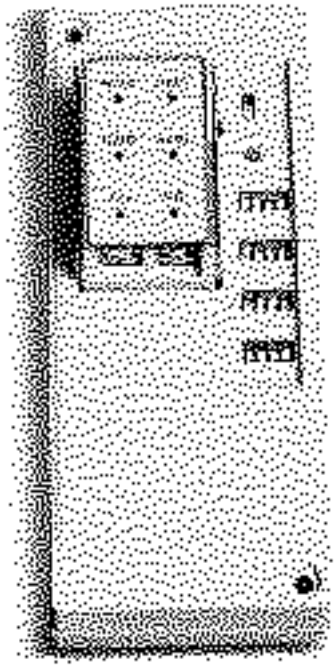
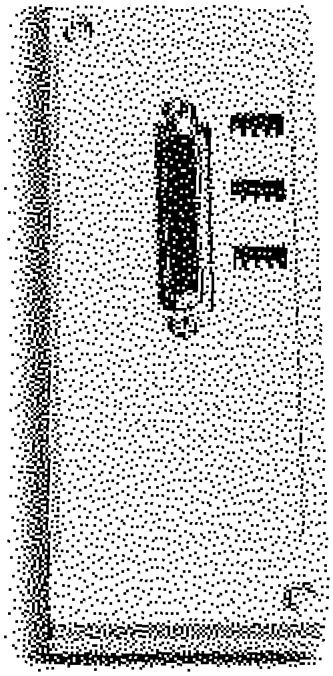
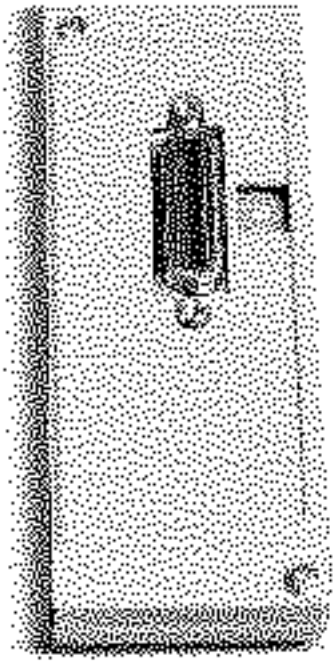
User's Guide







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Introduction

This Communication Interface User's Manual describes the functions and commands of the optional GP-IB, RS-232-C and RS-422-A/RS-485 interfaces. Read this manual carefully before using these interface functions, and be sure to keep this manual on hand for future reference should any problems arise.
As manuals relative to the DR130, DR230, DR240, the following manuals are also provided. Read them if necessary.

Name of manuals	Manual No.
DR130/DR230/DR240 Hybrid Recorder	M3225/1298

Note

- We reserve the right to change the content of this manual at any time without prior notice because of improvements in performance or functions. Actual displays on the screen may also be a little different from the screen displays described in this manual.
- All reasonable efforts have been made to ensure the accuracy of this manual. If, however, any errors or ambiguities are found, please inform us.
- No part of this manual may be reproduced in any form without prior written permission from us.
- The warranty card is attached to the packing box. This card cannot be reissued. Thoroughly read the card and carefully store it.

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- MS-DOS and Windows are registered trademarks of Microsoft Corporation, USA.
- Other product names are trademarks or registered trademarks of the relevant companies.

Configuration and Use of This Manual

Configuration

This user's manual is composed of chapter 1 to chapter 6 and indices.

Chapter 1 Overview and Specifications of GP-IB Interface
Describes the functions and specifications of the GP-IB interface and the address setting method.

Chapter 2 Overview and Specifications of RS-232-C Interface
Describes the functions and specifications of the RS-232-C interface and the parameter setting method.

Chapter 3 Overview and Specifications of RS-422A/RS-485 Interface
Describes the functions and specifications of the RS-422-A/RS-485 interface and the parameter setting method.

Chapter 4 Command Format
Describes how to specify command formats and channel numbers.

Chapter 5 Commands
Describes the commands for various setting items, commands for executing actions, data request commands for measured data saved in memory, or commands requesting output of internally set data.

Chapter 6 Output Format
Describes the output formats for set data, measured data, etc.

Chapter 7 Sample Program
Useful sample programs are presented.

Appendix Computation Equation
Describes the optional computation equation.

Index There are command and general indices.

TABLE OF CONTENTS

1.1 Description of Functions

Listener and Talker Functions

Listener Function

This allows almost all settings except power on/off and operation control.

- Settings except communication settings.
- Operation control except power on/off.
- Call-up of setting data
- Specifying of output data (specifying of channel numbers or output data types)
- Specifying of causes of interrupt generation (see IM command: page 5-18)

Talker Function

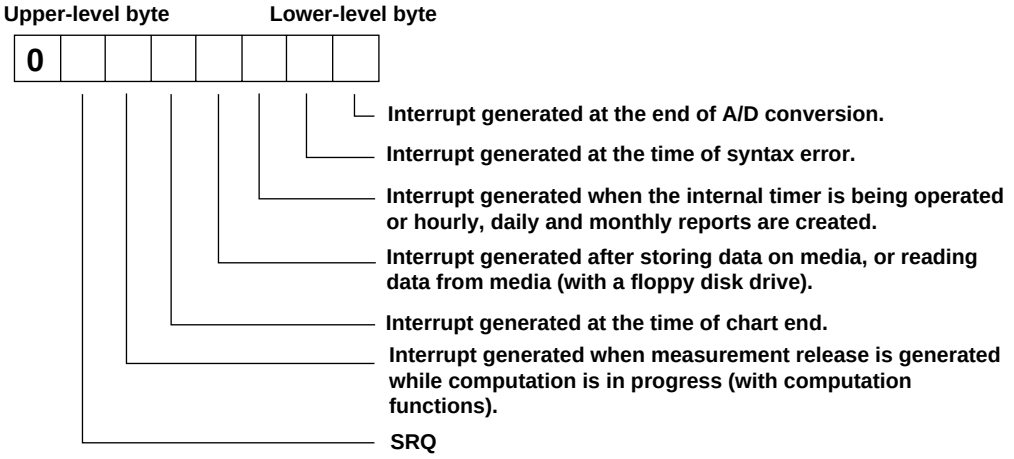
The following data can be output:

- Measured data
- Computed data
- System configuration
- Data for operation mode setting
- Data for setup mode setting

For measured data and computed data, either binary output or ASCII output can be selected. Other data are output in the form of ASCII data.

Status Byte Format

The format of status byte output in serial polling is as follows:



Bit 8: Not used. Always 0.

Bit 7: SRQ

This bit changes to 1 when any cause of the bits 1 to 3 or bit 5 has been generated and interrupts the controller. After responding to serial polling, this bit is set to 0.

Bit 6 This bit changes to 1 when a measurement release is generated while the computation is in progress; otherwise, it is 0. This bit is effective only with optional computation functions. After responding to serial polling, this bit is set to 0.

Bit 5 This bit changes to 1 when the chart reaches its end.

Bit 4 This bit changes to 1 after storing data on media, or reading data from media; otherwise, it is 0. After responding to serial polling, this bit is set to 0.

Bit 2: This bit changes to 1 when a syntax error occurs in a command and is normally 0.

If there is an error in a command description, this changes to 1. After responding to serial polling, this bit is set to 0.

Bit 1: This bit changes to 1 at the end of an A/D conversion; otherwise, it is 0.

When the A/D conversion of measured data is terminated, this changes to 1. After responding to serial polling, this bit is set to 0.

Status byte and serial polling

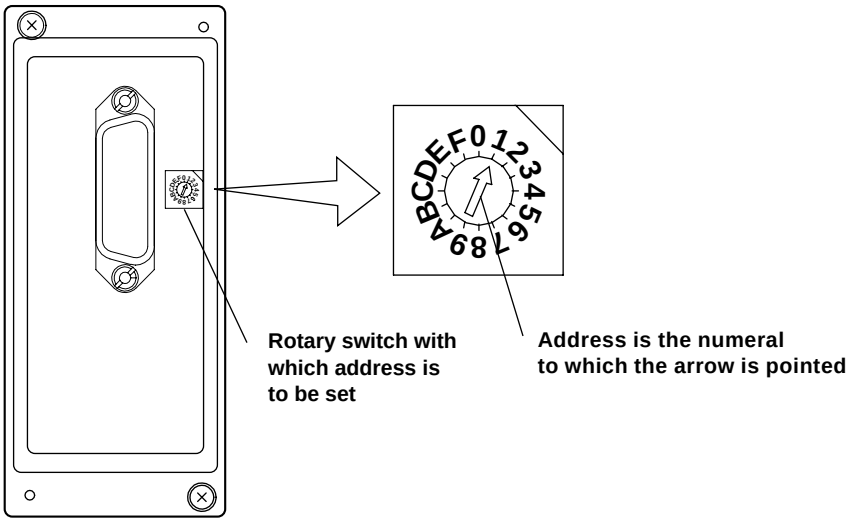
- In IM commands, the bit status that is to be made effective must be specified. The status of unspecified bits does not change to 1.
- If a new cause is generated before reading out a status byte for which a cause has already been generated, the existing cause remains in the status byte as is and the new cause is added. For example, if bit 1 is in 1 state and bit 2 is newly changed to 1 before reading out the status byte, both bit 1 and bit 2 become 1.

The initial value

The initial value is ‘ IM2 ’.

1.2 Setting of Address of GP-IB Interface

The GP-IB address is set with the rotary switch located on the side of the GP-IB module connector. Turn the arrow on the rotary switch with a flat-blade screwdriver or the like to align the arrow with the address to be set.



1.3 Specifications

Electrical and mechanical specifications: Conforming to IEEE St'd 488-1975
Code to be used: ISO (ASCII) code
Function specifications

Function	Subset name	Description
Source handshake	SH1	All transmission handshake functions operative
Acceptor handshake	AH1	All transmission handshake functions operative
Talker	T6	Basic talker functions, serial poll, and talker release function by listener are provided.
Listener	L4	Basic listener function and listener release function by talker are provided.
Service request	SR1	All service request functions operative
Remote/local	RL1	All remote/local functions operative
Parallel poll	PP0	No parallel poll function
Device clear	DC1	All device clear functions operative
Device trigger	DT1	All device trigger functions operative
Controller	C0	No controller function

2.1 Description of Functions

Listener and Talker Functions

Listener Function

This allows almost all settings except power on/off and operation control.

- Settings except communication settings.
- Operation control except power on/off.
- Call-up of setting data
- Specifying of output data (specifying of channel numbers or output data types)

Talker Function

The following data can be output:

- Measured data
- Computed data
- System configuration
- Data for operation mode setting
- Data for setup mode setting

For measured data and computed data, either binary output or ASCII output can be selected. Other data are output in the form of ASCII data.

Data Output

When trigger(GET) becomes activated DR130/DR230/DR240 will store the new data in a buffer. When an output request such as the FM command is received, these new data will be output.

Commands Applicable to RS-232-C Only

The following commands are only applicable to RS-232-C.

ESC T Trigger Execution

Setting ESC T<terminator>

Description Before executing this command, select the output data using the TS command. The data selected with the TS command are prepared for output. The data are output with the FM, LF, or CF command.

ESC S Status Output Command

Setting ESC S<terminator>

Description The status for a sent command is output.

ESC R Switch from Local Status to Remote Status

Setting ESC R<terminator>

Description
- Panel setting conditions in the local status are retained even if the status is switched to the remote status.
- When the status is switched to the remote status, no key except DISP can be used. Panel operation can be done by pressing the DISP key or switching the status to local using the ESC L command described below.

ESC L Switch from Remote Status to Local Status

Setting ESC L<terminator>

Description The panel setting conditions in the remote status are retained even if the status is switched to the local status.

Note

- ESC corresponds to hexadecimal code (1B)H.

Status Byte Format

When the status byte output command (ESC S) is received, any of the ER00CRLF to ER03CRLF status will be output.

ER□□CrLf

An ASCII character string of a numeral (numerals) shown inparentheses at the end of any of the following items or the sum of the numerals of the relevant items is output.
For example, if out-of-chart and timer operation occur, ER20CrLf is output.
Items not specified with an IM command are invalid and not included in this status output.

- **A/D conversion end (1)**
  When an A/D conversion for measured data ends, “1” is output.
- **Syntax error (2)**
  If an error occurs in the description of a command, “2” is output.
- **Storing data or reading data end (8)**
  When storing data on media, or reading data from media ends, “8” is output.
- **Out-of-chart (16)**
  If out-of-chart is detected, “16” is output.
- **Measurement release (32)**
  If a measurement release is generated while the computation is in progress, “32” is output.

Items Applicable to RS-232-C Only

With RS-232-C, all commands can be acknowledged by ACK output. The ACK output is as follows, except for the FM, LF and CF commands, whose ACK output will described later on.

E0 : Commands are processed succesfully

E1 : Commands are not processed succesfully

After having sent the output request, make sure to retrieve the data.

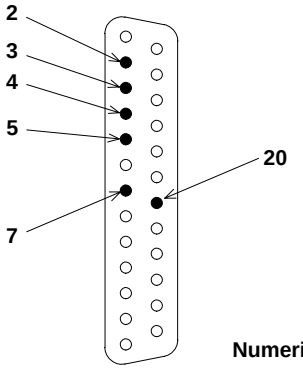
2.2 Specifications

Electrical & mechanical specs	:	Conform to the EIA RS-232-C Standard.
Connection format	:	Point-to point
Communication format	:	Half duplex
Synchronizing format	:	Start-stop asynchronous transmission (synchronized by start/stop bit)
Baud rate (bps)	:	150, 300, 600, 1200, 2400, 4800, 9600, 19200
START bit	:	1 bit, fixed.
Data length	:	Either 7 or 8 bits (selectable).
Parity	:	Even, Odd, or None (selectable).
STOP bit	:	Either 1 or 2 bits (selectable).
Connector	:	DBSP-JB25S (JAE)
Hardware handshake	:	Transmission/reception control by DTR, RTS, CTS.
Software handshake	:	Transmission control by XON, XOFF.
Reception buffer length	:	200 bytes
Escape sequence	:	Trigger; Status call.

2.3 RS-232-C Interface Connection

When connecting this instrument to a personal computer, first it is necessary to match settings such as handshake format, data transmission speed, and data format at the computer's side. For details relating to these settings, refer to the description on this and following pages. Furthermore, make sure to use an interface cable which matches this instrument's specifications.

Connector and Signal Names



Numeric values in the above figure indicate Pin Nos.

2.TXD (Send Data) : Data transmitted to the host computer.
Signal direction : Output.

3.RXD (Received Data) : Data received from the host computer.
Signal direction : Input.

4.RTS (Request to Send) : Handshake signal used for reception of data from the host computer.
Signal direction : Output.

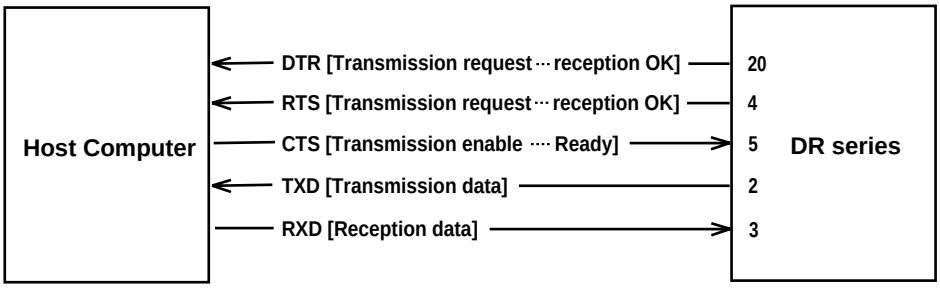
5.CTS (Clear to Send) : Handshake signal used for transmission of data to the host computer.
Signal direction : Input.

7.GND (Signal Ground) : Signal ground connection.

20.DTR (Equipment Ready) : Handshake signal used for reception of data from the host computer.
Signal direction : Output.

Pin Nos. 1, 6 and 8 to 19 are not used.

Signal direction



RS-232-C Signal List and Corresponding JIS & CCITT Abbreviation

Signal Table

Pin No.	Abbreviation			Name
	RS-232-C	CCITT	JIS	
7	AB(GND)	102	SG	Signal ground
2	BA(TXD)	103	SD	Transmitted data
3	BB(RXD)	104	RD	Received data
5	CB(CTS)	106	CS	Transmission enable
4	CA(RTS)	105	RS	Transmission request
20	CD(DTR)	108/2	ER	Data terminal ready

2.4 Handshake Format Selection

In order to ensure proper data transfers between the recorder and the host computer via the RS-232-C interface, a mutual procedure is required for processing the electrical signals. Such a procedure is referred to as a 'handshake'. Several handshake formats are available, with selection depending on the host computer being used. The same handshake format must be designated for both the recorder and the host computer.
The recorder parameter settings permit any one of the following 5 formats to be selected.

Format Selection	Transmission Data Control (Control format when transmitting data to the host computer)			Reception Data Control (control format when receiving data from the host computer)		
	Software Handshake	Hardware Handshake		Hardware Handshake		
	Transmission is stopped when X-OFF is received, and is resumed when X-ON is received.	Transmission is stopped when CTS is FALSE, and is resumed when CTS is TRUE.	No Handshake	When reception of data becomes impossible DTR becomes FALSE, when data recept becomes possible DTR becomes TRUE.	When reception of data becomes impossible RTS becomes FALSE, when data recept becomes possible RTS becomes TRUE.	No Handshake
OFF-OFF			○			○
XON-RTS	○			○		
XON-DTR	○				○	
CTS-RTS		○		○		
CTS-DTR		○			○	

OFF-OFF

- Transmission data control : There is no handshake status between the recorder and host computer. the X-OFF signal from the host computer is processed as data, and the CTS signal is ignored.
- Reception data control : There is no handshake status between the recorder and host computer. When the recorder reception buffer becomes full, the excess data is discarded.
  DTR=True, RTS=True (both fixed).

Note

- It is necessary to create a host computer program which prevents the recorder and host computer reception buffers from becoming full.

XON-RTS

- Transmission data control : A software handshake status is established between the recorder and the host computer. The recorder will stop a data transmission when an X-OFF signal is received from the host computer. The transmission will be resumed when the next X-ON signal is received.
  The CTS signal from the host computer is ignored.
- Reception data control : A hardware handshake status is established between the recorder and the host computer. When the recorder recept of data becomes impossible, an 'RTS=False' status will be established. When data recept becomes possible, an 'RTS=True' status will be established.
  DTR=True (Fixed).

XON-DTR

- Transmission data control : A software handshake status is established between the recorder and the host computer. The recorder will stop a data transmission when an X-OFF signal is received from the host computer. The data transmission will be resumed when the next X-ON signal is received. The CTS signal from the host computer is ignored.
- Reception data control : A hardware handshake status is established between the recorder and the host computer. When the recorder recept of data becomes impossible, an 'DTR=False' status will be established. When data recept become possible, an 'DTR=True' status will be established. RTS=True (Fixed).

CTS-RTS

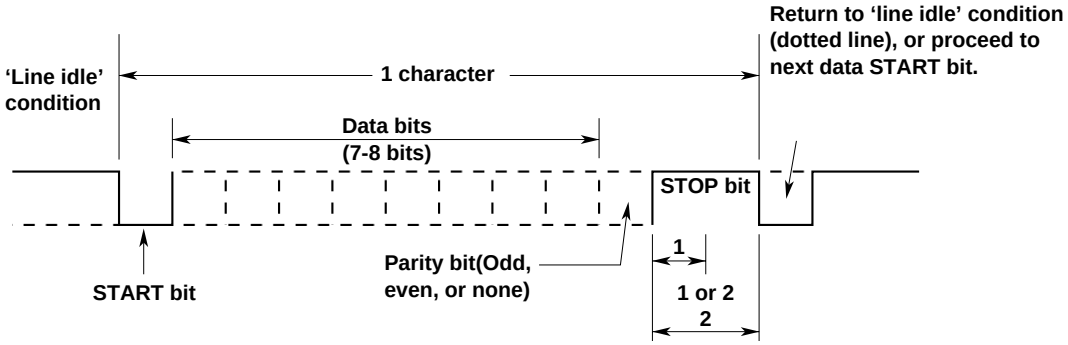
- Transmission data control : A hardware handshake status is established between the recorder and the host computer. The recorder will stop a data transmission if a 'CTS=False' status is established, and will resume the transmission when a 'CTS=True' status is established. The X-OFF and X-ON signals from the host computer are processed as data.
- Reception data control : A hardware handshake status is established between the recorder and the host computer. An 'RTS=False' status will be established when the recorder recept of data becomes impossible, and an 'RTS=Ture' status will be established when data recept becomes possible. DTR=Ture (Fixed).

CTS-DTR

- Transmission data control : A hardware handshake status is established between the recorder and the host computer. The recorder will stop a data transmission if a 'CTS=False' status is established, and will resume the transmission when a 'CTS=True' status is established. The X-OFF and X-ON signals from the host computer are processed as data.
- Reception data control : A hardware handshake status is established between the recorder and the host computer. A 'DTR=False' status will be established when the recorder recept of data becomes impossible and a 'DTR=True' status will be established when data recept becomes possible. RTS=Ture (Fixed).

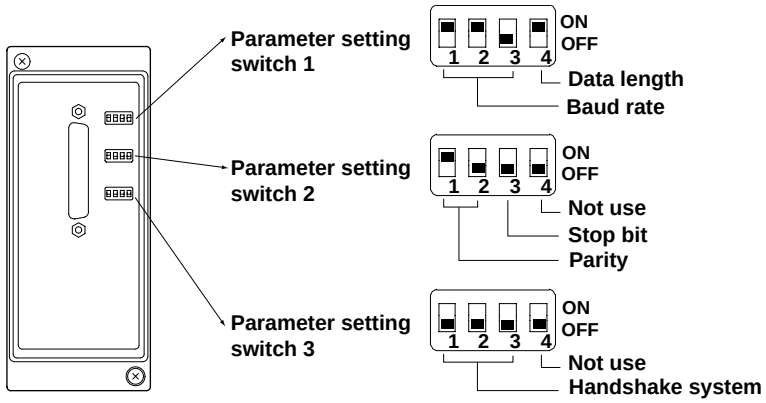
2.5 Communication Data Format

The RS-232-C interface uses a START-STOP communication format. With this format, a START bit is placed at the beginning of each character transmitted, followed by the data bits, parity bit, and stop bit, in that order. (See the figure below.)



2.6 RS-232-C Interface Parameter Setting Procedure

Setting of the RS-232-C parameters must be carried out using the 3 dipswitches located next to the module connector.



Baud rate (Switch No.1 to 3 of parameter setting switch 1)

Baud rate	No.1	No.2	No.3	
150	OFF	OFF	OFF	
300	OFF	OFF	ON	
600	OFF	ON	OFF	
1200	OFF	ON	ON	
2400	ON	OFF	OFF	
4800	ON	OFF	ON	
9600	ON	ON	OFF	←Default
19200	ON	ON	ON	

Data length (Switch No.4 of parameter setting switch 1)

Data length	No.4	
7	OFF	
8	ON	←Default

Parity (Switch No.1 and 2 of parameter setting switch 2)

Parity	No.1	No.2	
NONE	OFF	OFF	
ODD	OFF	ON	
EVEN	ON	OFF	←Default

Stop bit (Switch No.3 of parameter setting switch 2)

Stop bit	No.4	
1	OFF	←Default
2	ON	

Handshake system (Switch No.1 to 3 of parameter setting switch 3)

Handshake system	No.1	No.2	No.3	
No handshake	OFF	OFF	OFF	←Default
XON-ER	OFF	OFF	ON	
XON-RS	OFF	ON	OFF	
CS-ER	OFF	ON	ON	
CS-RS	ON	OFF	OFF	

3.1 Description of Functions

Listener and Talker Functions

Listener Function

This allows almost all settings except power on/off and operation control.

- Settings except communication settings.
- Operation control except power on/off.
- Call-up of setting data
- Specifying of output data (specifying of channel numbers or output data types)

Talker Function

The following data can be output:

- Measured data
- System configuration
- Data for operation mode setting
- Data for setup mode setting

For measured data, binary output or ASCII output can be selected. (for RS-422-A with using the multi point.) Other data are output in the form of ASCII data.

Data Output

When trigger(GET) becomes activated DR will store the new data in a buffer. When an output request such as the FM command is received, these new data will be output.

Commands Applicable to RS-422-A/RS-485 Only

The following commands are only applicable to RS-422-A/RS-485.

ESC O Open Command (address a communication destination)

Setting ESC O xx<terminator>
xx : address, 01 to 31

Description Specifies the communicating device by its address. When this command is executed, all commands to the DR series (including ESC T) become effective.

- Only one device can be opened.
- Executing ESC O automatically closes all opened devices.
- When the DR series receives this command correctly, it sends “ESC O xx” in response to the computer.
- CR+LF can only used for the terminator.

ESC C Close Command (close the addressed state of a device)

Setting ESC C xx<terminator>
xx : address, 01 to 31

Description Disconnects the device currently connected. When this command is executed, it allows opening communication with other devices with the ESC O command.

- When the DR series receives this command correctly, it sends “ESC C xx” in response to the computer.
- CR+LF can only used for the terminator.

The following commands are same as the RS-232-C interface. Refer to User’s Manual shown below.

ESC T (Trigger Execution), ESC S (Status Output Command)

Note

- ESC corresponds to hexadecimal code (1B)H. On the N88-BASIC, “ESC x” is denoted as “CHR$(&H1B)+”x”.”

3.2 Specifications

Electrical & mechanical specs	:	Conform to the EIA RS-422-A and EIA RS-485 Standard
Connection format	:	Multi-drop 1:n (n=16 for RS-422-A, n=31 for RS-485)
Communication format	:	Half duplex
Synchronizing format	:	Start-stop asynchronous transmission (synchronized by start/stop bit)
Baud rate (bps)	:	150, 300, 600, 1200, 2400, 4800, 9600 or 19200 (selectable)
START bit	:	1 bit (fixed)
Data length	:	Either 7 or 8 bits (selectable)
Parity	:	Even, Odd, or None (selectable)
STOP bit	:	Either 1 or 2 bits (selectable)
Connector	:	6 point screw type terminal (uses M4 screws)
Minimum response time	:	0, 10, 20, 50 or 100 ms (selectable)
Reception buffer length	:	250 bytes
Escape sequence	:	Trigger, Status call, Open and Close
Electrical characteristics	:	SDA, SDB, RDA, RDB, SG. Between the signal terminal and the main internal circuit is insulated functionally.
Communication distance	:	1.2 km maximum
Terminator	:	Internal resistor (120 ohm, 1W) switch with the slide switch

3.3 RS-422-A/RS-485 Interface Connection

The following explains how the RS-422-A/RS-485 module is connected to the computer.

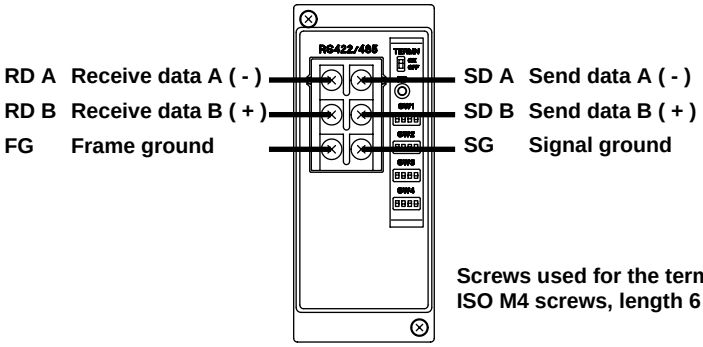
Cable Used

There are two types of cables: two-wire cable and four-wire cable. Make sure each type meets the following conditions.

Cable used	: twisted pair shielded cable 2 pairs of 24 AWG minimum (two-wire), 3 pairs 24 AWG minimum (four-wire)
Characteristic impedance	: 100 ohm
Capacitance	: 50 pF/m
Length of cable	: 1.2 km maximum *

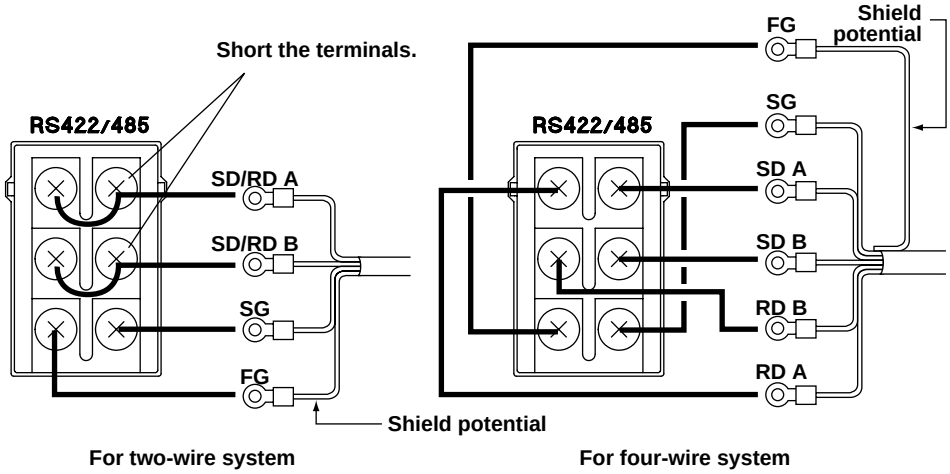
* Communication distance of the RS-422-A/RS-485 interface is not the linear distance, but the total length of the cable (shielded twisted pair cable).

Terminal Arrangement of the RS-422-A/RS-485 Module



Connecting the Cable

Attach crimp-on lugs (for 4 mm screws) with insulation sleeves on the leadwire ends as shown in the diagram below. Make the exposed portion of the shielded cable to be less than 5 cm.



WARNING

To prevent an electric shock, ensure the main power supply is turned OFF.

Note

- As shown on the next page, connect terminal RD to SD(TD) of the computer (converter) and terminal SD to RD of the computer.

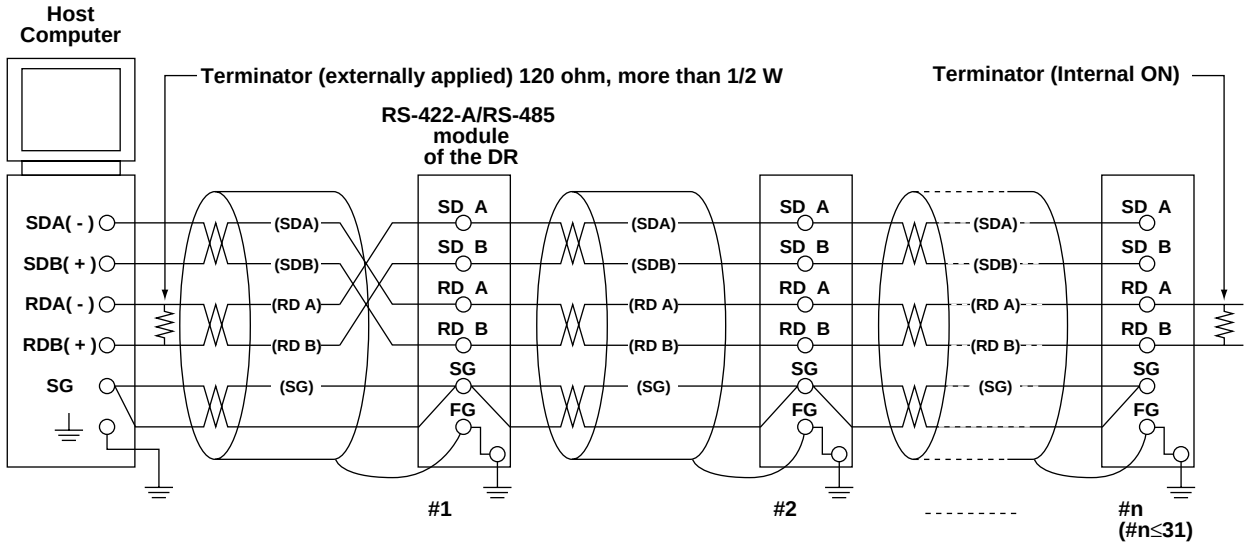
Connecting to the Host Computer

Can be connected to a host computer with RS-232-C, RS-422-A, RS-485 ports.

- In the case of RS-232-C, a converter is used as shown in the diagram below.
- For information on recommended converters, refer to “Converters” in the latter.
- Dip switch needs to be changed depending on whether it is a two-wire system or four-wire system. Refer to “3.5 RS-422-A/RS-485 Interface Parameter Setting Procedure.”

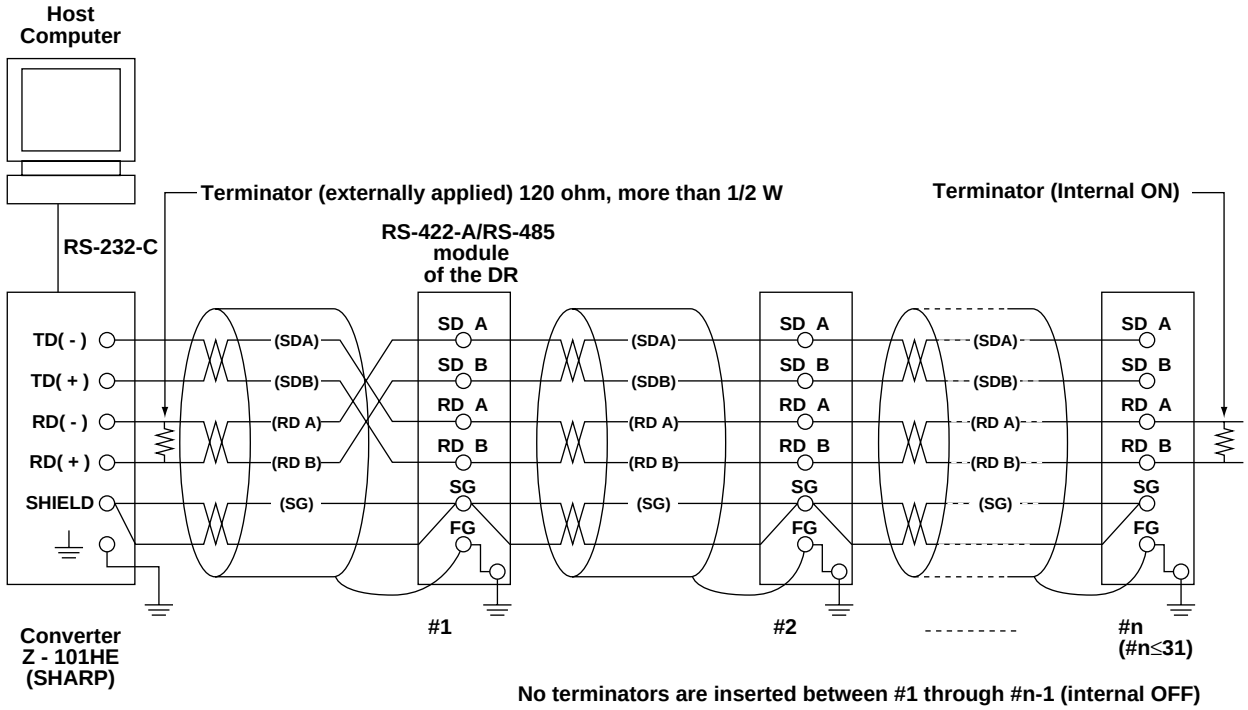
In the case of four-wire system

In general, the recorder is wired to the host computer using a four-wire system. When four-wire system is used, the send and receive wires need to be crossed.



No terminators are inserted between #1 through #n-1 (internal OFF)

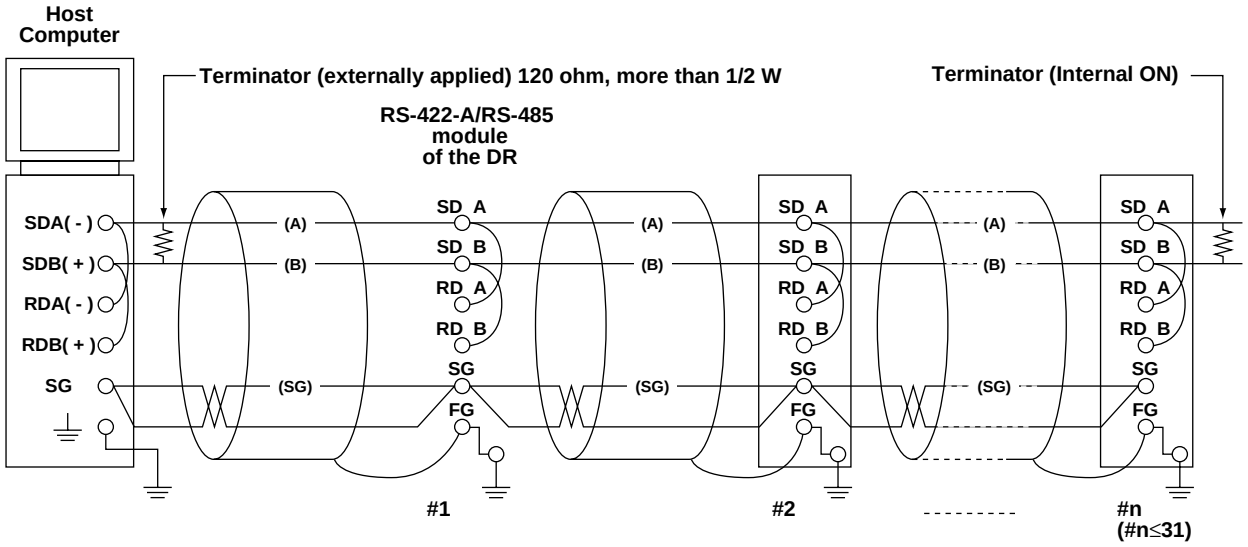
(Diagram below shows the case when the port of the host computer is RS-232-C)



No terminators are inserted between #1 through #n-1 (internal OFF)

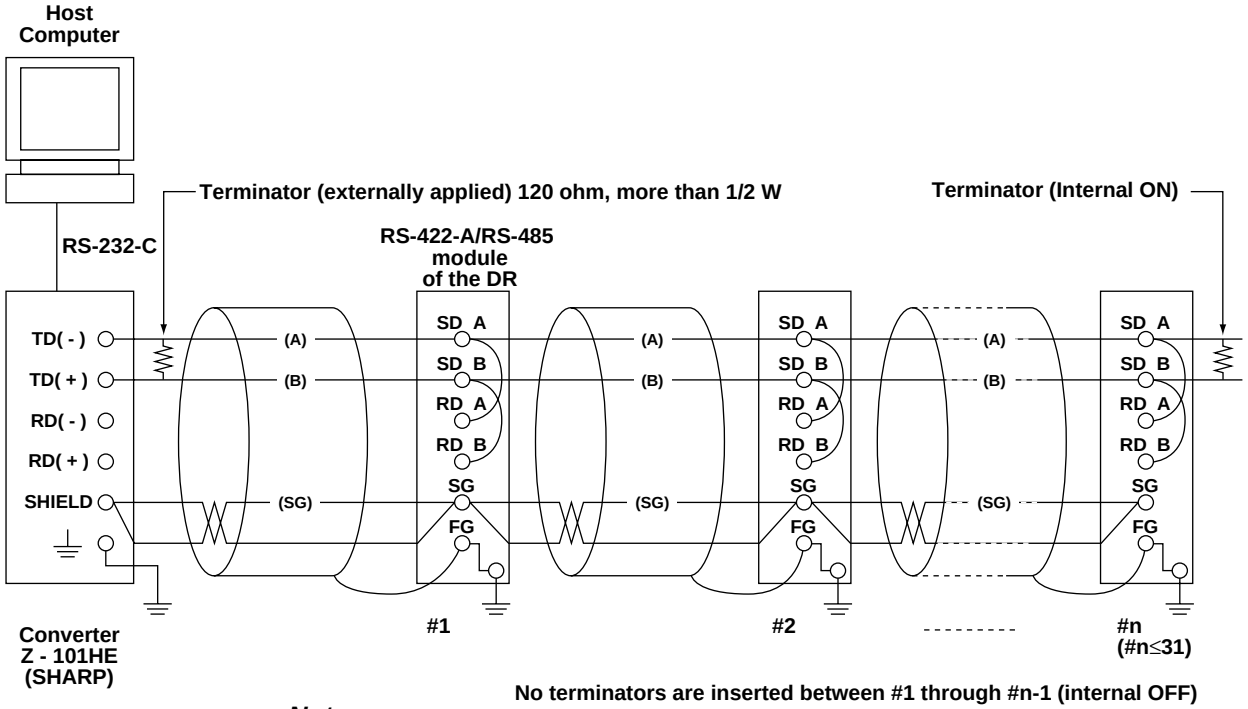
In the case of two-wire system

Connect send and receive terminals with the same signal polarity on the terminal arrangement of the RS-422-A/RS-485 module. Only two wires are used in connecting to other units.



No terminators are inserted between #1 through #n-1 (internal OFF)

(Diagram below shows the case when the port of the host computer is RS-232-C)



No terminators are inserted between #1 through #n-1 (internal OFF)

Note

- The method in eliminating noise depends on the condition in which it is used. In the example, shielded cable is grounded only at the DR (one-sided grounding). This method is effective in eliminating noise in long distance communication in which there is potential difference between the ground of the PC and the ground of the DR. When there is no potential difference between the ground of the PC and the ground of the DR, grounding both sides (two-sided grounding) is sometimes effective. In addition, there are cases when grounding both sides with one side having a capacitor connected in series is effective.
  Consider all the above cases in eliminating the noise.

Converter

Recommended converter : Sharp Z-101HE

Caution

Some converters other than the recommended, do not have the FG and SG terminals insulated. In such cases, do not connect as in the diagram on the previous page (do not connect anything to the FG and SG terminals of the converter). Especially when it is long distance, the potential difference may damage the devices or the communication may become unreliable.
Also, converters without the SG terminal can be used without grounding. For details, refer to the converter's manual.

Some converters other than the recommended have their signal polarity reversed (indication of A/B or +/-). In this case, reverse the connection. If the "RD" LED on the front panel of the RS-422-A/RS-485 module blinks when it receives data, the connection is correct. If it lights, the connection may be reversed.

In the case of the two-wire system, the host computer must control the ON/OFF of the transmission driver of the converter in order to prevent the collision of the send and receive data. When using the recommended converter, ON/OFF is controlled using RTS.

Using the Module with Devices Using the RS-422-A

Maximum of 31 devices with respect to 1 host computer can be connected with this module, but in a system in which devices using the RS-422-A are used together, this may not be possible.

- In a system in which former recorders are used together
  Some of the former recorders (such as HR2400 and μR) use the RS-422-A driver. In this case, the maximum number of devices that can be connected is 16.

Note

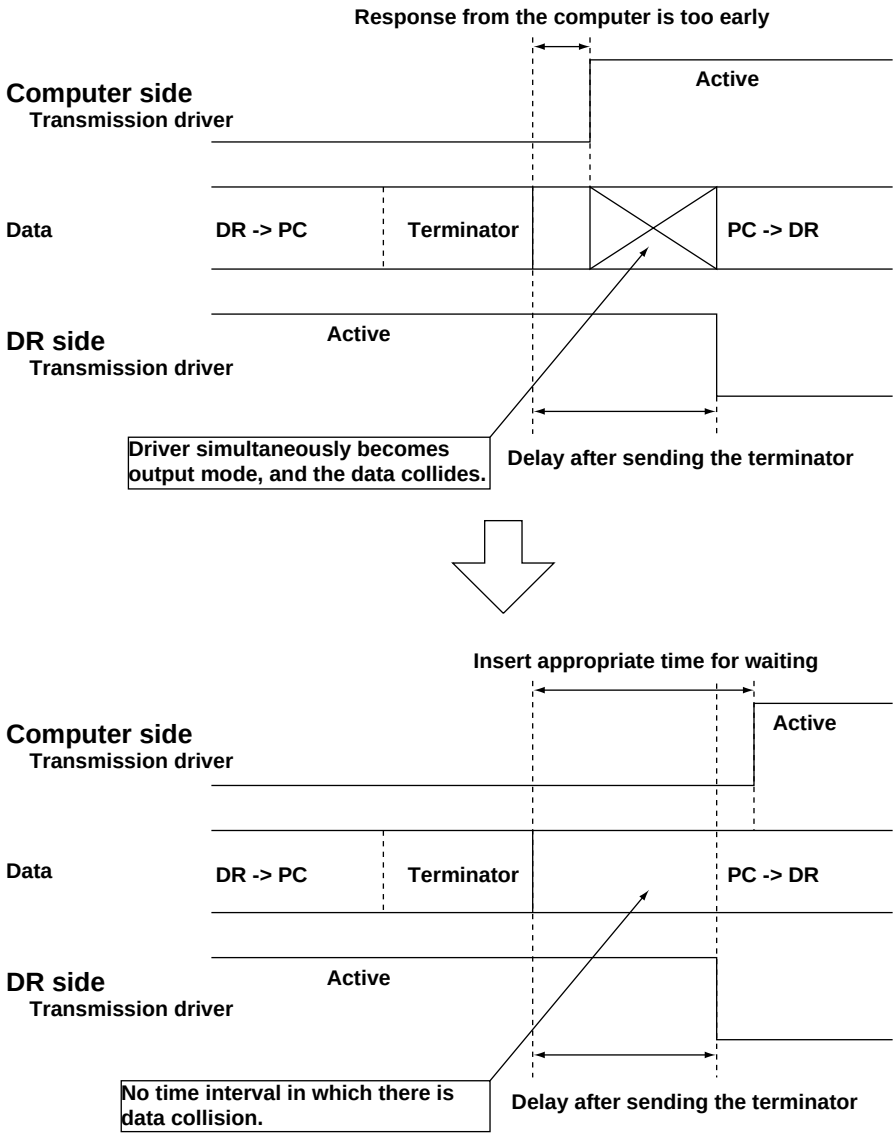
- According to the RS-422-A standard, the maximum number of devices that can be connected with respect to one port is 10 devices (in the case of a four-wire system).

Terminator

When devices are connected in multi-drop configuration (includes point-to-point connections), turn the terminators of the modules on the extreme ends ON. All modules in between should have them turned off. Terminators are turned ON/OFF using the TERMIN switch on the front panel.
Also, turn ON the terminator on the host computer (refer to the computer's manual). When converters are used, turn their terminators ON also. The recommended converter needs an external terminator to be installed, but some converters are internal types.

Minimum Response Time

Because send and receive are done on the same line in the two-wire system, minimum response time needs to be set. The minimum response time is the amount of time the RS-422-A/RS-485 module waits in order for the host computer to be able to receive the data after it sends data. The time can be set in the range from 0 to 100 ms. Set the time using the dip switch on the front panel of the RS-422-A/RS-485 module to match the computer or the converter's specification. (Refer to "3.5 RS-422-A/RS-485 Interface Parameter Setting Procedure.") Note that the minimum response time is, as the name indicates, the minimum time for responding. Not all responses will take place in this time. In the four-wire system, the minimum response time does not need to be set (set to 0 ms).



3.4 Communication Data Format

Same as the RS-232-C interface. For a description, refer to “2.5 Communication Data Format.”

3.5 RS-422-A/RS-485 Interface Parameter Setting Procedure

Setting of the RS-422-A/RS-485 parameters must be carried out using the 4 dip switches located next to the module connector.

Baud rate (No.1 to 3 of SW1)

Baud rate	No.1	No.2	No.3	
150	OFF	OFF	OFF	
300	OFF	OFF	ON	
600	OFF	ON	OFF	
1200	OFF	ON	ON	
2400	ON	OFF	OFF	
4800	ON	OFF	ON	
9600	ON	ON	OFF	<- Default Setting
19200	ON	ON	ON	

Data length (No.4 of SW1)

Data length	No.4	
7	OFF	
8	ON	<- Default Setting

Parity (No.1 to 2 of SW2)

Parity	No.1	No.2	
None	OFF	OFF	
ODD	OFF	ON	
EVEN	ON	OFF	<- Default Setting

Stop bit (No.3 of SW2)

Stop bit	No.3	
1	OFF	<- Default Setting
2	ON	

Switch between four-wire/two-wire systems (No.4 of SW2)

four-wire/two-wire	No.4	
four-wire	OFF	<-Default Setting
two-wire	ON	

Minimum response time (No.1 to 3 of SW3)

Minimum response time	No.1	No.2	No.3	
0ms	OFF	OFF	OFF	<- Default Setting
10ms	OFF	OFF	ON	
20ms	OFF	ON	OFF	
50ms	OFF	ON	ON	
100ms	ON	OFF	OFF	

Address (No.4 of SW3 and No.1 to 4 of SW4)

Address	No.4(SW3)	No.1(SW4)	No.2(SW4)	No.3(SW4)	No.4(SW4)	
1	OFF	OFF	OFF	OFF	ON	<- Default Setting
2	OFF	OFF	OFF	ON	OFF	
3	OFF	OFF	OFF	ON	ON	
4	OFF	OFF	ON	OFF	OFF	
5	OFF	OFF	ON	OFF	ON	
6	OFF	OFF	ON	ON	OFF	
7	OFF	OFF	ON	ON	ON	
8	OFF	ON	OFF	OFF	OFF	
9	OFF	ON	OFF	OFF	ON	
10	OFF	ON	OFF	ON	OFF	
11	OFF	ON	OFF	ON	ON	
12	OFF	ON	ON	OFF	OFF	
13	OFF	ON	ON	OFF	ON	
14	OFF	ON	ON	ON	OFF	
15	OFF	ON	ON	ON	ON	
16	ON	OFF	OFF	OFF	OFF	
17	ON	OFF	OFF	OFF	ON	
18	ON	OFF	OFF	ON	OFF	
19	ON	OFF	OFF	ON	ON	
20	ON	OFF	ON	OFF	OFF	
21	ON	OFF	ON	OFF	ON	
22	ON	OFF	ON	ON	OFF	
23	ON	OFF	ON	ON	ON	
24	ON	ON	OFF	OFF	OFF	
25	ON	ON	OFF	OFF	ON	
26	ON	ON	OFF	ON	OFF	
27	ON	ON	OFF	ON	ON	
28	ON	ON	ON	OFF	OFF	
29	ON	ON	ON	OFF	ON	
30	ON	ON	ON	ON	OFF	
31	ON	ON	ON	ON	ON	

4.1 Command Format

Commands are configured with ASCII codes and the content is divided into a command, parameters, delimiters and a terminator.
(Example) SR001, VOLT, 20 mV <terminator>

Command

This is defined with two upper-case letters.

Parameter

- A delimiter (comma) is used to separate two parameters.
- Numerical values are all set using integers.
- If a parameter is a numeric value, the effective setting range varies with the command.
- Spaces before and after a parameter and embedded spaces in a parameter are ignored. (However, for parameters (unit) specified with ASCII character strings, these spaces are effective.)
- Parameters which do not need to be changed from the current setting can be omitted. However, delimiters cannot be omitted.
  (Example) SR001,, 2 V <terminator>
  If delimiters continue at the end due to the omission of more than one parameter, they can be omitted.
  (Example) SR001, VOLT,,, <terminator> -> SR001, VOLT<terminator>
- The number of digits of the following parameters is fixed. If an erroneous number of digits is input, a syntax error occurs.
  - Date and time
    Date YY/MM/DD (8 characters)
    YY: Year (enter the last two digits)
    MM: Month
    DD: Day
    Time HH:MM:SS (8 characters)
    HH: Hour
    MM: Minute
    SS: Second

- Channel number
  A channel number ..... 3 characters
  Range of channel numbers ..... 6 characters AAA-BB
  For details of channel numbers, see page 4-4.

Note

- If the same setting is to be done for subsequent channels, it can be achieved by connecting channels with a "-" (minus sign). However, channels that can be set subsequently are effective only in the same unit.
  (Example) Setting channels from 1 to 60 in subunit 0 to VOLT, 2 V:
  SR001-60, VOLT, 2V
- Do not specify the channels of a module which the DR130/DR230/DR240 has not recognized. Otherwise, an error occurs. Modules that cannot be recognized by the DR130/DR230/DR240 are those which have been newly added or whose slots have been changed. In order for the DR130/DR230/DR240 to recognize them, reconstruct the system using the RS command.
- For specifying subsequent channels, the channels must all be in a module that can be recognized by the DR130/DR230/DR240.

- Relay number
  Relay numbers are expressed with 3 characters.
  For details on the relay numbers, see page 4-4.

Terminator

Any one of the following forms a terminator.

- CR + LF
- LF
- EOI = True
  (If EOI is to be used for a terminator, add EOI = True to the last parameter character.)

Sub-delimita

Several commands can be executed in a row when they are divided by a semicolon (;).

Example

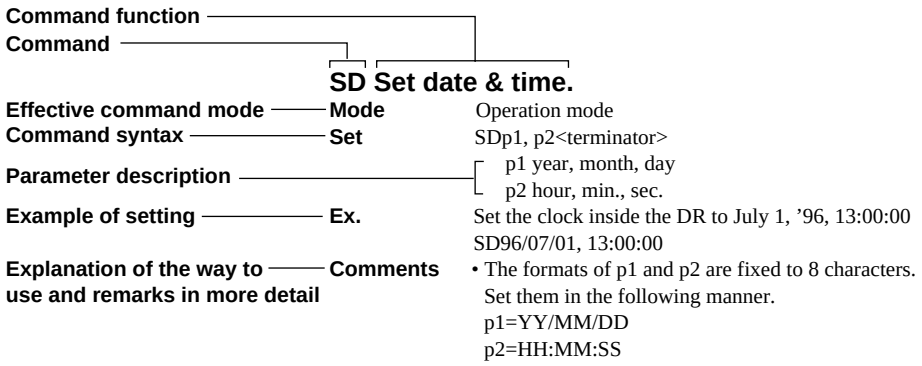
XA2, 2, 0.5 ; XV4 ; XI2, AUTO CrLf

Note

- The total data length from the first character to the terminator should not exceed 200 bytes.
- A sub-delimita cannot be used for the commands FM, LF, CF, RC, RS, DS, XE or XZ. These commands can only be carried out one by one.
- In case of RS-232-C one ACK-status (E0/E1) will be output for each command devided by ;.

4.2 Command Syntax

In this manual, each command is explained as shown below.



Mode

There are the following three modes in the DR130/DR230/DR240.

- Operation (measurement) mode
  Mode to perform normal operation (measurement).
- Setup mode
  Mode to set the basic specifications for the DR130/DR230/DR240.
- A/D calibration mode
  Mode to execute calibration of the A/D module.

Each mode is selected by the DS command. For details, see DS Command on page 5-20.
Also in each mode, commands and parameters that can be set and parameters that can be output differ. See the description for each command.

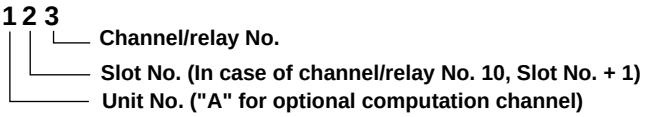
Number of Channels

The configurable numbers of measurement and computation channels vary, from recorder to recorder, between model DR130 and stand-alone models of the DR230/240.

Type of DR Recorder	Highest Measurement-channel Number	Highest Computation-channel Number
DR130	020	A30
Stand-alone models of DR230/240	030	A30

4.3 Setting a Channel No., and Alarm Output Relay No.

Channel and relay numbers are expressed as shown below in three characters.
Unit No. + Slot No. + Number in slot



Channel Number

	DR130/DR230/DR240 (Stand-alone type)
Unit No.	0
Slot No.	0 to2 (0 or 1 for DR130)
Channel No.	1 to 10 (CH10: 0)*

*: For CH10, the channel number digit is expressed by 0 and the slot number digit, by slot number + 1.

Note

- If successive channel numbers are to be specified, enter as ABC-DE, where
  ABC: the above 3-digit channel number (unit no., slot no., and channel no.)
  DE: the channel number except the unit number (slot no., and channel no.)
  Successive channels can only be specified for a unit.

Relay Number

	DR130/DR230/DR240
Unit No.	0 S(Internal switch)
Slot No.	1 to 5 (1 to 3 for DR130)
Relay No.	1 to 10 (Relay No. 10: 0)*2

*2: For relay No. 10, the channel number digit is expressed by 0 and the slot number digit, by slot number + 1.

Example

- Channel 9 of the module mounted in slot 2: 029

4.4 Command List

Setting the Input

Command	Content	Effective mode
SR	Range setting	Operation mode
SN	Unit setting (scale unit)	Operation mode
XV	Sample rate setting	Setup mode
XI	A/D integration time setting	Setup mode
XQ	Filter setting	Setup mode

Setting Alarms

Command	Content	Effective mode
SA	Alarm setting	Operation mode
XA	Setting related to alarm	Setup mode
XY	Relay reflash setting	Setup mode
XN	Relay AND/OR setting	Setup mode
XD	Relay energizing/deenergizing setting	Setup mode
XH	Relay hold setting	Setup mode

Setting the Display

Command	Content	Effective mode
UD	Setting the display mode on the upper part of the display	Operation mode
MD	Setting the display mode on the middle part of the display	Operation mode
LD	Setting the display mode on the lower part of the display	Operation mode
XW	Setting the switching time for the displayed channel	Setup mode

Setting the Recording

Command	Content	Effective mode
SC	Chart speed setting	Operation mode
SE	Second chart speed setting	Operation mode
SS	Select the trend records/logging records	Operation mode
SZ	Recording zone setting	Operation mode
SP	Partially expanded recording setting	Operation mode
SG	Message setting	Operation mode
ST	Tag setting	Operation mode
SH	Header setting	Operation mode
SJ	Title setting	Operation mode
SF	Format for list printing setting	Operation mode
SB	Interpolation setting	Operation mode
PT	Trend recording ON/OFF	Operation mode
PD	Digital recording ON/OFF	Operation mode
PM	Manual printing ON/OFF	Operation mode
PA	Alarm printing ON/OFF	Operation mode
PC	Scale printing ON/OFF	Operation mode
PL	List printing ON/OFF	Operation mode
XR	Performs settings related to records	Setup mode
XC	Dot printing colors setting	Operation mode

Other Settings

Command	Content	Effective mode
SD	Date and time setting	Operation mode
SV	Moving average setting	Operation mode
SY	Copy between channels	Operation mode
SX	Group setting	Operation mode
SI	Timer setting	Operation mode
SQ	Match time setting	Operation mode
SL	Event/action setting	Operation mode
SO	Computation expression setting (option)	Operation mode
SK	Computation constant setting (option)	Operation mode
CM	Setting of input data to be computed (option)	Operation mode
MH	Setting of channel number to save setting data (with a floppy disk drive)	Operation mode
SW	Setting of summer-winter time	Operation mode

Command	Content	Effective mode
XK	Key lock setting	Setup mode
XF	Function screen setting	Setup mode
XS	Setting screen setting	Setup mode
XB	Burnout setting	Setup mode
XJ	Reference junction compensation setting	Setup mode
XG	Setting of computation error handling method (option)	Setup mode
XT	Setting of temperature unit	Setup mode
VL	Setting of language	Setup mode
XE	Setup setting data	Setup mode
XZ	Setting for execution, data modification, and data storage in A/D calibration	A/D calibration mode

Control Execution Command

Command	Content	Effective mode
PS	Recording start/stop	Operation mode
MP	Manual printing start/stop	Operation mode
LS	List printing start/stop	Operation mode
HD	Header printing start/stop	Operation mode
SU	Setup list printing start/stop	Operation mode
MS	Message printing start	Operation mode
AK	Acknowledgment of alarm status	Operation mode
AR	Alarm reset	Operation mode
IR	Timer reset	Operation mode
AC	Alarm buffer clear	Operation mode
MC	Message buffer clear	Operation mode
EX	Computation start/stop/reset/clear (Option)	Operation mode
BL	Executing the initial balancing	Operation mode
MW	Storing measured/computed data (with a floppy disk drive function)	Operation mode
MR	Reading measured/computed data (with a floppy disk drive function)	Operation mode
MV	Storing set data (with a floppy disk drive function)	Operation mode
ML	Reading set data (with a floppy disk drive function)	Operation mode
ME	Deleting a file (with a floppy disk drive function)	Operation mode
MY	Copying a file (with a floppy disk drive function)	Operation mode
FV	Saving set data on a floppy disk (with a floppy disk drive function)	Operation mode
FL	Reading set data from a floppy disk (with a floppy disk drive function)	Operation mode
FE	Deleting a file on a floppy disk (with a floppy disk drive function)	Operation mode
YV	Saving set data on a floppy disk (with a floppy disk drive function)	Setup mode
YL	Reading set data from a floppy disk (with a floppy disk drive function)	Setup mode
YE	Deleting a file on a floppy disk (with a floppy disk drive function)	Setup mode
RS	System reconstruction	Operation mode
RC	RAM clear (initialization of operation mode)	Operation mode
DS	Setting mode selection	All modes

Output Request Command

Command	Content	Effective mode
TS	Selection of talker output data	All modes
FM	Measured data output request	Operation mode
MF	Request to output measured data	Operation mode
LF	Setting data output request	All modes
CF	System configuration data output request	All modes
BO	Byte output order specification	Operation mode
IM	Interrupt mask specification	Operation mode
SM	Auxiliary mask specification	Operation mode

Note

- The execution of a command in a mode different from the effective mode will cause a syntax error. Select a mode in which the command is effective using the DS command and do the setting and execution.

4.5 Input Range Parameter

DC Voltage Input

Nominal	Parameter input format	Setting range
20mV	20mV	–20.000 to 20.000mV
60mV	60mV	–60.00 to 60.00mV
200mV	200mV	–200.00 to 200.00mV
2V	2V	–2.0000 to 2.0000V
6V	6V	–6.000 to 6.000V
20V	20V	–20.000 to 20.000V
50V	50V	–50.00 to 50.00V

Thermocouple

Nominal	Parameter input format	Setting range
R	R	0.0 to 1760.0°C
S	S	0.0 to 1760.0°C
B*1	B	0.0 to 1820.0°C
K	K	–200.0 to 1370.0°C
E	E	–200.0 to 800.0°C
J	J	–200.0 to 1100.0°C
T	T	–200.0 to 400.0°C
N	N	0.0 to 1300.0°C
W	W	0.0 to 2315.0°C
L	L	–200.0 to 900.0°C
U	U	–200.0 to 400.0°C
KpAu7Fe	KP	0.0 to 300.0K

*1: Accuracy compensation range Type-B

Resistance Temperature Detector (RTD)

Nominal	Parameter input format	Setting range
Pt100: 1mA	PT1	–200.0 to 600.0°C
Pt100: 2mA	PT2	–200.0 to 250.0°C
JPt100: 1mA	JPT1	–200.0 to 550.0°C
JPt100: 2mA	JPT2	–200.0 to 250.0°C
Pt50: 2mA	JPT50	–200.0 to 550.0°C
Pt100: 1mA-H	PT1S	–140.00 to 150.00°C
Pt100: 2mA-H	PT2S	–70.00 to 70.00°C
JPt100: 1mA-H	JPT1S	–140.00 to 150.00°C
JPt100: 2mA-H	JPT2S	–70.00 to 70.00°C
Ni100: 1mA-S*1	NI1	–200.0 to 250.0°C
No100: 1mA-D*2	NI2	–60.0 to 180.0°C
Ni120: 1mA*3	NI3	–70.0 to 200.0°C
Cu10: GE*4	CU1	–200.0 to 300.0°C
Cu10: L&N	CU2	–200.0 to 300.0°C
Cu10: WEED*4	CU3	–200.0 to 300.0°C
Cu10: BAILEY*4	CU4	–200.0 to 300.0°C
J263*B	J263B	–0.0 to 300.0K

*2: RTD (SAMA)
*3: RTD (DIN)
*4: RTD (McGRAW EDISON COMPANY)
*5: RTD (Cuid corresponding to specific manufacturer)

Accuracy compensation range
Cu10:GE –84.4 to 170.0°C
Cu10:L & N –75.0 to 150.0°C
Cu10:WEED –20.0 to 250.0°C
Cu10:BAILEY –20.0 to 250.0°C

Contact

Nominal	Parameter input format	Setting range
VOLT	LEVL	0 to 1*1
CONTACT	CONT	0 to 1*2

*1: Less than 2.4 V → Off (0), 2.4 V or more → On (1)
*2: Contact On (1), Contact Off (0)

DC Current Input

Nominal	Parameter input format	Setting range
20mA	20mA	-20.000 to +20.000mA

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4.6 ASCII Code Table

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			SP	0		P		p								
1				1	A	Q	a	q							°	
2				2	B	R	b	r							Ω	
3			#	3	C	S	c	s							μ	
4				4	D	T	d	t							ε	
5			%	5	E	U	e	u								
6			&	6	F	V	f	v							ʊ	
7				7	G	W	g	w								
8			(	8	H	X	h	x								
9			)	9	I	Y	i	y								
A	LF		*	:	J	Z	j	z								
B			+	;	K		k									
C					L		l									
D	CR		–		M		m									
E			.		N		n									
F			/		O		o									

Treatment of °
- **For measured data output (TS0) or decimal point output (TS2): Space (20H)**
- **For setting data output (TS1): E1H**
- **For listener setting: E1H**

5.1 Setting the Input

SR Sets the range.

Mode Operation mode

Setting the range to SKIP

Setting SRp1, p2<terminator>

- p1 Channel number (001 to 030)
- p2 SKIP

Example Skip channel 01 of slot 0.

SR001, SKIP

Comments
- Channel(s) set to SKIP are not measured.

Setting voltage, thermocouple, RTD or contact input

Setting SRp1, p2, p3<terminator>

- p1 Channel number (001 to 030)
- p2 Type of input
  - VOLT DC voltage
  - TC Thermocouple
  - RTD Resistance temperature detector
  - DI Contact
- p3 Measurement range
- p4 Span left value
- p5 Span right value

Example Set channel 01 of slot 1 to the thermocouple type R,and set span left value to 0 °C, span right value to 1760.0 °C.

SR101, TC, R, 0, 1760.0

Comments
- For the p3 measurement range, see the range parameter table on Pages 4-7 and 4-8.
- Set the span in p4 and p5 within the setting range shown on pages 4-7 and 4-8.
- For p4 and p5 setting value, enter them within 6 digits excluding the decimal point. The decimal point is fixed. Refer to setting range on pages 4-7 and 4-8.

Setting DELTA(difference between channels)/ RRJC(remote RJC)

Setting SRp1, p2, p3<terminator>

- p1 Channel number (001 to 030)
- p2 DELTA/RRJC
- p3 Reference channel (01 to 29)
- p4 Span left value
- p5 Span right value

Example Set channel 10 of slot 2 to DELTA that is difference value from channel 01 of the same unit,and set span left value to -100.0, span right value to 100.0.

SR210, DELTA, 01, -100.0, 100.0

Comments
- As the reference channel, set a channel of the same unit as the channel to be set to DELTA or RRJC. In addition, the reference channel number must be smaller than the source channel number.
- For RRJC, input for the reference channel must be of a thermocouple type.
- If the input mode (type of input, scaling...) or the measurement range of the reference channel is changed, DELTA or RRJC setting is cleared. The input mode changes to the mode before the reference channel was changed.
- If any change has been made to the number, input mode (type of input or scaling), or measuring range of a given reference channel, the alarm setting of the channel for which the item “DELTA/RRJC” is being set changes to “OFF.”
- If any change has been made to the number or input mode (type of input or scaling) of a given reference channel, to the measuring range, or to the span of the set channel, the partial-expansion setting of the channel for which the item “DELTA/RRJC” is being set changes to “OFF.”
- Set the span in p4 and p5 within the setting range for the reference channel shown on pages 4-7 and 4-8.
- For p4 and p5 setting value, enter them within 6 digits excluding the decimal point. The decimal point is fixed. Refer to setting range on pages 4-7 and 4-8.
- RRJC setup is valid only for recorders with the optional computing function.

Setting Scaling

Setting SRp1, p2, p3, p4, p5, p6, p7, p8, p9<terminator>

- p1 Channel number (001 to 030)
  Conputation channel number (A01 to A30)
- p2 SCL
- p3 Type of input
  - VOLT DC voltage
  - TC Thermocouple
  - RTD Resistance temperature detector
  - DI Contact
  - mA DC current
- p4 Measurement range
- p5 Left value of span
- p6 Right value of span
- p7 Left value of scale (-30000 to 30000)
- p8 Right value of scale (-30000 to 30000)
- p9 Decimal point position of scale (0 to 4)

Example Change channel 02 of subunit 0 to an input in which 1 V is converted to 0.00 and 5 V to 100.00.
SR002, SCL, VOLT, 6V, 1000, 5000, 0, 10000, 2

Comments
- For the p4 measurement range, see the range parameter table on Pages 4-7 and 4-8.
- For the p5 and p6 setting spans, set them in the ranges shown in the setting range on Pages 4-7 and 4-8.
- For p5 and p6 setting values, enter them within 6 digits excluding the decimal point.
- Select either to set all three parameters, p7, p8 and p9, or to omit them all.

SN Sets the scaling unit.

Mode Operation mode

Setting SNp1, p2<terminator>

- p1 Channel number (001 to 030)
  Computation channel number (A01 to A30)
- p2 Unit character string (up to 6 characters)

Example Set the scaling unit for channel 01 slot 0 to ABCDEF.
SN001, ABCDEF

Comments
- For a character string that can be used as units, see the characters in Section 4.6, “ASCII Code Table.” However, note that a semi-colon “;” cannot be used.
- The optional computation channel number for a stand-alone model is A01 to A30.

XQ Sets the filter.

Mode Setup mode
Setting XQp1<terminator>
p1 ON Filter on
OFF Filter off
Example Insert a filter in the input.
XQON

XV Sets the measurement period.

Mode Setup mode
Setting XVp1<terminator>
p1 Measurement interval (2, 3, 4, 5, 6, 10, 12, 15, 20, 30, or 60)
Example Set the measurement period to 10 seconds.
XV10
Comments • The shortest measurement period that can be set differs depending on the A/D integration time and the filter on/off setting as follows.

Integration time: Equivalent to 50/60 Hz

Input module	Filter off	Filter on
10CH	2 s	3 s
20CH	2 s	4 s
30CH	2 s	4 s

Integration time: 100 ms

Input module	Filter off	Filter on
10CH	4 s	12 s
20CH	5 s	15 s
30CH	6 s	20 s

XI Sets the A/D integration time.

Mode Setup mode
Setting XIp1, p2<terminator>
p1 Subunit (0 to 5)
p2 Integration time (AUTO, 50 Hz, 60 Hz, 100 ms)
Example Set the A/D integration time in subunit 0 to 50 Hz.
XI0, 50Hz

5.2 Setting Alarms

SA Sets the alarm.

Mode Operation mode

Setting SAp1, p2, p3, p4, p5<terminator>

- p1 Channel number (001 to 030)
  Computation channel number (A01 to A30)
- p2 Alarm level (1 to 4)
- p3 Type of alarm
  - OFF No alarm setting
  - H High limit alarm
  - L Low limit alarm
  - dH Difference high limit alarm
  - dL Difference low limit alarm
  - RH Rate-of-change limit alarm on increase
  - RL Rate-of-change limit alarm on decrease
- p4 Alarm value
- p5 Output relay number (Off or relay number)

Example Set the high limit alarm (alarm value=1000) to level 1 of channel 02 of slot 0 and use relay module 1 in slot 5 of as an output when an alarm is generated.

SA002, 1, H, 1000, 051

Comments
- If the measurement range setting is SKIP, p3 can only be set to OFF.
- In the following cases, alarm settings in that channel are all canceled.
  Change in the type of input (VOLT, TC .....)
  Change in the measurement range
  Change in the indicating span or scaling value when the scaling indication is set (including a change in decimal point position)
  In differential input or RRJC, a change in reference channel number or type of input/ measurement range
  When the computation channel is set to on or off, or the computational expression or measuring span is changed
  When the wiring method and the input range of the power monitor module are change
- If contiguous channels are set to p1, the decimal point in alarm values when the measurement ranges for set channels differ take the positions determined for each measurement range (see Pages 4-7 to 4-9). If the result exceeds the measurable ranges, an error occurs. For example, if the channels of measurement ranges 20 mV, 2 V, and type T thermocouple are set to p1 and the alarm value is set to 10000, the following applies:
  - The alarm value for the channel of the 20 mV measurement range: 10.000 mV
  - The alarm value for the channel of the 2 V measurement range: 1.0000 V
  - The alarm value for the channel of the type T thermocouple: 1000.0°C
  - Since the measurement range of the type T thermocouple is -200.0 to 400.0°C, an error occurs. For decimal point positions, see Pages 4-7 to 4-9.
- If p3 is off, the parameters for p4 and p5 are invalid.
- The dH or dL setting for p3 is effective only when the input range is a differential input.
- If p3 is set to RH or RL, set the interval with the XA command.
- The setting ranges of p4 alarm values are given on Pages 4-7 to 4-9.
- Set the alarm value for the computation channel within the range of a given recording span.
- Enter the p4 alarm value with up to 6 characters, excluding the decimal point.
  For computation channels, set the alarm value in no more than 8 digits, excluding the decimal point.
- Setting the output relay number of a module that is not connected to p5 causes an error. For details on how to specify the relay number, see Page 4-4.
- Hysteresis should be set using the XA command.For optional computation channel, the hysteresis is fixed to 0.
- For the computation channel the only alarms, that can be set are the upper limit alarm(H) and lower limit alarm(L).
- The optional computation channel number is A01 to A30.

XA Performs alarm-related settings.

Mode Setup mode

Setting XAp1, p2, p3<terminator>

- p1 Interval for rate-of-change limit on increase (1 to 15)
- p2 Interval for rate-of-change limit on decrease (1 to 15)
- p3 Alarm hysteresis (0.0 to 1.0)
- p4 Retention or no retention of alarm display ON/OFF

Example Set the interval for the rate-of-change limit on increase to 10, the interval for the rate-of-change limit on decrease to 10, and the alarm hysteresis to 0.5% and the alarm display is no retention.

XA10, 10, 0.5, OFF

Comments
- This command sets the interval at which to detect the rate-of-change alarm and hysteresis.
- Set the interval using the measurement period as the unit.
- Set the hysteresis as a percentage of the measurement range.
- For optional computation channel, the hysteresis is fixed to 0.

XY Sets the re-alarm for a failure which recurs.

Mode Setup mode

Setting XYp1, p2<terminator>

- p1 Reflash number (1 to 6)
- p2 Off, relay number

Example Set reflash relay 1 to relay module 1 connected to slot 0 of unit 1.

XY1, 101

Comments
- Setting the output relay number in a module which is not connected to p2 causes an error. For details on how to specify relay numbers, see Page 4-4.

XN Sets AND/OR of the alarm output relay.

Mode Setup mode

Setting XNp1, p2<terminator>

- p1 Unit No.
  0 to 5
- p2 Relay number to be set to AND (01 to 60)
  NONE All are OR.
  01-XX (XX=01 to 60)
  Relays whose numbers are 1 to XX are set to AND.

Example Use No. 1 of slot 5 to No.10 of slot 5 in the alarm output relay module connected to the main unit as AND relay outputs.
XNI, 01-10

Comments
- The setting is effective only in the same unit.
- Set p2 with the first relay number (01=fixed) to the last relay number. If all OR outputs are to be set, set p2 to NONE.
- If a remote or output relay module is not connected to the specified unit, an error occurs.

XD Sets energizing or deenergizing.

Mode Setup mode

Setting XDp1, p2<terminator>
- p1 Relay number
- p2 Selection of energizing/deenergizing
  - ENERG Energizing
  - DE-EN Deenergizing

Example Set the relays of No. 1 in slot 5 to No. 10 in slot 5 to energizing outputs.
XD051-10, ENERG

Comments
- If a successive number of output relays are to be set, insert a minus sign (-) between the first relay number and the last relay number, as shown in the example. However, only relays in the same subunit can be successively set.
- If a remote or output relay module is not connected to the specified unit, an error occurs.

XH Sets the hold/non-hold.

Mode Setup mode

Setting XHp1<terminator>
- p1 Output relay hold on/off
  - ON Hold
  - OFF Non-hold

Example Hold the output state of an alarm output relay.
XHON

5.3 Setting the Display

UD Changes the display mode on the upper part of the display.

Mode Operation mode

Setting UDp1, p2<terminator>
- p1 Display mode
  - 0: Auto
  - 1: Manual
  - 2: Page
  - 3: Alarm search
- p2 Display channel number (001 to 030)

Example Display in Auto mode.
UD0

Comments
- p2 is effective if p1 is Manual, as shown on Page.
- The display modes are as follows:

  Auto
  Displays a channel after automatically selecting a channel.

  Manual
  Can freely change the channel to be displayed.

  Page
  The channel to be displayed can be changed every five channels. The channel number in p2 cannot be set to numbers other than those whose leastsignificant digit is 1 or 6.

  Alarm search
  Displays measured data in the channel in which an alarm occurs in turn.

MD Changes the display mode on the middle part of the display.

Mode Operation mode

Setting MDp1, p2, p3<terminator>
- p1 Display mode
  - 0: Auto
  - 1: Manual
  - 3: Alarm search
  - 4: Bargraph
  - 5: Alarm status
  - 6: Relay status
- p2 Display channel number (001 to 030)
  If p1 is the relay status, internal switches (S01 to S60) can be set.
  If p1 is in the manual mode or alarm status, and the optional computational functions or floppy disk drive functions are provided, the computational channel (A01 to A30) can be set.
- p3 Display channel number (001 to 030)

Example Display the alarm statuses for relay number 2 in slot 5.
MD5, 052

Comments
- The MD command is ineffective if the display mode for the upper part is “page.”
- If p1 is manual, set a channel to be displayed on the left side of the display with p2 and a channel to be displayed on the right side of the display with p3.
- P2 is effective when p1 is Manual, Alarm status, or Relay status, but is not effective when the display mode on the upper part is Manual 2.
- p3 is effective when p1 is Manual, but is not effective when the display on the upper part is Manual 2.

- The display modes are as follows:
  - Auto
    Displays a channel after automatically selecting a channel.
  - Manual
    Can freely change the channel to be displayed.
  - Alarm search
    Displays measured data in the channel in which an alarm occurs in turn.
  - Bargraph
    Displays measured data using a bargraph.
  - Alarm status
    Displays alarm statuses in up to 30 channels.
  - Relay status
    Displays statuses of up to 30 alarm output relays.

LD — Changes the display mode on the lower part of the display.

Mode: Operation mode
Setting: LDp1, p2, p3<terminator>
- p1: Display mode
  0: Auto
  1: Manual
  3: Alarm search
  5: Alarm status
  6: Relay status
  7: Date and time
- p2: Display channel number (001 to 030)
  If p1 is the relay status, internal switches (S01 to S60) can be set.
  If p1 is in the manual mode or alarm status, and the optional computational functions or floppy disk drive functions are provided, the computational channel (A01 to A30) can be set.
- p3: Display channel number (001 to 030)

Example: Display the measured value of channel numbers 1 and 3 in slot 5.
LD1, 051,053

Comments:
- The LD command is ineffective if the display mode for the upper part is "page."
- If p1 is manual, set a channel to be displayed on the left side of the display with p2 and a channel to be displayed on the right side of the display with p3.
- p2 is effective when p1 is Manual, Alarm status or Relay status.
- p3 is effective when p1 is Manual.
- The display mode is the same as that for the middle part.

XW — Set the switching time for the displayed channel in auto display.

Mode: Setup mode
Setting: XWp1<terminator>
- p1: Switching time for the displayed channel
  2, 3, 4, or 5 (seconds)

Example: Set the display switching time to 5 seconds.
XW5

Comments:
- Sets the display switching time when the display modes at the upper, middle, and lower parts are Auto. This is common to the upper, middle or lower parts.

5.4 Setting the Recording

SC — Sets the chart speed.

Mode: Operation mode
Setting: SCp1<terminator>
- p1: Paper feed speed (1 to 1500 mm/h)

Example: Set the paper feed speed to 100 mm/h.
SC100

SE — Sets the second chart speed.

Mode: Operation mode
Setting: SEp1<terminator>
- p1: Chart speed (1 to 1500 mm/h)
- p2: ABSOLUTE: Absolute time
  RELATIVE: Relative time
- p3: Time interval
  For ABSOLUTE
  1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 10 min, 12 min, 15 min, 20 min, 30 min, 1 h, 2 h, 3 h, 4 h, 5 h, 6 h, 8 h, 12 h, 24 h
  For RELATIVE,
  Fixed to 8 characters
  DD HH:MM
  DD: Day
  HH: Hour
  MM: Minute
- p4: Reference time (fixed to 5 characters)
  HH:MM
  HH: Hour
  MM: Minute

Example: Set the second chart speed to 50 mm/h and set timer to intervals of 15 minutes each starting at 15:15..
SE50, ABSOLUTE, 15 min, 15:15

Comments:
- p4 is effective when p2 is ABSOLUTE.
- In ABSOLUTE, the time interval set with p3 is used from the time set with p4.
- In RELATIVE, the time interval set with p3 is used from the time when the timer setting is completed, the power is turned on, or the set timer is executed.

SS — Selects the trend records/logging records (digital value).

Mode: Operation mode
Setting: SSp1, p2<terminator>
- p1: TREND (analog trend record)
  LOGGING (logging record)
- p2: Dot printing period
  AUTO (automatic selection)
  FIX

Example: Change the dot printing period to AUTO in trend recording.
SSTREND, AUTO

Comments:
- p2 (dot printing period) is effective when p1 is TREND.
- If the dot printing period is set to AUTO, the dot printing period is automatically changed according to the recording conditions.
- If the dot printing period is set to FIX, the dot printing period is the same as the measuring period. However, if the measuring period is 2 seconds or less, the dot printing period is fixed to 2 seconds.

SZ Sets the recording zone.

Mode Operation mode
Setting SZp1, p2, p3<terminator>
- p1 Channel number (001 to 030)
  Computation channel number (A01 to A30)
- p2 Lower limit of zone (0 to 245 mm, or 0 to 145 mm for the DR130)
- p3 Upper limit of zone (5 to 250 mm, or 5 to 150 mm for the DR130)

Example Set the recording zone of channel 6 in slot 3 to 10 to 50 mm.
SZ036, 10, 50

Comments
- Set p2 smaller than p3.
- This is effective for analog recording.
- The optional computation channel number for a stand-alone model is A01 to A30.

SP Sets partially expanded recording.

Mode Operation mode
Setting SPp1, p2, p3, p4<terminator>
- p1 Channel number (001 to 030)
  Computation channel number (A01 to A30)
- p2 ON/OFF of partially expanded recording
  - ON Performs partially expanded recording.
  - OFF Does not perform partially expanded recording.
- p3 Boundary recording position (1 to 99%)
- p4 Boundary value

Example Partially compress and record channel 6 in slot 3 at the boundary recording position of 25% for the boundary value 0 V.
SP036, 25, 0

Comments
- A waveform can be partially expanded by setting the set input level (boundary value) as a percentage of the recording chart (boundary recording position).
- This is effective for analog recording.
- If contiguous channels are set to p1, the decimal point in boundary values when the measurement ranges for set channels differ take the positions determined for each measurement range (see Pages 4-7 and 4-8). If the result exceeds the measurable ranges, an error occurs. For example, if the channels of measurement ranges 20 mV, 2 V, and type T thermocouple are set to p1 and the boundary value is set to 10000, the following applies:
  - The boundary value for the channel of the 20 mV measurement range: 10.000 mV
  - The boundary value for the channel of the 2 V measurement range: 1.0000 V
  - The boundary value for the channel of the type T thermocouple: 1000.0°C
    Since the measurement range of the type T thermocouple is -200.0 to 400.0°C, an error occurs. For decimal point positions, see Pages 4-7 and 4-8.
- The optional computation channel number for a stand-alone model is A01 to A30.
- Set p4 to a value within the recording span, or within the left/right scale if linear scaling is applied. It is not possible, however, to set the recording span nor the left/right scale.
- In the case of power monitor module, if the settings of the wiring method and the input range are changed, the partially expanded recording setting is set to OFF.

SG Sets or copies a message.

Message setting

Mode Operation mode
Setting SGp1, p2<terminator>
- p1 Message number (01 to 20)
- p2 Message character string (Up to 16 characters)

Example Set the message “test” to message No. 5.
SG05, test

Comments
- For details of the character strings that can be used in messages, see the characters in the table of ASCII codes on Page 4-11.

Message copy

Mode Operation mode
Setting SGp1, p2, p3<terminator>
- p1 COPY
- p2 Message number at a message source (01 to 20)
- p3 Message number at a message destination (01 to 20)

Example Copy message No. 5 to message No. 12.
SGCOPY, 05, 12

ST Sets a tag.

Mode Operation mode
Setting STp1, p2<terminator>
- p1 Channel number (001 to 030)
  Computation channel number (A01 to A30)
- p2 Tag character string (up to 16 characters)

Example Set “TEST” as the tag for channel 6 in slot 3.
ST036, TEST

Comments
- For details of the character strings that can be used as tags, see the characters in the table of ASCII codes on Page 4-10.
- The optional computation channel number for a stand-alone model is A01 to A30.

SH Sets a header.

Mode Operation mode
Setting SHp1, p2<terminator>
- p1 Setting line number (1 to 5)
- p2 Header character string

Example Set the line of number 2 to “TEST RECORDE.”
SH2, TEST RECORDE

Comments
- Set the character string to be printed in the first place of a record.
- For details of the character strings that can be used as headers, see the characters in the table of ASCII codes on Page 4-9.
- Parameter p2 can have no more than 60 characters for the DR130 and no more than 80 characters for the DR230/240.

SJ Sets a title.

Mode Operation mode
Setting SJp1<terminator>
- p1 Title character string (up to 32 characters)

Example Set the title to “TEST RECORDE.”
SJTEST RECORDE

Comments
- Sets a character string which is recorded in a fixed interval in analog recording. The interval to be recorded is set using the XR command (see 5-9).
- For details of character strings that can be used as titles, see the characters in the table of ASCII codes on Page 4-9.

SF Sets the format for list printing.

Mode Operation mode
Setting SFp1, p2, p3, p4<terminator>
- p1 ON/OFF of range list printing (ON, OFF)
- p2 ON/OFF of alarm list printing (ON, OFF)
- p3 ON/OFF of parameter list related to printing (ON, OFF)
- p4 ON/OFF of other parameters (ON, OFF)

Example Print the range list and alarm list but do not print the parameter list related to printing or the other parameter list.
SFON, ON, OFF, OFF

SB Sets whether interpolation is performed or not.

Mode Operation mode
Setting SBp1, p2<terminator>
p1 Channel number (001 to 030)
Computation channel number (A01 to A30)
p2 ON/OFF
Example Perform step interpolation for channel 6 in slot 3.
SB036, ON
Comments
- If step interpolation is performed, the space between recorded points is recorded .
- If two or more channels are step-interpolated in the same position, the recording priority depends on the recording color, and recording is done in the following order:
Black > blue-purple > magenta > navy blue > red > blue > brown > green > orange > yellow-green
For example, if two channels being recorded in black and in blue are step-interpolated in the same position, the overlapped parts are recorded in black.
- The optional computation channel number for a stand-alone model is A01 to A30.

PT Turns on or off every channel of trend record.

Mode Operation mode
Setting PTp1, p2<terminator>
p1 Channel number (001 to 030)
Computation channel number (A01 to A30)
p2 ON/OFF
Example Turn on the analog recording of channel 6 in slot 3.
PT036, ON
Comments
- The optional computation channel number for a stand-alone model is A01 to A30.

PD Turns on or off every channel of digital records.

Mode Operation mode
Setting PDp1, p2, p3<terminator>
p1 Channel number (001 to 030)
Computation channel number (A01 to A30)
p2 ON Records.
OFF Does not record.
p3 1 to 6 timer number (recording interval: Effective only when digital records are set for "multiple")
Example Perform digital recording of channel 6 in slot 3 at the interval of timer 2.
PD036, ON, 2
Comments
- The optional computation channel number for a stand-alone model is A01 to A30.

PM Turns on or off every channel of manual printing.

Mode Operation mode
Setting PMp1, p2<terminator>
p1 Channel number (001 to 030)
Computation channel number (A01 to A30)
p2 ON/OFF
Example Perform manual printing for channel 6 in slot 3.
PM036, ON
Comments
- The optional computation channel number for a stand-alone model is A01 to A30.

PA Turns on or off the alarm printing for every channel level.

Mode Operation mode
Setting PAp1, p2, p3, p4<terminator>
p1 Channel number (001 to 030)
Computation channel number (A01 to A30)
p2 Level (1 to 4)
p3 OFF No alarm printing
ON1 Printing when an alarm is generated
ON2 Printing when an alarm is generated or reset
p4 Selection of additional message
OFF Does not print an additional message.
01 to 20 Message number
Example When an alarm of level 2 of channel 6 in slot 3 is generated, print the alarm and message No. 5.
PA036, 2, ON1, 05
Comments
- When an alarm is generated or reset, the alarm generation time or alarm type is printed.
- If an additional message is specified, the message set with the SG command is also printed.
- The optional computation channel number for a stand-alone model is A01 to A30.

PC Turns on or off scale printing for every channel.

Mode Operation mode
Setting PCp1, p2<terminator>
p1 Channel number (001 to 030)
Computation channel number (A01 to A30)
p2 OFF No scale printing
ON1 Printing for every 20% of the scale length
ON2 Printing at 0% and 100% of the scale length
ON3 Printing at 0%, 50%, and 100% of the scale length
Example Print the scale of channel 6 in slot 3 of subunit 4 at positions 0%, 50% and 100%.
PC036, ON3
Comments
- For a channel for which recording is done in partially expanded recording, the following applies regardless of the p2 setting:
If the recording width is 100 mm or more, printing is carried out at positions 0%, 100% and at a point on the partially expanded recording boundary.
If the recording width is less than 100 mm but 50 mm or more, printing is carried out at positions 0% and 100%.
If the recording width is less than 50 mm, printing is not carried out.
- This is effective for analog recording channels.
- A channel whose recording width is less than 50 mm is not printed.
- If ON1 is set to a channel whose recording width is less than 150 mm, the setting is invalid. Printing is carried out at positions 0%, 50% and 100% only.
- If ON2 is set to a channel whose recording width is less than 100 mm, the setting is invalid. Printing is carried out at positions 0% and 100% only.
- The optional computation channel number for a stand-alone model is A01 to A30.

PL Turns ON or OFF list printing for every channel.

Mode Operation mode

Setting PLp1, p2<terminator>

- p1 Channel number (001 to 030)
  Computation channel number (A01 to A30)
- p2 ON/OFF

Example Perform list printing for channel 6 in slot 3
PL036, ON

Comments
- The optional computation channel number is A01 to A30.

XR Performs settings related to records.

Mode Setup mode

Setting XRp1, p2, p3, p4, p5, p6, p7, p8, p9, p10, p11<terminator>

- p1 CHANNEL Channel number recording/displaying
  TAG Tag recording/displaying
- p2 Number of characters recorded in a tag (7 to 16)
- p3 Analog trend recording mode
  - NORMAL Normal analog trend recording
  - ALARM1 Analog trend recording starts at an alarm occurrence.
  - ALARM2 Analog trend recording starts at an alarm occurrence and stops at an alarm reset.
  - GROUP Analog trend recording of a group set for an event action.
- p4 Turning on/off of chart speed change printing (ON, OFF)
- p5 Turning on/off of printing “PRINT ON” (ON, OFF)
- p6 Number of channels to be recorded in a line for time printing (1 to 4, only 1 or 2 for the DR130)
- p7 Channel printing interval
  - OFF No printing
  - 5.0 mm 5 mm
  - 12.5 mm 12.5 mm
- p8 Title printing interval
  - OFF No printing
  - 600 mm 600 mm
  - 1500 mm 1500 mm
- p9 Turning on/off of scale check (ON, OFF)
- p10 Logging record format
  - HORIZON Horizontal writing
  - VERTICAL Vertical writing
- p11 Selection of printing interval in logging or digital recording
  - SINGLE Logging printing is recorded at the time interval set in timer No. 1.
    In digital printing, the printing interval is automatically determined by the chart speed.
  - MULTIPLE Recording is done at the recording interval set for each channel.

Example Perform tag display/recording with 7 characters, analog recording when an alarm occurs, time printing in 4 channels in a line, channel printing interval of 12.5 mm, title printing with 600 mm interval, and horizontal writing of logging records and at the intervals set for each channel.
XRTAG, 7, ALARM1, OFF, OFF, 4, 12.5 mm, 600 mm, OFF, HORIZON, MULTIPLE

Comments
- Set the timer with the SI command (see 5-10).
- If p11 is set to MULTIPLE, recording is done at the interval set with the PD command.
- If p11 is set to SINGLE, the digital printout recording interval is automatically determined according to the chart speed, and the number ofchannels and rows in which numeric values are printed. For details, see the separate manual.

XC Sets dot printing colors.

Mode Setup mode

Setting XCp1, p2<terminator>

- p1 Channel number (001 to 030)
  Computation channel number (A01 to A30)
- p2 Dot printing color
  - PURPLE
  - RED
  - GREEN
  - BLUE
  - BROWN
  - BLACK
  - NAVY(Navy blue)
  - YEL-GR(Yellow-green)
  - RED-PR(Red-purple)
  - ORANGE

Example Record channel 6 in slot 3 in red-purple.
XC036, RED-PR

Comments
- The optional computation channel number is A01 to A30.

5.5 Other Settings

SD Sets the date and time.

Mode Operation mode

Setting SDp1, p2<terminator>

- p1 Date (year, month, day)
- p2 Time (hour, minute, second)

Example Set the clock in the DR230/DR240 to 1 o'clock pm, (0 min., 0 sec.) on July 1, 1996.

SD96/07/01, 13:00:00

Comments
- The formats for p1 and p2 are fixed at 8 characters. Set them in the following manner:
  p1 = YY/MM/DD (Last two digits of the year, month, day)
  p2 = HH:MM:SS (Hour:minute:second)
- Do not place space(s) before and after, or embed them in the parameter. Otherwise, an error occurs.

SV Sets a moving average.

Mode Operation mode

Setting SVp1, p2<terminator>

- p1 Channel number (001 to 030)
- p2 Number of moving averages (0 to 64)
  0 = Off

Example Take moving averages 64 times in the input, channel 01.

SV001, 64

SY Sets how to copy the channel setting parameters between channels.

Mode Operation mode

Setting SYp1, p2, p3, p4, p5-p6<terminator>

- p1 Copy range parameters including unit (ON, OFF)
- p2 Copy alarm parameters (ON, OFF)
- p3 Copy the other parameters (ON, OFF)
- p4 Copy source channel numbers (001 to 030)
  Computation channel number (A01 to A30)
- p5 First channel number of copy destination (001 to 030)
  Computation channel number (A01 to A30)
- p6 Last channel number of copy destination (01 to 30)

Example Copy only the range setting data in channel 01 of slot 0, to channel 01 to channel 10 of slot 1.

SYON, OFF, OFF, 001, 011-020

Copy only the range setting data in channel 02 of slot 0, to channel 03 of slot 0.

SYON, OFF, OFF, 002, 003

Comments
- If the copy command is to be applied to successive channels, insert a minus sign (-) between the first channel number and the last channel number. However, only channels in the same subunit can be set successively.
- The optional computation channel number for a stand-alone model is A01 to A30.
- No copying is possible between measurement and computation channels.

SX Sets channels in a group.

Mode Operation mode

Setting SXp1, p2<terminator>

- p1 Group number (G01 to G07)
- p2 Channel number (up to 36 characters)

Example Set channels from channel 1 in slot 1 to channel 10 in slot 1, channel 5 in slot 2 to group 3.

SXG03, 011-020, 025

Comments
- Delimit the channels set in p2 with a comma (,). For successive channels, insert a "-" (minus) between the first and last channels.

SI Sets the timer.

Mode Operation mode

Setting SXp1, p2, p3, p4<terminator>

- p1 Timer number (1 to 6)
- p2 ABSOLUTE: Absolute time
  RELATIVE: Relative time
- p3 Time interval
  For ABSOLUTE
  1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 10 min, 12 min, 15 min, 20 min, 30 min, 1 h, 2 h, 3 h, 4 h, 5 h, 6 h, 8 h, 12 h, 24 h
  For RELATIVE,
  Fixed to 8 characters
  DD HH:MM
  DD: Day
  HH: Hour
  MM: Minute
- p4 Reference time (fixed to 5 characters)
  HH:MM
  HH: Hour
  MM: Minute

Example Set timer No. 3 to intervals of 15 minutes each starting at 15:15.

SI3, ABSOLUTE, 15 min, 15:15

Comments
- p4 is effective when p2 is ABSOLUTE.
- In ABSOLUTE, the time interval set with p3 is used from the time set with p4.
- In RELATIVE, the time interval set with p3 is used from the time when the timer setting is completed, the power is turned on, or the set timer is executed.

SQ Sets a match time.

Mode Operation mode

Setting SQp1, p2<terminator>

- p1 Match time number (1 to 3)
- p2 Time (fixed to 11 characters)
  DD HH:MM (day hour:minute)

Example Set a match time 1 at 12:00 on the 15th day.

SQ1, 15 12:00:00

Comments
- When the time set here is reached, the operation set for the match time is executed.

SL Sets an event/action.

Mode Operation mode

Release of event/action setting

Setting SLp1, p2<terminator>

- p1 event/action box number (01 to 30)
- p2 NONE

Event action setting by an alarm or chart end event

Setting SLp1, p2, p3, p4, p5<terminator>

- p1 Event action box number (01 to 30)
- p2 Event (ALARM, CHART_END)
- p3 Action mode (EDGE, LEVL)
- p4 Action
  - ALARM_ACK Acknowledgement of alarm status.
  - ALARM_RST Alarm reset
  - TIMER_RST Timer reset
  - RECORD Record start/stop
  - SPEED_CHG Change to second chart speed
  - MSG_PR Message print
  - MANUAL_PR Manual print

MSG_DISP Display message
DIGITAL_PR Digital print
GR_TREND Trend recording in groups
MEMRY Store measured/computed data on a RAM disk or write them to DR.
FLOPY Store setup data on a floppy disk or write them to DR.
MATH Computation start/stop/reset/clear

p5 Auxiliary action information
- For p4=RECORD, selection of record start or stop (ON, OFF)
- For p4=MSG_PR or MSG_DISP, message number (01 to 20)
- For p4=GR_TREND, group number (G01 to G07)
- For p4=MEMRY
  DATA_WR When the data retention period is LOGIC, measured/computed data are stored at every measurement for each event action.
  WR_TRG Measured/computed data are stored.
  RD_TRG Measured/computed data are read.
  LD_TRG1 Setting data are read.
  LD_TRG2 Setting data are read.
  LD_TRG3 Setting data are read.
- For p4=FLOPY
  LD_TRG1 Setting data are read.
  LD_TRG2 Setting data are read.
  LD_TRG3 Setting data are read.
- For p4=MATH
  START Computation starts.
  STOP Computation stops.
  RESET Computed data are reset.
  CLEAR Computed data are cleared.

Event function setting by a remote, relay, timer, manual function key or match time event

Setting SLp1, p2, p3, p4, p5, p6<terminator>

p1 Event action box number (01 to 30)
p2 Event (REMOTE, RELAY, TIMER, MFUNC_KEY, MATCH_TIME)
p3 Auxiliary action information
- For p2=REMOTE, contact number (1 to 12)
- For p2=RELAY, relay number
- For p2=TIMER, timer number (1 to 6)
- For p2=MFUNC_KEY, MFUNC_KEY number (1 or 2)
- For p2=MATCH_TIME, match time number (1 to 3)

p4 Action mode (EDGE, LEVL)
p5 Action
ALARM_ACK Acknowledgement of alarm status.
ALARM_RST Alarm reset
TIMER_RST Timer reset
RECORD Record start/stop
SPEED_CHG Change to second chart speed
MSG_PR Message print
MANUAL_PR Manual print
MSG_DISP Display message
DIGITAL_PR Digital print
GR_TREND Trend recording in groups
MEMRY Store measured/computed data on a RAM disk or write them to DR.
FLOPY Store setup data on a floppy disk or write them to DR.
MATH Computation start/stop/reset/clear

p6 Auxiliary action information
- For p5=RECORD, record start/stop selection (ON, OFF)
- For p5=MSG_PR, MSG_DISP, message number (01 to 20)
- For p5=GR_TREND, group number (G01 to G07)
- For p5=MEMRY
  DATA_WR When the data retention period is LOGIC, measured/computed data are stored at every measurement for each event action.
  WR_TRG Measured/computed data are stored.
  RD_TRG Measured/computed data are read.
  LD_TRG1 Setting data are read.
  LD_TRG2 Setting data are read.
  LD_TRG3 Setting data are read.
- For p5=FLOPY
  LD_TRG1 Setting data are read.
  LD_TRG2 Setting data are read.
  LD_TRG3 Setting data are read.
- For p5=MATH
  START Computation starts.
  STOP Computation stops.
  RESET Computed data are reset.
  CLEAR Computed data are cleared.

Example Set an event action to record message number 04 when the chart ends in event action box 02.
SL02, CHART_END, EDGE, MSG_PR, 04

Comments
- With an action as the start (event), another action (action) can be executed automatically.
- Thirty types of event actions can be set.
- If the action mode is EDGE, the set action continues even if the event action is over.
- If the action mode is set to LEVL and the action is set to RECORD, SPEED_CHG, GR_TREND, or MATH, the set action continues from the first event occurrence to the next event occurrence.
- If the event is set to TIMER, MFUNC_KEY or MATCH_TIME, the action mode to LEVL, and the action to RECORD, the set action continues from the first event occurrence to the next event occurrence.
- For details on an event/action, see the separate manual (IMDR231-01E).

SO Sets the computational expression.

Mode Operation mode

Setting SOp1, p2, p3, p4, p5, p6<terminator>

p1 Channel for computation: A01 to A30
p2 Computation on/off (on/off)
p3 Computational expression (up to 40 characters)

p4 Span left value (-9999999 to 99999999)
p5 Span right value (-9999999 to 99999999)
p6 Position of decimal point for span (0 to 4)

Example 1 Set the sum of channel numbers 001 and 002 to channel A01 for computation. Set -10.0000 to 15.0000 for the span.
SOA01, ON, 001+002, -100000, 150000, 4

Example 2 Set the data in channel number 003, which are stored in the built-in RAM disk to channel number A02 for computation. Set -100,000 to 150.000 for the span.
SOA02, ON, M003, -100000, 150000, 3

Comments
- This command is effective only with optional computation functions or a floppy disk drive function.
- With a floppy disk drive function applied, if you attempt to read data stored on the floppy disk drive, assign a new channel number to the computation expression.
  Measurement date
  M001 to M030
  Computation data
  MA01 to MA30
- With a floppy disk drive function applied, but without computation functions, you cannot use operators. For operators, see the Appendix at the end of this manual.
- p4, p5, and p6 may be omitted.
- If successive channels are set, place a "-" (hyphen) between the first and last channels.

SK Sets the computational constants.

Mode Operation mode

Setting SKp1, p2 <terminator>
p1 Computational constant number: K01 to K30
p2 Constants

Example Set 300 to a computational constant K10.
SKK10, 300

Comments
- This command is effective only with the optional computation functions.
- Constant setting ranges are -1.0000E35 to -1.0000E-35, 0, 1.0000E-35 to 1.0000E35.

CM Sets communication input data.

Mode Operation mode

Setting CMp1, p2 <terminator>
p1 Communication input data number: C01 to C30
P2 Numeric value: -32000 to 32000

Example Set 300 to the communication input data number C10.
CMC10, 300

Comments
- This command is effective only with the optional computation functions.
- The position of the decimal point is selected according to the position of the decimal point set for the span with SO command. So you can set communications input data without taking the decimal point into consideration.

MH Sets the channel for setting data that are stored on a RAM disk.

Mode Operation mode

Setting MHp1, p2 <terminator>
p1 Channel number/channel number for computation
p2 On/off

Example Assume that the setting data in channels A01 to A05 for computation are stored.
MHA01-A05, ON

Comments
- This command is effective only with a floppy disk drive function.
- If successive channels are set, place a "-" (hyphen) between the first and last channels.
- Channel numbers are recognized in the order of input channel and channel for computation. If 005-A10 is set, the objective channels that are set are from input channel 005 to the last channel including channels A01 and A10 for computation.

SW Set the summer-winter time

Mode Operation mode

Setting SWp1,p2<terminator>
p1 Summer time or Winter time
SUMMER Summer time
WINTER Winter time
p2 Changing time

Example Change to summer time at 12clock 15th June 1996
SWSUMMER,96/06/15 12

XK Sets the key lock.

Mode Setup mode

Setting XKp1, p2, p3, p4, p5, p6, p7, p8<terminator>
p1 USE Uses the key lock.
NOT Does not use the key lock.
p2 RECORD key (LOCK, FREE)
p3 FEED key (LOCK, FREE)
p4 PRINT key (LOCK, FREE)
p5 FUNC key (LOCK, FREE)
p6 P.FUNC1 key (LOCK, FREE)
p7 P.FUNC2 key (LOCK, FREE)
p8 Pass number (0 to 9999)

Example Lock the RECORD, FEED, PRINT keys and set the password number to 123.
XKUSE, LOCK, LOCK, LOCK, FREE, FREE, FREE, 123

XF Sets the function to be displayed on the function screen.

Mode Setup mode

Setting XFp1, p2<terminator>
p1 Content to be displayed on the function screen.
ALARM_ACK
Acknowledgment of current alarm status
ALARM_RESET
Alarm is reset.
TIMER_RESET
Timer is reset.
KEY_LOCK_ON
Key lock is turned on.
MATH_START
Starts computation.
MATH_CLR_START
Clears computation results then re-start computation.
MATH_STOP
Stops computation.
MATH_ACK
Clears the computation status indication.

KEY_LOCK_OFF
Key lock is turned off.
S/U_LIST_START
Setup list printing starts.
S/U_LIST_STOP
Setup list printing is stopped.
MSG_PRINT
Message printing begins.
ALM_BUF_CLEAR
Alarm buffer is cleared.
MSG_BUF_CLEAR
Message buffer is cleared.
RAM_INIT
Internal memory is initialized.
COMM_INF
Information on communication module parameter
MODULE_INF
Module information
ALL_ITEM
All items of parameter p1

p2 Type of screen
OFF No display on the function screen
FUNC1 Screen that appears when the FUNC key is pressed.
FUNC3 Screen that appears when the FUNC key is pressed for 3 seconds.
INIT Initialize (Effective only when p1 is set to ALL_ITEM.)

Example Display setup list printing start on the FUNC1 screen.
XFS/U_LIST_START, FUNC1

Comments
- More than one function can be displayed on each function screen.
- A function can be easily executed by being displayed on the function screen.

XS Sets which settings are to be displayed on the setting screen.

Mode Setup mode

Setting XSp1, p2<terminator>

p1 Contents to be displayed on the set screen
SYSTEM: System settings
UNIT Unit settings
MATH Settings for computation of respective computation channels
CONST Settings for computation constants
MEMORY Settings relating to data saving/reading in the built-in RAM disk
FLOPPY Settings relating to data saving/reading on floppy disks
ZONE Zone recording settings
PARTIAL partially expanded record settings
CHART2 Second chart speed settings
TAG Tag settings
TIMER Timer settings
LOGIC Logic settings
MESSAGE Message settings
GROUP Group settings
TREND Turning on or off analog records for each channel
DIGITAL_PR Turning on or off digital records for each channel
LIST_PR Turning on or off list printing for each channel
MANUAL_PR Turning on or off manual printing for each channel
SCALE_PR Turning on or off scale printing for each channel
ALARM_PR Turning on or off alarm printing for each channel
HEADER Header settings
TITLE Title settings
MOVE_AVE Moving average settings
INTERPOL Step interpolation settings
MATCH_TIME Match time settings
LIST_FMT List printing format settings
COPY Copy contents settings
DST Summer/winter time
ALL_ITEM All items of parameter p1

p2 Type of screen
OFF Nothing appears on the set screen.
SET Screen when the set key is pressed
SET3 Screen when the set key is pressed for 3 seconds
INIT Initialize. (Effective only when p1 is set to ALL_ITEM.)

Example Show the settings of a tag on the screen for which you have pressed the SET key.
XSTAG, SET

Comments
- More than one setting item can be displayed on the set screen.
- By displaying a setting item on the set screen, the setting item can be easily set.
- MATH in parameter p1 is valid only for recorders with the optional computing function or floppy disk drive function.
- CONST is valid only for recorders with the optional computing function.
- MEMORY and FLOPPY are valid only for recorders with the floppy disk drive function.

XB Sets the burnout.

Mode Setup mode

Setting XBp1, p2<terminator>

p1 Channel number (001 to 030)
p2 Selection of burnout
OFF
UP Upscale traveling beyond the scale
DOWN Downscale traveling beyond the scale

Example Set channels 01 to 10 of subunit 0 to upscale burnout.
XB001-10, UP

Comments
- If channels are to be set successively, the setting is effective only when the channels are in the same unit.

XJ Selection of reference junction compensation

Mode Setup mode

Setting XJp1, p2, p3<terminator>

p1 Channel number (001 to 030)
p2 Selection of reference junction compensation value
INT Internal compensation circuit
EXT External junction compensation
p3 External reference junction compensation value (-20000 to 20000)

Example Set channel 01 of subunit 0 to external junction compensation at a compensation value of 1000 μV
XJ001, EXT, 1000

Comments • For p2 = INT, parameter p3 is ineffective.
• The unit of p3 is μV.

XG Sets computation error handling.

Mode Operation mode
Setting XGp1, p2, p3, p4<terminator>
p1 Computation error handling (+OVER/-OVER)
p2 Scale unit for TLOG computation (OFF, /SEC, /MIN, /HOUR)
p3 Handling of abnormal data in a channel for TLOG computation
ERROR Handled as computation error.
SKIP Abnormal data are skipped (ignored) and computations are executed.
p4 Handling of overflow data in a channel for TLOG computation
ERROR Handled as computation error.
SKIP Abnormal data are skipped (ignored) and computations are executed
LIMIT If linear scaling has been set, its upper- and lower-limit values are computed. If it has not been set, the upper- and lower-limit values in the measurement range are computed.
p5 handling of data for TLOG.PSUM(only for PULSE input module)
OVER A result of the computational expression TLOG.PSUM (XXX) exceeding 99999999 as an overflow
ROTATE A result of the computational expression TLOG.PSUM (XXXX) exceeding 99999999 to continue computing with the value following 99999999 reset to 0.
Example Compute computation error as +OVER and TLOG computation scale value as off, and ignore abnormal data in a channel and overflow data in a channel for computation and a result of the computational expression TLOG.PSUM (XXX) exceeding 99999999 as an overflow. .
XG+OVER, OFF, SKIP, SKIP, OVER
Comments • This command is effective only with the optional computation functions.
• p2 is effective for the totalization of flow signals, which are expressed in engineering units — /s, / min, /h.
If p2 is set according to the input unit, the measurement data are computed based on that unit at the specified measurement intervals. For example, set the measurement interval to 2s, the input value to 100 m3/min, and p2 to /MIN. By doing this, because 2s/60s is multiplied for each measurement interval, then after 1 minute, approximate actual input values are obtained.

XT Sets the temperature unit

Mode Setup mode
Setting XTp1<terminator>
p1 Temperature unit
C °C
F °F
Example Set temperature unit to °C
XTC

XL Sets the language

Mode Setup mode
Setting XLp1<terminator>
p1 Language
ENGLISH
GERMAN
FRENCH
Example Set temperature unit to GERMAN
XTGERMAN

XE Establishes the contents of the setup mode setting.

Mode Setup mode
Setting XEp1<terminator>
p1 Selection of establishment or destruction
STORE Establishment
ABORT Destruction
Example Store a parameter set in the setup mode in NVRAM.
XESTORE
Comments • A parameter set in the setup mode becomes ineffective if the mode is changed without executing STORE. After setting all parameters in the setup mode, you must store the set data in the internal memory using the XE command. After normal processing with the XE command, the mode is transferred to the operation mode.
• Since execution of the XE command takes an indefinite time, return an ACK after the processing is completed. On the controller side, execute the next processing after receiving an ACK after transmitting the XE command. The format of the ACK status is as follows:
E0Cr+Lf The processing of a received command completed normally.
E1Cr+Lf There is an error in the received command.

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5.6 Control and Execution Command

PS Starts or stops recording.

Mode Operation mode
Setting PSp1<terminator>
p1 0 Recording starts.
1 Recording stops.

MP Starts or stops manual printing.

Mode Operation mode
Setting MPp1<terminator>
p1 0 Manual printing starts.
1 Manual printing stops.
Example Start manual printing.
MP0

LS Starts or stops list printing.

Mode Operation mode
Setting LSp1<terminator>
p1 0 List printing starts.
1 List printing stops.
Example Start list printing.
LS0

HD Starts or stops header printing.

Mode Operation mode
Setting HDp1<terminator>
p1 0 Header printing starts.
1 Header printing stops.
Example Start header printing.
HD0

SU Starts or stops setup list printing.

Mode Operation mode
Setting SUp1<terminator>
p1 0 Setup list printing starts.
1 Setup list printing stops.
Example Start setup list printing.
SU0

MS Starts message printing.

Mode Operation mode
Setting MSp1<terminator>
p1 01 to 20 (message number)
Example Start printing message No. 5.
MS05

AK Confirms the current alarm status.

Mode Operation mode
Setting AKp1<terminator>
p1 0 Confirms the current alarm status.
Example Confirm the current alarm status.
AK0

AR Resets an alarm.

Mode Operation mode
Setting ARp1<terminator>
p1 0 The alarm is reset.
Example Reset the alarm.
AR0

IR Resets the timer.

Mode Operation mode
Setting IRp1<terminator>
p1 0 The timer is reset.
Example Reset the timer.
IR0

AC Clears the alarm buffer.

Mode Operation mode
Setting ACp1<terminator>
p1 0 The alarm buffer is cleared.
Example Clear the alarm buffer.
AC0

MC Clears the message buffer.

Mode Operation mode
Setting MCp1<terminator>
p1 0 The message buffer is cleared.
Example Clear the message buffer.
MC0

EX Computation start/stop, restart of computed data after they are cleared, and release of statuses after completing measurement.

Mode Operation mode
Setting EXp1<terminator>
p1 Computation start/stop, restart of computed data after they are cleared, and execution of releasing statuses after completing measurement.
0: Computation start
1: Computation stop
2: Restart of computed data after they are cleared
3: Computed data clear
4: Release of statuses after completing measurement
Example Start the computation.
EX0
Comments
- This command is effective only with the optional computation functions or a floppy disk drive function.
- If MATH is set for level action in the event/action, a computation start/stop/start after clearing the computed data cannot be done using EX command.
- This command is not executable during the saving/reading of setup data.

MW Stores the measured data/computed data on a RAM disk.

Mode Operation mode
Setting MWp1, p2, p3, p4, p5<terminator>
p1 Retention mode
DIRECT Data storage starts immediately after sending an MW command.
TRIGER Data storage starts after a trigger signal is generated.
REPEAT Specified data are repeated for storage each time the trigger signal is generated.
p2 File name (up to eight characters for other than REPEAT, up to five characters for REPEAT)

p3 Retention interval
INTVL Data are stored at measurement intervals.
1 min/2 min/5 min/10 min Data are stored at specified intervals.
LOGIC Data are stored each time the specified event is generated.
p4 Data length
(10, 20, 40, 50, 100, 200, 300, 400, 500, 1k, 2k, 3k, 4k, 5k, 10k, 20k, 30k, 40k, 50k)
p5 Pretrigger

Example After generating a trigger signal, store only a file of data length of 3K of the measured
data. Set the retention interval at 2 min, the pretrigger to 10%.
MWTRIGER, TEST, 2 min, 3K, 10

Comments
- This command is effective only with a floppy disk drive function.
- If p3 is in DIRECT mode, the pretrigger setting for p5 will be invalid.
- The FUNC key and event/action functions are available as trigger features.
- If p1 is in the TRIGGER or REPEAT mode, the event/action functions need to set MEMRY:WR _TRIG for its action.
- If LOGIC3 is set for p3, the event/action functions need to set MEMRY:DATA_WR for their action.
- AUX, CON, PRN, NUL, or CLOCK cannot be used in a file name. In addition, no space can be used for the first character.
- When the pretrigger is set, the data ranges that have been set before generating a trigger signal are stored. Pretrigger setting is done in a percentage of the data length. If 0 is set, the data before generating a trigger signal cannot be stored.

MR Reads measured data that have been stored on a RAM disk.

Mode Operation mode
Setting MRp1, p2, p3<terminator>
p1 Read mode
DIRECT Reads measured data immediately after sending a MR command.
TRIGGER Reads measured data after generating a trigger signal.
p2 File name (up to eight characters)
p3 Selection to begin reading data (YES/NO)

Example Read the measured data of a file name TEST immediately after sending an MR
command.
MRDIRECT, TEST, YES

Comments
- This command is effective only with an optional floppy disk drive function.
- If the read mode is in TRIGGER, the setting of p3 will be invalid.
- If p1 is in the TRIGGER mode, the event/action functions need to set MEMRY:RD_TRIG for their action.

MV Stores setting data on a RAM disk.

Mode Operation mode
Setting MVp1<terminator>
p1 File name (up to eight characters)

Example Store the setting data with the file name SET1.
MVSET1

Comments
- This command is effective only with a floppy disk drive function.
- Data set in the setup mode cannot be stored. To store the data seting in the setup mode, use a YV command.

ML Reads set data from the RAM disk.

Mode Operation mode
Setting MLp1, p2<terminator>
p1 Method of reading the set data:
DIRECT Starts reading immediately after sending an ML command.
TRIG1 to 3 Starts reading at the same time as an event occurrence in event/action functions.
p2 File name (up to eight characters)

Example Read the set data with the file name SET1 immediately.
MLDIRECT, SET1

Comments
- This command is effective only with an optional floppy disk drive function.
- Setting data in the setup mode cannot be read. To read the setting data in setup mode, use YL command.
- If any of TRIG1 to 3 is set to p1, the event/action functions need to set MEMRY:LD_TRG1 to 3 for their action.
- This command is not executable during computation.

ME Deletes a file on a RAM disk.

Mode Operation mode
Setting MEp1, p2<terminator>
p1 Type of file
DATA measured/computed data
PANEL Setting data
p2 File name (up to eight characters)

Example Delete a file with measured data (TEST)
MEADATA, TEST

Comments
- This command is effective only with an optional floppy disk drive function.
- A setting data file in the setup mode cannot be deleted. To delete it, use YE command.

MY Makes a copy of files between the RAM and floppy disks.

Mode Operation mode
Setting MYp1, p2, p3, p4, p5, p6, p7, p8<terminator>
p1 Copy destination/copy source
TO_FDD Copies a file from the RAM disk to the floppy disk.
FROM_FDD Copies a file from the floppy disk to the RAM disk.
p2 Type of file
DATA Measured/computed data
PANEL Seting data
p3 File name (up to eight characters)
p4 ASCII conversion on/off
p5 First channel number for ASCII conversion
p6 Last channel number for ASCII conversion
p7 First data number for ASCII conversion
p8 Last data number for ASCII conversion

Example Make an ASCII conversion of data numbers 1 to 100 from the input channels 005 to
010 in the file TEST on the RAM disk and make a copy of them on a floppy disk.
MYTO _FDD, DATA, TEST, ON, 005, 010, 1, 100

Comments
- This command is effective only with an optional floppy disk drive function.
- Parameters from p4 to p8 are effective only when p2 is set to DATA.
- Parameters from p5 to p8 are effective only when p4 is on.
- Parameters p7 and p8 are set in the range from 1 to the last data number in the file.
- Channel numbers are recognized in the order of input channel and channel for computation. If you set 005 for the first channel and A10 for the last channel, an ASCII conversion will be made in input channel 005 to the last input channel as well as channels A01 to A10 for computation.
- This command is not executable during computation.

FV Stores setting data on a floppy disk.

Mode Operation mode
Setting FVp1<terminator>
p1 File name (up to eight characters)
Example Store the setting data with the file name SET1.
FVSET1
Comments
- This command is effective only with an optional floppy disk drive function.
- Setting data in the setup mode cannot be stored. To store them, use a YV command.
- This command is not executable during computation.

FL Reads the setting data from a floppy disk.

Mode Operation mode
Setting FLp1 p2<terminator>
p1 Method of reading data:
DIRECT Starts reading data immediately after sending an FL command.
TRIG1 to 3 Starts reading data at the same time as an event occurrence in event/action functions.
p2 File name
Example Read setting data with the file name SET1 immediately.
FLDIRECT, SET1
Comments
- This command is effective only with an optional floppy disk drive function.
- Setting data in the setup mode cannot be read. To read them, use a YL command.
- If TRIG1 to TRIG3 are set to p1, event/action functions need to set FLOPY:LD_TRG1 to 3 for their actions.
- This command is not executable during computation.

FE Deletes a file on a floppy disk.

Mode Operation mode
Setting FEp1<terminator>
p1 File name
Example Delete the file SET2.
FESET2
Comments
- This command is effective only with an optional floppy disk drive function.
- A data file in the setup mode cannot be deleted. To delete it, use a YE command.

YV Stores set data in the setup mode on a floppy disk.

Mode Setup mode
Setting YVp1<terminator>
p1 File name (up to eight characters)
Example Store set data in the setup mode with the file name SET1.
YVSET1
Comments
- This command is effective only with an optional floppy disk drive function.

YL Reads set data in the setup mode from a floppy disk.

Mode Setup mode
Setting YLp1<terminator>
p1 File name (up to eight characters)
Example Read set data in the setup mode, which are on the disk with the file name SET1.
YLSET1
Comments
- This command is effective only with an optional floppy disk drive function.

YE Deletes a file on a floppy disk (Setup Mode).

Mode Setup mode
Setting YEp1<terminator>
p1 File name
Example Delete the file SET2.
YESET2
Comments
- This command is effective only with an optional floppy disk drive function.

BL Executes the initial balancing of the strain input channel

Mode Operation mode
Setting BLp1, p2, p3<terminator>
p1 The first channel for executing the initial balancing
p2 The last channel for executing the initial balancing
p3 Select either initial balancing or initialization
EXEC: Execute initial balancing
INIT: Execute initialization
Example Execute initial balancing on subunit 0 and channels 01 to 08.
BL001, 008, EXEC
Comments
- Channels other than strain input channels or channels that are not connected within the specified range are ignored.
- If initial balancing is executed, number-of-channels worth of data are returned in the following format.
S1 S2 CCC DDCrLf
S1: Data status 1
N: Normal
S: SKIP
S2: Data status 2
Space: Data in the middle
E: Data at the end
CCC: Channel number
DD: Result of the initial balancing
OK: Initial balancing succeeded
NG: Initial balancing failed
DF: Default values set
_: Skip module

RC Initialize the set values.

Mode Operation mode

Setting RCp1<terminator>

p1 0 The set values are initialized.

Example Initialize the operation mode parameters (measuring range, unit, alarm, date & time, and moving average).

RC0

Comments
- Since it takes an indefinite time to execute the RC command, return an ACK after processing. On the controller side, execute the following processing after receiving an ACK after transmitting the RC command. The format of the ACK status is as shown below.

  E0Cr+Lf The received command was normally processed.

  E1Cr+Lf There is an error in the received command.
- After executing the command, the clock is initialized to 96/01/01 00:00:00.

DS Transfers the setting mode.

Mode All modes

Setting DSp1<terminator>

p1 0 Transfers to operation mode.
1 Transfers to setup mode.
2 Transfers to A/D calibration mode.

Example Transfer the DR230/DR240 mode to the setup mode.

DS1

Comments
- Since it takes an indefinite time to execute the DS command, return an ACK after processing. On the controller side, execute the following processing after receiving an ACK after transmitting the DS command. The format of the ACK status is as shown below.

  E0Cr+Lf The received command was normally processed.

  E1Cr+Lf There is an error in the received command.

5.7 Data Output Request Command

TS Selects the output data.

Mode All modes (A/D calibration data output is limited to A/D calibration mode only.)

Setting TSp1<terminator>

p1 0 Measured data output
1 Setting data output
2 Unit data output
4 Report data output
5 System configuration data output
8 A/D calibration data output
9 Setting data output in setup mode

Comments
- The setting for p1=0, 1 or 2 is effective only in the operation mode.
- The setting for p1=8 is effective only in the A/D calibration mode.
- The setting “p1=3” is valid only for recorders with a floppy disk drive function .
- Do not output data from the RAM disk using a TS3 command during computation.
- The setting, p1=4 is effective when the instrument has the report function and one of hourly, daily and monthly reports is ON.

FM Selects the output format for measured/computed data.

Mode Operation mode

Setting FMp1, p2, p3<terminator>

p1 0 Outputs measured data in ASCII format.
1 Outputs measured data in binary format.
2 Outputs computed data in ASCII format.
3 Outputs computed data in binary format.

p2 First output channel (001 to 030)
First output computed channel (A01 to A30)

p3 Last output channel (001 to 030)
Last output computed channel (A01 to A30)

Comments
- You must specify data to be output with the TS command and execute “GET” or “ESC T”before sending the FM command.
- The command selects the output format of measured/computed data, either ASCII or binary, and the output channel.
- If no input channel is recognized by the DR130/DR230/DR240 among the specified channels, a syntax error occurs.
- The setting “p1=2” or “p1=3” is valid only for recorders with the optional computing function or floppy disk drive function.
- The optional computation channel numbers are A01 to A30.

MF Sets the output formats of the measured data/computed data on a RAM disk.

Mode Operation mode

Setting MFp1, p2, p3, p4, p5, p6<terminator>

p1 Output contents
0 File directory
1 Measured/computed data output in ASCII format.
2 Measured/computed data output in binary format
3 On/off information on channel on which specified file exists

p2 File name (up to eight characters)
p3 First output channel number
p4 Last output channel number
p5 First output data number
p6 Last output data number

Comments
- This command is effective only with an optional floppy disk drive.
- Always specify data that are output with TS command before sending MF command, and execute [GET] or [ESCT].
- If p1 is set to 0 (file directory), the settings for p2 to p6 will be invalid.
- If p1 is set to 3 (on/off information on the channel on which the specified file exists), the settings for p5 and p6 will be invalid.
- Parameters p5 and p6 are set in the range from 1 to the last data number in a file.
- Channel numbers are recognized in the order of input channel and channel for computation. If you set 005 for the first channel and A10 for the last channel, the target computation will be done in input channel 005 to the last input channel as well as channels A01 to A10.

RF Selects the output format of the report.

Mode Operation mode
Setting RFp1, p2, p3<terminator>
p1 0 Output hourly report data
1 Output daily report data
2 Output monthly report data
3 Output the status of the hourly/daily/monthly data
p2 First channel for output (R01 to R30)
p3 Last channel for output (R01 to R30)

Comments
- Before transmitting the RF command, be sure to specify the data to output using the TS command and execute "GET."
- If the daily report is to be output using extended format, the extended information must be output within 1 hour from the creation of the report. If the monthly report is to be output using extended format, the extended information must be output within 1 day from the creation of the report. After that, the extended information can not be output.
- If there is no valid data within the specified report channel range, "FFFFH" is output.

LF Specifies the output channels for setting data output, unit, and decimal point data.

Mode All modes
Setting LFp1, p2<terminator>
p1 First output channel (001 to 030)
First output computed channel (A01 to A30)
p2 Last output channel (001 to 030)
Last output computedchannel (A01 to A30)

Comments
- You must specify data to be output with the TS command and execute “GET” or “ESC T” before sending the LF command.
- If no input channel is recognized by the DR230/DR240 among the specified channels, a syntax error occurs.
- The optional computation channel number is A01 to A30.

CF Specifies the system configuration output format.

Mode All modes
Setting CFp1<terminator>
p1 0 Information on system-configured modules
1 Current status module information (real-time information)

Comments
- You must specify data to be output with the TS command and execute “GET” or “ESC T” before sending the CF command.

BO Specifies the order of byte output (in binary output).

Effective mode Operation mode
Setting BOp1<terminator>
p1 0 Output from MSB (upper-digit byte)
1 Output from LSB (lower-digit byte)

IM Specifies the mask of a status byte.

Mode Operation mode
Setting IMp1<terminator>
p1 First numerical value of the items (or combination of those values) shown below
0 All interrupts are OFF.
1 Interrupt occurs at the end of an A/D conversion.
2 Interrupt occurs at the time of a syntax error.
4 Interrupt occurs when internal timer is being operated or the time for hourly, daily and monthly reports arrives.
8 Interrupt generated after storing data on media, or reading data from media.
16 Interrupt occurs at the time of a chart end.
32 Interrupt generated when measurement release is generated while computation is in progress.

Comments
- Masks the causes of interrupt in the status byte.
- When either of the phenomena effectively specified with this command occurs, bit 7 (SRQ) of the status byte is set to “1” and causes an interrupt to the controller.
- For detailed instructions on the status byte, see Pages 1-2 and 2-2.

SM Sets the auxiliary mask of the status byte.

Mode Operation mode
Setting SMp1<terminator>
p1 A figure determined by the following calculation:
p1 = a + b + c + d + e + f + g
a=1 Interrupt occurs when timer No. 1 operates.
=0 No interrupt occurs.
b=2 Interrupt occurs when timer No. 2 operates.
=0 No interrupt occurs.
c=4 Interrupt occurs when timer No. 3 operates.
=0 No interrupt occurs.
d=8 Interrupt occurs when timer No. 4 operates.
=0 No interrupt occurs.
e=16 Interrupt occurs when timer No. 5 operates.
=0 No interrupt occurs.

f=32 Interrupt occurs when timer No. 6 operates.
=0 No interrupt occurs.
g=64 Interrupt occurs when the time for hourly, daily and monthly reports arrives.
=0 No interrupt occurs.

Comments
- Sets the auxiliary mask of interrupt when the timers described in the IM command operate.
- When any of the timers whose numbers are specified with this command operates, an interrupt due to the internal time operation occurs.

6.1 Functions as Talker

There are the following seven types of data output:

- Measured data output (ASCII code): TS0 + “Device Trigger (GET)” + FM0
- Measured data output (binary code): TS0 + “Device Trigger (GET)” + FM1
- Computed data output (ASCII code): TS0 + “Device Trigger (GET)” + FM2
- Computed data output (binary code): TS0 + “Device Trigger (GET)” + FM3
- Setting of data output in the operation mode: TS1 + “Device Trigger (GET)” + LF
- Unit and decimal point position data output: TS2 + “Device Trigger (GET)” + LF
- System configuration data output: TS5 + “Device Trigger (GET)” + CF
- A/D calibration data output: TS8 + “Device Trigger (GET)” + LF
- Setting of data output in the setup mode: TS9 + “Device Trigger (GET)” + LF
- Outputting of a file directory on a RAM disk: TS3 + [GET] + [MF0]
- Outputting of measured/computed data (ASCII code) on a RAM disk: TS3 + [GET] + MF1
- Outputting of the measured/computed data (binary code) on a RAM disk: TS3 + [GET] + MF2
- Outputting of channel on/off on a RAM disk: TS3 + [GET] + MF3

Measured data output (TS0/TS3)

After executing “GET,” be sure to output data using the FM or MF command. Execution of “GET” alone without executing the FM or MF command does not output the data. After reading all the data specified by the FM command, subsequent specification of the FM command without executing “GET” enables the data within a scan to be output.

Because the MF command requests the output of data stored on the internal RAM disk, so a differential in time occurs between the time when the data are measured and the time when [GET] is executed.

Measured data output (TS1, TS2, TS8 or TS9)

After transmitting the device trigger “GET ”be sure to output data using the LF command. Execution of “GET” alone without executing the FM command does not output the data. After reading all the data specified by the LF command, subsequent specification of another channel using the LF command enables the data contents to be output. A/D calibration data output by the TS8 command can be executed in the A/D calibration mode only.

System configuration output (TS5)

After transmitting the device trigger “GET ”be sure to output data using the CF command. Execution of “GET” alone without executing the CF command does not output data.

Note

- When using an RS-232-C, RS-422-A or RS-485 interface, execute an ESCT command rather than a GET command.
- Do not transmit the FM, LF, CF or MF command before outputting data for specified channels.
- If an FM, LF, CF or MF command is received while data are being transmitted, transmission of the data is suspended automatically.
- If the type of output data is changed using the TS command after the execution of “GET,” the changed contents are not reflected without executing “GET” again. Execute “GET” again.
- After executing “GET,” the execution of “GET” again without outputting data using the FM, LF, CF or MF command or without completing the data output sets new data to the buffer. Be careful because old data are lost.

6.2 Measured/Computed Data Output Format (ASCII code)

The data are output in the following format by receiving TS0 + “Device Trigger (GET)” + FM0/FM2:

DATEYYMMDDCrLf
TIMEhhmmssCrLf
S1S2A1A1A2A2A3A3A4A4UUUUUUCCC, ±DDDDDE - ECrLf

Each symbol denotes the following:

YY: Year
MM: Month
DD: Day
hh: Hour
mm: Minute
ss: Second
S1: Data status 1
- E ---------- Abnormal
- N ---------- Normal
- D ---------- Differential input
- O ---------- Over
- S ---------- Measuring range is “skip” or computation channel is “off”

S2: Data status 2
- Space ------- Interim data
- E ---------- Last data

A1A1: Alarm status (level 1)
A2A2: Alarm status (level 2)
A3A3: Alarm status (level 3)
A4A4: Alarm status (level 4)
- H□ --------- Upper-limit alarm
- L□---------- Lower-limit alarm
- dH ---------- Upper-differential-limit alarm
- dL ---------- Lower-differential-limit alarm
- RH ---------- Increasing rate-of-change limit alarm
- RL ---------- Decreasing rate-of-change limit alarm

UUUUUU: Unit
- mV□□□□--- mV
- V□□□□□-- V
- □C□□□□-- °C
- UUUUUU------- Arbitrary

CCC: Channel number
±: Data polarity (+, -)
DDDDD: Data mantissa (8 characters for the computation channel)
- ±99999 ----- Over data
- +99999 ----- Abnormal data

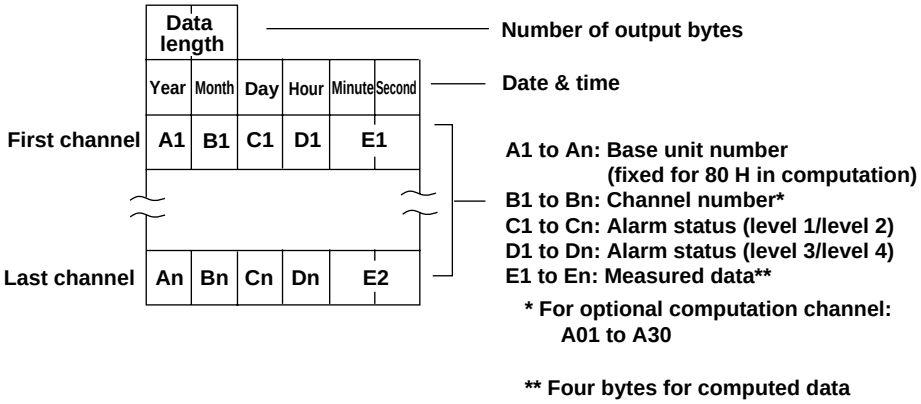
E - E: Data exponent

Note

- Data in the channel not connected in the system settings, including channel numbers, are not output.
- In a channel for data computation, the channel number CCC is indicated as follows:
  DR130/DR230/DR240: A01 to A30

6.3 Measured/Computed Data Output Format (Binary code)

The data are output in the following format by receiving TS0 + “Device Trigger (GET)” + FM1:



Data length

The number of output bytes can be determined using the following equation.

Number of output bytes = 6 x N + 6 (N = number of output channels)

Number of output bytes = 8 x M + 6 (M = number of output channels)

Alarm status (C1 to Cn/D1 to Dn)

0: No alarm
1: Upper-limit alarm
2: Lower-limit alarm
3: Upper-differential-limit alarm
4: Lower-differential-limit alarm
5: Increasing rate-of-change limit alarm
6: Decreasing rate-of-change limit alarm

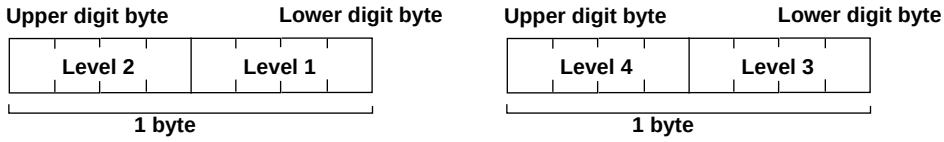
Measured data (E1 to En)

7FFFH (7FFF7FFFH): Positive over-limit data
8001H (80018001H): Negative over-limit data
8002H (80028002H): Measurement range setting skips.
8004H (80048004H): Abnormal data
8005H (80058005H): No data

*Data inside the parentheses ( ) are computed data.

Alarm status format

For the alarm status, one byte indicates two levels.



The status of two levels is output in hexadecimal notation. For example, if the level 1 alarm status is 2 (lower-limit alarm) and the level 2 alarm status is 4 (lower-differential-limit alarm), 42H is output.

Note

- The output data are all output in hexadecimal notation.
- Measured data can be output either from the MSB (upper digit) or LSB (lower digit) according to the specification of the output order.

Since the instrument determines upper byte and lower byte in units of 2-byte data, the 4-byte computed data are output in the following way.

If MSB(upper byte): "ABCD"

If LSB(lower byte): "BADC"

The default of BO command is “MSB”

- Data in the channel not connected in the system settings, including channel numbers, are not output.

6.4 Setting Data Output Format (Operation mode)

The operation mode parameters are output in the following order by the TS1 + "Device Trigger (GET)" + LF command:

PS	Status of Recorder	CrLf
SR ⋮ SR	Measurement range setting data for the first channel ⋮ Measurement range setting data for the last channel	CrLf ⋮ CrLf
SO ⋮ SO	Computation expression setting data for the first computation channel ⋮ Computation expression setting data for the last computation channel	CrLf ⋮ CrLf
SN ⋮ SN	Scaling unit setting data for the first channel ⋮ Scaling unit setting data for the last channel	CrLf ⋮ CrLf
SA ⋮ SA	Alarm setting data for the first channel ⋮ Alarm setting data for the last channel	CrLf ⋮ CrLf
SC	Setting data for the chart speed	CrLf
SS	Setting data for the recording type(trend/digital)	CrLf
ST ⋮ ST	Tag setting data for the first channel ⋮ Tag setting data for the last channel	CrLf ⋮ CrLf
SZ ⋮ SZ	Zone recording setting data for the first ⋮ Zone recording setting data for the last	CrLf ⋮ CrLf
SP ⋮ SP	Patial expanded recording setting data for the first channel ⋮ Patial expanded recording setting data for the last channel	CrLf ⋮ CrLf
PT ⋮ PT	Trend recording ON/OFF setting data for the first channel ⋮ Trend recording ON/OFF setting data for the last channel	CrLf ⋮ CrLf
PD ⋮ PD	Digital recording ON/OFF setting data for the first channel ⋮ Digital recording ON/OFF setting data for the last channel	CrLf ⋮ CrLf
PM ⋮ PM	Manual printout ON/OFF setting data for the first channel ⋮ Manual printout ON/OFF setting data for the last channel	CrLf ⋮ CrLf
PA ⋮ PA	Alarm printout ON/OFF setting data for the first channel ⋮ Alarm printout ON/OFF setting data for the last channel	CrLf ⋮ CrLf
PC ⋮ PC	Scale printout ON/OFF setting data for the first channel ⋮ Scale printout ON/OFF setting data for the last channel	CrLf ⋮ CrLf
PL ⋮ PL	List printout ON/OFF setting data for the first channel ⋮ List printout ON/OFF setting data for the last channel	CrLf ⋮ CrLf

SG ⋮ SG	Setting data for No. 1 message ⋮ Setting data for No. 20message	CrLf ⋮ CrLf
SH ⋮ SH	Header setting data for the first line ⋮ Header setting data for the last line	CrLf ⋮ CrLf
SJ	Setting data for the title	CrLf
SI ⋮ SI	Setting data for No.1 timer ⋮ Setting data for No.6 timer	CrLf ⋮ CrLf
SQ ⋮ SQ	Setting data for No.1 match time ⋮ Setting data for No.3 match time	CrLf ⋮ CrLf
SF	Setting data for the format for list printing	CrLf
SL ⋮ SL	Setting data for No.1 event action ⋮ Setting data for No.30 event action	CrLf ⋮ CrLf
SE	Setting data for the second chart speed	CrLf
SB ⋮ SB	Interpopation ON/OFF setting data for the first channel ⋮ Interpopation ON/OFF setting data for the last channel	CrLf ⋮ CrLf
SV ⋮ SV	Moving average setting data for the first channel ⋮ Moving average setting data for the last channel	CrLf ⋮ CrLf
SX ⋮ SX	Setting data for No. 1 group ⋮ Setting data for No. 1 group	CrLf ⋮ CrLf
SW	Setting data for summer/winter time	CrLf
SK ⋮ SK	Constant setting data for the first constant number ⋮ Constant setting data for the last constant number	CrLf ⋮ CrLf
MH ⋮ MH	Data storage ON/OFF setting data for the first channel ⋮ Data storage ON/OFF setting data for the flast channel	CrLf ⋮ CrLf
UD	Setting data for the display mode on the upper part of the display	CrLf
MD	Setting data for the display mode on the middle part of the display	CrLf
LD	Setting data for the display mode on the lower part of the display	CrLf
EN	Output completed	CrLf

Setting data for the channels in the range specified by the LF command are output for every unit. Channel numbers are output in the order of input channels and computation channels. For example, when LF005 and A10 are set, the data are output starting from input channel 005 to the last input channel. Then, the data are output starting from computation channels A01 to A10.

Data are output in the order of setting parameters subsequent to the setting command. Each data item is delimited with a comma (,).

Alarm setting data

For alarm setting data, setting data from level 1 to level 4 are output for every channel.

First channel	SA	Level 1 alarm setting data	CrLf
		Level 2 alarm setting data	CrLf
		Level 3 alarm setting data	CrLf
	SA	Level 4 alarm setting data	CrLf
Second channel	SA	Level 1 alarm setting data	CrLf
		Level 2 alarm setting data	CrLf
		Level 3 alarm setting data	CrLf
	SA	Level 4 alarm setting data	CrLf
	⋮	⋮	⋮
Last channel	SA	Level 1 alarm setting data	CrLf
		Level 2 alarm setting data	CrLf
		Level 3 alarm setting data	CrLf
	SA	Level 4 alarm setting data	CrLf

6.5 Setting Data Output Format (Setup mode)

The setup mode parameters are output in the following order by the TS9 + "Device Trigger (GET)" + LF command:

XR	Setting data for for measurement period	CrLf
XA	Setting data for alarm	CrLf
XI	A/D integration time setting data for the first unit	CrLf
⋮	⋮	⋮
XI	A/D integration time setting data for the last unit	CrLf
XQ	Setting data for filter on/off	CrLf
XY	Setting data for reflash relay 1	CrLf
⋮	⋮	⋮
XY	Setting data for reflash relay 6	CrLf
XN	AND/OR setting data for the relay in the first unit	CrLf
⋮	⋮	⋮
XN	AND/OR setting data for the relay in the last unit	CrLf
XD	Setting data for energizing/deenergizing the first relay	CrLf
⋮	⋮	⋮
XD	Setting data for energizing/deenergizing the last relay	CrLf
XH	Setting data for a hold/non-hold of the relay	CrLf
XK	Setting data for a key lock	CrLf
XB	Burnout setting data for the first channel	CrLf
⋮	⋮	⋮
XB	Burnout setting data for the last channel	CrLf
XJ	Reference junction compensation setting data for the first channel	CrLf
⋮	⋮	⋮
XJ	Reference junction compensation setting data for the last channel	CrLf
XC	Dot printing color setting data for the first channel	CrLf
⋮	⋮	⋮
XC	Dot printing color setting data for the last channel	CrLf
XF	Setting data for the function screen	CrLf
XS	Setting data for the setting screen	CrLf
XV	Setting data for measurement interval	CrLf
XT	Setting data for the temperature unit	CrLf
XG	Setting data for computation error	CrLf
EN	Output completion	CrLf

Channel numbers are output in the order of input channels and computation channels. For example, when LF005 and A10 are set, the data are output starting from input channel 005 to the last input channel. Then, the data are output starting from computation channels A01 to A10.

Data are output in the order of setting parameters subsequent to the setting command. Each data item is delimited with a comma (,).

Range of outputting

If output data are issued on a unit or slot basis, the number of units or slots to which the data are output is determined by specified channels. For example, if channels 002 to 036 are specified by the LF command, data from slot 0 to slot 3 are output.

Note

- Data which are output for burnout and reference junction compensation are those of the channel up to the maximum number connected in the specified range.
- Data which are output for the A/S integration time and AND/OR of relays are those of connected channels.
- Data which are output for energizing/deenergizing relays are output on the basis of the unit to which the module is connected.
- The data of XH command and XY command are output only when DI/DO module or alarm output module is mounted to DR230/DR240.
- "S" as data of XN command is meaningless.

6.6 Output Format for Unit and Decimal Point Position

These outputs are issued in the following format by the TS2 + "Device Trigger (GET)" + LF command.

S1S2CCCUUUUUU, PCrLf

Each symbol denotes the following:

S1: Data status 1
- N ---------- Normal
- D ---------- Differential input
- S ---------- Measurement range skips.

S2: Data status 2
- Space ---------- Interim data
- E ---------- Final data

CCC: Channel number (3 characters)
Computation channels
A01 to A30 (DR130/230/240)

UUUUUU: Unit (6 characters)
- mV□□□□------- mV
- V□□□□□------ V
- □C□□□□------ °C
- UUUUUU---------- arbitrary

P: Decimal point position (0 to 4)
- 0 ---------- 00000
- 1 ---------- 0000.0
- 2 ---------- 000.00
- 3 ---------- 00.000
- 4 ---------- 0.0000

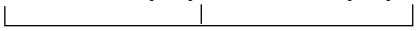
Note

- Data in the channels not connected in the system settings, including channel numbers, are not output.

6.7 System Configuration Output Format

The measurement interval and system connection data are output in the following format by the TS5 + “Device Trigger (GET)” + CF command:

M : sssssCrLf
S1 : 0=MMMMMM(DD)1=MMMMMM(DD)~5=MMMMMM(DD)CrLf



Slot number

Each symbol denotes the following:

M:	Measurement interval mark
sssss:	Measurement interval; output down to one decimal place (Example: 10.0 for a measurement interval of 10 sec.). The unit is “second.”
S1:	Subunit number
	0 ---------- DR130/DR230/DR240
	E ---------- End mark
MMMMMM:	Module name (6 characters)
	COMM ---------- Communication module
	RELAY --------- Relay output module
	REMOTE ------- Remote module
	INPUT ---------- Universal input module
	ERROR --------- Module error
(DD):	Internal code (hexadecimal, ASCII, 2 characters)

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6.9 RAM Disk Output Format (File Directory Output)

The following formats are output by the TS3 + [GET] + MF0 command.

_FFFFFFFF, YY/MM/DD hh:mm, NNNNNN, CCC, MMCrLf

_FFFFFFFF, YY/MM/DD hh:mm, NNNNNN, CCC, MMCrLf
_ENDCrLf

Each symbol denotes the following:
FFFFFFFF: File name (eight characters)
YY/MM/DD hh:mm: Date and time (year/month/day hour: minute) when a trigger signal or data storage is started.
NNNNNN: Amount of data stored (six characters)
CCC: Number of channels in which data are stored
Channel for computation
A01 to A30
MM: Memory in which data are stored
DR130/DR230/DR240

Note

- If the RAM disk is faulty or if there are no files at all containing measured/computed data on the RAM disk, the character string "# ERROR ON DATA MEMORY" will be output.

6.10 RAM Disk Output Format (ASCII Code)

The following formats are output by the TS3 + [GET] + MF1 command.

Header	**AAAAAA-BBBBBB, CCCCCC,DDD-EEECH, FFFFFGGGCrLf**
	YY-MM-DD hh:mm:ssCrLf
First Data Number	***SNNNNNCrLf**
Date and Time	**YY-MM-DD hh:mm:ssCrLf**
First Data	**S1S2UUUUUUCCC, ±DDDDDE-EpCrLf**

Last Data Number	***SNNNNNCrLf**
Date and Time	**YY-MM-DD hh:mm:ssCrLf**
Last Data	**S1S2UUUUUUCCC, ±DDDDDE-EpCrLf**

Each symbol denotes the following:

Header

AAAAAA: First output data (six characters)
BBBBBB: Last output data (six characters)
CCCCCC: Data number of trigger position (six characters)
DDD: First output channel (three characters)
Channel for computation
A01 to A30 (DR130/DR230/DR240)
EEE: Last output channel (three characters)
Channel for computation
A01 to A30 (DR130/DR230/DR240)
FFFFF: Data save interval (five characters)
GGG: Unit of data save interval (three characters)
YY-MM-DD hh:mm:ss
Year-Month-Day Hour:Minute:Second

Data number

*: Indicates information for data numbers.
S: Trigger information
Space ---------- other than a trigger point
T ---------- trigger point
NNNNN: Data number (five characters)

Date and Time

Date and time when the data are saved.
The time is in 0.5-second units depending on the measurement interval used.

Data

S1: Data status 1
N ---------- normal
O ---------- over (data of ±99999)
S ---------- skip (data of all space)
E ---------- abnormal
S2: Data status 2
Space ---------- interim data
E ---------- last data
UUUUUU: Units (six characters)
mV [ ] [ ] [ ] [ ] -------- mV
V [ ] [ ] [ ] [ ] [ ] ------- V
[ ] C [ ] [ ] [ ] [ ] ------- °C
UUUUUU ---------- arbitrary

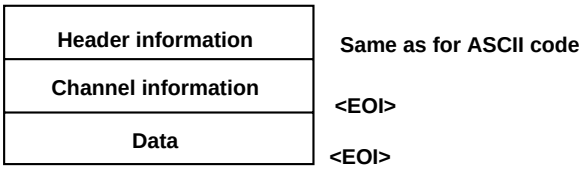
CCC:Channel number (three characters)
Channel for computation
A01 to A30 (DR130/DR230/DR240)
±: Data polarity (+, -)
DDDDD: Data mantissa (eight characters for computed data)
± 99999 ---------- data overflow
+ 99999 ---------- abnormal data
E - E: Data exponent

Note

- If the RAM disk is faulty, the character string "# ERROR ON DATA MEMORY" will be output.
- If there are no appropriate files, the character string "# FILE NAME ERROR" will be output.

6.11 RAM Disk Output Format (Binary Code)

The following formats are output by the TS3 + [GET] + MF2 command.



Header information AAAAAA-BBBBBB, CCCCCC, DDD-EEECH, FFFFFGGGCrLf
YY-MM-DD hh:mm:ssCrLf
Channel information S1S2CCUUUUUU, PCrLf

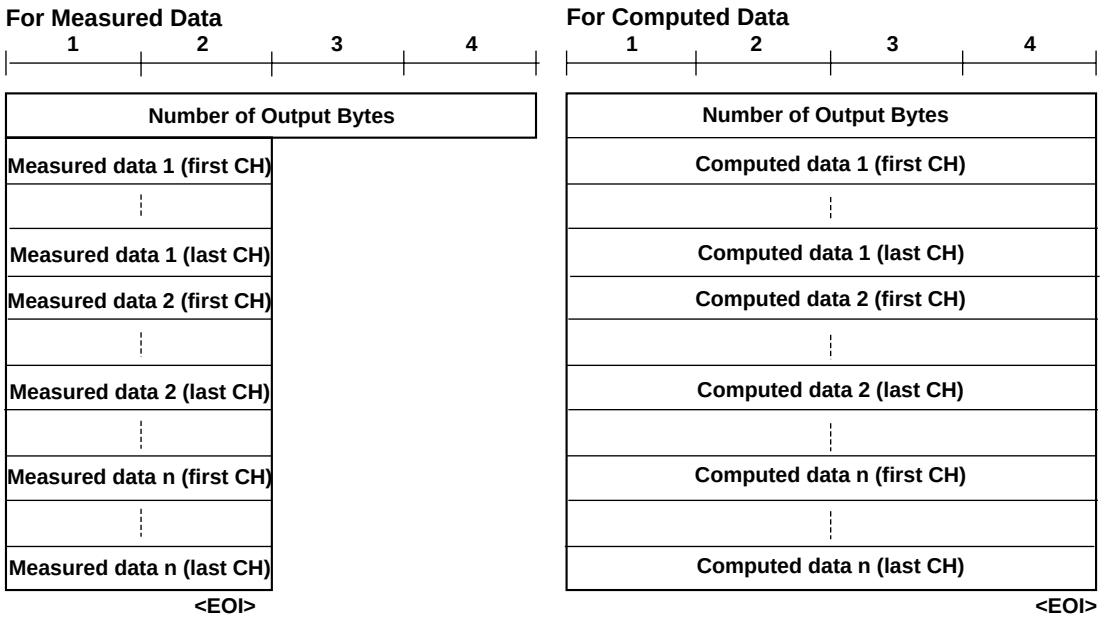
Each symbol denotes the following:

Header

AAAAAA: First output data (six characters)
BBBBBB: Last output data (six characters)
CCCCCC: Data number of trigger position (six characters)
DDD: First output channel (three characters)
Channel for computation
A01 to A30 (DR130/DR230/DR240)
EEE: Last output channel (three characters)
Channel for computation
A01 to A30 (DR130/DR230/DR240)
FFFFF: Data save interval (five characters)
GGG: Unit of data save interval (three characters)

Channel information

S1: Data status 1
N ---------- normal
S ---------- skip (data of 8002H)
S2: Data status 2
Space ---------- interim data
E ---------- last data
CCC: Channel number (three characters)
Channel for computation
A01 to A30 (DR130/DR230/DR240)
UUUUUU: Units
P: Position of decimal point (0 to 4)
0 ---------- AAAAA
1 ---------- AAAA. A
2 ---------- AAA. AA
3 ---------- AA. AAA
4 ---------- A. AAAA



The above number of output bytes is indicated as follows:

Measured data: 2 x channel number x n byte (n: number of data items per channel)
Computed data: 4 x channel number x n byte (n: number of data items per channel)

Invalid data are output as follows:

Plus over data	7FFFH (7FFF7FFFH for computed data)
Minus over data	8001H (80018001H for computed data)
Measurement range setting is SKIP	8002H (80028002H for computed data)
Abnormal data	8004H (80048004H for computed data)
No data	8005H (80058005H for computed data)

Note

- The output data are all in hexadecimal format.
- Measured data can be output with either the most significant byte or least significant byte following the order of output bytes with the BO command.
- If the RAM disk is faulty, the character string “# ERROR ON DATA MEMORY” will be output.
- If there are no appropriate files, the character string “# FILE NAME ERROR” will be output.

6.12 RAM Disk Output Format (Channel On/Off)

The following formats are output by the TS3 + [GET] + MF3 command.

_NNNNNNNNCrLf
_CCC-MMMCrLf
_----------
_ENDCrLf

Each symbol denotes the following:

NNNNNNNN: File name (eight characters)
CCC: Channel number (three characters)
Channel for computation
A01 to A30 (DR130/DR230/DR240)
MMM: With/without data
ON -------- with data
OFF ------- without data
END: End

Note

- The channel for computation is output subsequent to the channel for measurement.
- If the RAM disk is faulty, the character string "# ERROR ON DATA MEMORY" will be output.
- If there are no appropriate files, the character string "# FILE NAME ERROR" will be output.

7.1 GP-IB Sample Programs

This section describes sample program for a system using PC 9801 series (NEC) with National Instruments GP-IB.
Sample programs in this manual are writen in N88-BASIC(Standard language for PC9801 series).
We hope that these samples will aid you in creating your own program.

GP-IB Address

ALL the sample programs given in this chapter use address 1 for DR130/DR230/DR240.

Setting the personal Computer

Be carefull when receiving BINARY data that the received data does not overrun the capacity of the receive buffer in the personal computer which may be small as 255 bytes in some case.

Output the Setting Data

Read out the setting data from DR130/DR230/DR240, display them on CRT of personal computer, and save them to floppy disk.

```
10    'TS1 <GET> LF
20    OPEN "TS1.DAT" FOR OUTPUT AS #1
30    ISET IFC
40    CMD DELIM=0
50    PRINT @1;"TS1"
60    WBYTE &H3F,&H21,&H8,&H3F;
70    PRINT @1;"LF001,010"
80    LINE INPUT @1;D$:PRINT D$:PRINT #1,D$
90    LINE INPUT @;D$:PRINT D$:PRINT #1,D$
100   IF LEFT$(D$,2)<>"EN" GOTO 90
110   CLOSE:STOP
120   END
```

Write the Setting Data to DR130/DR230/DR240

Read out the setting data from floppy disk, display them on CRT of personal computer, and write them to DR130/DR230/DR240.

```
10    'SETTEI
20    ISET IFC
30    ON SRQ GOSUB *SSS
40    POLL 1,B
50    SRQ ON
60    OPEN "TS1.DAT" FOR INPUT AS #1
70    ISET IFC
80    CMD DELIM=0
90    PRINT @1;"IM2"
100   LINE INPUT #1,D$
110   IF LEFT$(D$,2)="EN" GOTO 140
120   PRINT @1;D$:PRINT D$
130   GOTO 100
140   CLOSE:STOP
150   END
160   '
170   *SSS
180   POLL 1,B
190   IF (B AND &H42)=&H42 THEN PRINT "SYNTAX ERROR"
200   RETURN
```

Output the Unit and Decimal Point Data

Read out the unit and decimal point data from DR130/DR230/DR240, display them on CRT of personal computer, and save them to floppy disk.

```
10    'TS2 <GET> LF
20    OPEN "TS2.DAT" FOR OUTPUT AS #1
30    ISET IFC
40    CMD DELIM=0
50    PRINT @1;"TS2"
60    WBYTE &H3F,&H21,&H8,&H3F;
70    PRINT @1;"LF001,010"
80    LINE INPUT @1;D$:PRINT D$:PRINT #1,D$
90    GOTO 110
100   LINE INPUT @;D$:PRINT D$:PRINT #1,D$
110   IF MID$(D$,2,1)<>"E" THEN 100
120   CLOSE:STOP
130   END
```

Output the measurement data (ASCII Code)

Read out the measurement data by ASCII code from DR130/DR230/DR240, display on CRT of personal computer, and save to floppy disc.

```
10    'TS0 <GET> FM0
20    OPEN "TS0ASC.DAT" FOR OUTPUT AS #1
30    ISET IFC
40    CMD DELIM=0
50    PRINT @1;"TS0"
60    WBYTE &H3F,&H21,&H8,&H3F;
70    PRINT @1;"FM0,001,010"
80    LINE INPUT @1;D$:PRINT D$:PRINT #1,D$
90    LINE INPUT @;D$:PRINT D$:PRINT #1,D$
100   IF MID$(D$,2,1)<>"E" THEN 90
110   CLOSE:STOP
120   END
```

Output the measurement data (BINARY Code)

Read out the measurement data by BINARY code from DR130/DR230/DR240, display on CRT of personal computer, and save to floppy disc.

```
10    'TS0 BO1 <GET> FM1
20    OPEN "TS0BIN.DAT" FOR OUTPUT AS #1
30    ISET IFC
40    CMD DELIM=0
50    PRINT @1;"TS0"
60    PRINT @1;"BO1"
70    WBYTE &H3F,&H21,&H8,&H3F;
80    PRINT @1;"FM1,001,010"
90    CMD DELIM=3
100   LINE INPUT @1;D$:PRINT #1,D$
110   A=CVI(MID$(D$,1,2)):PRINT A
120   L=0
130   PRINT ASC(MID$(D$,3,1));:PRINT "/";
140   PRINT ASC(MID$(D$,4,1));:PRINT "/";
150   PRINT ASC(MID$(D$,5,1));:PRINT
160   PRINT ASC(MID$(D$,6,1));:PRINT ":";
170   PRINT ASC(MID$(D$,7,1));:PRINT ":";
180   PRINT ASC(MID$(D$,8,1));:PRINT
190   L=0
200   FOR I=6 TO A-1
210   PRINT RIGHT$("0"+HEX$(ASC(MID$(D$,I+3,1))),2)+" ";
220   L=L+1
230   IF L=6 THEN L=0 :PRINT
240   NEXT I
250   CLOSE:STOP
260   END
```

Output the system configuration data

Read out the configuration data from DR130/DR230/DR240, display on CRT of personal computer, and save to floppy disc.

```
10    'TS5 <GET> CF
20    OPEN "TS5.DAT" FOR OUTPUT AS #1
30    ISET IFC
40    CMD DELIM=0
50    PRINT @1;"TS5"
60    WBYTE &H3F,&H21,&H8,&H3F;
70    PRINT @1;"CF0"
80    LINE INPUT @1;D$:PRINT D$:PRINT #1,D$
90    LINE INPUT @;D$:PRINT D$:PRINT #1,D$
100   IF LEFT$(D$,2)<>"E:" GOTO 90
110   CLOSE:STOP
120   END
```

7.2 RS-232-C Sample Programs

This section describes sample program for a system using PC 9801 series (NEC) with the RS-232-C interface.

Sample programs in this manual are writen in N88-BASIC(Standard language for PC9801 series).

We hope that these samples will aid you in creating your own program.

Setting the RS-232-C Parameter

In this sample program, the RS-232-C parameter settings are as shown below.

Baud rate 9600
Data length 8
Parity Even
Stop bit1
Handshaking OFF-OFF

Setting the personal Computer

Be carefull when receiving BINARY data that the received data does not overrun the capacity of the receive buffer in the personal computer which may be small as 255 bytes in some case.

Output the Setting Data

Read out the setting data from DR130/DR230/DR240, display them on CRT of personal computer, and save them to floppy disk.

```
10    'TS1 <ESC T> LF
20    OPEN "COM1:E81N" AS #1
30    OPEN "TS1.DAT" FOR OUTPUT AS #2
40    PRINT #1,"TS1"
50    LINE INPUT #1,D$:PRINT D$
60    PRINT #1,CHR$(&H1B)+"T"
70    LINE INPUT #1,D$:PRINT D$
80    PRINT #1,"LF001,010"
90    LINE INPUT #1,D$:PRINT D$:PRINT #2,D$
100   IF LEFT$(D$,2)<>"EN" GOTO 90
110   CLOSE
120   END
```

Write the Setting Data to DR230/DR240

Read out the setting data from floppy disk, display them on CRT of personal computer, and write them to DR130/DR230/DR240.

```
10    'SETTEI
20    OPEN "COM1:E81N" AS #1
30    OPEN "TS1.DAT" FOR INPUT AS #2
40    LINE INPUT #2,D$
50    IF LEFT$(D$,2)="EN" GOTO 100
60    PRINT #1,D$:PRINT D$
70    LINE INPUT #1,D$
80    IF LEFT$(D$,2)="E1" THEN PRINT "SYNTAX ERROR"
90    GOTO 40
100   CLOSE
110   END
```

Output the Unit and Decimal Point Data

Read out the unit and decimal point data from DR130/DR230/DR240, display them on CRT of personal computer, and save them to floppy disk.

```
10    'TS2 <ESC T> LF
20    OPEN "COM1:E81N" AS #1
30    OPEN "TS2.DAT" FOR OUTPUT AS #2
40    PRINT #1,"TS2"
50    LINE INPUT #1,D$:PRINT D$
60    PRINT #1,CHR$(&H1B)+"T"
70    LINE INPUT #1,D$:PRINT D$
80    PRINT #1,"LF001,010"
90    LINE INPUT #1,D$:PRINT D$:PRINT #2,D$
100   IF MID$(D$,2,1)<>"E" THEN 90
110   CLOSE
120   END
```

Output the measurement data (ASCII Code)

Read out the measurement data by ASCII code from DR130/DR230/DR240, display on CRT of personal computer, and save to floppy disc.

```
10    'TS0 <ESC T> FM0
20    OPEN "COM1:E81N" AS #1
30    OPEN "TS0ASC.DAT" FOR OUTPUT AS #2
40    PRINT #1,"TS0"
50    LINE INPUT #1,D$:PRINT D$
60    PRINT #1,CHR$(&H1B)+"T"
70    LINE INPUT #1,D$:PRINT D$
80    PRINT #1,"FM0,001,010"
90    LINE INPUT #1,D$:PRINT D$:PRINT #2,D$
100   IF MID$(D$,2,1)<>"E" THEN 90
110   CLOSE
120   END
```

Output the measurement data (BINARY Code)

Read out the measurement data by BINARY code from DR130/DR230/DR240, display on CRT of personal computer, and save to floppy disc.

```
10    'TS0 BO1 <ESC T> FM1
20    OPEN "COM1:E81N" AS #1
30    OPEN "TS0BIN.DAT" FOR OUTPUT AS #2
40    PRINT #1,"TS0"
50    LINE INPUT #1,D$:PRINT D$
60    PRINT #1,"BO1"
70    LINE INPUT #1,D$:PRINT D$
80    PRINT #1,CHR$(&H1B)+"T"
90    LINE INPUT #1,D$:PRINT D$
100   PRINT #1,"FM1,001,010"
110   D$=INPUT$(2,#1):PRINT #2,D$
120   A=CVI(MID$(D$,1,2)):PRINT A
130   D$=INPUT$(A,#1):PRINT #2,D$
140   L=0
150   PRINT ASC(MID$(D$,1,1));:PRINT "/";
160   PRINT ASC(MID$(D$,2,1));:PRINT "/";
170   PRINT ASC(MID$(D$,3,1));:PRINT
180   PRINT ASC(MID$(D$,4,1));:PRINT ":";
190   PRINT ASC(MID$(D$,5,1));:PRINT ":";
200   PRINT ASC(MID$(D$,6,1));:PRINT
210   L=0
220   FOR I=4 TO A-3
230   PRINT RIGHT$("0"+HEX$(ASC(MID$(D$,I+3,1))),2)+" ";
240   L=L+1
250   IF L=6 THEN L=0 :PRINT
260   NEXT I
270   CLOSE
```

Output the system configuration data

Read out the configuration data from DR130/DR230/DR240, display on CRT of personal computer, and save to floppy disc.

```
10    'TS5 <ESC T> CF
20    OPEN "COM1:E81N" AS #1
30    OPEN "TS5.DAT" FOR OUTPUT AS #2
40    PRINT #1,"TS5"
50    LINE INPUT #1,D$:PRINT D$
60    PRINT #1,CHR$(&H1B)+"T"
70    LINE INPUT #1,D$:PRINT D$
80    PRINT #1,"CF0"
90    LINE INPUT #1,D$:PRINT D$:PRINT #2,D$
100   IF LEFT$(D$,2)<>"E:" GOTO 90
110   CLOSE
120   END
```

7.3 RS-422-A/RS-485 Sample Programs

This section describes sample program for a system using PC9801 series (NEC) with the RS-422-A/RS-485 interface. We hope that these samples will aid you in creating your own program.

Configuration

Model : NEC PC9801 series
Language : N88-BASIC (Standard programming language on the PC9801 series)
Wiring system : four-wire system (both four-wire and two-wire systems are introduced in this manual for the ASCII output of the measured data).

Setting the RS-422-A/RS-485 Parameter

Baud rate : 9600
Data length : 8
Parity : Even
Stop bit : 1
Address : 01

Setting the Personal Computer

Be careful when receiving BINARY data that the received data does not overrun the capacity of the receive buffer in the personal computer which may be small as 255 bytes in some case.

Output the Setting Data

Read out the setting data from DR series, display them on CRT of the personal computer, and save them to floppy disk.

```
10    ‘
20    OPEN “COM1:E81N” AS #1
30    OPEN “TS1.DAT” FOR OUTPUT AS #2
40    ‘
50    PRINT #1,CHR$(&H1B)+”O 01"
60    LINE INPUT #1,D$  :PRINT D$
70    PRINT #1,”TS1"
80    LINE INPUT #1,D$  :PRINT D$
90    PRINT #1,CHR$(&H1B)+”T”
100   LINE INPUT #1,D$  :PRINT D$
110   PRINT #1,”LF001,010"
120   LINE INPUT #1,D$
130   PRINT D$
140   PRINT #2,D$
150   IF LEFT$(D$,2)<>”EN” THEN GOTO 270
160   ‘
170   PRINT #1,CHR$(&H1B)+”C 01"
180   LINE INPUT #1,D$  :PRINT D$
190   CLOSE
200   END
```

Write the Setting Data to DR series

Read out the setting data from floppy disk, display them on CRT of the personal computer, and write them to DR series.

```
10    ‘
20    OPEN “COM1:E81N” AS #1
30    OPEN “TS1.DAT” FOR INPUT AS #2
40    ‘
50    PRINT #1,CHR$(&H1B)+”O 01"
60    LINE INPUT #1,D$  :PRINT D$
70    LINE INPUT #2,D$
80    IF LEFT$(D$,2)=”EN” THEN GOTO 300
90    PRINT #1,D$
100   PRINT D$
110   LINE INPUT #1,D$
120   IF LEFT$(D$,2)=”E1" THEN PRINT “SYNTAX ERROR”
130   GOTO 220
140   ‘
150   PRINT #1,CHR$(&H1B)+”C 01"
160   LINE INPUT #1,D$  :PRINT D$
170   CLOSE
180   END
```

Output the Unit and Decimal Point Data

Read out the unit and decimal point data from DR series, display them on CRT of the personal computer, and save them to floppy disk.

```
10    ‘
20    OPEN “COM1:E81N” AS #1
30    OPEN “TS2.DAT” FOR OUTPUT AS #2
40    ‘
50    PRINT #1,CHR$(&H1B)+”O 01"
60    LINE INPUT #1,D$  :PRINT D$
70    PRINT #1,”TS2"
80    LINE INPUT #1,D$  :PRINT D$
90    PRINT #1,CHR$(&H1B)+”T”
100   LINE INPUT #1,D$  :PRINT D$
110   PRINT #1,”LF001,010"
120   LINE INPUT #1,D$
130   PRINT D$
140   PRINT #2,D$
150   IF MID$(D$,2,1)<>”E” THEN GOTO 270
160   ‘
170   PRINT #1,CHR$(&H1B)+”C 01"
180   LINE INPUT #1,D$  :PRINT D$
190   CLOSE
200   END
```

Output the Measurement Data (ASCII Code, four-wire)

Read out the measurement data by ASCII code from DR series, display on CRT of the personal computer, and save to floppy disk.

```
10    ‘
20    OPEN “COM1:E81N” AS #1
30    OPEN “TS0ASC.DAT” FOR OUTPUT AS #2
40    ‘
50    PRINT #1,CHR$(&H1B)+”O 01"
60    LINE INPUT #1,D$  :PRINT D$
70    PRINT #1,”TS0"
80    LINE INPUT #1,D$  :PRINT D$
90    PRINT #1,CHR$(&H1B)+”T”
100   LINE INPUT #1,D$  :PRINT D$
110   PRINT #1,”FM0,001,010"
120   LINE INPUT #1,D$
130   PRINT D$
140   PRINT #2,D$
150   IF MID$(D$,2,1)<>”E” THEN GOTO 270
160   ‘
170   PRINT #1,CHR$(&H1B)+”C 01"
180   LINE INPUT #1,D$  :PRINT D$
190   CLOSE
200   END
```

Output the Measurement Data (ASCII Code, two-wire)

Read out the measurement data by ASCII code from DR series, display on CRT of the personal computer, and save to floppy disk.

```
10      ‘
20      OPEN “COM1:E81N” AS #1
30      OPEN “TS0ASC.DAT” FOR OUTPUT AS #2
40      OUT &H32,&H5
50      ‘
60      D$=CHR$(&H1B)+”O 01"
70      GOSUB *RPRINT   :GOSUB *RRECIVE   :PRINT D$
80      D$=”TS0"
90      GOSUB *RPRINT   :GOSUB *RRECIVE   :PRINT D$
100     D$=CHR$(&H1B)+”T”
110     GOSUB *RPRINT   :GOSUB *RRECIVE   :PRINT D$
120     ‘
130     D$=”FM0,001,010"   :GOSUB *RPRINT
140     GOSUB *RRECIVE
150     PRINT D$
160     PRINT #2,D$
170     IF MID$(D$,2,1)<>”E” GOTO 290
180     ‘
190     D$=CHR$(&H1B)+”C 01"    :GOSUB *RPRINT   :GOSUB *RRECIVE
200     CLOSE
210     END
220     ‘
230     ‘
240     *RPRINT
250       OUT &H32,&H25
260       FOR K=1 TO 1000   :NEXT K
270       PRINT #1,D$
280       IF(INP(&H32) AND &H4) THEN OUT &H32,&H5 ELSE 430
290       RETURN
300     ‘
310     *RRECIVE
320       D$=””
330       INCHR$=INPUT$(1,#1)
340       D$=D$+INCHR$
350       IF ASC(INCHR$)<>&HA THEN GOTO 500
360       PRINT D$
370       RETURN
```

- This program is designed for the converter using RS (RTS) for send control.
- BIT 5 is the RS (RTS) control BIT in the XX value of “OUT &H32,&HXX” in the program. Bits other than BIT 5 may be different in other applications.
- Comments on the program are indicated below.

  Line 40 Set RS (RTS) to FALSE and turn the send control OFF.

  Line 250 Set RS (RTS) to TRUE and turn the send control ON.

  Line 260 Insert a wait before sending data. This value need to be adjusted depending on the PC. This wait time is usually not necessary unless the PC is extremely fast and the data sent from the DR side collides with the data sent by the PC side.

  Line 280 On the send complete indication from the PC (TxEMP is TRUE), set RS (RTS) to FALSE and turn the send control OFF.

  Line 310 This subroutine accurately reads up to LF.

Output the Measurement Data (Binary Code)

Read out the measurement data by BINARY code from DR series, display on CRT of the personal computer, and save to floppy disk.

```
10    ‘
20    OPEN “COM1:E81N” AS #1
30    OPEN “TS0BIN.DAT” FOR OUTPUT AS #2
40    ‘
50    PRINT #1,CHR$(&H1B)+”O 01"
60    LINE INPUT #1,D$  :PRINT D$
70    PRINT #1,”TS0"
80    LINE INPUT #1,D$  :PRINT D$
90    PRINT #1,”BO1"
100   LINE INPUT #1,D$  :PRINT D$
110   PRINT #1,CHR$(&H1B)+”T”
120   LINE INPUT #1,D$  :PRINT D$
130   PRINT #1,”FM1,001,010"
140   D$=INPUT$(2,#1)
150   PRINT #2,D$
160   A=CVI(MID$(D$,1,2))
170   PRINT A
180   D$=INPUT$(A,#1)
190   PRINT #2,D$
200   PRINT ASC(MID$(D$,1,1));    :PRINT “/”;
210   PRINT ASC(MID$(D$,2,1));    :PRINT “/”;
220   PRINT ASC(MID$(D$,3,1));    :PRINT
230   PRINT ASC(MID$(D$,4,1));    :PRINT “:”;
240   PRINT ASC(MID$(D$,5,1));    :PRINT “:”;
250   PRINT ASC(MID$(D$,6,1))
260   ‘
270   L=0
280   FOR I=7 TO A
290     PRINT RIGHT$(“0”+HEX$(ASC(MID$(D$,I,1))),2)+” “;
300     L=L+1
310     IF L=5 THEN L=0 : PRINT
320   NEXT I
330   ‘
340   PRINT #1,CHR$(&H1B)+”C 01"
350   LINE INPUT #1,D$  :PRINT D$
360   CLOSE
370   END
```

Output the System Configuration Data

Read out the configuration data from DR series, display on CRT of the personal computer, and save to floppy disk.

```
10      ‘
20      OPEN “COM1:E81N” AS #1
30      OPEN “TS5.DAT” FOR OUTPUT AS #2
40      ‘
50      PRINT #1,CHR$(&H1B)+”O 01"
60      LINE INPUT #1,D$  :PRINT D$
70      PRINT #1,”TS5"
80      LINE INPUT #1,D$  :PRINT D$
90      PRINT #1,CHR$(&H1B)+”T”
100     LINE INPUT #1,D$  :PRINT D$
110     PRINT #1,”CF0"
120     LINE INPUT #1,D$
130     PRINT D$
140     PRINT #2,D$
150     IF LEFT$(D$,2)<>”E:” THEN GOTO 270
160     ‘
170     PRINT #1,CHR$(&H1B)+”C 01"
180     LINE INPUT #1,D$  :PRINT D$
190     CLOSE
200     END
```

App.1 Computing Equation

DR130/DR230/DR240 can execute computations with the measured data of each input channel taken as a variable, and the results can be displayed/saved (functions available for use only when DR130/DR230/DR240 has the -M1 option) . The following operators can be used for computation.

Basic operators

Type	Operator	Example	Description
Addition	+	001+002	Obtain the sum of the measured data of channel 001 and channel 002.
Subtraction	-	002-001	Obtain the difference of the measured data of channel 002 and channel 001.
Multiplication	*	003*K1	Multiply constant K1 to the measured data of channel 003.
Division	/	004/K2	Divide the measured data of channel 004 by constant K2.
Power	**	005**006	Take the power of measured data of channel 005 with the measured data of channel 006.
Absolute value	ABS()	ABS(001)	Obtain the absolute value of the measured data of channel 001.
Square root	SQR()	SQR(002)	Obtain the square root of the measured data of channel 002.
Common logarithm	LOG()	LOG(003)	Obtain the common logarithm of the measured data of channel 003.
Natural Logarithm	LN()	LN(004)	Obtain the natural logarithm of the measured data of channel 004.
Exponent	EXP()	EXP(005)	Make the measured data of channel 005 to be x and obtain e^x.

* +/- can be used as signs as in -(001).

Logical operators

Type	Operator	Example	Description
Logical product	AND	001AND002	when channel 001=0 and channel 002=0, “0”. when channel 001=nonzero and channel 002=0, “0”. when channel 001=0 and channel 002=nonzero, “0”. when both channel 001 and channel 002 are nonzero, “1”.
Logical sum	OR	001OR002	when channel 001=0 and channel 002=0, “0”. when channel 001=nonzero and channel 002=0, “1”. when channel 001=0 and channel 002=nonzero, “1”. when both channel 001 and channel 002 are nonzero, “1”.
Exclusive OR	XOR	001XOR002	when channel 001=0 and channel 002=0, “0”. when channel 001=nonzero and channel 002=0, “1”. when channel 001=0 and channel 002=nonzero, “1”. when both channel 001 and channel 002 are nonzero, “0”.
Logical negation	NOT	NOT001	when channel 001=0, “1”. when channel 001=nonzero, “0”.

Relational operators

Type	Operator	Example	Description
Equal	.EQ.	001.EQ.002	when channel 001 = channel 002, “1”. when channel 001 ≠ channel 002, “0”.
Not equal	.NE.	002.NE.001	when channel 001 ≠ channel 002, “1”. when channel 001 = channel 002, “0”.
Greater than	.GT.	003.GT.K1	when channel 003 > constant K1, “1”. when channel 003 ≤ constant K1, “0”.
Less than	.LT.	004.LT.K10	when channel 004 < constant K10, “1”. when channel 004 ≥ constant K10, “0”.
Greater than or equal to	.GE.	003.GE.K1	when channel 003 ≥ constant K1, “1”. when channel 003 < constant K1, “0”.
Less than or equal to	.LE.	004.LE.K10	when channel 004 ≤ constant K10, “1”. when channel 004 > constant K10, “0”.

Specified channel statistical operators

Type	Operator	Example	Description
Maximum value	TLOG.MAX()	TLOG.MAX(001)	Obtain the maximum value of the measured data of channel 001.
Minimum value	TLOG.MIN()	TLOG.MIN(002)	Obtain the minimum value of the measured data of channel 002.
Max-min value	TLOG.P-P()	TLOG.P-P(003)	Obtain the P-P value of the measured data of channel 003.
Total value	TLOG.SUM()	TLOG.SUM(004)	Obtain the total value of the measured data of channel 004.
Average value	TLOG.AVE()	TLOG.AVE(005)	Obtain the average value of the measured data of channel 005.

* Statistical computation of the measured data for the specified channel performed for an interval from the start of computation to the end of computation. When combining with each of the operators, MAX(), MIN(), P-P(), SUM(), and AVE(), the value that can be specified inside the () is limited to the input channel number or the computation channel number (Example: TLOG.MAX(A01)).

Statistical operators within the group

Type	Operator	Example	Description
Maximum value	CLOG.MAX()	CLOG.MAX(G01)	Obtain the maximum value of the measured data of group G01.
Minimum value	CLOG.MIN()	CLOG.MIN(G02)	Obtain the minimum value of the measured data of group G02.
Max-min value	CLOG.P-P()	CLOG.P-P(G03)	Obtain the P-P value of the measured data of group G03.
Total value	CLOG.SUM()	CLOG.SUM(G04)	Obtain the total value of the measured data of group G04.
Average value	CLOG.AVE()	CLOG.AVE(G05)	Obtain the average value of the measured data of group G05.

* Statistical computation of the measured data of the input channel within the same group measured at the same time every specified interval.

Special operators

Type	Operator	Example	Description
Previous value*	PRE()	PRE(001)	Obtain the previous measured data of channel 001
Hold**	HOLD():	HOLD(001):TLOG.SUM(002)	When the measured value of channel 001 changes from 0 to a nonzero value, maintain the integrated value of the measured data of channel 002 while the measured value of channel 001 is nonzero.
Reset**	RESET():	RESET(001):TLOG.SUM(002)	When the channel 001 = nonzero, reset the integrated value of the measured data of channel 002

* Previously measured data or computed data. In the case of computed data, the value is set to 0 when the computation is reset. At the start of the computation, if the computation was reset, the value is "0". If it was not reset, the value is the last value of the previous computation. The value that can be specified inside the() is limited to the input channel number (001 to 030) or the computation channel number (A01 to A30). Each computing equation can be used once.

** When specifying HOLD(A):B or RESET(A):B, A and B are channel numbers or computing equations. These can be used once in the beginning of the computing equation.

Computing equations are set according to the following rules.

The number of computing equations

"30" computing equations can be set. Each computing equation is assigned a number. The numbers are "A01" to "A30". These numbers are called computation channel numbers.

Data to be computed

- Measured data
  Specified with channel numbers (example: 030).
- Computed data
  Specified with computation channel numbers.
- Constants
  "30" constants for the DR130/DR230/DR240 can be set. Each constant is expressed by a number from "K01" to "K30" .

Priority of operators

The priority of operators in a computing equation is as follows. The operators are placed in order from the highest priority.

Type	Operators
Function	ABS(), SQR(), LOG(), LN(), EXP(), MAX(), MIN(), P-P(), SUM(), AVE(), PRE(), HOLD():, RESET():
Exponentiation	**
Signs, logical negation	+, -, NOT
Multiplication, division	*, /
Addition, subtraction	+, -
Greater/less relation	.GT., .LT., .GE., .LE.
Equal/not equal relation	.EQ., .NE.
Logical product	AND
Logical sum, exclusive OR	OR, XOR

Range when computing

When the value exceeds $\pm 10^{38}$ during the computation, computation error (overflow) occurs.

Units in computing equations

In computations, measured data are handled as numbers without units. For example, if the measured data of channel 001 is “20 mV” and the measured data of channel 002 is “20 V”, the computed result of “001+002” becomes “40”.

Limitations in computing equations

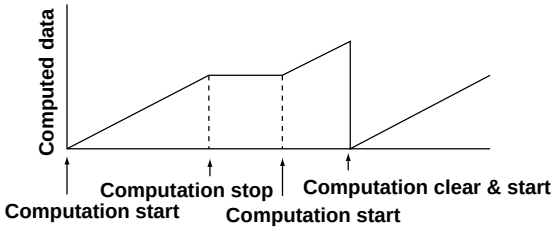
Multiple operators can be used in 1 computing equation. But, there are following limitations.

- Number of characters that can be used : 40 characters
- Total number of channel numbers and constants: 16 (Computation error occurs when 16 exceeded, and the computed result becomes +OVER or -OVER)
- Computation channel numbers: Computation channel numbers less than the current computation channel number can be used as variables within the computing equation.
  Example: A02=001+A01 ← Computation channel numbers greater than or equal to A03 can not be used in this computation.
- Statistical operators (TLOG. or CLOG.) can only be used once in 1 computing equation.

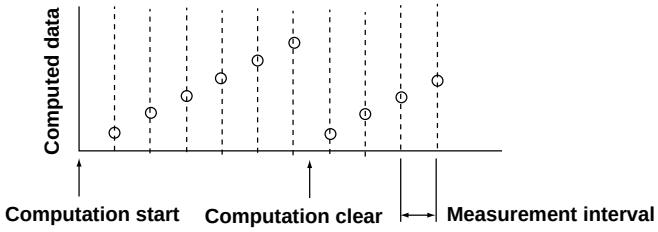
Control of the computing operation

There is a method to control using the data collection software and the method to control using the event/action function described on the next page.

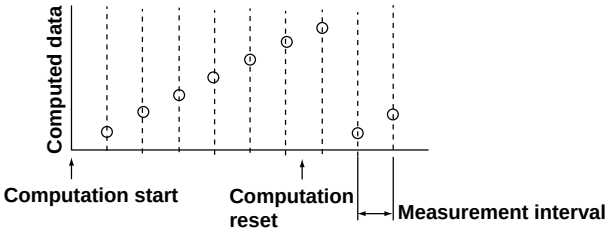
- Control using the data collection software
  This software allows for the start/stop of the computation, and the clearing of the computed result (select between just clearing or immediately compute after clearing).



- Control using the event/action function
  Can start/stop computations or clear/reset computed results by an event occurring. This function distinguishes clear and reset as shown below.
  - Clear
    When issued during the computation, the measured data is reset before doing the first computation.



  - Reset
    When issued during the computation, the measured data is reset after doing the first computation.



Alarm setting for the computation channel

Similar to the standard channels, up to 4 alarm values (levels) can be designated for each computation channel (upper limit alarm / lower limit alarm).

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USA WARRANTY/DISCLAIMER

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If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

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FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

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2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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