**Instruction Manual**

# Model $\mu$R 250 RS-232C Interface

**$\mu$R 250**

YOKOGAWA ◆

IM 4J1B1-10E
2nd Edition

# INTRODUCTION.

This manual describes the RS-232C Interface which is an optional function of the μR250 Pen Recorder. For effective and efficient use of this function, carefully read this instruction manual IM 4J1B1-10E, instruction manual IM 4J1B1-01E for μR250 Pen Recorder and also an instruction manual for RS-232C interface of your own personal computer in use, to well understand the contents and familiarize yourself with their functions, operations and handling.

This instruction manual comprises the following three chapters.

**Chapter 1. OUTLINE AND SPECIFICATIONS.**
General description of outline of built-in RS-232C interface and related functions.

**Chapter 2. DEDICATED DATA OUTPUT MODE.**
Description of the procedure for using the dedicated data output mode and commands used.

**Chapter 3. DATA OUTPUT AND SETTING MODE.**
Description of the procedure for using the data output and setting mode and remote control functions.

- Read the manual from Chapter 1 in sequence if you desire to know the whole contents of the RS-232C interface.
- If you want to use the dedicated data output mode or data output and setting mode immediately, you may read Chapter 2 or Chapter 3 only together with Chapter 1.

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# 1. OUTLINE AND SPECIFICATIONS.

This chapter describes the general description, outline of functions, and specifications of RS-232C Interface for μR250 Recorder.

Since it is a brief overall description of the interface functions, read it through prior to start operations.

**Items of Description in Chapter 1.**


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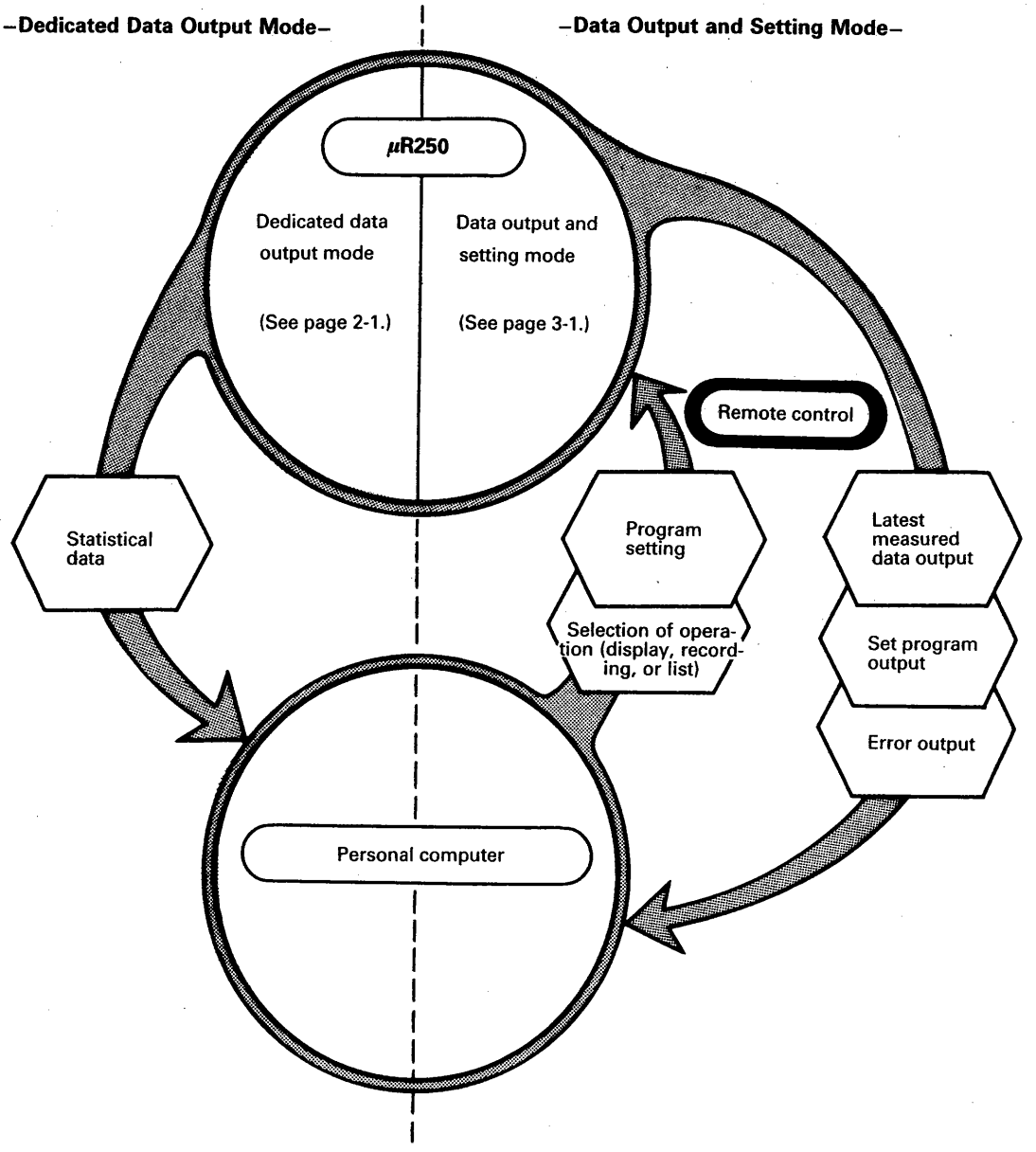
## 1-1. General.

The μR250 is a Pen Recorder having the recording width of 250 mm (approx. 10 inches) provided with a microprocessor. The recorder can receive not only DC voltage inputs but also direct temperature inputs by using nine types of thermocouples and resistance temperature detectors. This is a product useable in a wide fields of application with a single unit (see IM 4J1B1-01E).

This RS-232C Interface is provided for an optional function of the μR250 recorder. Thus, the μR250 recorder can be remotely controlled by combining the Interface with a personal computer (RS-232C controller)(Data output and setting mode).

In addition, closer analyses of data can be achieved by receiving the measured data in the μR250 recorder with a personal computer (Dedicated data output mode/data output and setting mode).



## 1-2. Functions of RS-233C Interface Incorporated in μR250 Recorder.

### 1-2-1. Signal Types and Direction.

Figure 1-1 shows the signal types and their direction used in the RS-232C interface incorporated in the μR250 recorder.

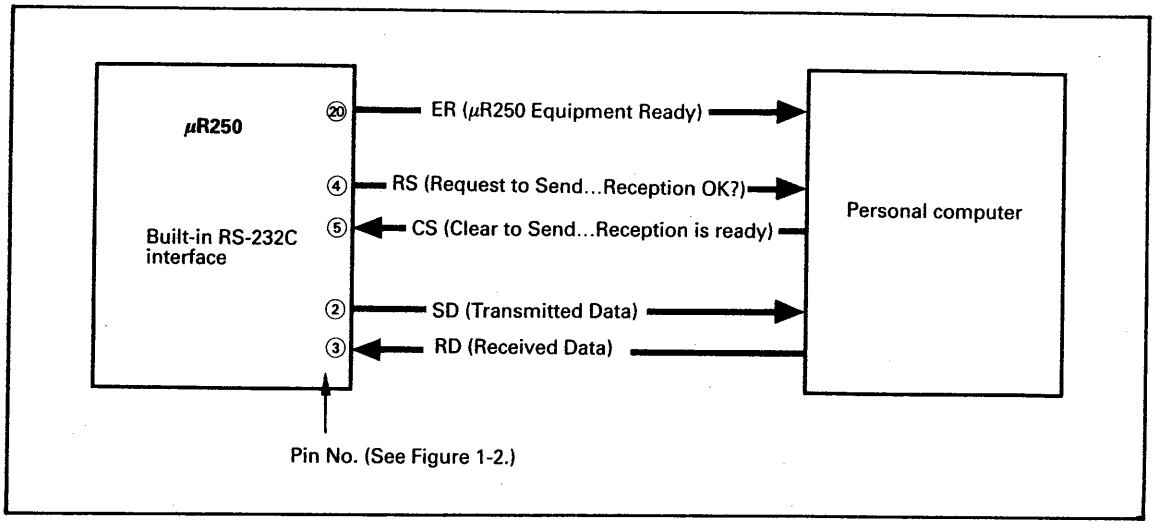



**Figure 1-1.**

### 1-2-2. Connector Pin Arrangement for RS-232C Interface.

Figure 1-2 shows the connector pin arrangement for built-in RS-232C interface. Table 1-1 indicates description for each pin.

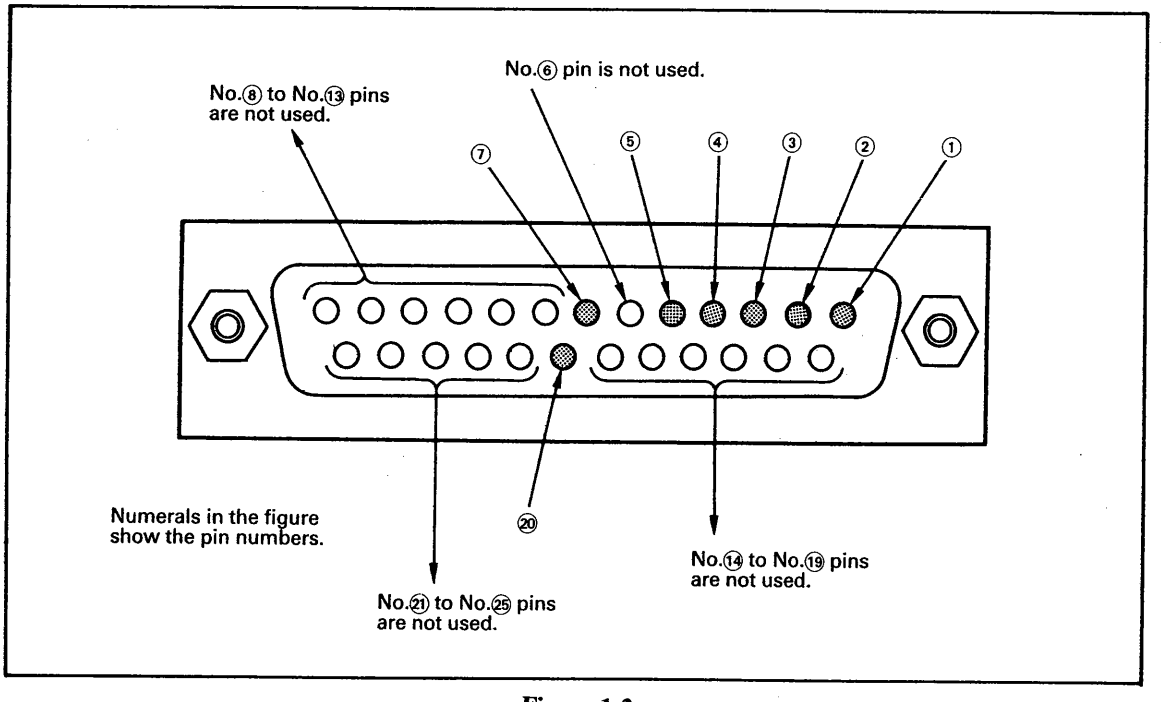



**Figure 1-2.**

**Table 1-1.**

| Pin No. | Mnemonic JIS | CCITT | EIA | Input/ Output | Name of Signal | Signal Monitoring | Application |
|---|---|---|---|---|---|---|---|
| ① | FG | 101 | AA | — | Frame Ground | — | Grounding of frame or casing |
| ② | SD | 103 | BA | Output | Transmitted Data | — | Data transmission |
| ③ | RD | 104 | BB | Input | Received Data | — | Data reception |
| ④ | RS | 105 | CA | Output | Request to Send | ○ | Used when data is sent out to the destination. |
| ⑤ | CS | 106 | CB | Input | Clear to Send | ○ | Used when the "clear to send" signal is sent from the destination. |
| ⑥ | This pin is not used in RS-232C interface for μR250. | | | | | | |
| ⑦ | SG | 102 | AB | — | Signal Ground | — | Grounding for circuits. |
| ⑧ to ⑲ | These pins are not used in RS-232C interface for μR250. | | | | | | |
| ⑳ | ER | 108/2 | CD | Output | Equipment Ready | — | This pin is ON (high voltage level) when the data terminal (μR250) power is ON and dat transmission/reception is ready. |
| ㉑ to ㉕ | These pins are not used in RS-232C interface for μR250. | | | | | | |

### 1-2-3. Data Communications.

**(1) Start Stop Communication System.**

The built-in RS-232C interface communicates with the start stop system.

The start stop system first adds the start bit to the head and then in turn adds the data bits (7 to 8 bits), parity bit and stop bit(s) in every transmission of one character (see Figure 1-3). Give the communication rate, data length, parity bit, and stop bit(s) with the respective dip switch (see page 1-11).

For start bit, one bit is automatically added and no setting is necessary.

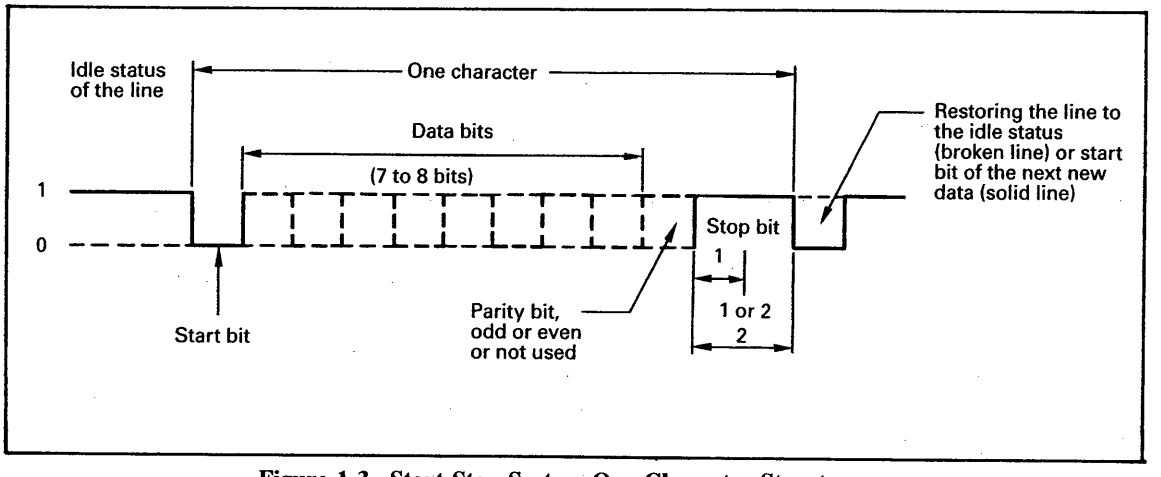



**Figure 1-3. Start Stop System One Character Structure.**

**(2) Text.**

Communication data is normally takes the form of more than one character added with terminator (terminating character). * This is called "text". Consider and handle a data in this unit (text) (see Figure 1-4).

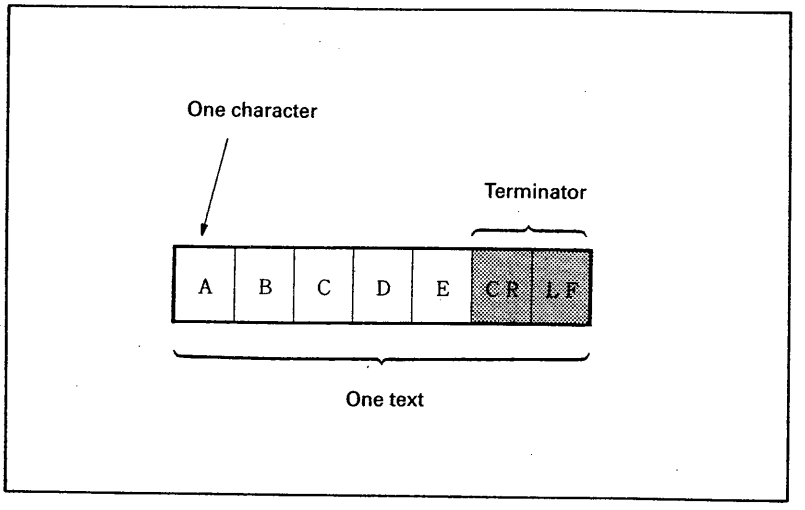



**Figure 1-4. Example of Text.**

* For terminator, see page 1-6 –Caution–.

**(3) Identification of Text.**

The built-in RS-232C interface identifies a text by regarding the reception of the terminator as the end of text (see Figure 1-5).

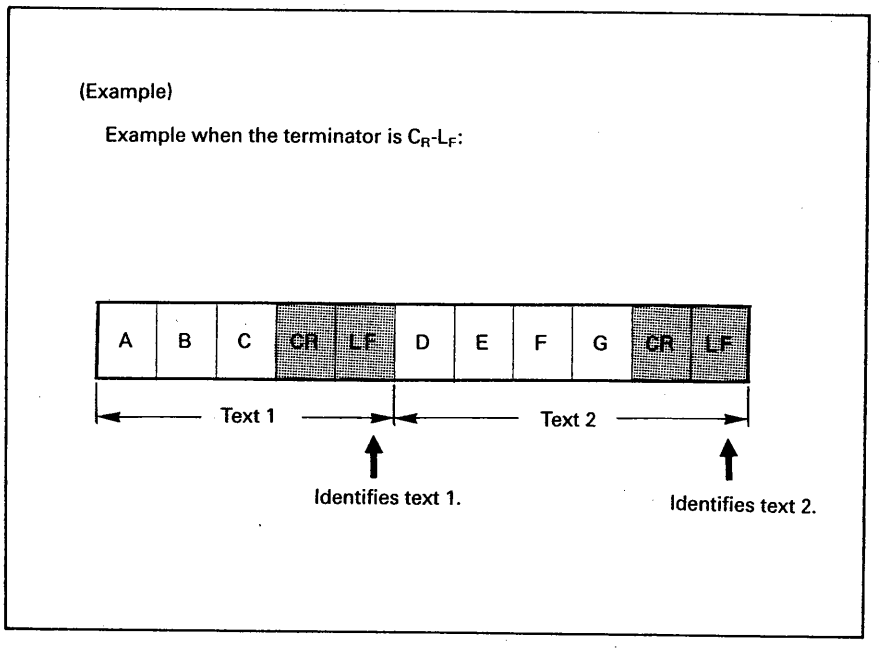



**Figure 1-5.**

**–Caution–**

**(Terminator)**

The μR250 identifies the text by regarding "$L_F$" or ";" as the terminator when receiving the data. (It sends out $C_R$ and $L_F$ as the terminator when the data is output.)

As the example of Figure 1-5, when $C_R$ and $L_F$ are used as the terminator, $C_R$ is ignored.

(Therefore, when communication is performed with a personal computer, the terminator is normally not necessary to be aware of.)

### 1-2-4. Input Buffer/Output Buffer.

Input and output buffers both take the form of rotary buffer (for capacity, see Table 1-2).

The rotary buffer outputs a text on the first-in first -out basis at the request of reading by BASIC while storing data in turn. It is not necessary for the user to be aware of in the program.

A merit of the rotary buffer is that it can flexibly cope with more than one text being sent contiguously because of low loss against variable text length.

**Table 1-2.**

| | Capacity |
|---|---|
| Input buffer | 64 bytes |
| Output buffer | 64 bytes |

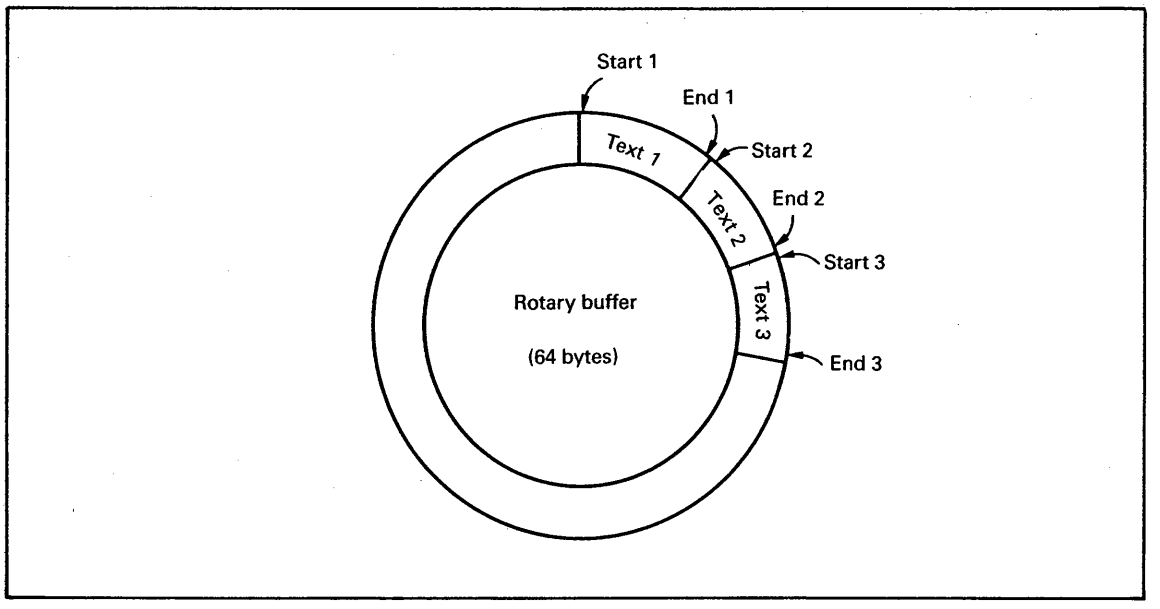



**Figure 1-6. Rotary Buffer.**

**1-2-5. Buffer-Full Control.**

As described before, the input/output buffers are necessary for data communication. The capacity, however, of these buffers is limited (64 bytes for μR250). Thus, specifically in the receiver, the buffer capacity may be come shorted if vast data is sent in a short time.

Overflow data are defeated and, in a transmitting station, already sent data are difficult to send again. These impair data communications.

Therefore, the receiving station monitors so that the buffer capacity is not shorted (buffer-full), inform the destination of communication of the buffer full status, and requests the temporary suspension of data transmission.

During the suspension of data transmission, the receiver processes the data in the buffer and requests the destination of communication to start transmission again when room is obtained in the buffer.

Control to intend to continue data communications punctually in a manner described above is the Buffer-Full control.

**X—ON/X—OFF**

The RS-232C interface of the μR250 recorder employs the "X-ON/X-OFF" method, one of buffer-full control methods.

- When the personal computer in the destination of communication sends out "X-OFF" at the Buffer-Full, the μR250 suspends data sending.
- When the personal computer in the destination of communication sends out "X-ON" at the release of Buffer-Full, the μR250 restarts sending data.

Note: In the Buffer-Full control by "X-ON/X-OFF", it is required that X-ON/X-OFF characters are always capable of being sent/received even during data transmission. This leads to the requirement of full duplex communication system.

## 1-3. Dip Switches.

In the RS-232C interface of μR250 recorder, settings must be carried out by transferring each dip switch.

This section describes the functions and operation of dip switches.

### 1-3-1. Dip Switch Locations.

Figure 1-7 shows the locations of the dip switches.

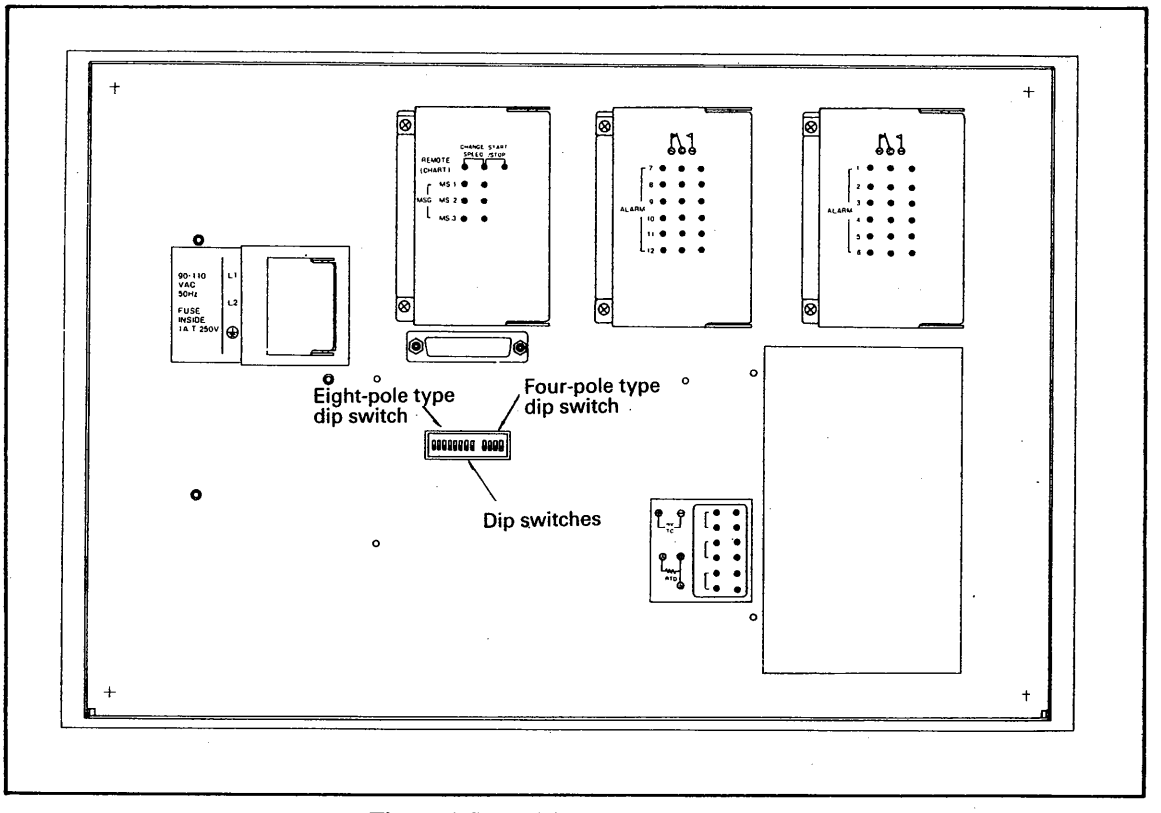



**Figure 1-7. μR250 Recorder Rear View.**

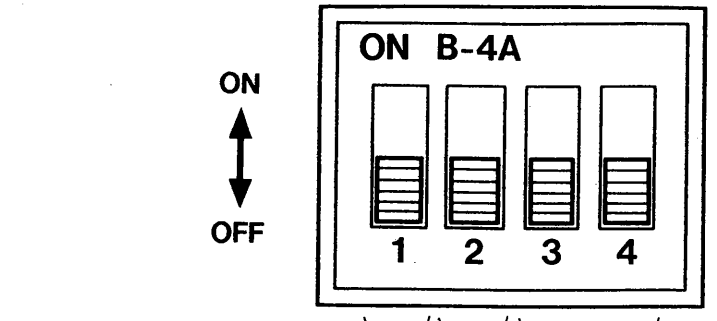
### 1-3-2. Types of Dip Switch.

As shown in Figure 1-7, there are two types of dip switch: four-pole type and eight-pole type. Each type of dip switch is used as described in ① and ② below.

① Four-pole type:
Used for specifying the data output and setting mode or dedicated data output mode and specifying data output period in the dedicated output mode for the μR250.
See also page 1-9 for functions of dip switch ON-OFF.

② Eight-pole type:
Used for specifying data transmission rate, data (word) length, type of parity, number of stop bits, and hardware handshake.
See also pages 1-10 and 1-11 for functions of dip switch ON-OFF.

### 1-3-3. Functions for Four-Pole Type Dip Switch.




**No.1 switch:**

This switch is not used but place this switch in OFF position.

**No.2 switch:**

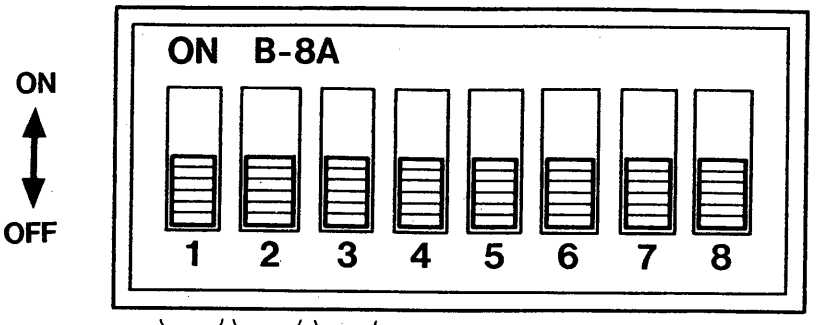
ON : Dedicated data output mode
OFF: Data output and setting mode

**Note:**
Set the switches only in the dedicated output mode (when No.2 switch is placed in the ON position) to specify the data output period.
In the data output and setting mode (when No.2 switch is placed in the OFF position), the output period cannot be determined because data input/output is controlled by a personal computer, a destination of communication.
Thus, No.3 and No.4 switches can be placed in either positions.

The data output period can be specified as shown below by ON/OFF positions of **No.3 and No.4** switches (see the above Note).

| No.3 | No.4 | Output Period (Seconds) |
|---|---|---|
| ON | ON | 60 |
| ON | OFF | 30 |
| OFF | ON | 10 |
| OFF | OFF | 5 |

### 1-3-4. Functions of Eight-Pole Type Dip Switch.




No.1, No.2, and No.3 switches are provided for specifying hardware handshaking.
Specify switch positions so that it is easier to use your own personal computer, the destination of communication, when connected.

**No.1 switch**

ON : Output control by CS signal is valid.
OFF: Output control by CS signal is invalid.

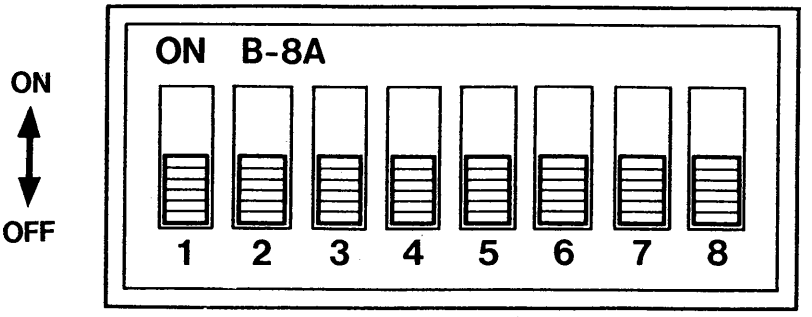
**No.2 switch:**

ON : ER signal is ON when the interface is ready for ER signal input, while ER signal is OFF when the interface is busy for ER signal input.
OFF: ER signal is always ON.

**No.3 switch:**

ON : RS signal is ON when the interface is ready for RS signal input, while RS signal is OFF when the interface is busy for RS signal input.
OFF: RS signal is always ON.

**–Caution–**
When CS, ER, and RS signals for hardware handshaking are made invalid or always "true" (dip switch position OFF), there is a danger in which part of the communication data is lost.
(When No.2 and No.3 switches are placed in ON positions, ON/OFF of the μR250 ER and RS signals is determined by the space factor of communications buffer data area. Those signals are OFF when about 3/4 of the buffer capacity is occupied with data, while ON when the buffer capacity occupancy is recovered to 1/4.)




Data format (data length, parity bit, and stop bit of one character to be transmitted) can be specified by combinations of ON/OFF positions of **No.4** and **No.5** switches.

| No.4 | No.5 | Data Length (Bits) | Parity Bit | Number of Stop Bit |
|---|---|---|---|---|
| ON | ON | 8 | None | 1 |
| ON | OFF | 7 | Even | 1 |
| OFF | ON | 7 | Odd | 1 |
| OFF | OFF | 7 | None | 2 |

Data transmission rate can be specified as shown below by combinations of ON/OFF positions of **No.6**, **No.7**, and **No.8** switches.

| No.6 | No.7 | No.8 | Transmission Rate (bps) |
|---|---|---|---|
| ON | ON | ON | 9600 |
| ON | ON | OFF | 4800 |
| ON | OFF | ON | 2400 |
| ON | OFF | OFF | 1200 |

| No.6 | No.7 | No.8 | Transmission Rate (bps) |
|---|---|---|---|
| OFF | ON | ON | 600 |
| OFF | ON | OFF | 300 |
| OFF | OFF | ON | 150 |
| OFF | OFF | OFF | 75 |

## 1-4. Specifications.

**Connecting system** : Point to point.

**Communication system** : Full duplex

**Synchronizing system** : Start stop system

**Transmission rate (bps)** : **75, 150, 300, 600, 1200, 2400, 4800, and 9600**
Specify any one of the above eight Baud rates (see page 1-11).

**Start bit** : **1 bit**
The start bit is fixed to one bit.

**Data length (word length)** : **7 or 8 bits**
For the number of bits for data (word) length, specify either 7 bits or 8 bits (see page 1-11).

**Parity** : **Even, Odd, or No parity**
Specify any one of the above three (see page 1-11).

**Stop bit** : **1 or 2 bits**
specify either 1 bit or 2 bits as the stop bit(s) (see page 1-11).

**Electrical characteristics** : **Conforms to EIA RS-232C.**

**Connector** : **DBSP - JB25S(JAE)**
(This is located at the rear of the μR250.)
As a cable for connecting to this RS-232C interface connector, use a cable DB-25P or equivalent.

**Hardware handshaking** : For signals **ER, RS**, and **CS**, selection either making always TRUE or using for control can be done individually (see page 1-10).

**Software handshaking** : Outputs are always controlled by X-ON/X-OFF signal sent out from the destination of communication in data communications. (Setting is not necessary.) (See pages 1-7.)

# 2. DEDICATED DATA OUTPUT MODE.

This chapter describes the dedicated data output mode of the RS-232C interface for the μR250 recorder.

**Items of Description in Chapter 2.**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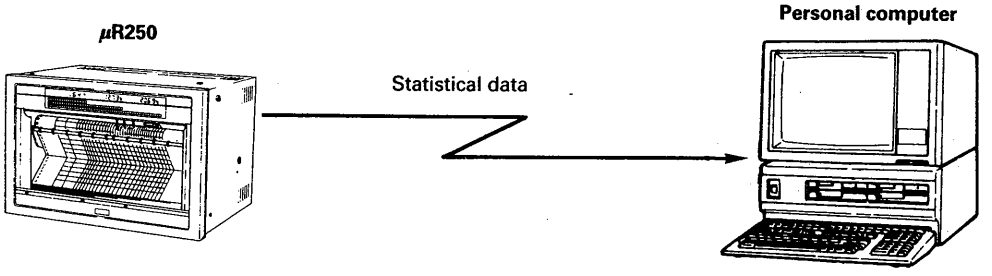
## 2-1. Outline of Dedicated Data Output Mode.

In the dedicated data output mode, statistical data can be output from the μR250 recorder to the destination of communication (your own personal computer). Other than statistical data are not output. *

Period of data outputs can be specified selecting any one of 5, 10, 30, and 60 seconds with a dip switch.




* For statistical data, see pages 2-6 to 2-8.

In this chapter, direct connection of the μR250 recorder to a personal computer with a connecting cable (equivalent to DB-25P) is specifically described. The distance in which the above direct connection is available is 15 m or less.
(The RS-232C interface of the μR250 recorder conforms to EIA RS-232C.)

## 2-2. Procedure for Using Dedicated Data Output Mode.

This section describes the procedure for communications in the dedicated data output mode of the μR250 recorder.

In the dedicated data output mode, only statistical data can be output (see page 2-6).

**–Procedure–**

1 Turn OFF the power switch of the μR250 recorder.

Specifications by dip switches are read at the time of turning the power switch ON (power boot-up). Therefore, if the power switch is kept "ON", specification by dip switches cannot be carried out.

The μR250 recorder is required to be with programs completed to be set. thus, check that the program is protected with a battery when the power switch is to be turned OFF.

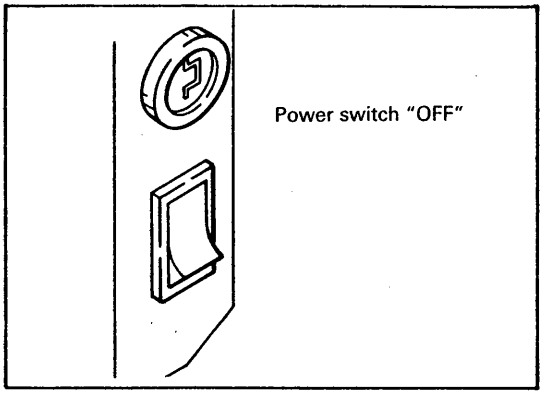



**Figure 2-1.**

2 Specify the dedicated data output mode with the four-pole type dip switch *−1 at the rear of the μR250 recorder. In doing this, turn ON No.2 switch.

No.1 switch is not used but place this switch in OFF position.

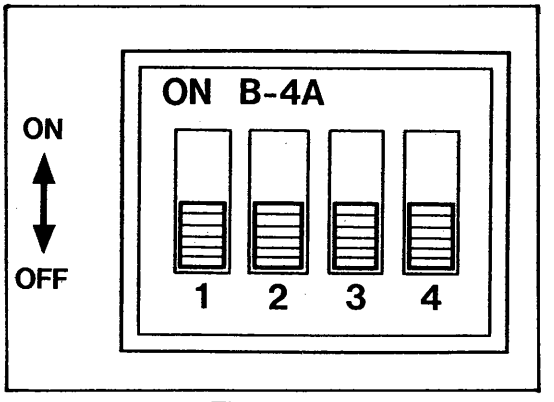



**Figure 2-2.**

3 Specify the μR250 data output period using the four-pole type dip switch. *−1

Example: If the output period is to be set to 5 seconds (fastest), place both No.3 and No.4 switches in OFF position.

(As the output period, specify any one of 5, 10, 30, and 60 seconds.)

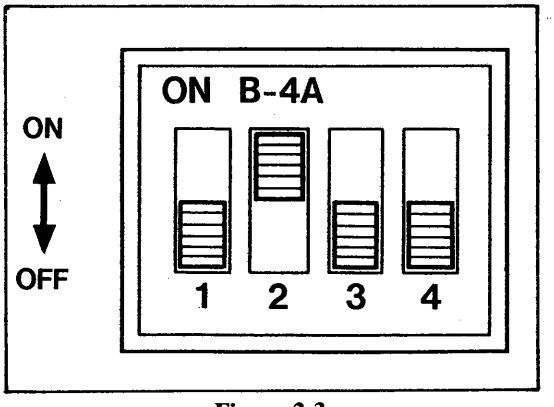
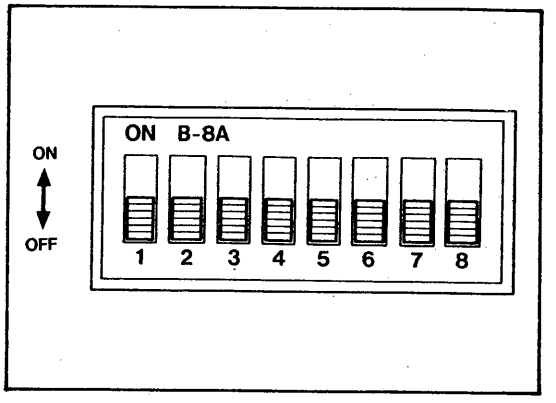



**Figure 2-3.**

*−1: For four-pole type dip switch, see page 1-9.

**4** Specify hardware handshaking with the eight-pole type dip switch *-2 at the rear of the μR250 recorder.




**(1) No.1 switch**

When this switch is placed in ON position, the output control by CS signal is valid.
When this switch is placed in OFF position, the output control by CS signal is invalid.
For CS signal, see page 1-4.

**(2) No.2 switch**

If this switch is placed in ON position,
ER signal is ON when the interface is ready for ER signal input, and
ER signal is OFF when the interface is busy for ER signal input.
If this switch is placed in OFF position, ER signal is always ON.
For ER signal, see page 1-4.

**(3) No.3 switch**

If this switch is placed in ON position,
RS signal is ON when the interface is ready for RS signal input, and
RS signal is OFF when the interface is busy for RS signal input.
If this switch is placed in OFF position, RS signal is always ON.
For RS signal, see page 1-4.

**5** Specify the data format (data length for one character, parity bit, and stop bit) with the eight-pole type dip switch. *-2
Use No.4 and No.5 switches.

| Switch No. | | Specified Status | | |
|---|---|---|---|---|
| No.4 | No.5 | Data Length (Bits) | Parity Bit | Number of Stop Bit |
| ON | ON | 8 | None | 1 |
| ON | OFF | 7 | Even | 1 |
| OFF | ON | 7 | Odd | 1 |
| OFF | OFF | 7 | None | 2 |

**6** Specify the data transmission rate usin the eight-pole type dip switch. *-2
Use No.6, No.7, and No.8 switches.

| Switch No. | | | Transmission Rate (bps) |
|---|---|---|---|
| No.6 | No.7 | No.8 | |
| ON | ON | ON | 9600 |
| ON | ON | OFF | 4800 |
| ON | OFF | ON | 2400 |
| ON | OFF | OFF | 1200 |

| Switch No. | | | Transmission Rate (bps) |
|---|---|---|---|
| No.6 | No.7 | No.8 | |
| OFF | ON | ON | 600 |
| OFF | ON | OFF | 300 |
| OFF | OFF | ON | 150 |
| OFF | OFF | OFF | 75 |

*-2: For the eight-pole type dip switch, see pages 1-10 and 1-11.

7 Turn ON the power switch of the μR250 recorder.
At this time, the μR250 recorder starts outputting the statistical data (the output period is the one set in step 3.)

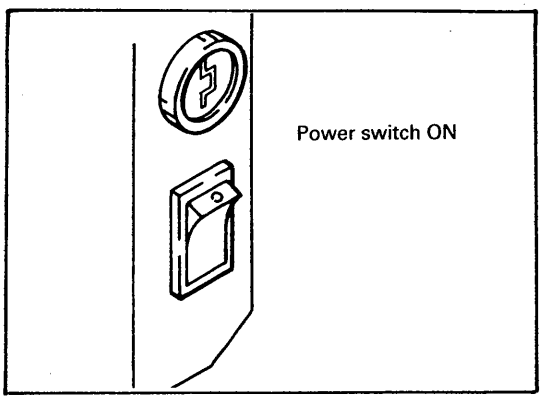



**Figure 2-5.**

8 Boot up the system of your personal computer to be used according to the predetermined procedure. Take the same transmission rate, data format and the like as set to the μR250 recorder. Subsequently execute the data receiving program in the personal computer and bring the personal computer into the data input waiting status.
Refer to an example of the data receiving program on page 2-9.

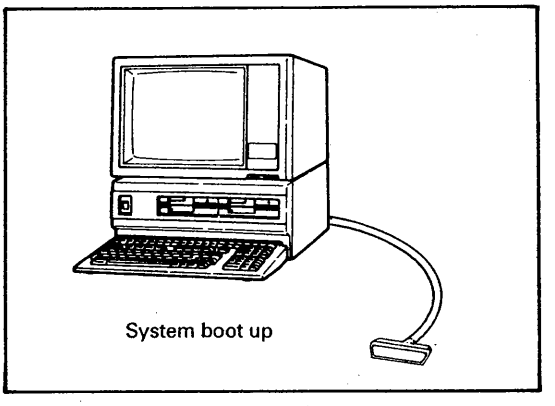



**Figure 2-6.**

9 Properly connect the connecting cable (equivalent to DB-25P) from the personal computer to the RS-232C interface connector located at the rear of the μR250 recorder.
At this time, check that the statistical data is properly transmitted from the μR250 recorder to the personal computer. (The μR250 recorder has no function to show that it is in data transmitting status with a display or similar device. Therefore, check it using the personal computer's CRT or the like.)

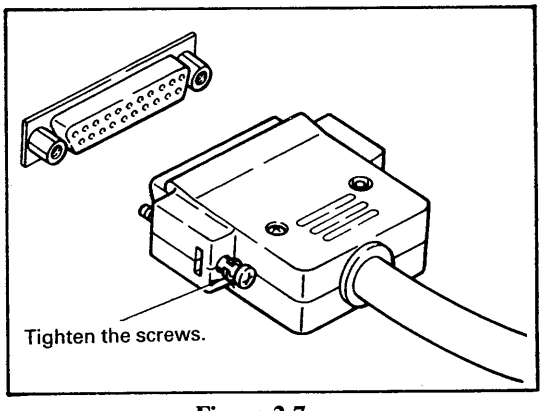



**Figure 2-7.**

## 2-3. Output Data.

### 2-3-1. Data Output Sequence.

The statistical data is output together with the data of system type, date and time.
Figure 2-8 shows the sequence of statistical data output for your reference.

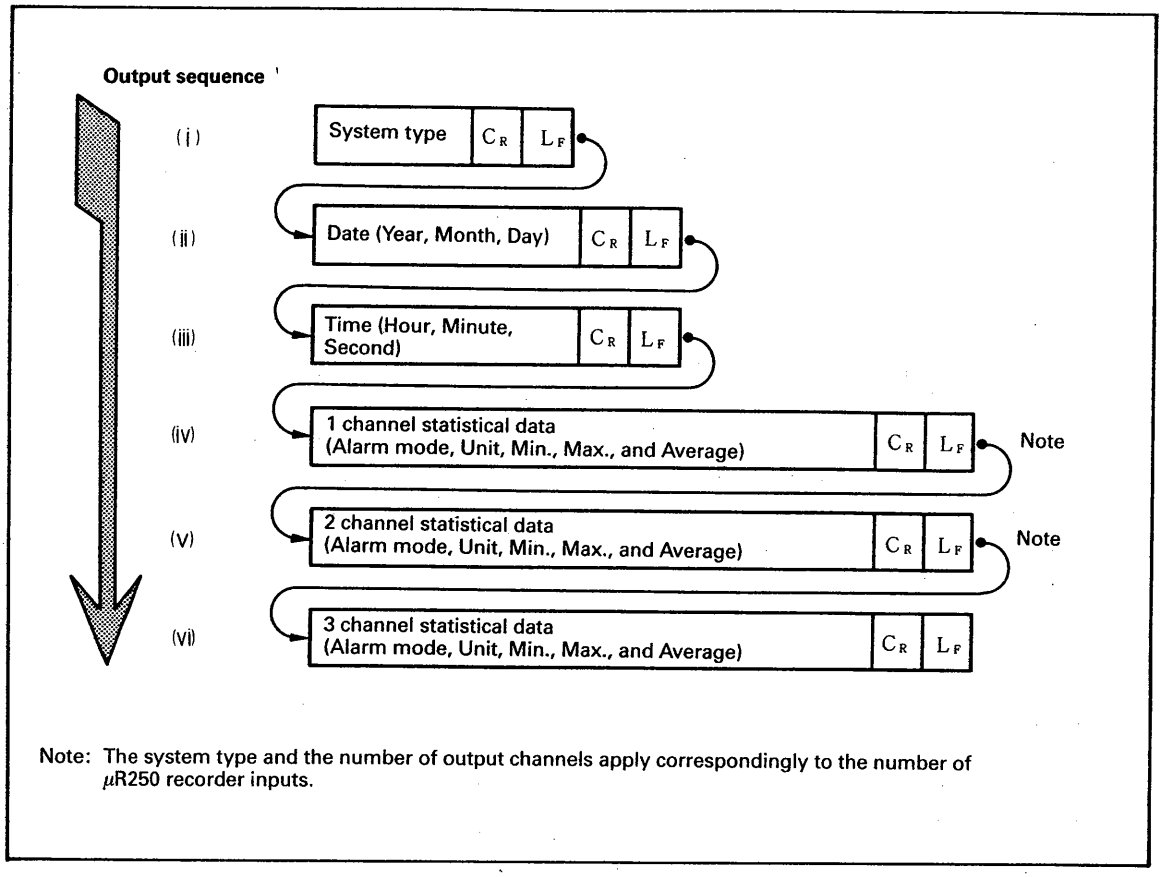



**Figure 2-8. Statistical Data Output Sequence.**

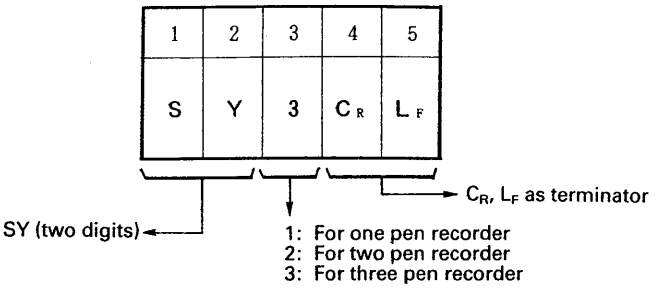
As shown in Figure 2-8, statistical data in each measuring channel is composed of types of alarm mode, setting unit, and further of the minimum, maximum and average values computed using the latest data measured at the time of data outputting.

The statistical data from the μR250 recorder is output continually in a period set with the dip switch in advance.

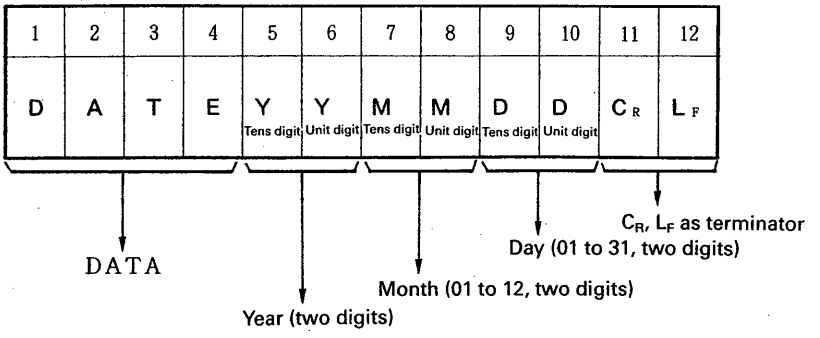
The μR250 recorder has no key operation for suspending communication halfway. Thus, if communication is to be suspended, operate so as to make communicating operation of the personal computer OFF after saving the data obtained so far on the personal computer side in advance.

### 2-3-2. Output Data Structure.

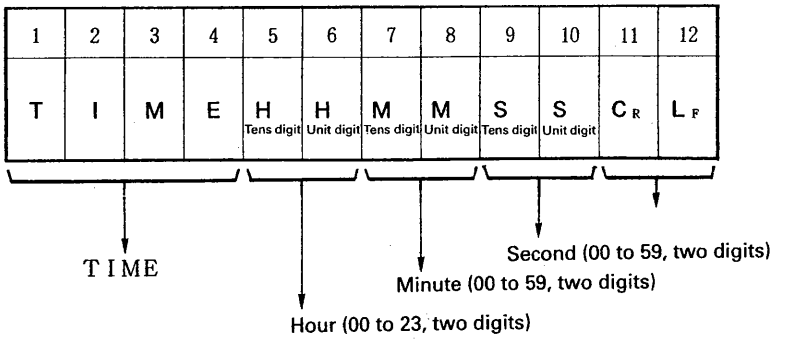
**(a) System Type Data**



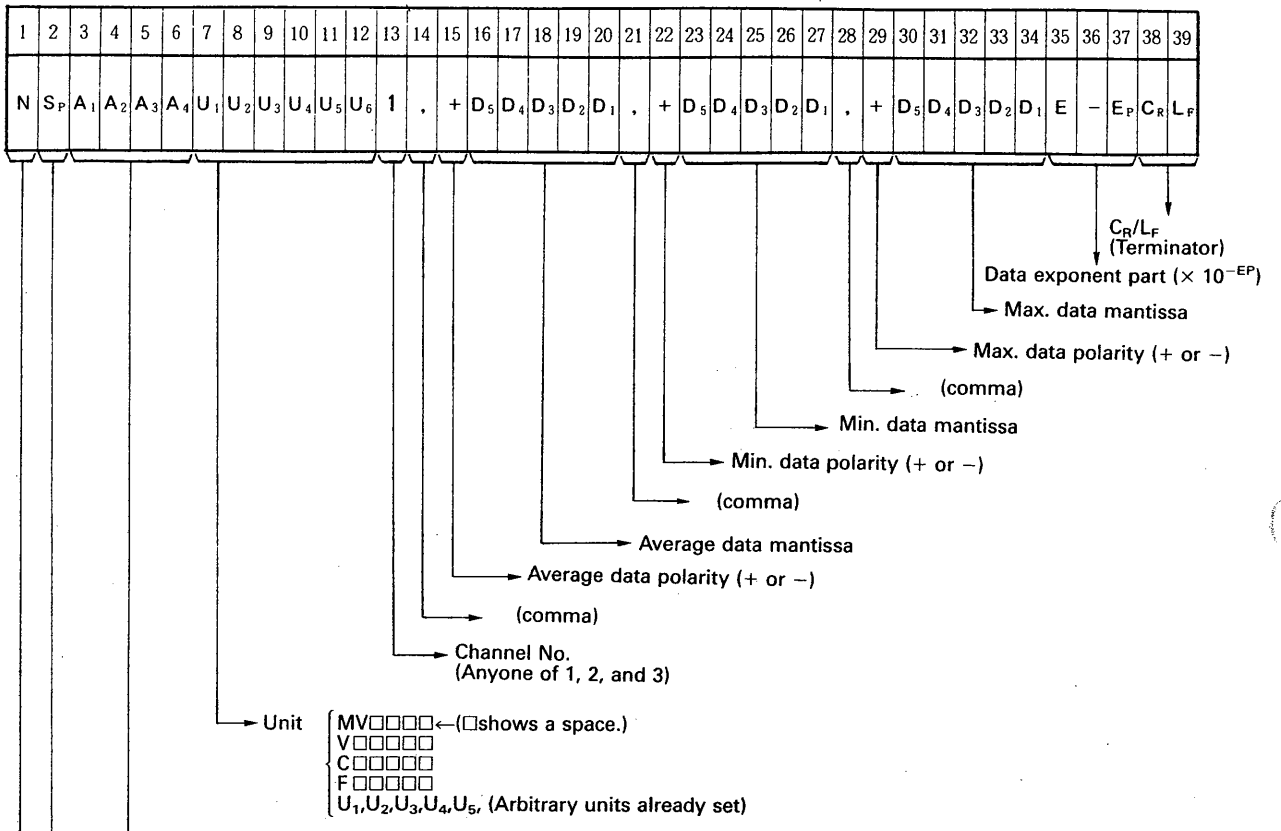

**(b) Date Data**




**(c) Hour Data**



### (d) Statistical Data




E : Last channel. For three pen recorder, it designates the third channel.
Sp : Others. This designates one or two channels when three pen recorder is used.

Alarm mode:

Positions of A1, A2, A3, and A4 indicates the alarm setting Nos.(level). Only when alarm occurs in a measuring period, predetermined alarm mode is output out of the following alarm modes. If alarm does not occur, these digits are all output with spaces. Refer to the next example.

- H : High limit alarm
- L : Low limit alarm
- h : High difference limit alarm
- l : Low difference limit alarm
- (□) : For no alarm

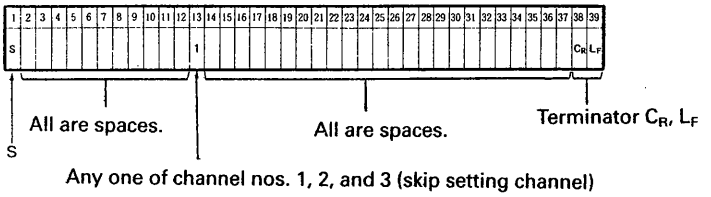
Example: If alarms H and h set in A1 and A4 digits out of alrms for a channel are ON, designation is as follows:

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| N | H | | h | | |

Data identifier

- O : Overrange
- S : Skip
- N : Normal
- D : Difference computation data

O : Overrange identifier is output when there is a measured data overrange even once in a data output (measurement) period specified with the dip switch separately.
S : For skip, the output statistical data becomes as shown below.



**2-4. Example of Data Receiving Program (IBM PC-5150 microcomputer is used.).**

```
100 OPEN "COM1:2400,N,8,1,RS,CS,DS,CD,LF" AS #1
110 LINE INPUT #1, A$
120 PRINT A$
130 GOTO 110
```

## 2-5. Example of Data Reception.

```
SY3
DATE870905
TIME124520
N       {C      1,+00272,+00271,+00273E-1
D L     {C      2,+00010,+00009,+00011E-1
NE      V       3,-00720,-00729,-00712E-3
SY3
DATE870905
TIME124525
N       {C      1,+00272,+00271,+00272E-1
D L     {C      2,+00010,+00009,+00010E-1
NE      V       3,-00736,-00740,-00729E-3
SY3
DATE870905
TIME124530
N       {C      1,+00272,+00271,+00273E-1
D L     {C      2,+00009,+00006,+00012E-1
NE      V       3,-00747,-00757,-00740E-3
```

# 3. DATA OUTPUT AND SETTING MODE.

This chapter describes the Data Output and Setting Mode of the RS-232C interface for the μR250 recorder.

**Items of Description in Chapter 3.**


—*Page*—

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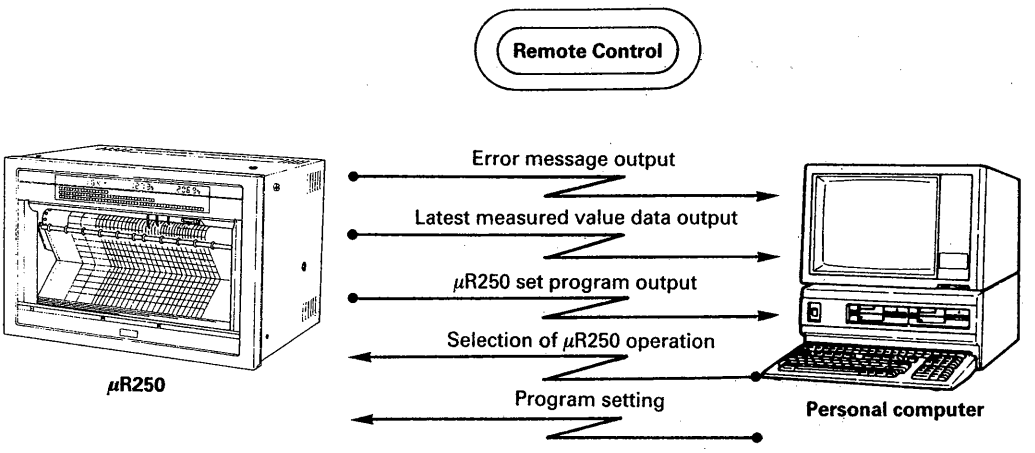
## 3-1. Outline of Data Output and Setting Mode.

In the data output and setting mode, the μR250 recorder can input/output various data by remote control from the destination of communication (your own personal computer).




**CAUTION**

In this chapter, direct connection of the μR250 recorder to a personal computer with a connecting cable (equivalent to DB-25P) is specifically described. The distance in which the above direct connection is available is 15 m or less.
(The RS-232C interface of the μR250 recorder conforms to EIA RS-232C.)

## 3-2. Command List.

This section describes all the commands used when the μR250 recorder communicates with the destination of communication via the built-in RS-232C interface, in a list (in the alphabetical order).

**Table 3-1.**

| Command | Outline of Functions | Reference Page |
|---|---|---|
| CS | Sets the speed of μR250 recording chart feed. | 3-15 |
| DS | Can select the μR250 display modes. | 3-11 |
| LS | Can print out a list of μR250 program setting data on a printer. | 3-11 |
| MS | Can print out messages of μR250 on a printer. | 3-12 |
| OE | Can output error numbers from the μR250. | 3-8 |
| PR | Can set partial compression or expansion recording out of the μR250 programs. | 3-30 |
| RC | Can Set the μR250 in either recording status or non-recording status. | 3-10 |
| SA | Can set alarm points out of the μR250 programs. | 3-23 |
| SC | Can set date and time to internal timers of the μR250. | 3-14 |
| ST | ① Can set measuring range out of the μR250 programs.<br>② Can set scaling out of the μR250 programs. | 3-16<br>3-19 |
| TG | ① Can set TAG No. out of the μR250 programs.<br>② Can set messages out of the μR250 programs. | 3-27<br>3-28 |
| TS | ① With TS0, the latest measured value data is output from the μR250.<br>② With TS1, the program set values are output from the μR250. | 3-34<br>3-38 |
| UN | Can set units out of the μR250 programs. | 3-25 |
| ZN | Can set zone recording out of the μR250 programs. | 3-29 |

For details of each command, see the reference pages shown in the table.

## 3-3. Procedure for Using Data Output and Setting Mode.

This section describes the procedure for communications in the data output and setting mode of the μR250 recorder.

**–Procedure–**

1 Turn OFF the power switch of the μR250 recorder.
Specifications by dip switches are read at the time of turning the power switch ON (power boot-up). Therefore, if the power switch is kept "ON", specification by dip switches cannot be carried out.
The μR250 recorder is required to be with programs completed to be set. Thus, check that the program is protected with a battery when the power switch is to be turned OFF.

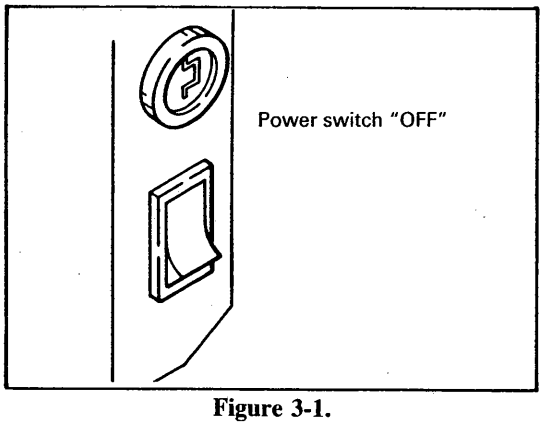


Figure 3-1.

2 Specify the data output and setting mode with the four-pole type dip switch *−1 at the rear of the μR250 recorder. In doing this, turn OFF No.2 switch.
When the data output and setting mode is selected, No.1, No.3, and No.4 switches may be placed each in either position.

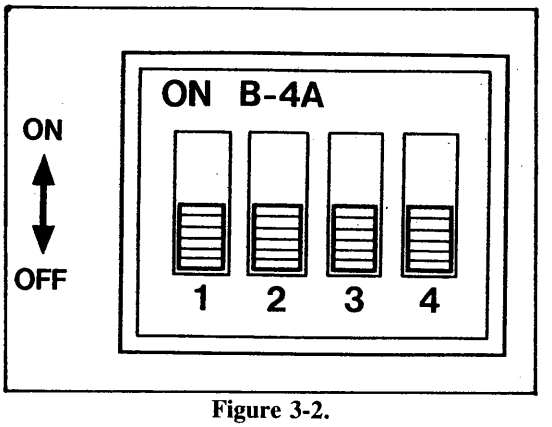


Figure 3-2.

3 Specify hardware handshaking with the eight-pole type dip switch *−2 at the rear of the μR250 recorder.
**(1) No.1 switch**
When this switch is placed in ON position, the output control by CS signal is valid.
When this switch is placed in OFF position, the output control by CS signal is invalid.
For CS signal, see page 1-4.

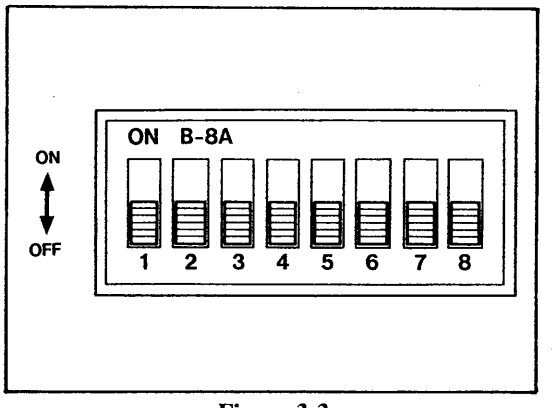


Figure 3-3.

*−1: For four-pole type dip switch, see page 1-9.
*−2: For eight-pole type dip switch, see pages 1-10 and 1-11.

**(2) No.2 switch**

If this switch is placed in ON position,
ER signal is ON when the interface is ready for ER signal input, and
ER signal is OFF when the interface is busy for ER signal input.
If this switch is placed in OFF position, ER signal is always ON.
For ER signal, see page 1-4.

**(3) No.3 switch**

If this switch is placed in ON position,
RS signal is ON when the interface is ready for RS signal input, and
RS signal is OFF when the interface is busy for RS signal input.
If this switch is placed in OFF position, RS signal is always ON.
For RS signal, see page 1-4.

**4** Specify the data format (data length for one character, parity bit, and stop bit) with the eight-pole type dip switch. *-2
Use No.4 and No.5 switches.

| Switch No. | | Specified Status | | |
|---|---|---|---|---|
| No.4 | No.5 | Data Length (Bits) | Parity Bit | Number of Stop Bit |
| ON | ON | 8 | None | 1 |
| ON | OFF | 7 | Even | 1 |
| OFF | ON | 7 | Odd | 1 |
| OFF | OFF | 7 | None | 2 |

**5** Specify the data transmission rate using the eight-pole type dip switch. *-2
Use No.6, No.7, and No.8 switches.

| Switch No. | | | Transmission Rate (bps) |
|---|---|---|---|
| No.6 | No.7 | No.8 | |
| ON | ON | ON | 9600 |
| ON | ON | OFF | 4800 |
| ON | OFF | ON | 2400 |
| ON | OFF | OFF | 1200 |

| Switch No. | | | Transmission Rate (bps) |
|---|---|---|---|
| No.6 | No.7 | No.8 | |
| OFF | ON | ON | 600 |
| OFF | ON | OFF | 300 |
| OFF | OFF | ON | 150 |
| OFF | OFF | OFF | 75 |

*-2: For eight-pole type dip switch, see pages 1-10 and 1-11.

6 Turn ON the power switch of the μR250 recorder.
At this time, the μR250 recorder is in the data output and setting mode.

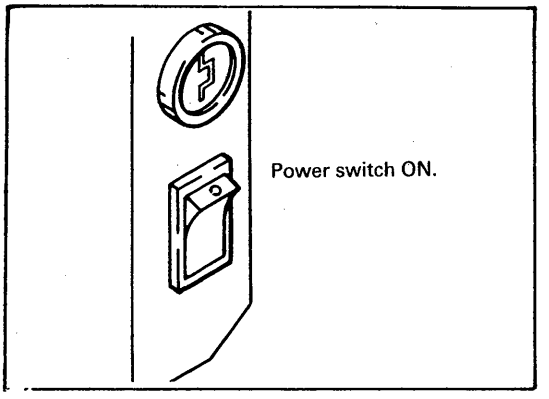



**Figure 3-4.**

7 Boot up the system of your personal computer to be used according to the predetermined procedure. Take the same transmission rate, data format and the like as set to the μR250 recorder.

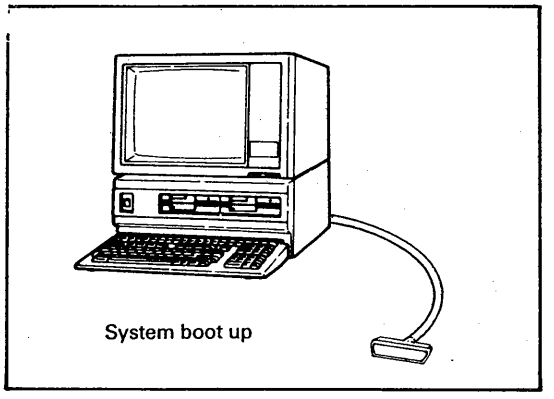



**Figure 3-5.**

8 Properly connect the connecting cable (equivalent to DB-25P) from the personal computer to the RS-232C interface connector located at the rear of the μR250 recorder.

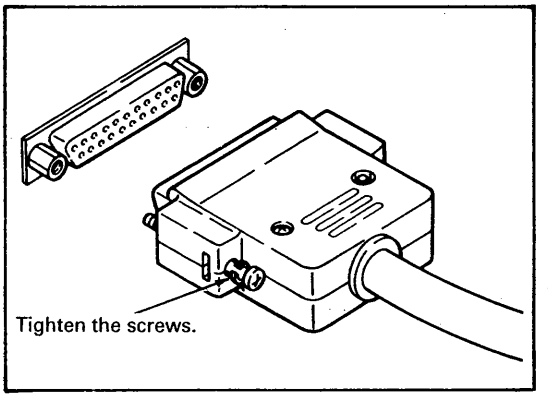



**Figure 3-6.**

9 Execute the data sending/receiving program using the personal computer.
Refer to examples of program described later.

–Reference page–
Page 3-8
Page 3-12
Page 3-32
Page 3-36
Page 3-43
Page 3-44

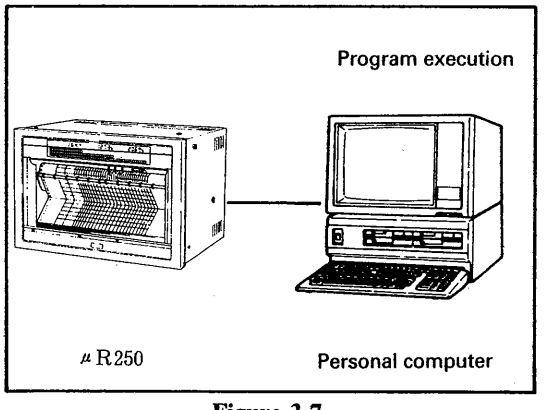



**Figure 3-7.**

## 3-4. Remote control 1. "Error Message Output".

Remote control from the personal computer can output an error message (number) from the μR250 recorder when an error occurs during communication between the μR250 recorder and the personal computer.

There are four types of error numbers, 00, 01, 02, and 03. When an error number output is requested, the μR250 output one number of them.

These numbers have the following meanings.

00: No error
01: Syntax error
02: Double error
03: Simultaneous occurrence of syntax error and double error

**CAUTION**

The μR250 recorder does not output any error message (number) unless error message output is requested.

However, if data communication is implemented via the interface, it is assumed that an error may occur for some reasons. In such a case, it can be known that whether or not the error is generated in the process of data communication by incorporating the error message output request in the program of the personal computer in advance. If an error does not occur, the above "00" (no error) is output.

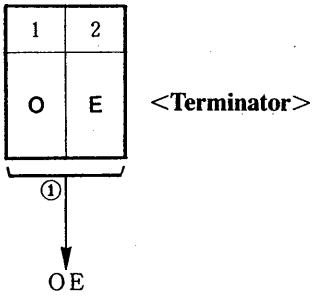
### 3-4-1. Description of Command Used.

A command necessary for outputting error message will be described.

## OE (Output Error)

**Function** The command can request an error number output.

**Data Structure**




For terminator, see page 1-6.

**Description**

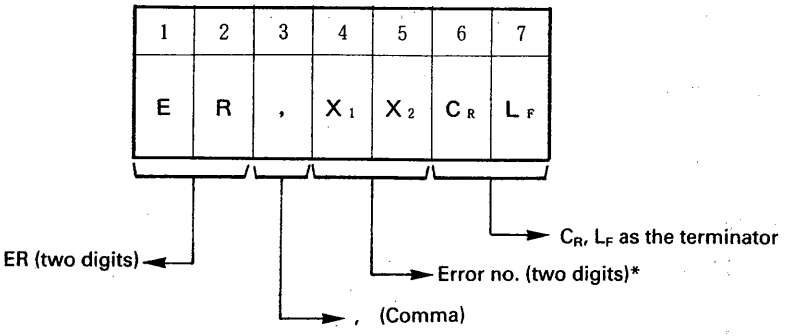
① This command can output an error number (data) from the μR250 recorder when the error occurs.

### 3-4-2. Example of Personal Computer Program (IBM PC-5150 microcomputer is used.).

```
100 OPEN "COM1:2400,N,8,1,RS,CS,DS,CD,LF" AS #1
110 A$ = "OE"
120 PRINT #1, A$
130 LINE INPUT #1, A$
140 PRINT A$
150 CLOSE
```

### 3-4-3. Output (Error) Data Structure.

- Error Data




* The error numbers are as follows:
Any one of the following is output depending on the situation.

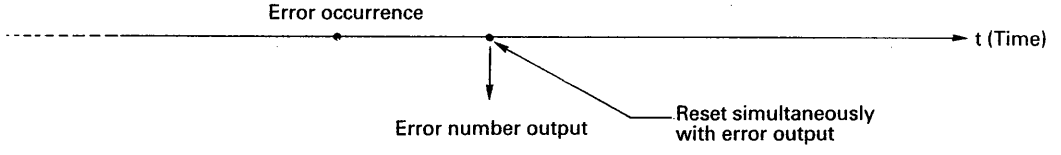
00: No error.
If "00" is output, it shows that no error has occurred in the process of communication.

01: Syntax error.

02: Double error.
This is an error that occurs when the μR250 cannot respond to the instruction times if the same instructions are given multiple times for a short period.

**–Reference–**

- Reset timing for error status.
At the time the error number is output, the error status is reset for the error that occurred before that time.



## 3-5. Remote Control 2. "Selection of μR250 Operation".

Remote control from the personal computer can switch ON/OFF the μR250 recording, start the list print-out, select the display mode (measured data/date), and can start the message printing.

### 3-5-1. Description of Commands Used.

The commands required will be described below in the order as written.
Refer to the required pages.

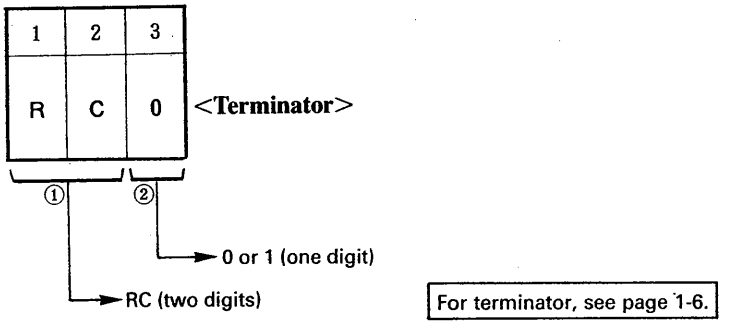

- Record ON/OFF **RC** .....Page 3-10.
- List Start **LS** .....Page 3-11.
- Display Select **DS** .....Page 3-11.
- Message Start **MS** .....Page 3-12.


## RC (Record ON/OFF)

**Function**

This command can set the μR250 to either the recording status or the not-recording status.
This serves as the same function as RCD ON/OFF key on the μR250 keyboard.

**Data Structure**




For terminator, see page 1-6.

**Description**

① By this command, the recording/non-recording mode of μR250 recorder can be selected.
② For selecting recording mode (RCD ON), ..... Designate 0.
For selecting non-recording mode (RCD OFF), ..... Designate 1.

The data taken as an example in Data Structure is for setting recording mode.

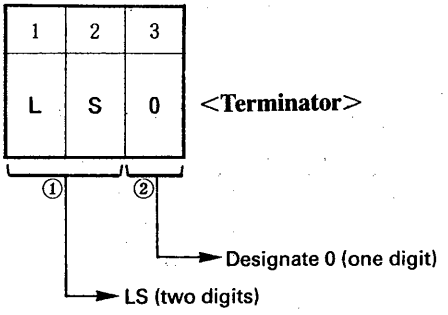
## LS (List Start)

### Function

This command can print the μR250 program setting data list.

This serves as the same function as LIST key on the μR250 keyboard.

### Data Structure




For terminator, see page 1-6.

### Description

① By this command, the program list set in the μR250 recorder can be printed on the μR250 recorder chart.

② Designate 0 in this digit.

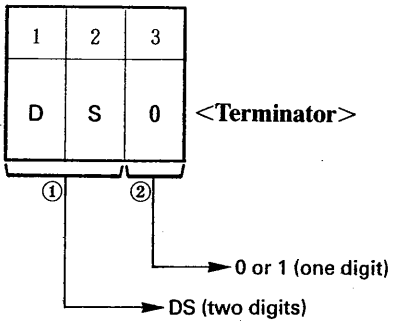
## DS (Display Select)

### Function

This command can select the μR250 recorder display mode.

This serves as the same function as DISPLAY key on the μR250 keyboard.

### Data Structure




For terminator, see page 1-6.

### Description

① By this command, the display mode can be selected.

② There are two types for the display modes which can be designated by the command.

0: CLK mode
Data and time are displayed in the μR250 display.

1: DATA mode
Measured values are displayed in the μR250 display.

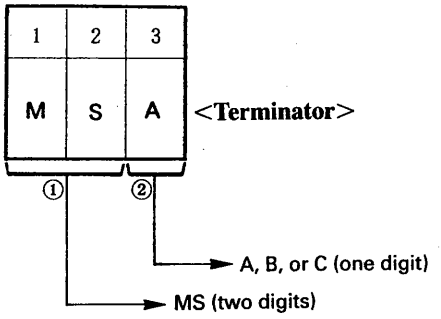
The data taken as an example of Data Structure is for setting to the mode "Date and time display"

## MS (Message)

### Function

This command can print the μR250 messages.
This serves as the same function as that with a contact for messages.

### Data Structure




For terminator, see page 1-6.

### Description

① By this command, a message can be output for printing.
② There are three types of message (No.) which can be designated.
Select one out of A, B, and C.

**3-5-2. Example of Personal Computer Program (IBM PC-5150 microcomputer is used.).**

Display date and time in the μR250 display.

```
100 OPEN "COM1:2400,N,8,1,RS,CS,DS,CD,LF" AS #1
110 A$ = "DSO"
120 PRINT #1, A$
130 CLOSE
```

## 3-6. Remote Control 3. "Program Setting (Program Data Input)".

Remote control from the personal computer can set (change) the μR250 programs.

### 3-6-1. Description of Commands Used.

Required commands will be described in the order written in the following.
Refer to each reference page.


- Date and time setting **SC** .....Page 3-14.
- Setting chart speed **CS** .....Page 3-15.
- Range setting **ST** ..... (1).....Page 3-16.
- Scaling setting **ST** ..... (2).....Page 3-19.
- Alarm setting **SA** .....Page 3-23.
- Unit setting **UN**.....Page 3-25.
- Tag setting **TG** ..... (1).....Page 3-27.
- Message setting **TG** ..... (2).....Page 3-28.
- Zone record setting **ZN** .....Page 3-29.
- Partially compressed or expanded record setting **PR** .....Page 3-30.

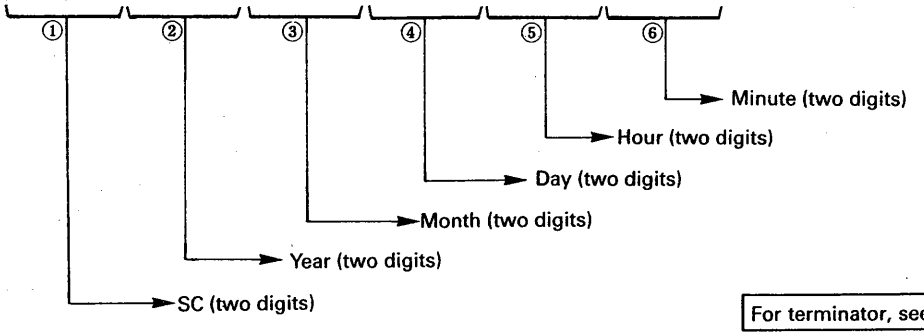
# SC (Set Clock)

## Function

This command can set date and time to a μR250 internal timer.

## Data Structure

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | C | 8 | 6 | 0 | 3 | 0 | 3 | 0 | 9 | 0 | 0 | <Terminator> |




For terminator, see page 1-6.

## Description

① By this command, date and time can be set to the μR250 recorder.

② Designate lower two digits representing the year A.D.
Ex. For 1987, designate 87.
The internal calendar of the μR250 recorder employs the year A.D.

③ Designate the numerals representing the month.
Numerals that can be designated are 01 to 12. Designation of numerals other than these causes an error.
Ex. For February, designate 02.

④ Designate the numerals represnting the day.
Numerals that can be designated are 01 to 31. Designation of numerals other than these causes an error.
Designation of a non-existing day, such as April 31, also causes an error.
Ex. For the third day of a month, designate 03.

⑤ Designate the numerals representing the hour.
Numerals that can be designated are 00 to 23. Designation of numerals other than these causes an error.
Ex. For 6 p.m. (18 : 00), designate 18.
(The internal timer of the μR250 recorder employs the 24-hour system for a day.)

⑥ Designate the numerals representing the minute.
Numerals that can be designated are 00 to 59. Designation of any numeral other than these causes an error.
Ex. For 2 minutes, designate 02.

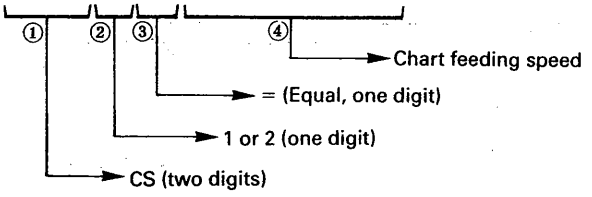
# CS (Chart Speed)

## Function

This command can set chart speeds for the μR250 recorder.

## Data Structure

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|---|---|---|---|---|---|---|---|---|---|
| C | S | 1 | = | 0 | 0 | 1 | 0 | 0 | <Terminator> |




For terminator, see page 1-6.

## Description

① By this command, a chart feeding speed for the μR250 recorder can be set.

② Two types of chart speed can be set for the μR250 recorder (in mm/h for either type). Designate any one of the following.
1: Normal chart speed (First set speed)
2: Alternate chart speed (Second set speed)
The second chart speed is not necessary unless /REM (optional specification) is used.

③ Designate "=" in this digit.

④ Set the numerals representing a chart speed (always in fixed length of five digits).
Numerals that can be set are as shown in Table 3-4. Designation of any numerals other than those in Table 3-4 causess an error.
The data taken as an example of Data Structure is the one for setting "the normal chart speed to 100 mm/h".

**Table 3-4.**

Unit : mm/h

| | | | | | | |
|---|---|---|---|---|---|---|
| 00005 | 00030 | 00080 | 00240 | 00600 | 01500 | 04320 |
| 00006 | 00032 | 00090 | 00250 | 00675 | 01600 | 04500 |
| 00008 | 00036 | 00096 | 00270 | 00720 | 01800 | 04800 |
| 00009 | 00040 | 00100 | 00300 | 00750 | 02000 | 05400 |
| 00010 | 00045 | 00120 | 00320 | 00800 | 02160 | 06000 |
| 00012 | 00048 | 00125 | 00360 | 00900 | 02250 | 07200 |
| 00015 | 00050 | 00135 | 00375 | 00960 | 02400 | 08000 |
| 00016 | 00054 | 00150 | 00400 | 01000 | 02700 | 09000 |
| 00018 | 00060 | 00160 | 00450 | 01080 | 02880 | 10800 |
| 00020 | 00064 | 00180 | 00480 | 01200 | 03000 | 12000 |
| 00024 | 00072 | 00200 | 00500 | 01350 | 03600 | |
| 00025 | 00075 | 00225 | 00540 | 01440 | 04000 | |

## ST (Set Range)...(1)

### Function

This command can set the measuring range out of the μR250 programs (for setting a measuring range accompanying scaling, see **ST (Set range)...(2)** on page 3-19).

### Data Structure

(i)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | T | 0 | , | 1 | A | 0 | 2 | − | 0 | 2 | 0 | 0 | 0 | , | + | 0 | 2 | 0 | 0 | 0 | <Terminator> |
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | | | ⑧ | | | | | ⑨ | ⑩ | | | | | ⑪ | |

① ST (two digits)
② Designate 0 (one digit).
③ , (Comma, one digit)
④ Channel No. (one digit)
⑤ Recording mode: A or D (one digit)
⑥ Range code (two digits)
⑦ Polarity : + or − (one digit)
⑧ Span low limit (five digits, fixed)
⑨ , (Comma, one digit)
⑩ Polarity : + or - (one digit)
⑪ Span high limit (five digits, fixed)

(ii)

| 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|
| S | T | 1 | , | 1 | <Terminator> |
| ① | ② | ③ | ④ | | |

① ST (two digits)
② Set 1 (one digit)
③ , (Comma, one digit)
④ Channel No. (one digit)

If the skip setting is carried out for the specific channel, it is sufficient to designate only ①, ②, ③ and ④ written in the description as shown left.

For terminator, see page 1-6.

### Description

① By this command, a measuring range (span setting or further difference computation) can be set (for setting a measuring range accompanying scaling, see **ST (Set range)...(2)** on page 3-19).
Each range setting is necessary for each channel.

② Designate for either setting or cancelling (skip setting).
0: Designate when setting is carried out. Refer to **(i) of Data Structure.**
1: Designate when setting is to be cancelled. Refer to **(ii) of Data Structure.**
In this case, measurement and recording in a measuring channel designated in ④ cannot be carried out.

③ Designate "," (comma) (one digit).
This shows an end of a data.

④ Designate the measuring channel No. (any one of 1, 2, and 3) to which the measuring range is to be set (or to be cancelled).

Notice: The μR250 recorder has three types: one pen, two pen, or three pen type). The channel No.3 cannot , of course, be designated to the one pen or two pen type recorder.
Designation of numerals that should not be given causes an error.

⑤ Designate the recording mode.
There are two types of recording mode : input absolute value recording A and difference recording D.

A: A mode in which measured input value is recorded without processings (if scaling is to be implemented, see **ST (Set range)...(2)** on page 3-19).

D: A mode in which difference between input values into the reference channel and designated channel is computed and recorded by providing a measuring channel to be used for the reference in advance.

⑥ Designate the measuring channel No. to be used for the reference channel when the difference recording mode D is designated in ⑤. (Designate this in two digits. If it is assumed as channel No.1, designate 01.)

Notice: For designating the difference recording mode D, the reference channel No. must be smaller than the measuring channel No. designated in ④.

Designate the measuring range code if the input absolute value recording mode A is designated in ⑤.

The measuring range codes are as shown in Table 3-5.

However, for measuring range codes 30 to 35, and 40 to 45 when scaling (linear scaling and square root extraction) is needed, refer to **ST (Set range)...(2)** on page 3-19.

**Table 3-5.**

| Type of Input | Measuring Range Code | Measuring Range JIS/ANSI | Measuring Range DIN (Partly ANSI) | Decimal Point Position |
|---|---|---|---|---|
| DC voltage | 00 | −20 to +20 m V | | □□□.□□ |
| | 01 | −200 to +200 m V | | □□□□.□ |
| | 02 | −2 to +2 V | | □□.□□□ |
| | 03 | −6 to +6 V | | □□.□□□ |
| | 04 | −20 to +20 V | | □□□.□□ |
| | 05 | −50 to +50 V | | □□□.□□ |
| Thermocouples (Note) The types N and W denotes the rating for the following products. N: NBS (National Bureau of Standards) W: HOSKINS | 10 | R 0 to 1760°C 32 to 3200°F | ← | □□□□.□ □□□□ |
| | 11 | S 0 to 1760°C 32 to 3200°F | PtRh-Pt 0 to 1760°C | □□□□.□ □□□□ |
| | 12 | B 400 to 1820°C 752 to 3308°F | ← | □□□□.□ □□□□ |
| | 13 | K −200 to 1370°C −328 to 2498°F | NiCr-Ni −200 to 1370°C | □□□□.□ |
| | 14 | E −200 to 800°C −328 to 1472°F | ← | □□□□.□ □□□□.□ |
| | 15 | J −200 to 1100°C −328 to 2012°F | Fe-CuNi −200 to 900°C | □□□□.□ □□□□.□ |
| | 16 | T −200 to 400°C −328 to 752°F | Cu-CuNi −200 to 400°C | □□□□.□ □□□□.□ |
| | 17 | N 0 to 1300°C 32 to 752°F | ← | □□□□.□ □□□□ |
| | 18 | W 0 to 2315°C 32 to 752°F | ← | □□□□.□ □□□□ |
| Resistance temperature detectors | 20 | JPt 100 Pt 100 −200 to 550°C | | □□□□.□ □□□□.□ |
| | | Pt 100 −328 to 1022°F | | |

An arrow oriented to the left ← means "same as mentioned left"

Note: JPt100 : JIS C 1604-1989, JIS C 1606-1989
Pt100 : JIS C 1604-1989, JIS C 1606-1989, DIN IEC 751, IEC 751

⑦ Designate the polarity (+ or −) of the low limit value of span in measurement or recording (one digit). Note

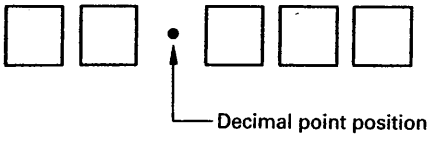
⑧ Designate the value of low limit of span in measurement or recording (fixed to five digits). When designating numerical values, measuring ranges in each channel must be considered (decimal point position must be considered).

**Example of Designation**

Perform as shown below when the measuring range code is designated "02" in ⑥ and the span low limit is to be designated "-1.5 V".

(i) Designate "-" for polarity in ⑦. This is "-" of -1.5 V.

(ii) Designate the numeric value 1.5 V in ⑧ so that the decimal point is properly positioned. As seen in Table 3-5, the decimal point should be positioned between the second and third digits for measuring range code "02".




Thus, designate 01500 for obtaining 1.5.

⑨ Designate "," (comma) (one digit).
This delimits data.

⑩ Designate the polarity (+ or −) of the high limit value of span in measurement or recording (one digit).

⑪ Designate the value of high limit of span in measurement or recording (fixed to five digits). When designating numerical values, measuring ranges in each channel must be considered. This is the same procedure as in ⑧ "Designation of span low limit in measurement or recording". See the above "Example of Designation"

**–Note–**

Designate + or − or 0 in the polarity digit if the low or high limit value of span in measurement or recording.

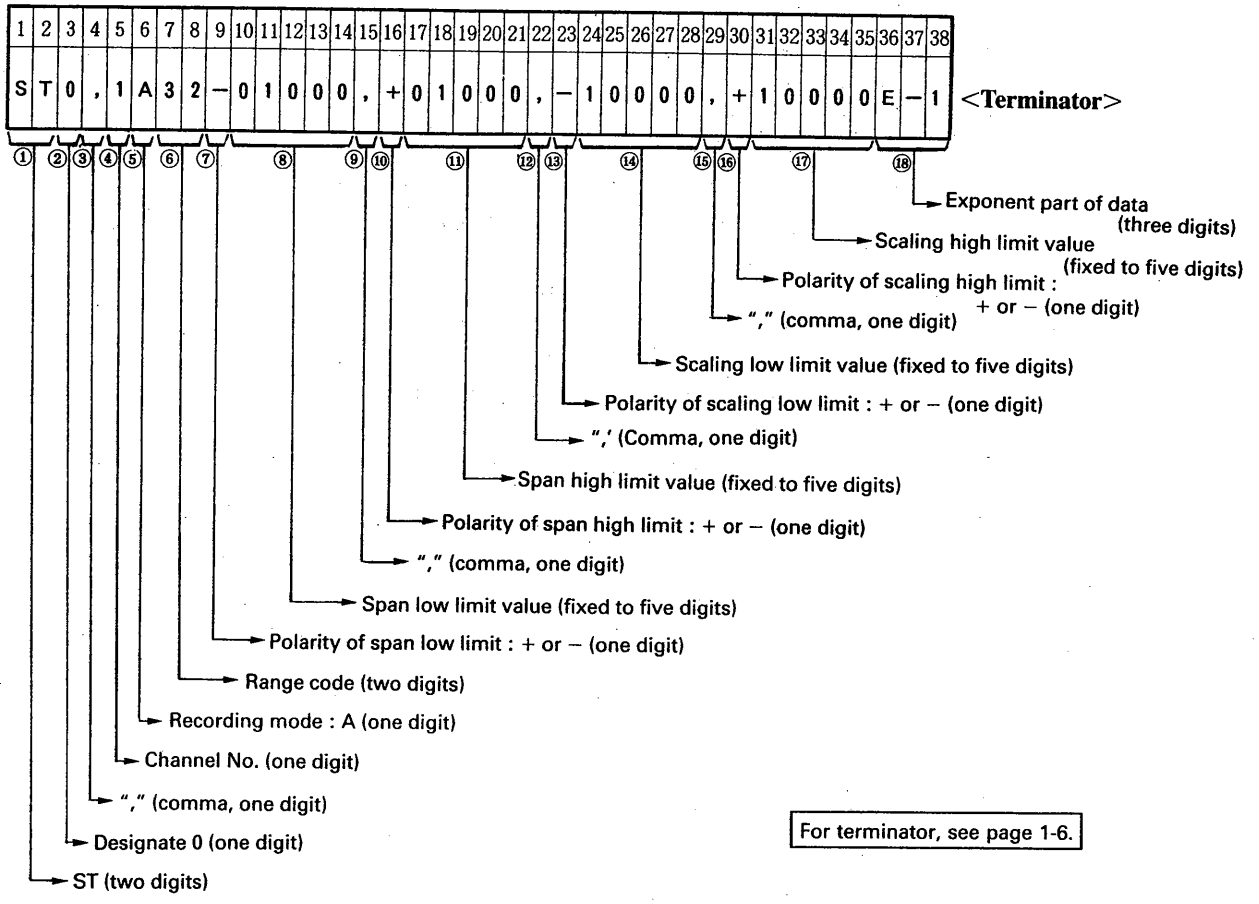
## ST (Set range)...(2)

### Function

This command can set the measuring range in which scaling (linear scaling and square root extraction) is carried out, out of the μR250 programs. (For setting the measuring range without accompanying scaling, refer to **ST (Set range)...(1)** on page 3-16).

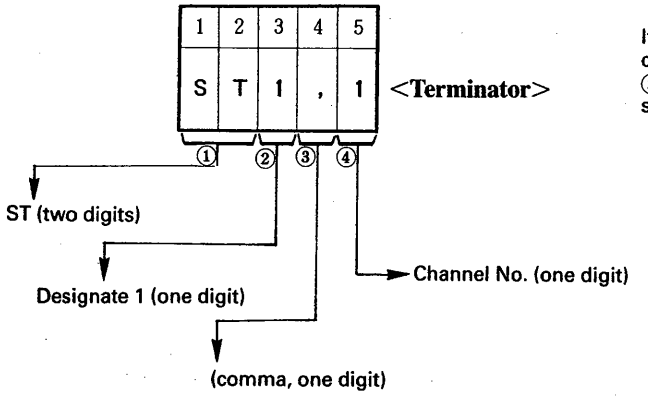
### Data Structure

**(i)**




For terminator, see page 1-6.

**(ii)**




If the skip setting is carried out for the specific channel, it is sufficient to designate only ①, ②, ③ and ④ written in the Description as shown left.

For terminator, see page 1-6.

**Description**

① By this command, a measuring range (span ) can be set. Specifically, setting for linear scaling and square root scaling are described. (For setting a measuring range without accompanying scaling, see **ST (Set range)...(1)** on page 3-16.)
Each range setting is necessary for each channel.

② Designate for either setting or cancelling (skip setting).
0: Designate when setting is carried out. Refer to **(i) of Data Structure**.
1: Designate when setting is to be cancelled. Refer to **(ii) of Data Structure**.
In this case, measurement and recording in a measuring channel designated in ④ cannot be carried out.

③ Designate "," (comma) (one digit).
This shows an end of a data.

④ Designate the measuring channel No. (anyone of 1, 2, and 3) to which the measuring range is to be set (or to be cancelled).
Notice: The μR250 recorder has three types : one pen, two pen, or three pen type). The channel No.3 cannot , of course, be designated to the one pen or two pen type recorder.
Designation of numerals that should not be given causes an error.

⑤ Designate A in this digit (one digit).
The recording mode also includes D : "Difference recording mode other than A, but in the measuring channel in which scaling is carried out, the difference recording cannot be set.

⑥ Designate the measuring range code (two digits).
The codes for measuring range in which scaling is to be carried out and used in the μR250 recorder are as shown in Table 3-6.

**Table 3-6.**

| Type of scaling (Input) | Measuring Range Code | Measuring Range | Decimal Point Position Before Scaling | Decimal Point Position After Scaling |
|---|---|---|---|---|
| Linear scaling (DC voltage) | 30 | −20 to +20 mV | □□□.□□ | □□□□□ Decimal point is freely positioned. |
| | 31 | −200 to +200 mV | □□□□.□ | |
| | 32 | −2 to +2 V | □□.□□□ | |
| | 33 | −6 to +6 V | □□.□□□ | |
| | 34 | −20 to +20 V | □□□.□□ | |
| | 35 | −50 to +50 V | □□□.□□ | |
| Square root scaling (DC voltage) | 40 | −20 to +20 mV | □□□.□□ | |
| | 41 | −200 to +200 mV | □□□□.□ | |
| | 42 | −2 to +2 V | □□.□□□ | |
| | 43 | −6 to +6 V | □□.□□□ | |
| | 44 | −20 to +20 V | □□□.□□ | |
| | 45 | −50 to +50 V | □□□.□□ | |

Notice: The decimal point position after linear scaling or square root scaling can be freely set.

⑦ Designate the polarity (+ or −) of the low limit value of span in measurement or recording (one digit).
(Refer to the Note on page 3-18.)

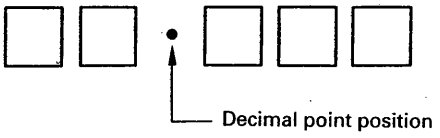
⑧ Designate the value of low limit of span in measurement or recording (fixed to five digits).

**Example of Designation**

Perform as shown below when the measuring range code is designated "32" in 6 and the span low limit is to be designated "-1.5 V".

(i) Designate "-" for polarity in ⑦. This is "-" of −1.5 V.

(ii) Designate the numeric value 1.5 V in ⑧ so that the decimal point is properly positioned. As seen in Table 3-6, the decimal point should be positioned between the second and third digits for measuring range code "32".




Thus, designate 01500 for obtaining 1.5.

⑨ Designate "," (comma) (one digit).
This delimits data.

⑩ Designate the polarity (+ or −) of the high limit value of span in measurement or recording (one digit) (Refer to the Note on page 3-18.).

⑪ Designate the value of high limit of span in measurement or recording (fixed to five digits).
When designating numerical values, measuring ranges in each channel must be considered.
This is the same procedure as in ⑧ "Designation of span low limit in measurement or recording". See the above **Example of Designation**.

⑫ Designate "," (comma) (one digit).
This delimits data.

⑬ Designate the polarity (+ or −) of the scaling low limit value (one digit).

⑭ Designate the value of scaling low limit (fixed to five digits).
The decimal point position for scaling values can be freely set by designating a data exponent described later in ⑱.
In this case, however, the same decimal point position as that of the scaling high limit value described later in ⑰ is set. Therefore, when designating the scaling low limit value, it should be considered that no problem is generated for decimal point position in designating the scaling high limit value.

⑮ Designate "," (comma) (one digit).
This delimits data.

⑯ Designate the polarity (+ or −) of the scaling high limit value (one digit).

⑰ Designate the value of scaling high limit (fixed to five digits). Do it considering the decimal point position of the scaling value as described in ⑭.

⑱ Designate the exponent part of the data for scaling values (high and low limits).

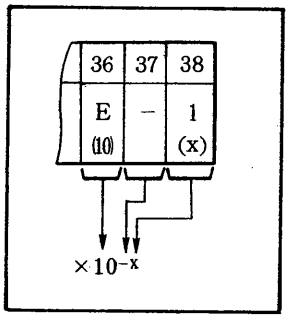



**Figure 3-8.**

- Designate the 36-th digit: E.
- Designate the 37-th digit: – (minus).
- Designate the 38-th digit: numerical value (one of 0 to 4).
  As shown in Figure 3-8, the exponent part of the data is composed of the 36-th, 37-th, and 38-th digits.

**–Reference–**

In the example used in data structure (i) on page 3-16, setting is made as shown below.

Scaling low limit value : $-10000\times10^{-1} = -1000.0$

Scaling high limit value: $+10000\times10^{-1} = 1000.0$

# SA (Set Alarm)

## Function

Alarm point can be set out of the μR250 programs.

## Data Structure

(i)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | A | 0 | , | 1 | / | 1 | H | 0 | 1 | – | 0 | 1 | 0 | 0 | 0 | <Terminator> |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | | ⑩ | | | | | |

① SA (two digits)
② Designate 0 (one digit).
③ , (Comma, one digit)
④ Channel No. (one digit)
⑤ / (Slash, one digit)
⑥ Level No. (one digit)
⑦ Alarm mode
⑧ Relay No. (two digits)
⑨ Polarity : + or – (one digit)
⑩ Alarm value (fixed to five digits)

(ii)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|
| S | A | 1 | , | 1 | / | 1 | <Terminator> |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | |

① SA (two digits)
② Designate 1 (one digit).
③ , (Comma, one digit)
④ Channel No. (one digit)
⑤ / (Slash, one digit)
⑥ Level No. (one digit)

For terminator, see page 1-6.

## Description

① This command permits alarm setting.
The alarm setting must be carried out for every measuring channel.

② Designate either to perform setting or to cancel setting (skip setting).
0: Designate when setting alarm. Refer to the **Data Structure (i)**.
1: Designate when cancelling alarm setting. Refer to the **Data Structure (ii)**.
In this case, the alarm corresponding to the alarm setting No. designated in ⑥ in the measuring channel designated in ④ is released.

③ Designate a comma (,) (one digit).
This delimits data.

④ Designate the measuring channel No. where an alarm is to be set (or to be cancelled) (any one of 1 to 3).
Notice: The μR250 recorder has three types : one pen, two pen, or three pen type). The channel No.3 cannot , of course, be designated to the one pen or two pen type recorder.
Designation of numerals that should not be given causes an error.

⑤ Designate a slash (/) in this digit. (one digit)

⑥ Designate the alarm setting No. which is to be set (or to be cancelled).
For alarm setting Nos., designate any one numeric value of 1 to 4 in one digit (for alarm setting Nos., see Instruction Manual for μR250 Recorder).

⑦ Designate the alarm mode (one digit).
There are the following four types. Designate one with one alphabetical character (code).
H : High limit alarm
L : Low limit alarm
h : Difference high limit alarm
l : Difference low limit alarm

⑧ Designate the No. of the alarm output relay (fixed to two digits).
- The μR250 recorder is provided with the alarm output relay to be optionally specified. There are two types of alarm output relay : /AK-06 (for 6 point outputs) and /AK-12 (for 12 point outputs).
  The output relay NO. must be designated in two digits. Designate it as shown below.
  For /AK-06, designate any one of 01 to 06.
  For /AK-12, designate any one of 01 to 12.
- Designate "−" (continuous two minus signs) if the alarm output relay is not used.

⑨ Designate the polarity of alarm set value (+ or −) (one digit)*.

⑩ Designate a numerical value of alarm setting (fixed to five digits).
In designating numerical values, measuring ranges for each channel must be considered (the decimal point position must be considered). For instance, when the alarm set value is to be 15.5 V in the measuring range of −20 to +20 V, designate "01550".
Make reference to Table 3-7 which shows relationship between each measuring range and decimal point positions.

**Table 3-7.**

| Type of Input | Measuring Range Code | Measuring Range JIS/ANSI | Measuring Range DIN (Partly ANSI) | Decimal Point Position |
|---|---|---|---|---|
| DC voltage | 00 | −20 to +20 m V | | □□□.□ |
| | 01 | −200 to +200 m V | | □□□□.□ |
| | 02 | −2 to +2 V | | □□.□□□ |
| | 03 | −6 to +6 V | | □□.□□□ |
| | 04 | −20 to +20 V | | □□□.□□ |
| | 05 | −50 to +50 V | | □□□.□□ |
| Thermocouples (Note) The types N and W denotes the rating for the following products. N: NBS (National Bureau of Standards) W: HOSKINS | 10 | R 0 to 1760°C 32 to 3200°F | ← | □□□□.□ □□□□ |
| | 11 | S 0 to 1760°C 32 to 3200°F | PtRh-Pt 0 to 1760°C | □□□□.□ □□□□ |
| | 12 | B 400 to 1820°C 752 to 3308°F | ← | □□□□.□ □□□□ |
| | 13 | K −200 to 1370°C −328 to 2498°F | NiCr-Ni −200 to 1370°C | □□□□.□ □□□□ |
| | 14 | E −200 to 800°C −328 to 1472°F | ← | □□□□.□ □□□□.□ |
| | 15 | J −200 to 1100°C −328 to 2012°F | Fe-CuNi −200 to 900°C | □□□□.□ □□□□.□ |
| | 16 | T −200 to 400°C −328 to 752°F | Cu-CuNi −200 to 400°C | □□□□.□ □□□□.□ |
| | 17 | N 0 to 1300°C | ← | □□□□.□ □□□□ |
| | 18 | W 0 to 2315°C | ← | □□□□.□ □□□□ |
| Resistance temperature detectors | 20 | JPt 100 Pt 100 −200 to 550°C | | □□□□.□ □□□□.□ |
| | | Pt 100 −328 to 1022°F | | |

An arrow oriented to the left ← means "same as mentioned left".
Note: JPt100 : JIS C 1604-1989, JIS C 1606-1989
Pt100 : JIS C 1604-1989, JIS C 1606-1989, DIN IEC 751, IEC 751

* Note: Designate + or − or 0 in the polarity digit if the alarm set value is set to 0.

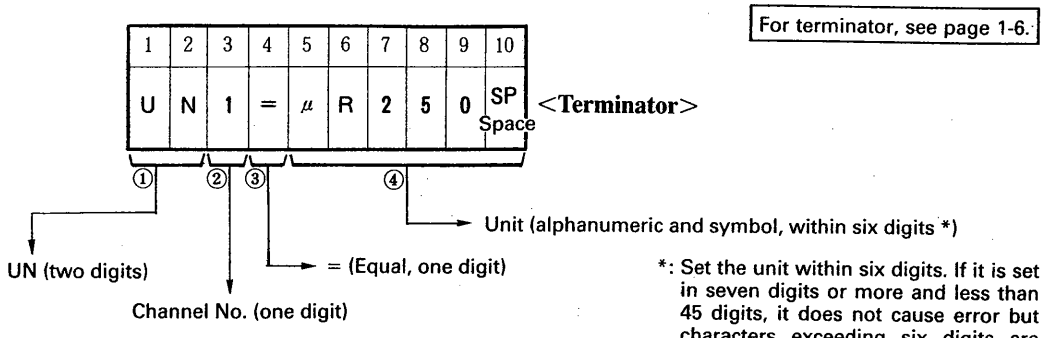
# UN (Unit)

## Function

The unit can be set out of the μR250 programs.

## Data Structure

For terminator, see page 1-6.




*: Set the unit within six digits. If it is set in seven digits or more and less than 45 digits, it does not cause error but characters exceeding six digits are ignored.
If it is set in digits exceeding 45, it causes an error.

## Description

① This command permits setting of the unit.
The unit setting can be carried out only for the measuring channels already set for linear scaling of square root scaling.
For measuring channels to which scaling is not set, the units of the measuring range (any of °C, °F, V, mV) set to each channel are used even if the unit is set here.

② Designate the channel No. to which a unit is to be set (any of 1 to 3, one digit).
Notice : The μR250 recorder has three types : one pen, two pen, or three pen type). The channel No.3 cannot , of course, be designated to the one pen or two pen type recorder.
Designation of numerals that should not be given causes an error.

③ Designate = (equal, one digit).
This delimits data.

④ Designate a unit within six digits.
Alphanumerics and symbols useable in the μR250 recorder are limited to the ones listed in ASCII Code Table also provided in this interface.
This may be different from the ASCII code system for your personal computer to be used. Refer to Table 3-8 on page 3-26.

| b \ a | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 0 | | 0 | @ | P | ' | p |
| 1 | ! | 1 | A | Q | a | q |
| 2 | " | 2 | B | R | b | r |
| 3 | # | 3 | C | S | c | s |
| 4 | $ | 4 | D | T | d | t |
| 5 | % | 5 | E | U | e | u |
| 6 | & | 6 | F | V | f | v |
| 7 | ' | 7 | G | W | g | w |
| 8 | ( | 8 | H | X | h | x |
| 9 | ) | 9 | I | Y | i | y |
| A | * | : | J | Z | j | z |
| B | + | ; | K | [ | k | ° |
| C | , | < | L | △ | l | Ω |
| D | − | = | M | ] | m | μ |
| E | . | > | N | ▽ | n | − |
| F | / | ? | O | _ | o | ŭ |

**μR250 ASCII Code Table**

–Notice–
When setting the unit by communication from a personal computer, (ASCII Code 3B) cannot be used. It is because the μR250 recorder regards it to be a terminator (see page 1-6).

**Table 3-8. ASCII Code Table (JIS Eight Bit Code Table).**

| B8 b7 b6 b5 | 0 0 0 0 | 0 0 0 1 | 0 0 1 0 | 0 0 1 1 | 0 1 0 0 | 0 1 0 1 | 0 1 1 0 | 0 1 1 1 | 1 0 0 0 | 1 0 0 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| b4–b1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0000 | NUL | DLE | SP | 0 | @ | P | ` | p | ↑ | ↑ |
| 0001 | SOH | $DC_1$ | ! | 1 | A | Q | a | q | | |
| 0010 | STX | $DC_2$ | " | 2 | B | R | b | r | | |
| 0011 | ETX | $DC_3$ | # | 3 | C | S | c | s | | |
| 0100 | EOT | $DC_4$ | $ | 4 | D | T | d | t | | |
| 0101 | ENQ | NAK | % | 5 | E | U | e | u | | |
| 0110 | ACK | SYN | & | 6 | F | V | f | v | | |
| 0111 | BEL | ETB | ' | 7 | G | W | g | w | | |
| 1000 | BS | CAN | ( | 8 | H | X | h | x | | |
| 1001 | HT | EM | ) | 9 | I | Y | i | y | | |
| 1010 | LF | SUB | * | : | J | Z | j | z | | |
| 1011 | VT | ESC | + | ; | K | [ | k | { | | |
| 1100 | FF | FS | , | < | L | ¥ | l | \| | | |
| 1101 | CR | GS | − | = | M | ] | m | } | | |
| 1110 | SO | RS | . | > | N | ^ | n | ~ | | |
| 1111 | SI | US | / | ? | O | _ | o | DEL | ↓ | ↓ |

Not yet defined

Not yet defined

| b \ a | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 0 | | 0 | @ | P | ' | p |
| 1 | ! | 1 | A | Q | a | q |
| 2 | " | 2 | B | R | b | r |
| 3 | # | 3 | C | S | c | s |
| 4 | $ | 4 | D | T | d | t |
| 5 | % | 5 | E | U | e | u |
| 6 | & | 6 | F | V | f | v |
| 7 | ' | 7 | G | W | g | w |
| 8 | ( | 8 | H | X | h | x |
| 9 | ) | 9 | I | Y | i | y |
| A | * | : | J | Z | j | z |
| B | + | ; | K | [ | k | ° |
| C | , | < | L | △ | l | Ω |
| D | − | = | M | ] | m | μ |
| E | . | > | N | ▽ | n | − |
| F | / | ? | O | _ | o | ♂ |

**μR250 ASCII Code Table**

Characters, symbols, and numerals useable in the μR250 recorder are limited to ones listed in the μR250 ASCII Code Table.

Thus, if the ASCII code system for your personal computer used is different, make the "μR250 ASCII Code Table" have precedence.

See subsection **3-6-2. Exmaple of Personal Computer Program** on page 3-32.

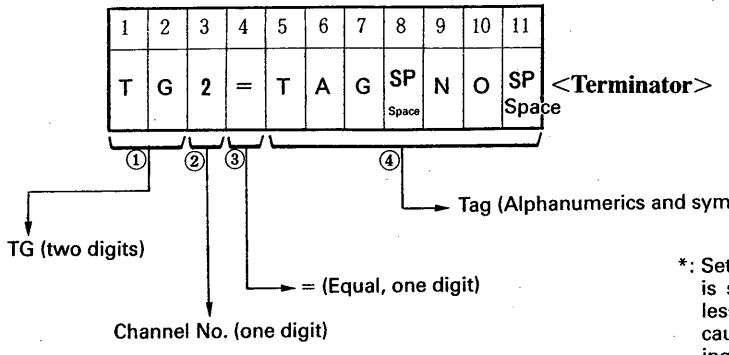
# TG...(1) Tag (TAG No.) Setting

## Function

Tag can be set out of the μR250 programs.

## Data Structure

For terminator, see page 1-6.




*: Set the tag within seven digits. If it is set in eight digits or more and less than 45 digits, it does not cause error but characters exceeding seven digits are ignored.
If it is set in digits exceeding 45, it causes an error.

## Description

① This command can set tag (TAG No.) (This command can also set a message. See TG...(2), "Message Setting on page 3-28).
Tag setting must be carried out for every measuring channel.

② Designate the measuring channel No. where the tag is to be set (any one of 1 to 3, one digit).
Notice: The μR250 recorder has three types : one pen, two pen, or three pen type). The channel No.3 cannot , of course, be designated to the one pen or two pen type recorder.
Designation of numerals that should not be given causes an error.

③ Designate = (equal, one digit).
This delimits data.

④ Designate a tag within seven digits.
Alphanumerics and symbols useable in the μR250 recorder are limited to the ones listed in ASCII Code Table also provided in this interface.
This may be different from the ASCII code system for your personal computer to be used. Refer to Table 3-8 on page 3-26.

| b \ a | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 0 | | 0 | @ | P | ' | p |
| 1 | ! | 1 | A | Q | a | q |
| 2 | " | 2 | B | R | b | r |
| 3 | # | 3 | C | S | c | s |
| 4 | $ | 4 | D | T | d | t |
| 5 | % | 5 | E | U | e | u |
| 6 | & | 6 | F | V | f | v |
| 7 | ' | 7 | G | W | g | w |
| 8 | ( | 8 | H | X | h | x |
| 9 | ) | 9 | I | Y | i | y |
| A | * | : | J | Z | j | z |
| B | + | ; | K | [ | k | ° |
| C | , | < | L | △ | l | Ω |
| D | − | = | M | ] | m | μ |
| E | . | > | N | ▽ | n | − |
| F | / | ? | O | _ | o | ʊ |

**μR250 ASCII Code Table.**

–Notice–
When setting the tag by communication from a personal computer, (ASCII Code 3B) cannot be used. It is because the μR250 recorder regards it to be a terminator (see page 1-6).

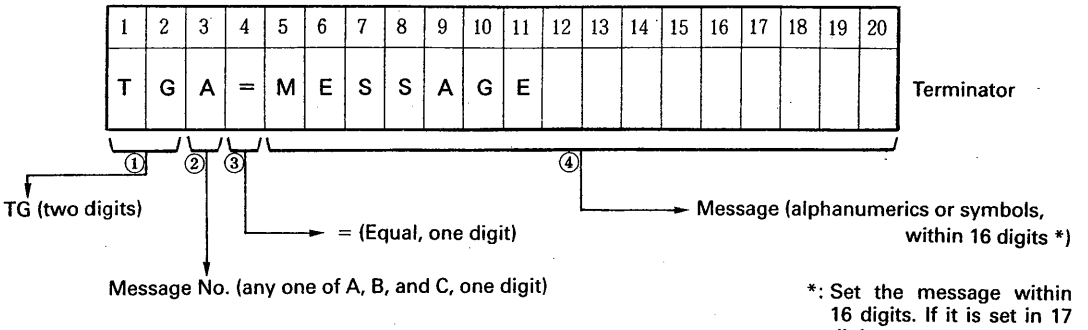
# TG...(2) Message Setting.

## Function

This command can set a message out of the μR250 programs.
(However, /MSG (optional specification) is necessary.)

## Data Structure

For terminator, see page 1-6.




*: Set the message within 16 digits. If it is set in 17 digits or more and less than 45 digits, it does not cause error but characters exceeding seven digits are ignored.
If it is set in digits exceeding 45, it causes an error.

## Description

① The command TG can set a message. (The TG command can also set the tag (TAG No.). See TG...(1), Tag (TAG No.) Setting on page 3-27).

② Three kinds of message can be set. Designate it with any one of A, B, or C.
Notice Do not mistake entry. Do not enter numerals (1, 2, 3, ..., etc.) In this case, setting is not for tags. Be sure to enter any of A, B, or C.

③ Designate = (equal, one digit).
This delimits data.

④ Designate a message within 16 digits.
Alphanumerics and symbols useable in the μR250 recorder are limited to the ones listed in ASCII Code Table also provided in this interface.
This may be different from the ASCII code system for your personal computer to be used. Refer to Table 3-8 on page 3-26.

| b \ a | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 0 | | 0 | @ | P | ' | p |
| 1 | ! | 1 | A | Q | a | q |
| 2 | " | 2 | B | R | b | r |
| 3 | # | 3 | C | S | c | s |
| 4 | $ | 4 | D | T | d | t |
| 5 | % | 5 | E | U | e | u |
| 6 | & | 6 | F | V | f | v |
| 7 | ' | 7 | G | W | g | w |
| 8 | ( | 8 | H | X | h | x |
| 9 | ) | 9 | I | Y | i | y |
| A | * | : | J | Z | j | z |
| B | + | ; | K | [ | k | • |
| C | , | < | L | △ | l | Ω |
| D | − | = | M | ] | m | μ |
| E | . | > | N | ▽ | n | − |
| F | / | ? | O | _ | o | ŭ |

**μR250 ASCII Code Table.**

–Notice–
When setting the message by communication from a personal computer, (ASCII Code 3B) cannot be used. It is because the μR250 recorder regards it to be a terminator (see page 1-6).

# ZN (Zone)

## Function

This command can set zone recording out of the μR250 programs.

## Data Structure

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Z | N | 1 | = | 0 | 0 | 0 | , | 2 | 5 | 0 | Terminator |

① ② ③ ④ ⑤ ⑥

ZN (two digits)

Channel No. (one digit)

= (Equal, one digit)

Left end position of the zone (fixed to three digits)

, (Comma, one digit)

Right end position of the zone (fixed to three digits)

For terminator, see page 1-6.

## Description

① This command can set zone recording. The setting must be carried out for every measuring channel.

② Designate the measuring channel No. where zone recording is to be set (any one of 1 to 3, one digit).

Notice The μR250 recorder has three types : one pen, two pen, or three pen type). The channel No.3 cannot , of course, be designated to the one pen or two pen type recorder.

Designation of numerals that should not be given causes an error.

③ Designate = (equal, one digit).

④ Designate the numeric value for the left end of the zone in three digits.

⑤ Designate a comma (,) in this digit (one digit).

⑥ Designate the numeric value for the right end of the zone in three digits.

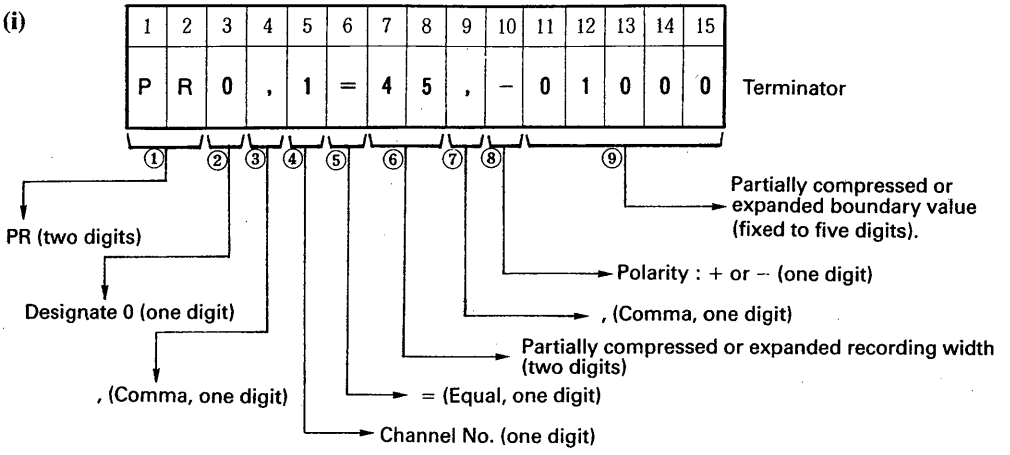
## PR (Partially compressed or expanded record setting).

### Function

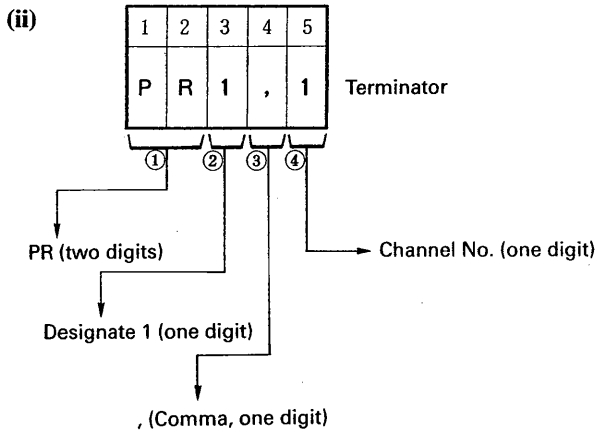
This command can set partially compressed or expanded recording out of the μR250 programs.

### Data Structure

(i)




(ii)




For terminator, see page 1-6.

If the partially compressed or expanded recording setting to a specific channel is to be cancelled, it is enough to designate only four items ①, ②, ③, and ④ in Description.

### Description

① This command can set the partially compressed or expanded recording.
Partially compressed or expanded recording setting must be carried out for every measuring channel.

② Designate either to perform setting or to cancel setting (skip setting).
0: Designate when carrying out setting. Refer to the **Data Structure (i)**.
1: Designate when cancelling the setting. Refer to the **Data Structure (ii)**.
In this case, the partially compressed or expanded recording is not carried out in the measuring channel designated in ④.

③ Designate a comma (,) (one digit).
This delimits data.

④ Designate the measuring channel No. where the partially compressed or expanded recording is to be set (any of 1 to 3).

Notice The μR250 recorder has three types : one pen, two pen, or three pen type). The channel No.3 cannot , of course, be designated to the one pen or two pen type recorder.

Designation of numerals that should not be given causes an error.

⑤ Designate = (equal) in this digit (one digit).

⑥ Designate the partially compressed or expanded boundary width (two digits).

⑦ Designate , (comma, one digit).
This delimits data.

⑧ Designate the polarity of partially compressed or expanded boundary value (+ or −) (one digit). Note

⑨ Designate the partially compressed or expanded boundary value (fixed to five digits).
When designating a numeric value, the measuring ranges in each channel must be considered (the decimal point positions must be considered). For instance, when the alarm set value is to be **15.5 V** in the measuring range of **−20 to +20 V**, designate "**01550**".
Make reference to Table 3-9 which shows relationship between each measuring range and decimal point positions.

**–Note–**

Designate + or − or 0 in the polarity digit if the partially compressed or expanded boundary value is set to 0.

**Table 3-9.**

| Type of Input | Measuring Range Code | Measuring Range JIS/ANSI | Measuring Range DIN (Partly ANSI) | Decimal Point Position |
|---|---|---|---|---|
| DC voltage (Note) :Range codes 30(40) to 35(45)are for primary scaling indication. | 00 | −20 to +20 m V | | □□□.□□ |
| | 01 | −200 to +200 m V | | □□□□.□ |
| | 02 | −2 to +2 V | | □□.□□□ |
| | 03 | −6 to +6 V | | □□.□□□ |
| | 04 | −20 to +20 V | | □□□.□□ |
| | 05 | −50 to +50 V | | □□□.□□ |
| | 30 (40) | −20 to +20 m V | | □□□□□ The decimal point position is selected freely. |
| | 31 (41) | −200 to +200 m V | | |
| | 32 (42) | −2 to +2 V | | |
| | 33 (43) | −6 to +6 V | | |
| | 34 (44) | −20 to +20 V | | |
| | 35 (45) | −50 to +50 V | | |
| Thermocouples (Note) The types N and W denotes the rating for the following products. N: NBS (National Bureau of Standards) W: HOSKINS | 10 | R 0 to 1760°C 32 to 3200°F | ← | □□□□.□ □□□□ |
| | 11 | S 0 to 1760°C 32 to 3200°F | PtRh-Pt 0 to 1760°C | □□□□.□ □□□□ |
| | 12 | B 400 to 1820°C 752 to 3308°F | ← | □□□□.□ □□□□ |
| | 13 | K −200 to 1370°C −328 to 2498°F | NiCr-Ni −200 to 1370°C | □□□□.□ □□□□ |
| | 14 | E −200 to 800°C −328 to 1472°F | ← | □□□□.□ □□□□.□ |
| | 15 | J −200 to 1100°C −328 to 2012°F | Fe-CuNi −200 to 900°C | □□□□.□ □□□□.□ |
| | 16 | T −200 to 400°C −328 to 752°F | Cu-CuNi −200 to 400°C | □□□□.□ □□□□.□ |
| | 17 | N 0 to 1300°C | ← | □□□□.□ □□□□ |
| | 18 | W 0 to 2315°C | ← | □□□□.□ □□□□ |
| Resistance temperature detectors | 20 | JPt 100 Pt 100 | −200 to 550°C | □□□□.□ □□□□.□ |
| | | Pt 100 | −328 to 1022°F | |

An arrow oriented to the left ← means "same as mentioned left"

Note: JPt100 : JIS C 1604-1989, JIS C 1606-1989
Pt100 : JIS C 1604-1989, JIS C 1606-1989, DIN IEC 751, IEC 751

**3-6-2. Examples of Personal Computer Program (IBM PC-5150 microcomputer is used.).**

As examples, Ⓐ setting the unit using the command UN (Unit) and Ⓑ setting the data and time using the command SC (Set Clock) will be described.

Ⓐ The character "u" is different in position in the general ASCII code table system and the μR250 ASCII code table system as shown on page 3-26. Here two examples of designating "u" are shown : ① in accordance with the general (μR250) ASCII code table and ② directly designating from the ASCII code.

① 
```
100 OPEN "COM1:2400,N,8,1,RS,CS,DS,CD,LF" AS #1
110 A$ = "UN1=}R250"
120 PRINT #1, AS
130 CLOSE
```
← Line 150 : Using "}" corresponding to "u".

② 
```
100 OPEN "COM1:2400,N,8,1,RS,CS,DS,CD,LF" AS #1
110 AS = "UN1="+CHR$(&H7D)+"R250"
120 PRINT #1, AS
130 CLOSE
```
← Line 150 : Designating with ASCII code "&H7D".

Ⓑ Date is set to "8601010000".

```
100 OPEN "COM1:2400,N,8,1,RS,CS,DS,CD,LF" AS #1
110 A$ = "SC8601010000"
120 PRINT #1, A$
130 A$ = "OE"
140 PRINT #1, A$
150 LINE INPUT #1, A$
160 PRINT A$
170 CLOSE
```

## 3-7. Remote Control 4. "Latest Measured Value Data Output".

### 3-7-1. Data Output Sequence.

The latest measured data output from the μR250 is output together with the system type, date and time data by the following command.

| | 1 | 2 | 3 | |
|---|---|---|---|---|
| Command | T | S | 0 | <Terminator> |

For terminator, see page 1-6.

Figure 3-9 shows the sequence of outputting the latest measured value data for reference.

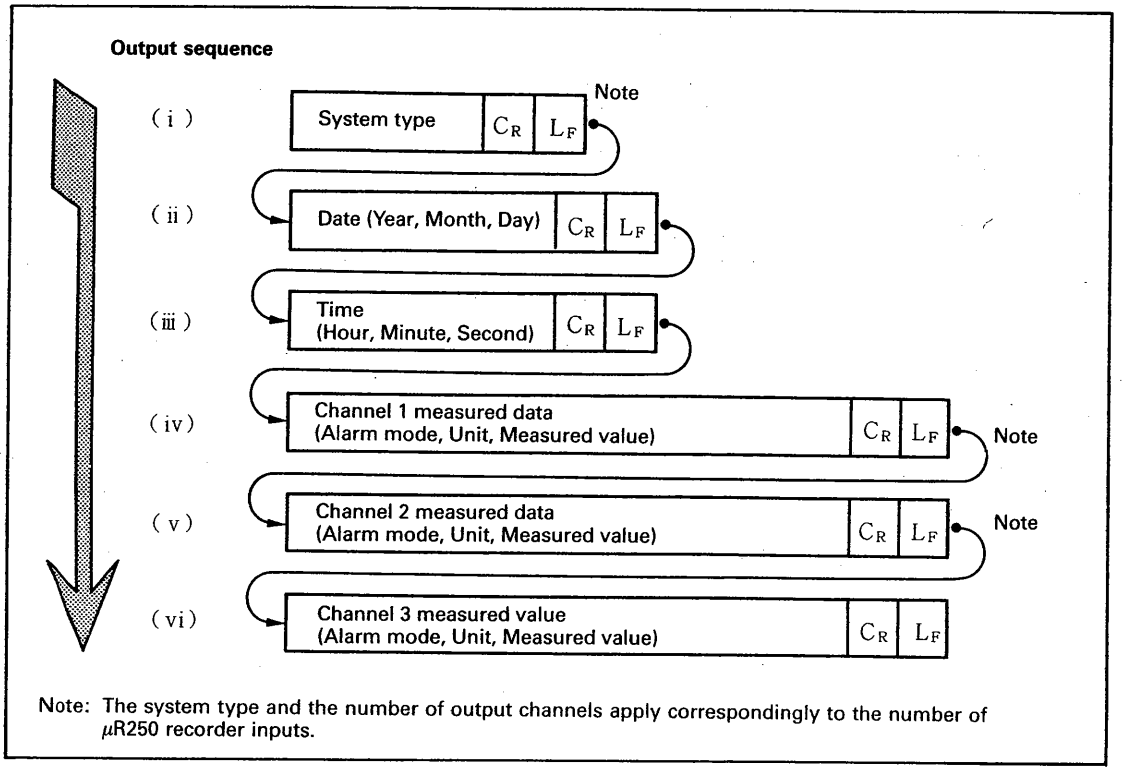



**Figure 3-9. Latest Measured Value Data Output Sequence.**

A series of latest measured value data is output once in the order shown in Figure 3-9 by designating a command from the personal computer.

The latest measured value data is not output from the μR250 recorder to the personal computer in every specific period.

If the data is to be newly or continually output, execute the program again or prepare a program that sends out the output continually.

### 3-8-2. Description of Command Used.

## TS...(2)

**Function**

This command can output the μR250 program setting data from the μR250 recorder.

**Data Structure**

| 1 | 2 | 3 | |
|---|---|---|---|
| T | S | 1 | <Terminator> |

① TS (two digits)
② Designate 1 (one digit)

For terminator, see page 1-6.

**Description**

① This command can output the μR250 program setting data set at that time from the μR250 recorder.
In this subsection, the function to output the program setting data only is described. For another function of "TS", the latest measured value data output, see page 3-34.

② Designate 1.
When TS1 is designated, the μR250 outputs the program setting data at that time.
For an example of program setting data output, see page 3-43.

### 3-8-3. Output (Program Setting) Data Structure.

**(i) System Type Data**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| S | Y | 3 | $C_R$ | $L_F$ |

SY (two digits)
1: For one pen type
2: For two pen type
3: For three pen type
$C_R$, $L_F$ as the terminator

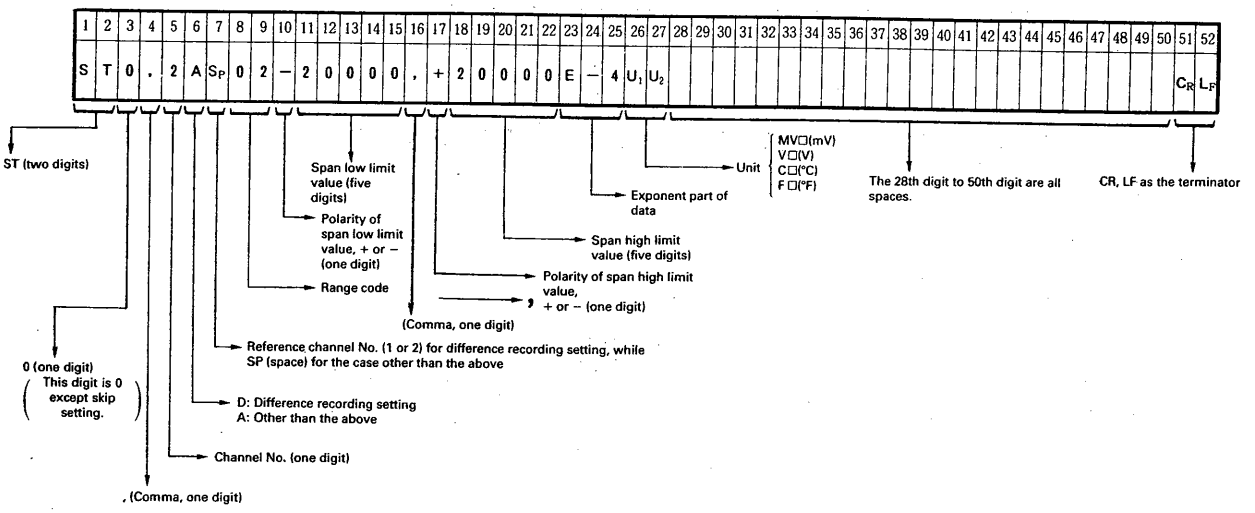
**(ii) Chart Feeding Speed**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | S | 1 | = | 0 | 0 | 1 | 0 | 0 | , | 2 | = | 0 | 0 | 1 | 5 | 0 | $C_R$ | $R_F$ |

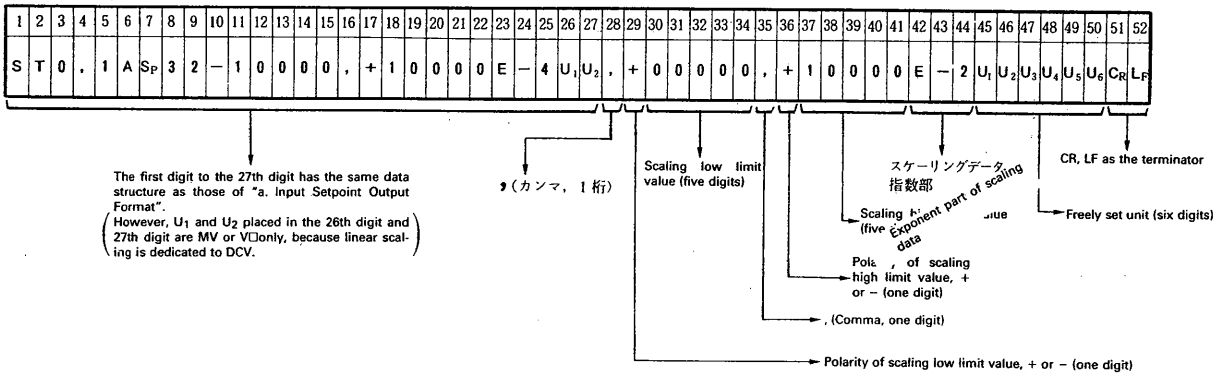
CS (two digits)
Normal chart feeding speed (five digits) (the first set speed)
Designation "1 =" shows that a numeric value of five digits following the designation is the first set speed.
, (Comma, one digit)
Designation "2 =" shows that a numeric value of five digits following the designation is the second set speed.
Alternate chart feeding speed (five digits) (the second set speed)
CR, LF as the terminator

## (iii) Range Setting Data

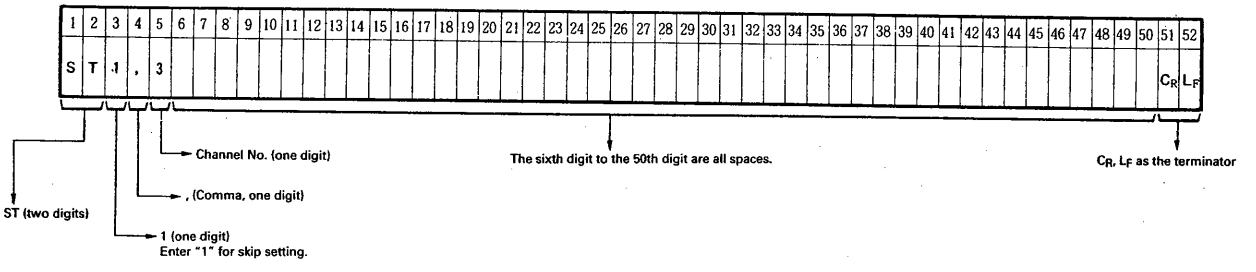
### a. Input Setpoint Output Format




### b. Scaling (linear and square root) Setpoint Output Format.

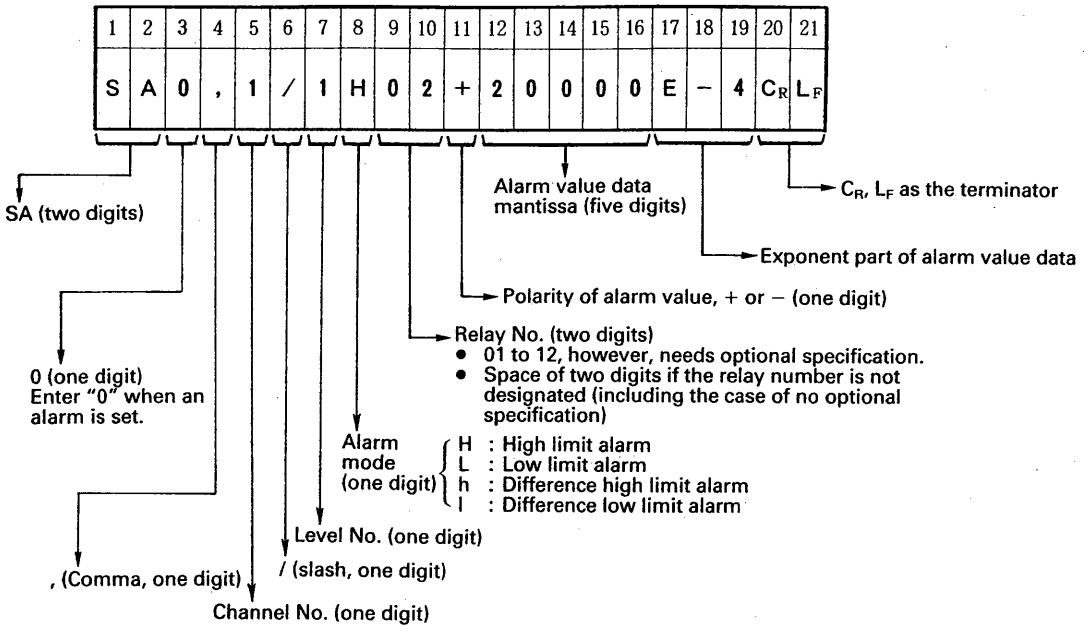



### c. SKIP Output format

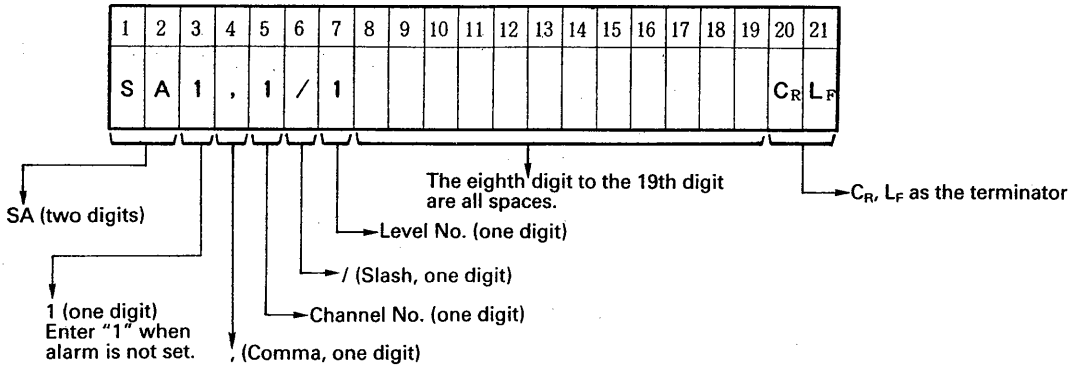


### (iv) Alarm Setting Data

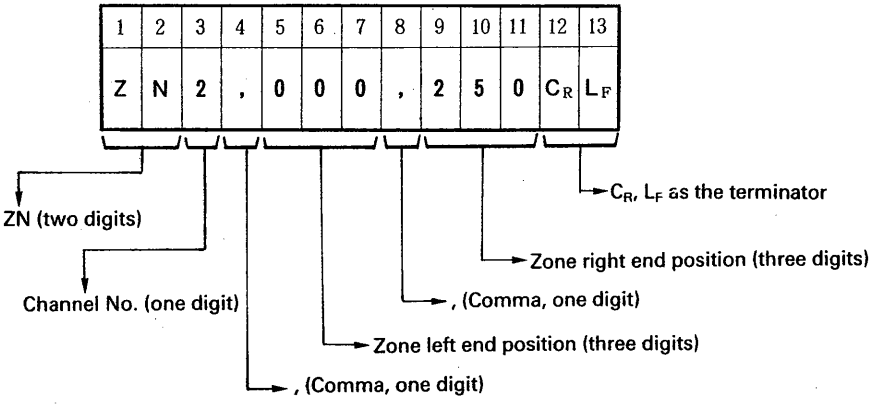
**a. Output Format When Alarm Is Set.**




**b. Output Format When Alarm Is Not Set (Alarm OFF).**

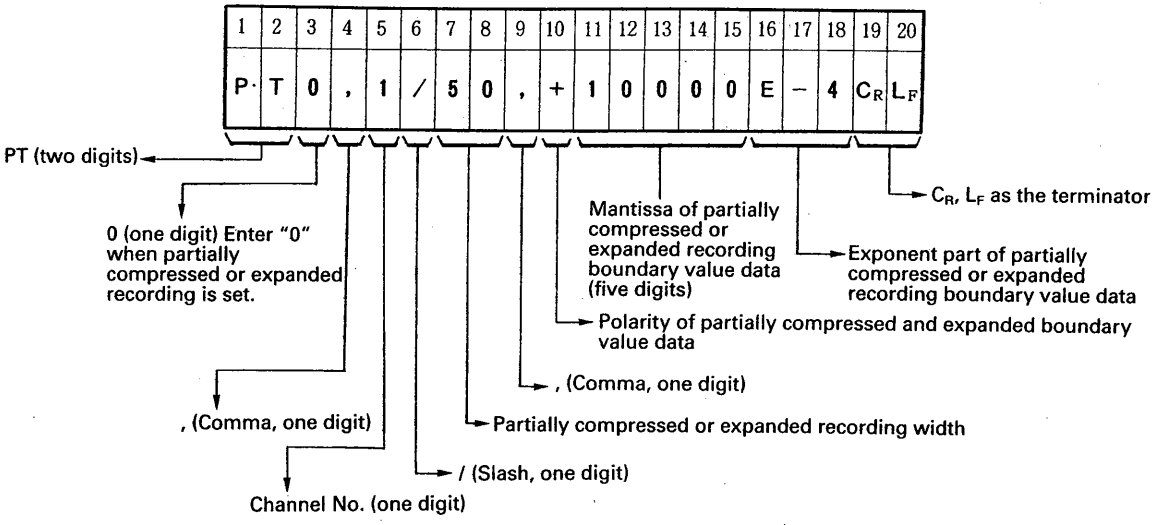



### (v) Zone Recording Setting Data.

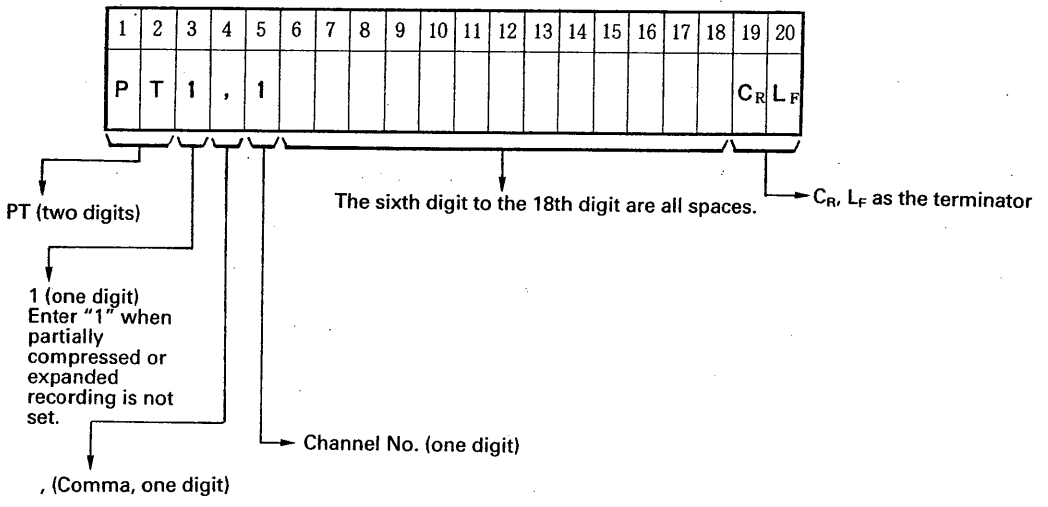


### (vi) Partially Compressed or Expanded Recording Setting Data.

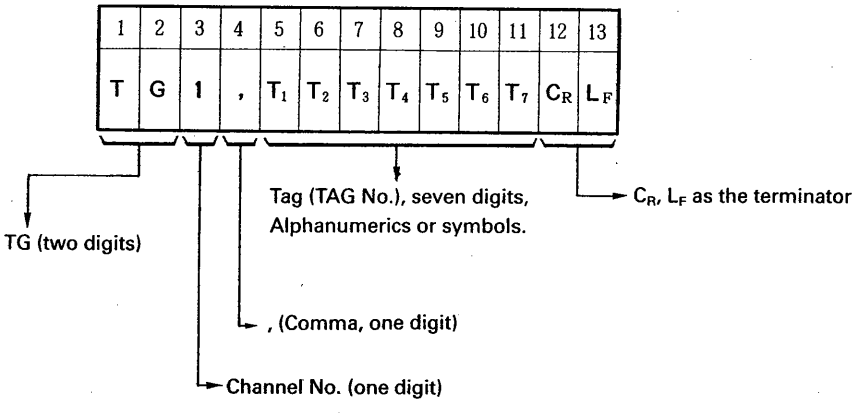
**a. Output Format When Partially Compressed or Expanded Recording Is Set.**




**b. Output Format When Partially Compressed or Expanded Recording Is Not Set.**




### (vii) Tag (TAG No.) Setting Data



### (viii) Message Setting Data

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | G | A | , | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | $M_7$ | $M_8$ | $M_9$ | $M_{10}$ | $M_{11}$ | $M_{12}$ | $M_{13}$ | $M_{14}$ | $M_{15}$ | $M_{16}$ | $C_R$ | $L_F$ |

TG (two digits)

Message NO.
Any one of A, B, and C.

$C_R$, $L_F$ as the terminator

, (Comma, one digit)

Message (16 digits)
From the 5th digit to the 20th digit.

### 3-8-4. Example of Program Setting Output.

```
CS1=00300,2=00600
ST0,1A 13-01000,+02000E-1{C
ST0,2D113-01550,+01550E-1{C
ST0,3A 03-06000,+06000E-3V
SA0,1/1H01+00330E-1
SA0,1/2H04+01000E-1
SA1,1/3
SA1,1/4
SA0,2/1L01+00800E-1
SA1,2/2
SA1,2/3
SA1,2/4
SA0,3/1L01-05000E-3
SA0,3/2H02+01000E-3
SA1,3/3
SA1,3/4
ZN1,000,100
ZN2,075,175
ZN3,150,250
PT1,1
PT0,2/30,+00000E-1
PT1,3
TG1,STN-A
TG2,STN-B
TG3,STN-C
TGA,MESSAG
TGB,
TGC,
```

**3-8-5. Example of Personal Computer Program (IBM PC-5150 microcomputer is used.).**

```
100 OPEN "COM1:2400,N,8,1,RS,CS,DS,CD,LF" AS #1
110 A$ = "TS1"
120 PRINT #1, A$
130 LINE INPUT #1, A$
140 B$ = MID$(A$,3,1)
150 Q = VAL(B$)
160 FOR I= 1 TO 4+Q*8
170 LINE INPUT #1, A$
180 PRINT A$
190 NEXT
200 CLOSE
```