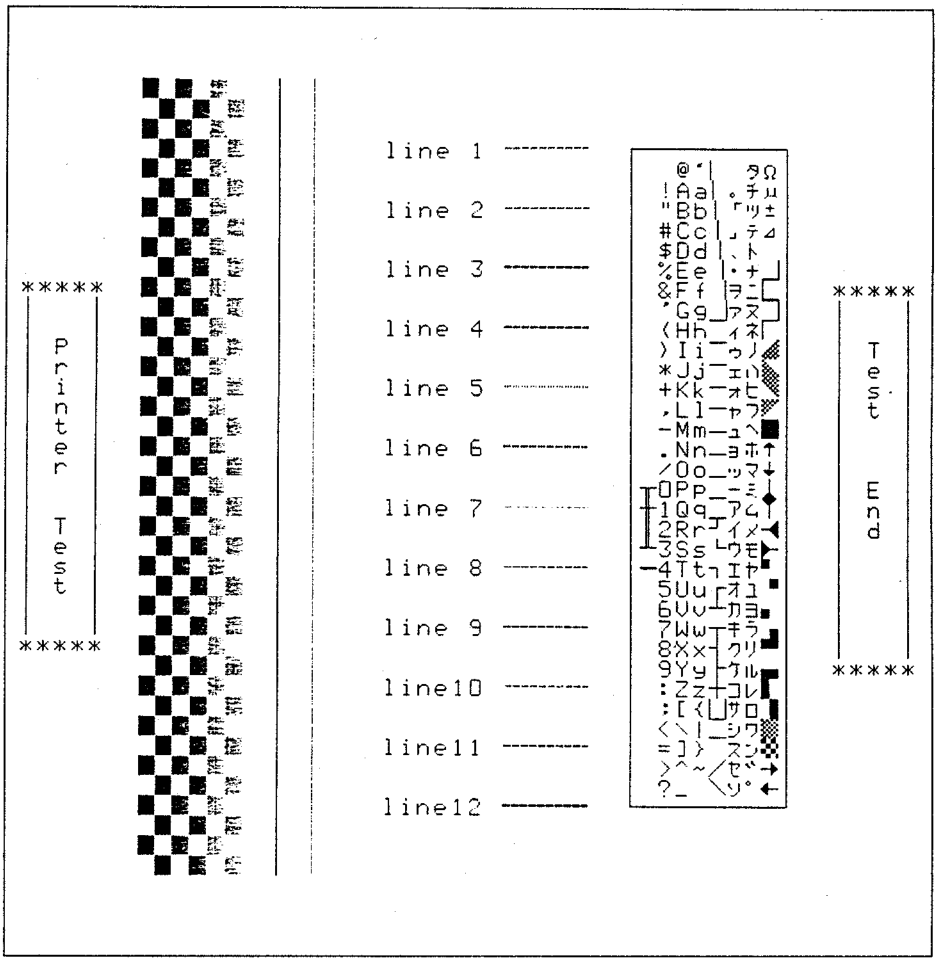


Figure 10 - 3 Printout for Printer Test

<2> ROM test

Select this test item to test the program memory for normal reading.

```
"rom testing ......"
```

Selecting the test item displays the message and after about two seconds, displays the test results as shown below.

```
"Pass ! sum : $00008C49, ref : $00008C49"
```

or

```
"Fail !!! sum : $00008C48, ref : $00008C49"
                         ↑                ↑
                    Check data      Expected data
```

<3> RAM test

Select this test item to test the data memory for normal reading/writing.
Selecting the test item displays the following message.

```
"ram testing ......"
```

And after about five seconds, displays the test results as shown below.

```
"Pass !"
```

or

```
"Fail !!! address : $00080000"
```

Except during measurement, you can perform this test at any one time because destruction of the program data is not caused by execution of the test. However, part of the memory area is not checked.

< 4 > Buffer-memory test

NOTE

Execution of this test destroys the entire data within the data buffer memory (option).

Select this test item to test the data buffer memory for normal reading/writing.
Select the test item displays the following message and starts the test.

```
"buffer memory testing ......"
```

During the test, its progress is displayed in eight steps (from 1/8 to 8/8) as shown below.

```
"1/8 Done ! testing continue ......"
```

The test is completed after about one minute, and the test results are displayed as shown below.

```
"Pass !"
```

or

```
"Fail !!! address : $00100000"
```

< 5 > Calibration

See Subsection 10.1.4 Calibration.

10.2 Recording Paper

10.2.1 Replacing the Recording Paper

A red marking will appear on the recording paper when its available amount decreases below 50cm in length. Replace the recording paper at this time.

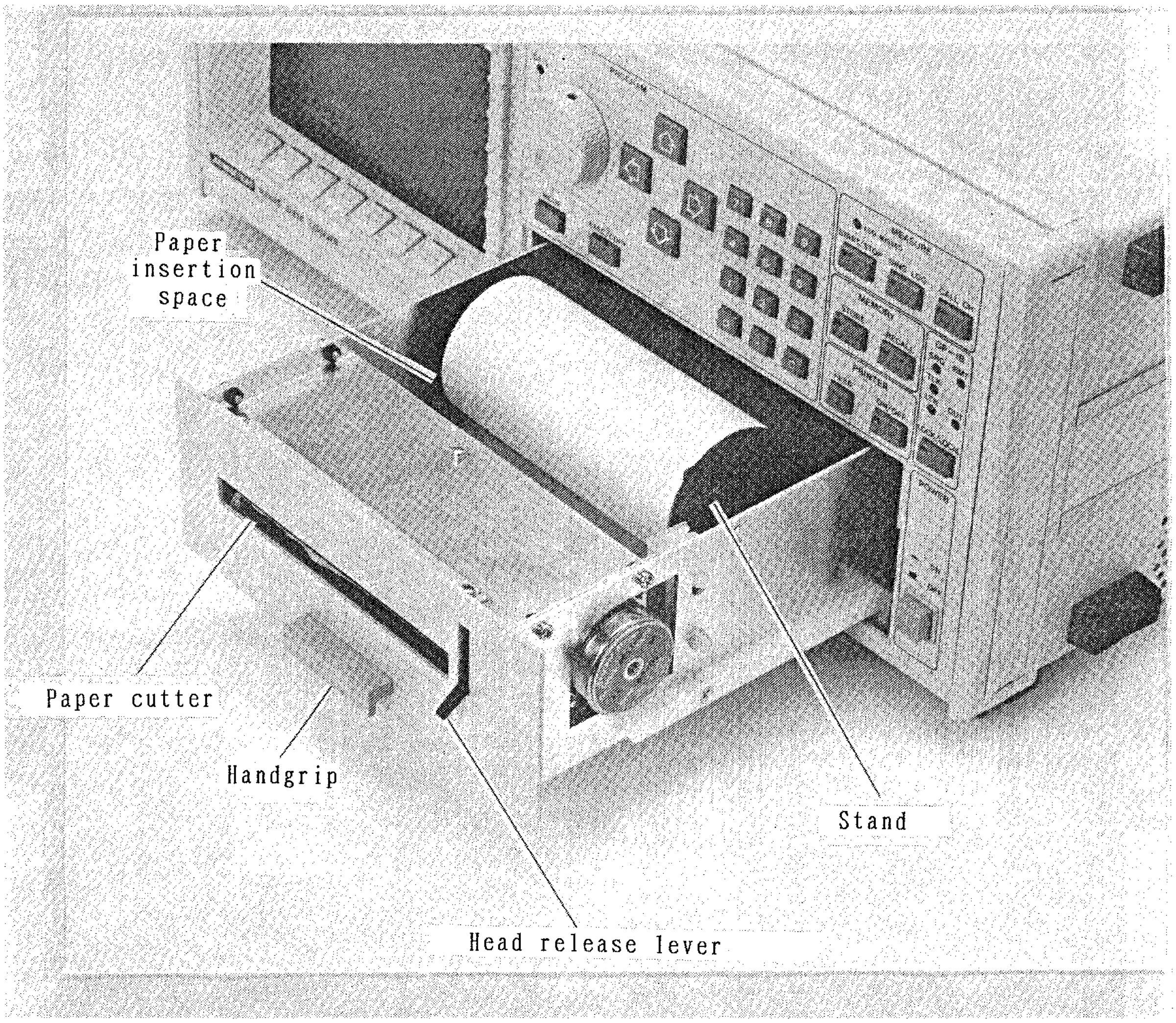


Figure 10 - 4 Printer Unit Pullout Section

[Replacement procedure]

① Pull the handgrip toward you to remove the printer unit.

② Raise the head release lever, and remove the recording paper, together with the flanges, from the stand. At this time, the recording paper can be readily removed from the stand by lifting the paper slightly.

③ Remove the flanges from the recording paper, and mount them on new recording paper.

④ The inner surface of recording paper is coated with a color-developing agent. As shown in Figure 10-5, hold the paper with its end facing you and insert it into the paper insertion space until about 5cm of paper has come out of the paper cutter section. After checking that the paper end is parallel to the paper cutter section, lower the head release lever to lock the printer head.

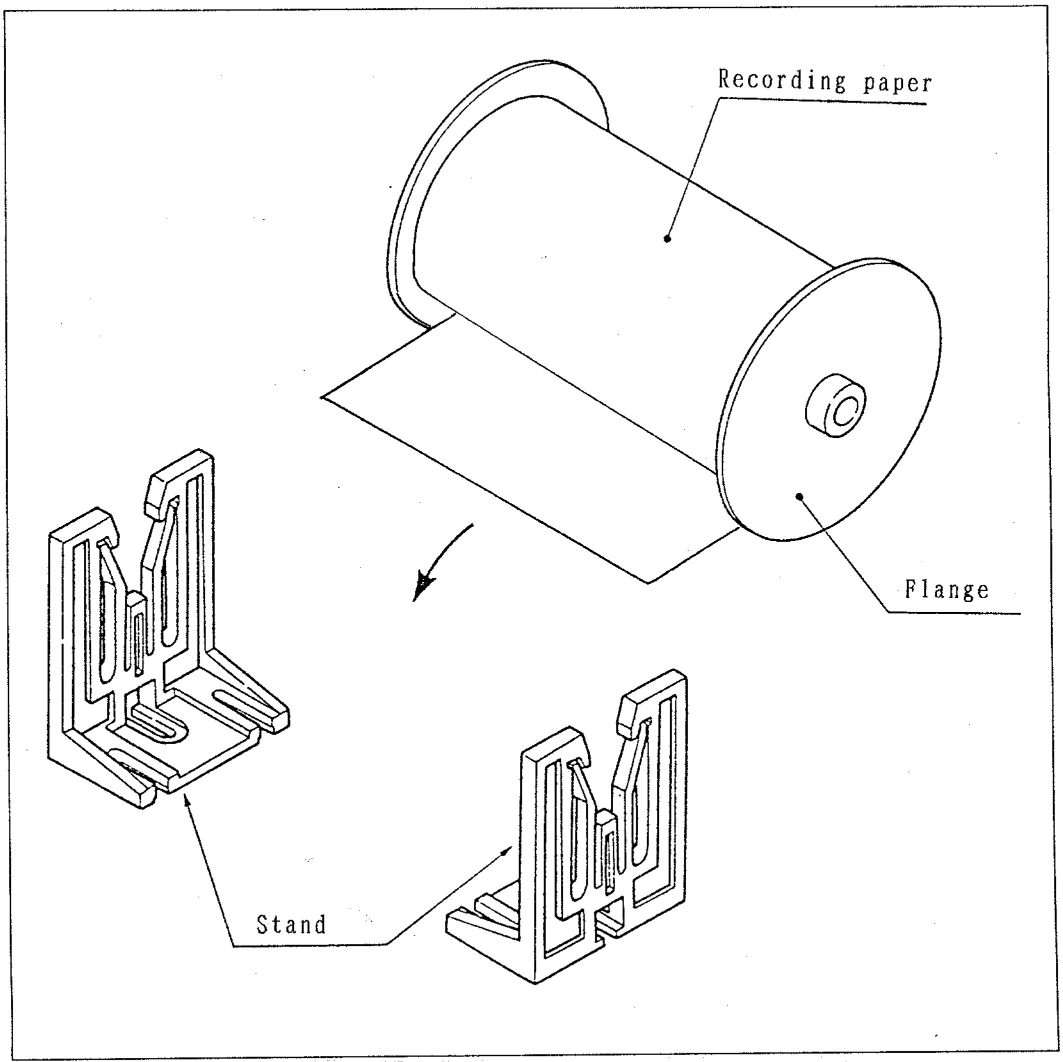


Figure 10 - 5 Mounting and Inserting New Recording Paper

10.2.2 Handling Notes on Recording Paper

(1) Storage of the Recording Paper

The thermal recording paper used in the equipment develops color by thermochemical reaction. Observe the following notes during storage and handling:

① Do not expose the paper to high temperatures or high humidities.

Exposure to high temperatures above 50°C or to moisture may cause deterioration of the color-developing capabilities or fogging. Fine recordings may not be obtained if the paper is touched with wet or sweaty hands.

② Keep the paper free from intense light.

Do not expose the paper to direct sunlight or to fluorescent light for long periods of time.

③ Do not use organic solvents near the paper.

Contact of the paper with an organic solvent or an organic-solvent containing adhesive may cause loss of recordings or coloration. Observe the following to prevent these from occurring:

- To apply adhesives to the recording paper, use either a starch-based, a PVA-based, or an Arabian-rubber based adhesive, or use a CMC-based synthetic adhesive or a paper-bonding agent.
- To tape the recording paper, apply double-sided adhesive tape to the reverse side of the paper.
- To write on the recording paper, use a pencil, a pen, or a water-soluble felt pen. Do not use fluorescent pens, signing pens, or plastic erasures.
- Do not stack the paper on dry-type diazo-copying paper.

④ Do not use surface-active agents or plasticizers.

If the paper is placed in contact with a cleaning agent that is heavily laden with a surface-active agent, with a plasticized synthetic resin material, or with the moldings of these substances, then this may cause deterioration of the color-developing capabilities of the paper or fading of color. For filing, use polyethylene-based, polypropyrence-based, or polyester-based card cases or sample books.

⑤ Do not apply strong pressures to the paper.

Coloration will result if you rub or scratch the paper surface strongly with a hard material.

(2) Recommended Storage Periods for the Thermal Recording Paper

Store the recording paper in a cold, dark place. Once you have unsealed the paper in a cold, dark place. Once you have unsealed the paper, use it up as soon as possible.
If you will store recorded sheets of paper for long periods, you should make copies of each of them.

The recommended periods of storage in a dark place are listed in Table 10-1 below.

Table 10 - 1 Recommended Storage Periods for the Thermal Recording Paper

	Short-term	Long-term
Temperature	+5°C to +45°C	Normal temperature (Average: +20°C)
Humidity	2% to 90% RH	Normal humidity (Average: 60% RH)
Sealing	3 months	3 years
Unsealing	1 month	1 year

10.3 Handling Notes on the Printer

(1) If you will not use the printer for a long period, store it with the thermal head up. If you leave the platen pressed by the head, nonuniform printout may result from possible bending of the platen.

(2) If condensation is occurring, dry the printer before operating it. Starting the printer in the presence of condensation may damage the thermal head.

(3) Always use the specified type of thermal recording paper.
Use of non-specified types of thermal recording paper may result in non-fine printout and a reduced life of the head.

10.4 Calibration Method

10.4.1 Outline

This section explains the calibration method to store the measurement accuracy in Chapter 11 "SPECIFICATION". Calibration is performed every six months. If keys on the front panel and the GPIB program are controlled, the ranges of direct voltage, Pt (Platinum resistance thermometer), and TC (thermocouple) can be calibrated (removing the main device case and adjusting the volume are not required).

10.4.2 Preparation for Calibration

Use calibration devices in Table 10-2 or equivalent.

Table 10 - 2 Equipment Required for Calibration

Calibration equipment	Range	Accuracy
Standard DC voltage generator	+5V to +50V	More than ±0.005%.
DC voltage potentiometer	Ratio of partial pressure 1/100 Output impedance is less than 2kΩ.	More than ±0.001%.
Standard resistor	100Ω	More than ±0.001%
Automatic reference cold junction	0℃	Less than ±0.03℃ .
T thermocouple	0℃	Less than ±0.1℃ .

10.4.3 Notes on Calibration

(1) Notes

① The AC voltage is used with in the range specified on the rear panel. The frequency for the power is set according to the area for use.

② Firmly ground the GND terminal of this instrument or standard equipment.

③ Perform calibration in environment below.

- Temperature : ±23℃ ±5℃
- Relative humidity (RH) : Less than 70%
- Avoid the dirty, vibrating, and noisy place for calibration.

④ This instrument requires warming-up of more than 30 minutes. Allow specified warming-up for equipment in use.

⑤ After calibration is completed, write the calibration data and the next calibration on the card or sticker.

(2) Notes on Calibration

① To perform calibration, be sure to power on the EXT CAL switch on the rear panel. Be sure to power off this switch after calibration.

② Only channel 1 is input for calibration.

③ Calibration is disabled while log is measured.

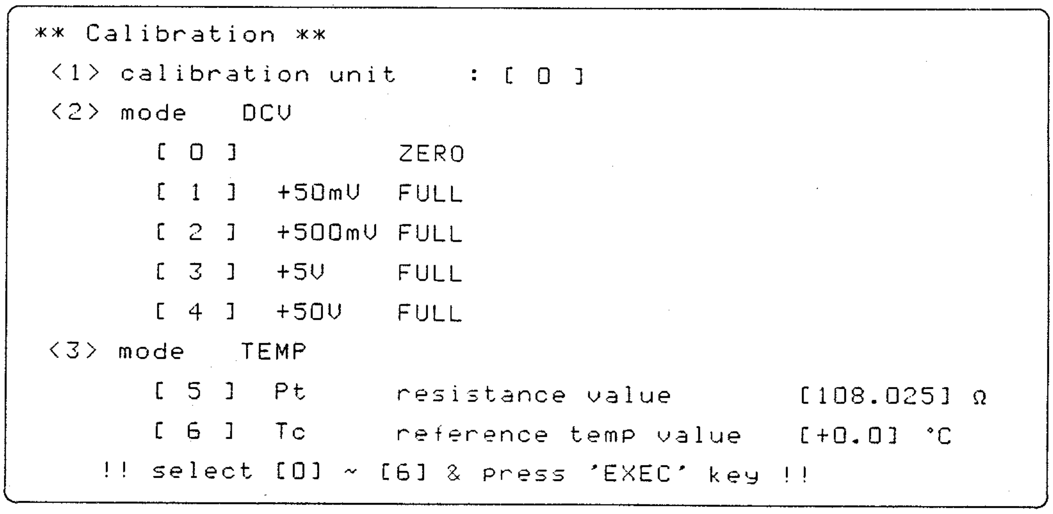
④ After calibration is completed, be sure to return to the measurement screen. Unless this step is done, the normal measurement may not be secured.

⑤ To use the GPIB program for calibration, perform every calibration and execute the PM command.

⑥ When calibrating the DCV +50V FULL, a fail sometimes occurs in the calibration equipment in use. In this case, input ADIN (+) (-), not channel 1.

10.4.4 Calibration

If you select test item <5> calibration, from the menu previously shown in Figure 10-2 and press the EXEC key, then you will see the following menu on the CRT:



```
** Calibration **
 <1> calibration unit     : [ 0 ]
 <2> mode    DCV
        [ 0 ]           ZERO
        [ 1 ]  +50mV    FULL
        [ 2 ]  +500mV   FULL
        [ 3 ]  +5V      FULL
        [ 4 ]  +50V     FULL
 <3> mode    TEMP
        [ 5 ]  Pt       resistance value        [108.025] Ω
        [ 6 ]  Tc       reference temp value    [+0.0] °C
    !! select [0] ~ [6] & press 'EXEC' key !!
```

Figure 10 - 6 Calibration Menu

<1> calibration unit

Set the number of the measurement unit to be calibrated. Calibration is performed for each measurement unit number. Therefore, if the data logger contains two measurement units (60 channels), you must perform this calibration function separately on each of the two units.

<2> mode DCV

NOTE

Perform ZERO calibration before executing FULL calibration.
When ending the calibration screen and re-entering, perform zero calibration and execute full calibration.

Items [0] through [4] in Figure 10-6 denote the DC voltage measurement modes you can use. Select and enter the appropriate item for the measurement unit you are going to calibrate. Then, press EXEC .

The following message will then be displayed to indicate that calibration has begun.

"calibrating ......"

After calibration, the results will be displayed as shown below.

"Done !"

or

"Fail !!! "

If "Fail !!!" is displayed, re-press EXEC key to perform the calibration once again. (Repeat the calibration several times until you see "Done !" on the CRT.)
If "Fail !!!" is displayed even with the EXT CAL switch placed in the ON position and the input voltage normal, then this implies that the measurement unit is malfunctioning.

- Calibration ranges and input voltages

(Input voltages)

[0]		ZERO	....	0.0000mV
[1]	+50mV	FULL	....	+50.0000mV
[2]	+500mV	FULL	....	+500.000mV
[3]	+5V	FULL	....	+5.00000V
[4]	+50V	FULL	....	+50.0000V

When full calibration of +50V fails, connect as follows.

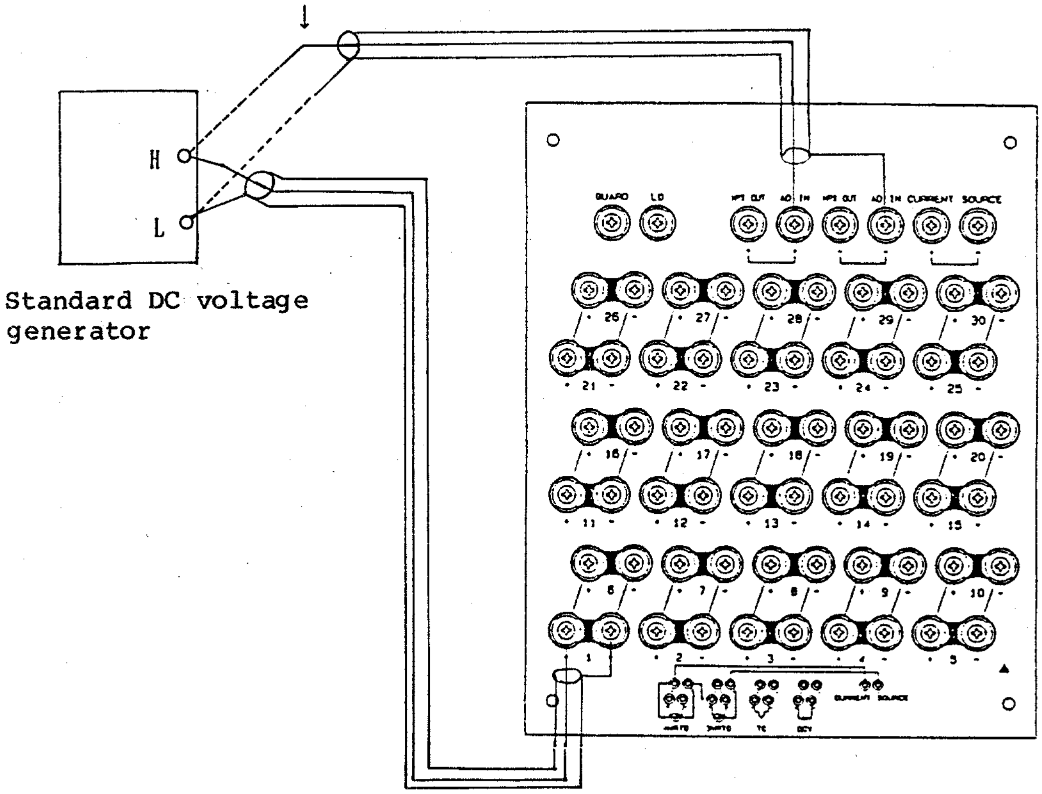


Figure 10 - 7 Example of DCV Input

<3> mode TEMP

NOTE

Pt calibration requires that 500mV calibration be completed beforehand.
Tc calibration requires that 50mV calibration and Pt calibration be completed beforehand.
Connect four wires to the standard resistor for Pt calibration.

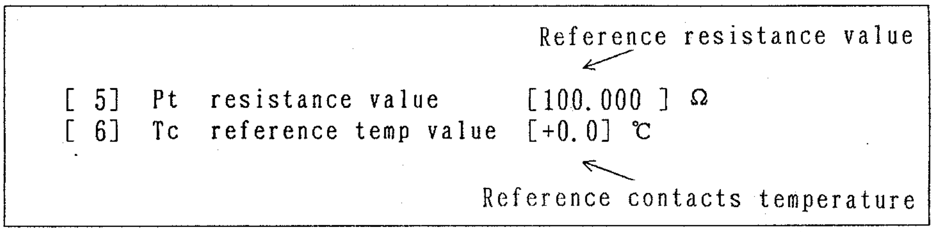
Items [5] and [6] in Figure 10-6 denotes the temperature measurement modes you can use. Select and enter the appropriate item for the measurement unit you are going to calibrate. Then, press EXEC key.

The following message will then be displayed to indicate that calibration has begun.

"calibrating ......"

After calibration, the results will be displayed in a similar form to that of item <2> above.

- Calibration ranges and input values



```
[ 5]  Pt  resistance value      [100.000 ] Ω
[ 6]  Tc  reference temp value  [+0.0] ℃
```

Item [5] is intended to calibrate the internal reference resistor used for temperature measurement of platinum resistance thermometer bulbs (Pt). Calibration is performed, based on the resistance value of 100Ω of the reference resistor connected across the input.

Item [6] is intended to calibrate the internal reference contacts compensator used for temperature measurement of thermocouples (Tc). The temperature value of the reference cold contacts used in 0^{o}C. Calibration will be performed, based on the true input temperature value that is determined by the particular temperature value of the thermocouple being used and the reference cold contacts temperature value of 0^{o}C.

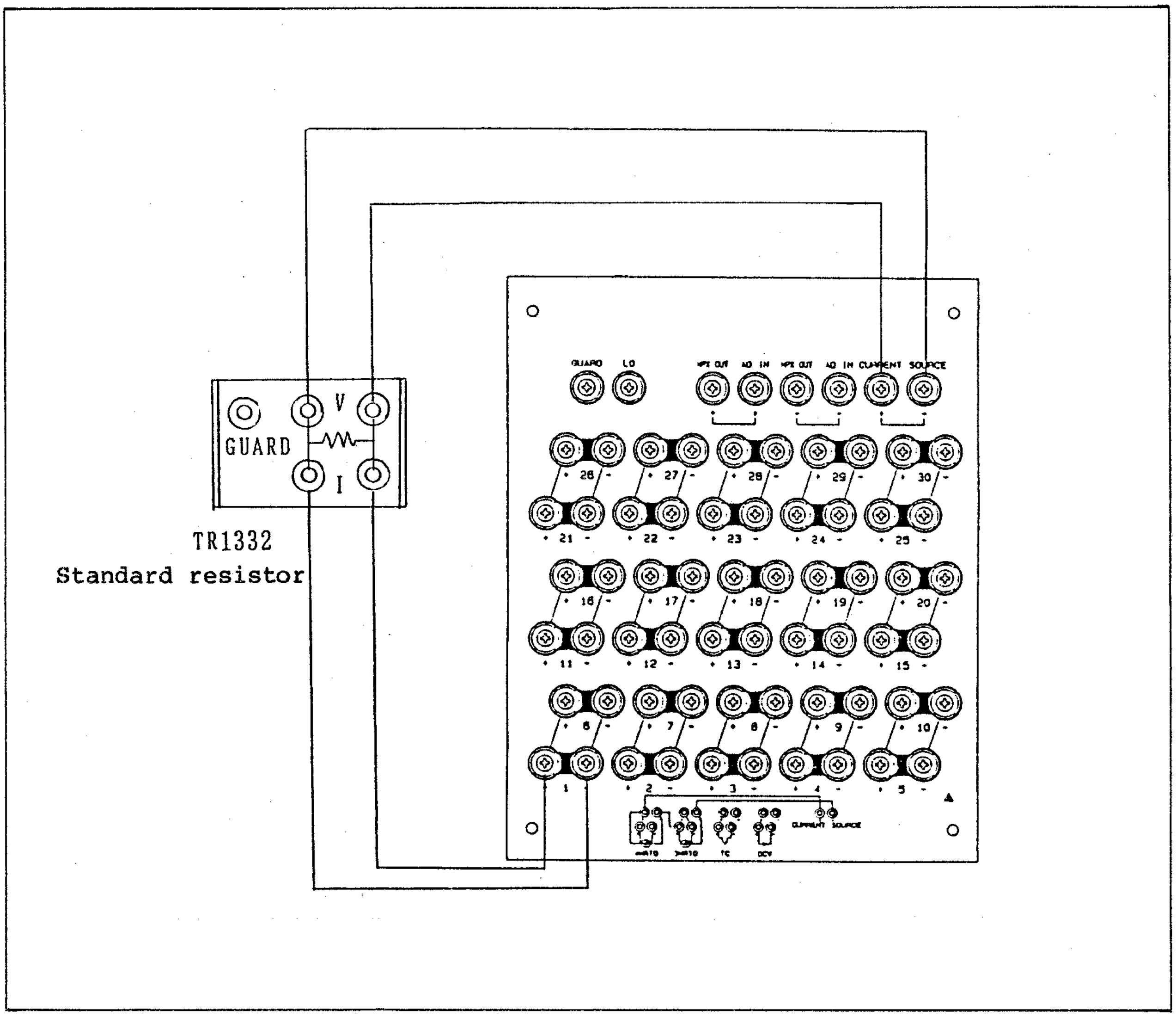


Figure 10 - 8 Example of Standard Resistor Connection

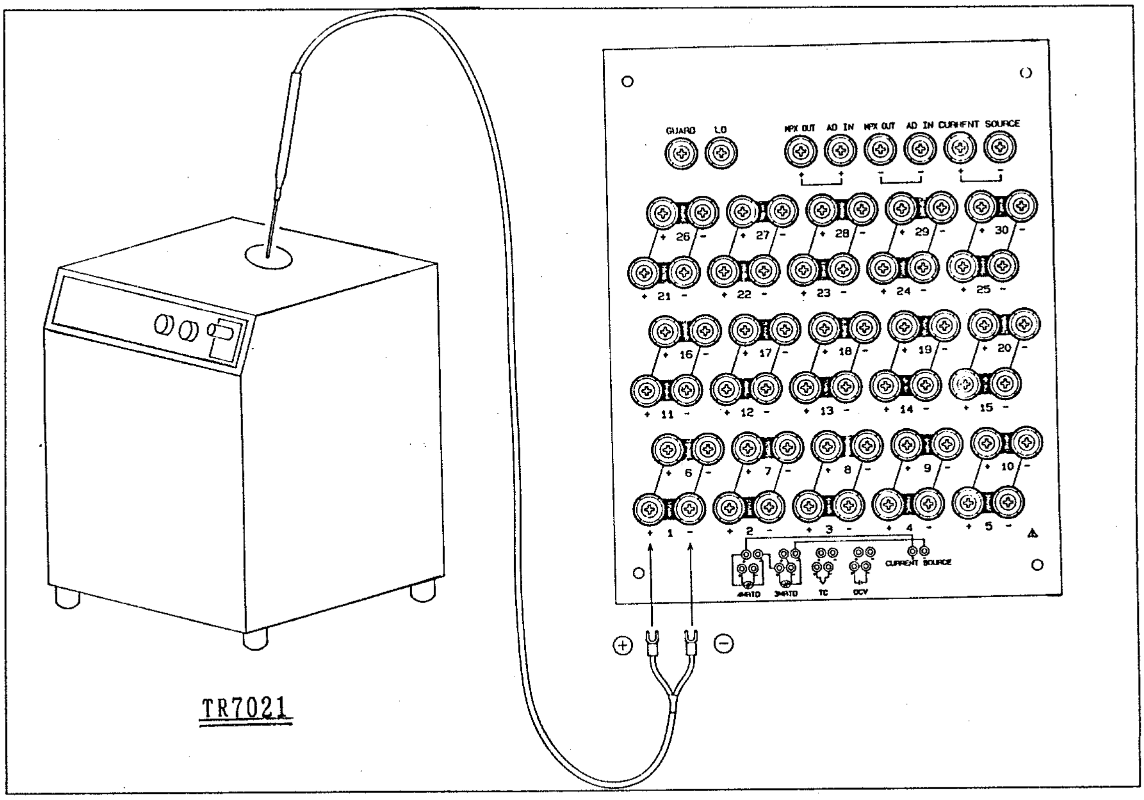


Figure 10 - 9 Example of Reference Contacts Input

NOTE

Even if you have carried out correct operations using the required calibration procedure, the calibration results may become "Fail". If this is the case, carry out the following procedure to initialize the calibration parameters within the measurement unit, and then repeat each of the required calibrations from the beginning.

[Initializing procedure]

① Return to the calibration menu and set a value in the input field of item <1> calibration unit.
② Return the programming screen to the measurement screen.
③ Turn off the power.
④ Turn the power back on.
⑤ On the measurement screen, key-in in the following order:
EXEC ◁ △ ▷ ▽ START/STOP
⑥ End of initialization

10.5 Replacing Line Fuses

NOTE

Before replacing a line fuse, set the POWER switch to OFF and then disconnect the power cable from the outlet.

The line fuses are housed in the fuse holder on the rear panel.

[Replacement procedure]

① Apply a screwdriver lightly to the cap of the fuse holder, and then turn the screwdriver through about 60 degrees counterclockwise and release it from the cap.

② The turning section will then come out about 3mm to the front. Pull out this turning section and replace the intended fuse.

③ To remount the turing section, set a screwdriver on it and turn the screwdriver through about 60 degrees clockwise.

The ratings of the line fuses are listed in Table 10-3.

Table 10 - 3 Ratings of the Line Fuses

Model	Supply voltage	Fuse
R7430	90VAC to 132VAC	T2A/250V
	198VAC to 250VAC	T1.25A/250V
R74301	90VAC to 132VAC	T0.4A/250V
	198VAC to 250VAC	T0.2A/250V

WARNING

To provide cotinual safeguard against fire hazards, always use fuses of the same type and same rating.

10.6 Storage

If the equipment is not to be used for long periods of time, place the built-in printer in its head-up state and then cover the equipment with a vinyl protective sheet (or encase the equipment in a cardboard) and store in a dry place free from direct sunlight. See subsection 10.2.2 for storage of the recording paper.
The following lists recommended environmental conditions for storage:

Model	Temperature	Relative humidity	Performance of backup memory
R7430	+5°C to +45°C	90% or less	Guaranteed
	-20°C to +60°C	90% or less	Not guranteed
R74301	-20°C to +70°C	90% or less	-

10.7 Transport

When transporting the equipment, use the packaging materials already supplied to you.
If you have lost the packaging materials, transport the equipment using the following procedure:

① Cover the equipment with a vinyl protective sheet.

② Have a 5mm-thickness cardboard ready at hand. Fill the cardboard with a cushioning material up to a thickness of 50mm or more. Then, place the equipment in the cardboard and wrap it up in the cushioning material.

③ Place the equipment accessories in the cardboard, and fill it with a cushioning material. Finally, seal the cardboard and tie the packaging string securely around it.

11. PERFORMANCE SPECIFICATIONS AND ACCESSORIES

This section lists the performance specifications of the equipment and its accessories.

11.1 Specifications Common to the R7430 and R74301

11.1.1 Input Specifications

- Types of input signals

Thermocouple : T, J, E, K, S, R, B, N (NICROSIL-NISIL), W (W5Re/W26Re)
Platinum resistance thermometer bulb : Nominal resistance value 100Ω 3-wire/4-wire
DC voltage : ±500mV, ±5V, ±50V
No-voltage contacts input : ON at 2kΩ or less, OFF at 30kΩ or more

- Scanning speeds (For auto-zero/auto-full OFF, no calculation, DC voltage range)

When 1 unit is used : 30 points/sec (for an integral time of 1PLC)
30 points/0.6sec (for an integral time of 1ms)

When 10 units are used : 300 points/sec (for an integral time of 1PLC)
300 points/0.6sec (for an integral time of 1ms)

Note: PLC (Power Line Cycle)
50Hz: 1PLC = 20ms
60Hz: 1PLC = 16.7ms

Table 11 - 1 Thermocouple-based Temperature Measurement Ranges and Accuracies (1 of 2)

(Guaranteed for 6 months at ambient temperature range of +23ºC ± 5ºC, relative humidity range below 85%, auto-calibration ON)

Integral time			1ms to 10ms	1PLC, 2PLC	5PLCto100PLC
Thermo-couple	Range (℃)	Reso-lution (℃)	Accuracy ±(% of rdg+℃)	Accuracy ±(% of rdg+℃)	Accuracy ±(% of rdg+℃)
T	-270 to -250	0.1	———	±(0.3 + 3.2)	±(0.3 + 3.0)
	-250 to -180		———	±(0.06 + 1.0)	±(0.08 + 0.9)
	-180 to +400		±(0.04 + 3.6)	±(0.03 + 0.4)	±(0.03 + 0.4)
J	-210 to 0		±(0.04 + 3.5)	±(0.03 + 0.5)	±(0.03 + 0.5)
	0 to +1200		±(0.04 + 1.4)	±(0.03 + 0.2)	±(0.03 + 0.2)
E	-270 to -250		———	±(0.4 + 3.5)	±(0.4 + 3.3)
	-250 to -200		———	±(0.1 + 0.7)	±(0.1 + 0.7)
	-200 to+1000		±(0.04 + 2.8)	±(0.03 + 0.4)	±(0.03 + 0.3)
K	-270 to -250		———	±(0.6 + 6.0)	±(0.6 + 5.5)
	-250 to -200		———	±(0.1 + 1.4)	±(0.1 + 1.3)
	-200 to+1372		±(0.04 + 4.5)	±(0.03 + 0.5)	±(0.03 + 0.4)
S	-50 to 0		———	±(0.03 + 1.5)	±(0.03 + 1.4)
	0 to +500		———	±(0.03 + 1.2)	±(0.03 + 1.1)
	+500 to+1769		±(0.04 + 7.3)	±(0.03 + 0.7)	±(0.03 + 0.6)
R	-50 to 0		———	±(0.03 + 1.9)	±(0.03 + 1.7)
	0 to +350		———	±(0.03 + 1.2)	±(0.03 + 1.1)
	+350 to+1769		±(0.04 + 6.6)	±(0.03 + 0.7)	±(0.03 + 0.6)
B	+100 to +500		———	±(0.05 + 6.0)	±(0.05 + 5.5)
	+500 to+1140		———	±(0.03 + 1.2)	±(0.03 + 1.1)
	+1140to+1820		±(0.04 + 6.3)	±(0.03 + 0.5)	±(0.03 + 0.4)

(2 of 2)

	Integral time		1ms to 10ms	1PLC, 2PLC	5PLCto100PLC
Thermo-couple	Range (℃)	Reso-lution (℃)	Accuracy ±(% of rdg+℃)	Accuracy ±(% of rdg+℃)	Accuracy ±(% of rdg+℃)
N	0 to +1300	0.1	±(0.04 + 2.9)	±(0.03 + 0.7)	±(0.03 + 0.7)
W	0 to +300		±(0.04 + 5.5)	±(0.03 + 1.1)	±(0.03 + 1.1)
	+300to +2320		±(0.04 + 4.8)	±(0.03 + 0.7)	±(0.03 + 0.6)

(Reference contacts compensation accuracy/sensor accuracy not included)

NOTE: Calibration related to T, J, E, K, S, R, and B complies with JIS-C1602-1981. (JIS = Japanese Industrial Standard)
Calibration related to N is as per NBS Table - 1978.
Calibration related to W is as per Hoskins Calibration Table.

Table 11 - 2 Thermocouple-based Measurement Temperature Coefficients

(At ambient temperature range of 0°C to +18°C, +28°C to +50°C)

Termo-couple	Range (℃)	Temp. coefficient ± (% of rdg+℃) /℃
T	-270 to -250	±(0.01 + 0.18)
	-250 to -180	±(0.0033 + 0.06)
	-180 to +400	±(0.0023 + 0.02)
J	-210 to 0	±(0.0015 + 0.02)
	0 to +1200	±(0.0009 + 0.007)
E	-270 to -250	±(0.0145 + 0.18)
	-250 to -200	±(0.0034 + 0.04)
	-200 to +1000	±(0.0023 + 0.014)
K	-270 to -250	±(0.02 + 0.35)
	-250 to -200	±(0.0051 + 0.09)
	-200 to +1372	±(0.002 + 0.022)
S	-50 to 0	±(0.0009 + 0.09)
	0 to +500	±(0.0013 + 0.07)
	+500 to +1769	±(0.0009 + 0.04)
R	-50 to 0	±(0.0012 + 0.12)
	0 to +350	±(0.0013 + 0.07)
	+350 to +1769	±(0.0009 + 0.035)
B	+100 to +500	±(0.002 + 0.35)
	+500 to +1140	±(0.0009 + 0.07)
	+1140to +1820	±(0.0006 + 0.035)
N	0 to +1300	±(0.0011 + 0.014)
W	0 to +300	±(0.0001 + 0.026)
	+300 to +2320	±(0.0009 + 0.025)

Table 11 - 3 Pt-based Temperature Measurement Ranges and Accuracies

(Guaranteed for 6 months at ambient temperature range of +23°C ± 5°C, relative humidity range below 85%, auto-calibration ON)

Integral time			1ms ~ 10ms	1PLC, 2PLC	5PLC~100PLC
Type of Pt	Range (℃)	Resolution (℃)	Accuracy ±(% of rdg+℃)	Accuracy ±(% of rdg+℃)	Accuracy ±(% of rdg+℃)
JPt/3w	-200to+649	0.01	±(0.02 + 1.5)	±(0.02 + 0.2)	±(0.02 + 0.2)
JPt/4w	-200to+649	0.01	±(0.02 + 1.2)	±(0.02 + 0.1)	±(0.02 + 0.1)
Pt/3w	-200to+660	0.01	±(0.02 + 1.5)	±(0.02 + 0.2)	±(0.02 + 0.2)
Pt/4w	-200to+660	0.01	±(0.02 + 1.2)	±(0.02 + 0.1)	±(0.02 + 0.1)

(Sensor accuracy not included)

NOTE: Calibration of Pt complies with JIS-C1602-1989.

Table 11 - 4 Pt-based Measurement Temperature Coefficients

(At ambient temperatures 0°C to +18°C, +28°C to +50°C)

Type of Pt	Temp. coefficient ±(% of rdg+℃) /℃
JPt/3w	± (0.0006 + 0.0005)
JPt/4w	
Pt/3w	± (0.0006 + 0.0005)
Pt/4w	

Table 11 - 5 DC Voltage Measurement Ranges and Accuracies

(Guaranteed for 6 months at ambient temperature range of +23°C ± 5°C, relative humidity range below 85%, auto-calibration ON)

Integral time			1ms ~ 10ms	1PLC, 2PLC	5PLC~100PLC
Range	Measuring range	Reso-lution	Accuracy ±(% of rdg +digit)	Accuracy ±(% of rdg +digit)	Accuracy ±(% of rdg +digit)
500mV	-549.999mV to 549.999mV	1μV	±(0.03 + 60)	±(0.025 + 6)	±(0.025 + 5)
5V	-5.49999V to +5.49999V	10μV	±(0.03 + 30)	±(0.025 + 3)	±(0.025 + 2)
50V	-54.9999V to +54.9999V	100μV	±(0.03 + 50)	±(0.025 + 5)	±(0.025 + 4)

Table 11 - 6 DC Voltage Measurement Temperature Coefficients

(At ambient temperatures $0^{o}C$ to $+18^{o}C$, $+28^{o}C$ to $+50^{o}C$)

Range	Temp. coefficient ± (% of rdg + digit)/^{o}C
500mV	±(0.0007 + 0.4)
5V	±(0.0006 + 0.1)
50V	±(0.0007 + 0.2)

- Reference contacts compensation (Internal):
  Internal/external selection
  Pt-based terminal board temperature measurement
  Compensation accuracy

Integral time	Accuracy
1ms to 10ms	±1.2^{o}C
1PLC to 100PLC	±0.6^{o}C

(Guaranteed for 6 months at ambient temperature range of $+23^{o}C$ ± $5^{o}C$, relative humidity range below 85%, input terminal temperature balanced state)

- Pt measuring current
  : Approx. 1mA (at open termial voltages of ±15V or less)
- Linearizing : Digital correction (9 types for thermocouple, 1 type for Pt 100Ω)
- Input terminals : Horizontal, M4 screw, 2-terminal/2-wire (4-terminal type is used for Pt)
- Thermocouple wire disconnections detection
  : Normal if 2kΩ or less, disconnected if 30kΩ or more.
  Detection current Approx. 50μA
  Pulse width Approx. 200μs
- Maximum permissible leads resistance of Pt
  : 10Ω or less (for 3-wire type)
  100Ω or less (for 4-wire type)

- Input impedance : 100Ω or more (for 50V range, at 10MΩ ± 0.5%)

- Maximum permissible input voltage
  : See the table below.

Measurement / Item	Thermocouple/ voltage measurement	Pt measurement
Across the same channel input	±100V	+40V -3V
Across mutual channel input	±100V	0V
Input terminal - Frame	±100V	±100V

- Noise rejection ratio:

AC effective CMRR	:	120dB or more (at an unbalanced input resistance of 1kΩ and an AC frequency of 50/60Hz ± 0.1%)
DC effective CMRR	:	120dB or more (at an unbalanced input resistance of 1kΩ)
NMRR	:	Approx. 60dB (at an AC frequency of 50/60Hz ± 0.1%)

- Crosstalk : 110dB or more (at DC voltage between channels)

11.2 Specifications of the R7430

11.2.1 Measurement

- Measurement commands

Log scan (Monitor scan) : Data is collected while selected channels are scanned during each preset interval.

Single log scan : Data is collected while selected channels are scanned only once when selected.

Call channel scan: Any ten points are measured at intervals of about one second, and the results are displayed.

- Measurement modes

log mode : Log scan is performed and digital recordings are ouput.

alarm mode : Log scan is performed and only the first-alarm-encountered digital recordings are output.

log/alarm mode : Log scan and monitor scan are performed, and digital data recordings and only the first of all sets of alarm-encountered monitor scan digital data recordings are output.

trend mode : Monitor scan is performed during the monitor interval time determined by the log interval time, and only trend recordings are output.

trend/alarm mode : Monitor scan is performed in a similar manner to that of the trend mode monitor scan, and trend recordings and only the first of all sets of alarm-encountered monitor scan digital data recordings of selected channels (up to 30 channels) are output.

log/trend mode : Log scan and monitor scan are performed, and the digital log data recordings of selected channels (up to 30 channels) and the trend recordings of monitor scans are output.

log/trend/alarm mode : Log scan and monitor scan are performed, and only the first set of alarm-encountered monitor scan digital data recordings of selected channels (up to 30 channels) are output.

11.2.2 Setting

- Scan formats

Date : Year, month, day
Time : Hours, minutes
Scan channels : Any measurement start/end channels can be set.
Log scan interval time:
100ms to 24h
(Monitor scan interval time: 100ms to 36min)
Measure mode : log, alarm, log/alarm, trend, trend/alarm, log/trend, or log/trend/alarm
Integreal time : 1ms, 5ms, 10ms, 1PLC, 2PLC, 5PLC, 10PLC, or 100PLC

- Function groups

Number of usable function groups
: 60 max.

(The following choices are available for each function group:)

Range : 9 types for thermocouple (Linearizing ON/OFF, room-temperature compensation ON/OFF); 100Ω for Pt (3-wire/4-wire); 3 types of DC voltage modes; contacts input
Scaling : (X - A)/B
A and B can be set to within the range from .000000 to ±999999. (B cannot be set equal to 0.)
Unit display : In addition to the automatically selected mV, V, or °C units (depending on the measurement range), the following 7 types of units are available: mV, V, °C, %, kg, Ω, blank
1st-order calculation
: ΔI ... Difference from initial data
ΔN ... Difference from any input data
ΔT ... Difference from the previous data
MAX ... Maximum value within one frame time
MIN ... Minimum value within one frame time
AVE ... Average value within one frame time

- Alarm groups

Number of usable alarm groups
: 60 max.

(The following choices are available for each alarm group:)

High-limit value : Alarm occurs if measured data > high-limit value
Low-limit value : Alarm occurs if measured data < low-limit value

- Calculate channels

Number of usable channels : 60 max.

(The following choices are available for each calculate channel:)

Function group : Must be the appropriate one for the selected calculate channel.

2nd-order calculation :
MAX ... Maximum value within the selected function group channel data
MIN ... Minimum value within the selected function group channel data
AVE ... Average value within the selected function group channel data

- Printer

Digital print channel : Digital recording channels for digital/trend combined recording must be selected (up to 30 channels selectable).

Trend channel : Trend recording channels must be selected (up to 12 channels selectable).

Trend position : The trend recording start position must be selected (0% to 120%).

Trend scale : The trend recording scale sensitivity must be set.

Trend mode : The appropriate printing position must be selected according to a combination with the trend position.
relative ... Initial data is recorded in trend form as the position preselected using the "trend position" above.
absolute ... Zero data is recorded in trend form as the position preselected using the "trend position" above.

- Buffer memory (Option)

Memory select : fix ... Measured data is stored into the memory until it has become full. Storage automatically terminates if the memory becomes full.
ring .. Measured data is stored into the memory until it has become full. Old data is overriden with new data if the memory becomes full.
fifo .. The memory can be used as a fifo buffer memory if data output cannot follow measurement.

11.2.3 Specifications of the Display Unit

- Display method: Measuring conditions, clock time, call channel data, etc. can be displayed on the 8-inch CRT.

- Screen control

PROGRAM	: Selection between the measurement screen and a programming screen
MENU	: Display of the items selectable on a programming screen
NEXT	: Display of the next programming screen
PREV	: Redisplay of the previous programming screen
FWD	: Bringing up the next program group
BACK	: Bringing up a previous program group

11.2.4 Specifications of the Printer Unit

- Printout

Log data	: Up to 300 channels (for digital/trend combined recording, up to 30 channels)
Trend data	: Up to 12 channels
Listing	: Listing of selected programs
Screen copy	: Printing of the screen display

- Printer Specifications

Digital printing speed:
Approx. 3sec/data frame
(1 data frame = 30 channels)
Head : 640-dot thermal printing head
Effective recording width:
Approx. 105.6mm
Paper width : Approx. 114mm

11.2.5 External Control Specifications

- External start/stop
  : The start/stop of log scan measurement is controlled using external contacts. Level or pulse modes are available.
  (Chattering: 30ms or less, Pulse width: 100ms or more)

- External REQ : External contacts signals are used to issue a request for execution of single log scan measurement.
  (Chattering: 30ms or less, Pulse width: 100ms or more)

- External SRQ : External contacts signals are used to issue a service request via the GPIB.
  (Chattering: 30ms or less, Pulse width: 100ms or more)

- Log busy signal : This signal is output during log scan measurement.
  Negative logic voltage signals (transistor outputs)
  HI-level output voltage: 3V or more (at an output current of 400A)
  LOW-level output voltage: 0.4V or less (at an input current of 1.6mA)

- Alarm out signal : Contacts signals are used to output this signal if measured data has overstepped the high/low limits.
  Maximum contacts operating voltage: 12VDC
  Maximum contacts operating current: 0.3A (at a DC rating of 10VA)
  Operating time (balancing time included): 1ms max.

11.2.6 GPIB Control Specifications

- Setting : Any type of measuring parameter can be set via the GPIB.
- Output : The clock time, channels, measured data, etc. can be output in one of three formats.

- Control signals and modes
  : Remote/local selection; talk-only function; SRQ signal issuance at the end of measurement/recall, at input of an SRQ, or in the event of a syntax error, an alarm, memory full status, etc.

- Electrical/mechanical specifications
  : Conform to IEEE Std. 488-1978.

- Interface functions
  : See Table 11-7.

Table 11 - 7 GPIB Interface Functions

Code	Function and description
SH1	Source handshaking
AH1	Acceptor handshaking
T5	Basic talker function, serial polling, talk-only mode function, talker release by listener selection
L4	Basic listener function, listener release by talker selection
SR1	Service request function
RL1	Remote/local selection
PP0	Parallel-polling function not provided
DC1	Device clear function (SDC, DCL, or other commnads can be used)
DT1	Device trigger function (GET commands can be used)
C0	No controller functions
E2	Tri-state driver is required.

11.2.7 General Specifications

- A/D conversion : Integration method
- Input method : Floating input
- Warming-up time : 30 minutes or less is required for the equipment to stay within the specifications (provided that the equipment has been stored at the same ambient temperature as the operating temperature).
- Power backup : In the even of power failures or of power interruptions by power switch OFF, the built-in nickel-cadmium battery provides backup power to protect data settings and the clock functions.
  - Backup time : Approx. 2 months (without buffer memory)
    Approx. 10 days (with buffer memory)
- Automatic diagnosis : Memory backup battery voltage checks, data memory read/write tests, program memory read tests, LED tests, etc. are performed at power-on.
- Manual diagnosis : Printing tests, ROM tests, RAM tests, and buffer memory (option) tests can be done.
- Reference clock signal stability : 5 sec/day or less (when the power remains turned on under normal operating conditions)
- Panel lock : Prohibits panel operations in a locked status.
- Operating environment :
  - Ambient temperature: +5°C to +40°C
  - Relative humidity : 85% or less
- Storage environment :
  - Ambient temperature: -20°C to +60°C (Without backup memory performance guarantee)
    +5°C to +45°C (With backup memory performance guarantee)
  - Relative humidity : 90% or less
- Power requirements : 90 to 110VAC (can be changed to 108 to 132VAC, 198 to 242VAC, or 216 to 250VAC, depending on the particular specifications, 48 to 66Hz, sine wave)

- Power consumption: 160VA or less

- Outline dimensions (Approximate)
  : 424mm (W) x 177mm (H) x 500mm (D) [without handgrips, rubber legs, or any other such protrusions]

- Weight : R7430 17kg or less
  R7430A 20kg or less
  R7430B 22kg or less

11.2.8 Options

- Data buffer memory (Option No. +71)

  Memory mode : fix, ring, or fifo
  Memory capacity: See the table below.

Mode	1CH scan	300CH scan
fix, ring	Approx. 22790 data	Approx. 73500 data
fifo	Approx. 20000 data	Approx. 43000 data

Calculation expression for the maximum storable number of sets of data:

If M = Number of scans, N = Number of scan channels:
First calculate M by the following expression.
fix, ring ... (16 + 7 x N) x (M + 2) = 524288
fifo ... (13 + 12 x N) x (M + 1) = 524288

Then calculate the number of sets of data, N, by the following expression.
D = M x N

NOTE: To use second-order calculate channels, the number of such channels to be used must be added to the value of N calculatd above.

- Optical link (Option No. +70):
  This optical adapter must be used to connect the R74301 expansion terminal to the R7430 via an optical cable.

11.3 Specifications of the R74301

11.3.1 General Specifications

- A/D conversion : Integration method
- Input method : Floating input
- Warming-up time : 30 minutes or less is required for the equipment to stay within the specifications (provided that the equipment has been stored at the same ambient temperature as the operating temperature).
- Automatic diagnosis : Data memory read/write tests, program memory read tests, calibration data checks, etc. are performed at power-on.
- Operating environment : Ambient temperature: +0°C to +50°C
  Relative humidity : 85% or less
- Storage environment : Ambient temperature: -20°C to +70°C
  Relative humidity : 90% or less
- Power requirements : 90 to 110VAC (can be changed to 108 to 132VAC, 198 to 242VAC, or 216 to 250VAC, depending on the particular specifications, 48 to 66Hz, sine wave)
- Power consumption: 36VA or less
- Outline dimensions (Approximate) : 424mm (W) x 177mm (H) x 400mm (D) [without handgrips, rubber legs, or any other such protrusions]
- Weight : R74301A 12kg or less
  R74301B 14kg or less

11.4 Accessories

TR1103-100 : Sheathed-type, T thermocouple
TR1103-110 : Sheathed-type, J thermocouple
TR1103-120 : Sheathed-type, E thermocouple
TR1103-130 : Sheathed-type, K thermocouple
TR1108-001 : Sheet-form T thermocouple
TR1108-010 : Sheet-form platinum resistance thermometer bulb

A01238-0001: Indoor-type optical cable (1m)
A01238-0010: Indoor-type optical cable (10m)
A01238-0020: Indoor-type optical cable (20m)
A01238-0050: Indoor-type optical cable (50m)
A01238-0100: Indoor-type optical cable (100m)
A01237-0001: Indoor-reinforced type optical cable (1m)
A01237-0010: Indoor-reinforced type optical cable (10m)
A01237-0020: Indoor-reinforced type optical cable (20m)
A01237-0050: Indoor-reinforced type optical cable (50m)
A01237-0100: Indoor-reinforced type optical cable (100m)
A01237-0200: Indoor-reinforced type optical cable (200m)
A01237-0500: Indoor-reinforced type optical cable (500m)
A01237-1000: Indoor-reinforced type optical cable (1000m)

APPENDIX

A1.1 Error Message List

Table A - 1 Error Message List (1 of 5)

Message	Description
100:'end_channel < 1'st_channel' at 'group number' group	The value of the first channel of the group is in excess of the value of the last channel of that group.
101:1'st exceeds last in scan channel	The value of the first channel within the scan range is in excess of the value of the last channel within that scan range.
102:Channel overlaps at [group number & group number	Identical channel settings are included in the group.
103:program parameter error	There are errors in the parameter settings.
104:Pt/3wire can't execute at channel number	An attempt has been made to select a Pt measurement function only for the compensation channel when that function was not effective for channel pairs.
105:Pt/4wire can't execute at channel number	An attempt has been made to select a Pt measurement function only for the compensation channel when that function was not effective for channel pairs.
106:Setting range is [lower-limit value to high-limit value]	Data out of the setting range has been set.
200:can't change parameter now	An attempt has been made to change the parameter during measurement or recall.
201:Can't change store_mode, 'buffer_memory_CLEAR'	An attempt has been made to change the store mode with the buffer memory uncleared.
202:Can't execute 'line_keep' on undefined line	An attempt has been made to keep the data present on an undefined line.
203:Can't execute 'line_set' on undefined line	An attempt has been made to set data on an undefined line.
204:Can't execute cal. in measure	An attempt has been made to execute calibration during measurement.
205:can't set 'store_key' in programing	An attempt has been made to set the STORE key to ON during programming.
206:Different column at 'keep' & 'set'	The column you attempted to set does not agree with the column already kept.

Table A - 1 Error Message List (2 of 5)

Message	Description
207:Enter with 'numeric_key' here	An attempt has been made to assign non-numeric data to an item that accepts only numeric data.
208:Enter with 'rotary_key' here	An attempt has been made to assign unacceptable data to an item that accepts only the data entered with the rotary key.
209:error, store_mode = fifo or off	An attempt has been made to recall data when the validstore mode was fifo or off.
210:illegal measure mode	An attempt has been made to enter the digital print channel setting screen when the valid measure mode was log/trend, trend/alarm, or log/trend/alarm.
211:Invalid key here	An invalid key has been pressed.
212:Invalid key in this page	An invalid key has been pressed for the page.
213:measure channel not exist	An attempt has been made to measure a nonexistent channel.
214:	
215:measure is not yet finished	Measurement is not yet completed.
216:memory not exist	An attempt has been made to execute a buffer memory CLEAR or test command in spite of the fact that the equipment does not have a buffer memory.
217:no connect, terminal	An attempt has been made to calibrate an unconnected terminal.
218:Non_column_data. Keep data before 'Set'	An attempt has been made to set column data not existing in the buffer.
219:Non_line_data. Keep data before 'Set'	An attempt has been made to set line data not existing in the buffer.
220:now 'measuring' or 'recalling'	An attempt has been made to carry out an operation not executable during measurement or recall.
221:now 'store switch ON', set OFF	An attempt has been made to clear the buffer memory with the STORE switch set to ON.

Table A - 1 Error Message List (3 of 5)

Message	Description
222:now measuring!	An attempt has been made to recall data during measurement.
223:now memory Full!	An attempt has beeen made to store data when the buffer memory was full.
224:now recalling	An attempt has been made to recall data during measurement.
225:printer being used now!	An attempt has been made to start the printer when it was already operating.
226:store_mode error, memory nothing : set 'off'	An attempt has been made to set the store mode to other than off without installing memory.
227:store_mode mismatch	An attempt has been made to set the STORE switch to ON with the ring or fix mode unselected.
228:too long string receive	A character string of more than 251 bytes has been input to the GPIB.
500:Battery low & default program!!!	The parameter settings have been initialized because the parameter backup battery voltage has decreased below the required level.
501:paper empty!	Printer paper has run out.
502:parameter error! Default set!	The parameter settings have been initialized because errors were detected during parameter check following the power-on sequence.
503:printer head up!	The printer head release lever remains raised.
504:terminal [Terminal number] ; down for a moment!	A momentary power-down state of the measurement unit has been detected.
505:terminal [Terminal number] ; power down!	The power of ht emeasurement unit is off.
506:clock was corrected!	The set value of the timer IC has been initialized.
900:sio_error Break received!	A hardware error has occurred during communication with the measurement unit.

Table A - 1 Error Message List (4 of 5)

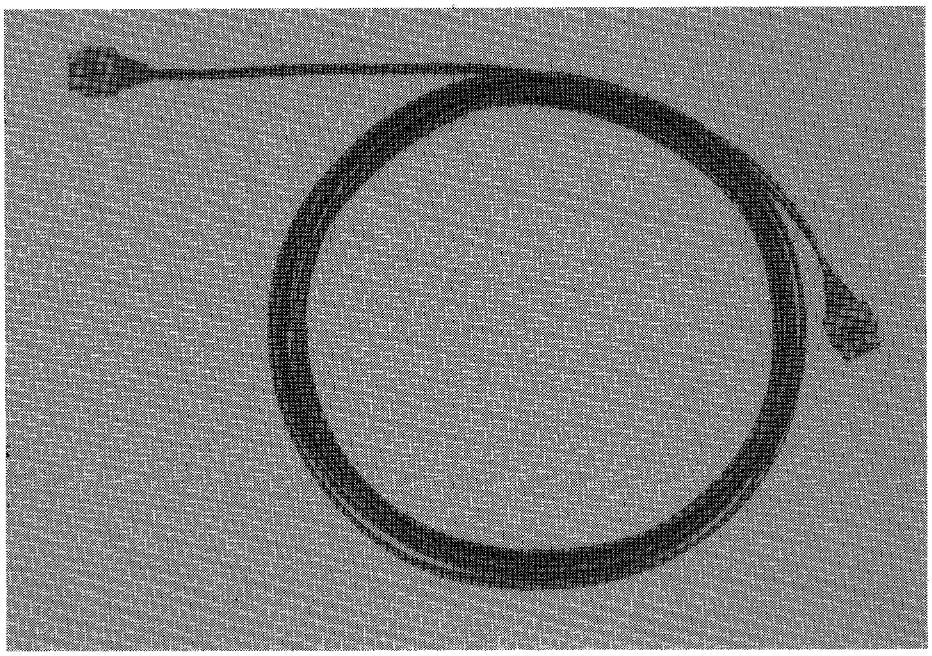
Message	Description
901:sio_error Ch_b received!	A hardware error has occurred during communication with the measurement unit.
902:sio_error CRC/Flaming!	A hardware error has occurred during communication with the measurement unit.
903:sio_error E/S bits!	A hardware error has occurred during communication with the measurement unit.
904:sio_error End of Frame!	A hardware error has occurred during communication with the measurement unit.
905:sio_error Parity!	A hardware error has occurred during communication with the measurement unit.
906:sio_error RX Overrun!	A hardware error has occurred during communication with the measurement unit.
907:sio_recieved CHECK_SUM error!	A check sum error has occurred in the data during communication with the measurement unit.
908:sio_recieved fatal error!	An uncorrectible error has occurred during communication with the measurement unit.
909:sio_recieved NACK code!	The measurement unit has received non-recognizable data.
910:sio_recieved not my address!	Data mismatch has occurred during communication with the measurement unit.
911:sio_recieved TERMINATER error!	Data mismatch has occurred during communication with the measurement unit.
912:sio_recieved unrecognized code!	Data mismatch has occurred during communication with the measurement unit.

Table A - 1 Error Message List (5 of 5)

Message	Description
913:Terminal address error!	Data mismatch has occurred during communication with the measurement unit.
914:measure data not exist!	Measure data has not been sent from the measurement unit.
915:terminal 〔Terminal No.〕 ; ROM/RAM error!	ROM/RAM error has occurred during self-diagnostics of the measurement unit.
916:terminal 〔Terminal No.〕 ; EEROM error!	An error occurred on the EEROM for calibration data during selef-diagnostics of the measurement unit.
917:terminal 〔Terminal No.〕 ; break down!	The measurement unit make no reply.

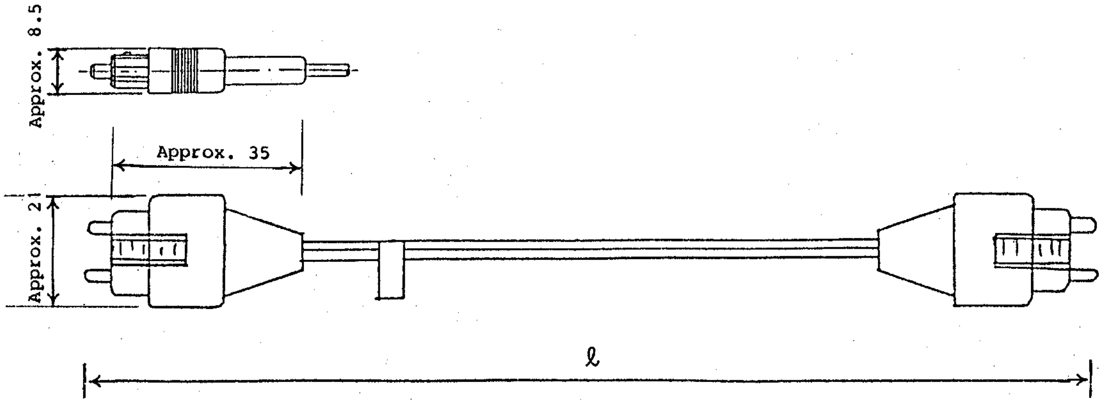
A1.2 Optical Cable Diagram

A01238 Indoor type optical cable

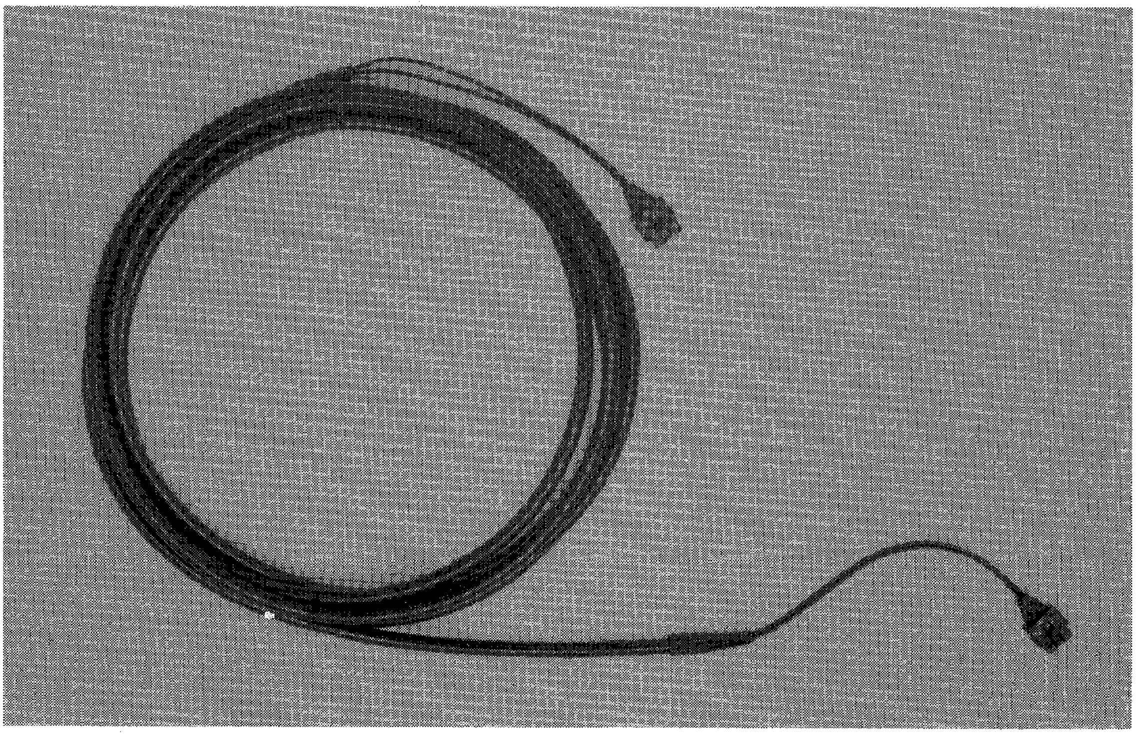


Type name :	A01238-0001	1m
	A01238-0010	10m
	A01238-0020	20m
	A01238-0050	50m
	A01238-0100	100m

Allowable bending diameter : 25mm ϕ or more
Operating temperature : -10 to +70°C
Storing temperature : -40 to +70°C

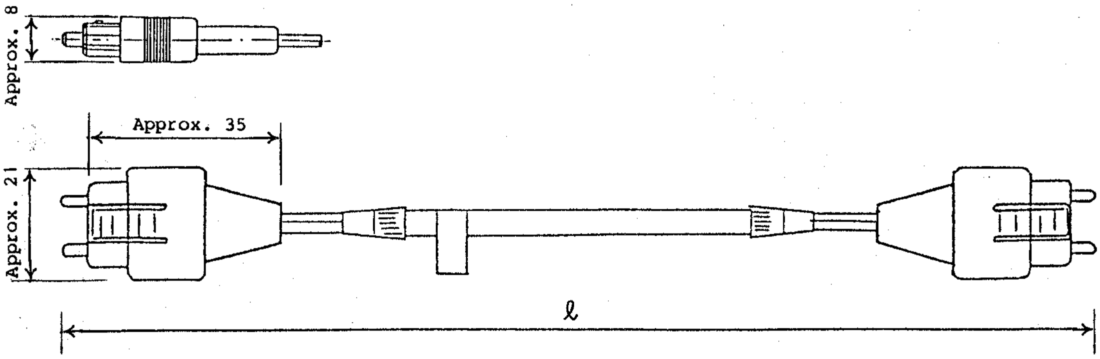


A01237 Indoor reinforced type optical cable



Type name :	A01237-0001	1m
	A01237-0010	10m
	A01237-0020	20m
	A01237-0050	50m
	A01237-0100	100m
	A01237-0200	200m
	A01237-0500	500m
	A01237-1000	1000m

Allowable bending diameter : 50mm ϕ or more
Operating temperature : −10 to +70°C
Storing temperature : −40 to +70°C



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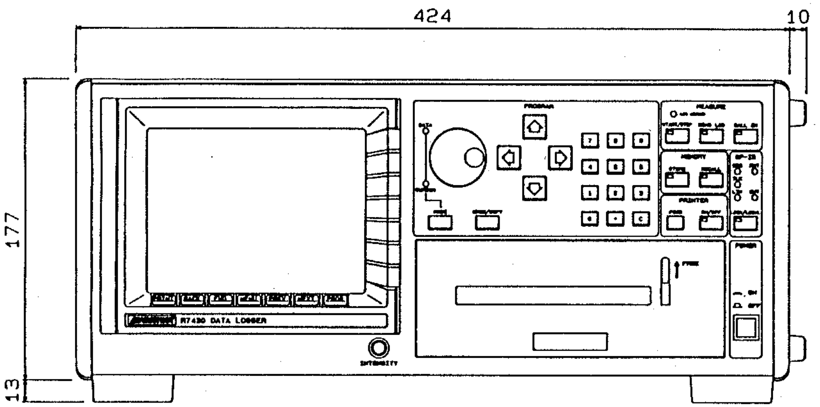
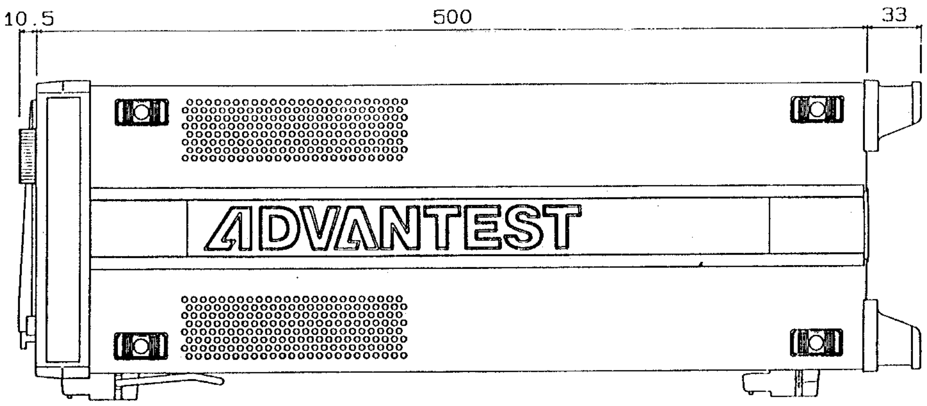
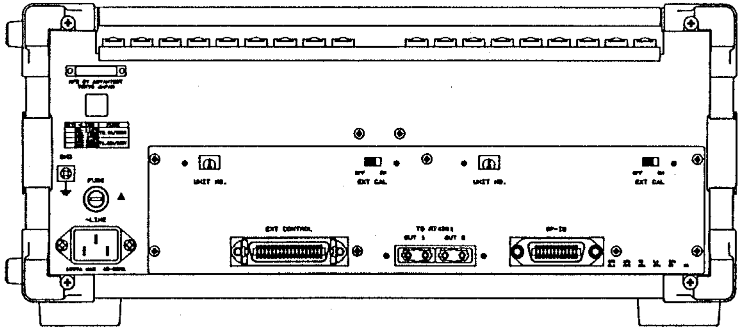


FRONT VIEW



SIDE VIEW

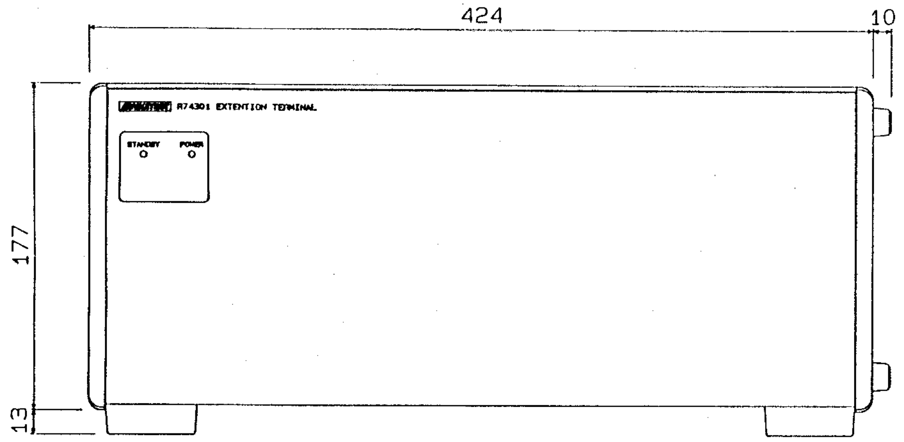


REAR VIEW

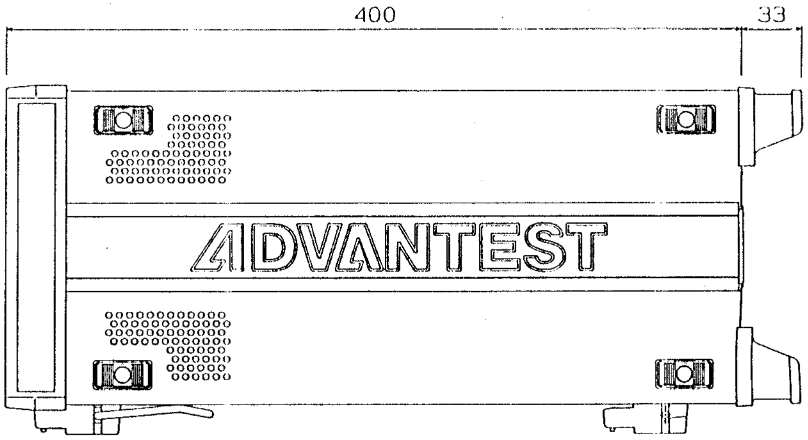
Unit:mm

R7430
EXTERNAL VIEW

7430EXT1-9001-C

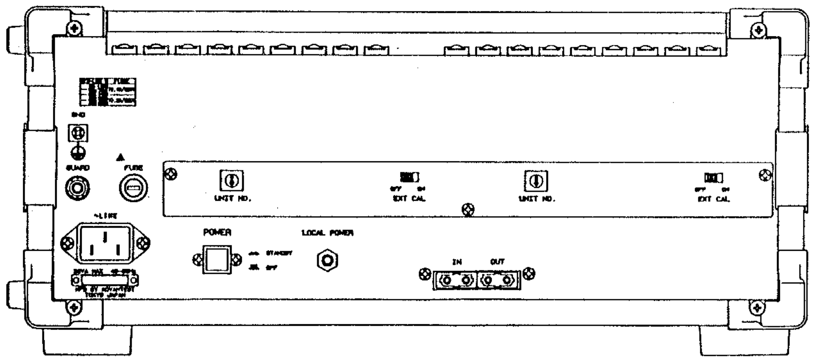


FRONT VIEW



SIDE VIEW

Unit:mm



REAR VIEW

R74301
EXTERNAL VIEW

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2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

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   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than ADVANTEST or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by ADVANTEST, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by ADVANTEST;

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In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, ADVANTEST recommends a regular preventive maintenance program under its maintenance agreement.

ADVANTEST's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest ADVANTEST office listed at the end of this Operation Manual or ADVANTEST's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest ADVANTEST office listed at the end of this Operation Manual or ADVANTEST's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL BUYER

The product should be thoroughly inspected immediately upon original delivery to buyer. All material in the container should be checked against the enclosed packing list or the instruction manual alternatively. ADVANTEST will not be responsible for shortage unless notified immediately.
If the product is damaged in any way, a claim should be filed by the buyer with carrier immediately. (To obtain a quotation to repair shipment damage, contact ADVANTEST or the local supplier.) Final claim and negotiations with the carrier must be completed by buyer.

SALES & SUPPORT OFFICES

Advantest America, Inc.(North America)
New Jersey Office
258 Fernwood Avenue Edison, NJ 08837, U.S.A.
Phone: +1-732-346-2600 Facsimile: +1-732-346-2610

Advantest Taiwan Inc. (Taiwan)
No.1 Alley 17, Lane 62, Chung-Ho Street,
Chu-Pei, Hsin-Chu Hsien, Taiwan R.O.C. 302
Phone: +886-3-5532111 Facsimile: +886-3-5541168

Advantest (Singapore) Pte. Ltd. (Singapore)
438A Alexandra Road, #08-03/06
Alexandra Technopark Singapore 119967
Phone: +65-6274-3100 Facsimile: +65-6274-4055

Advantest Korea Co., Ltd. (Korea)
22BF, Kyobo KangNam Tower, 1303-22,
Seocho-Dong, Seocho-Ku, Seoul #137-070, Korea
Phone: +82-2-532-7071 Facsimile: +82-2-532-7132

Advantest (Suzhou) Co., Ltd. (China)
Shanghai Branch Office
5F, No.46 Section Factory Building, No.555 Gui Ping Road,
Caohejing, Hi-Tech Area, Shanghai, China 200233
Phone: +86-21-6485-2725 Facsimile: +86-21-6485-2726
Beijing Branch Office
406/F, Ying Building, Quantum Plaza, No. 23 Zhi Chun Road,
Hai Dian District, Beijing, China 100083
Phone: +86-10-8235-3377 Facsimile: +86-10-8235-6717

ROHDE & SCHWARZ Europe GmbH (Europe)
Mühldorfstraße 15
D-81671 München, Germany
(P.O.B. 80 14 60
D-81614 München, Germany)
Phone: +49-89-4129-13711
Facsimile:+49-89-4129-13723

Technology Support on the Leading Edge
ADVANTEST®
ADVANTEST CORPORATION
Shin-Marunouchi Center Building, 1-6-2 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan
Tel: +81-3-3214-7500