Models DR130/DR231/DR232/DR241/DR242 Communication Interface Instruction Manual

IM DR231-11E

Introduction

This Communication Interface User's Manual describes the functions and commands of the optional GP-IB, RS-232-C, RS-422-A/RS-485, and Ethernet 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, DR231, DR232, DR241 and DR242, the following manuals are also provided. Read them if necessary.

Name of manuals	Manual No.
DR130/DR231/DR241 Hybrid Recorder (Stand-alone model) or	IM DR231-01E
DR232/DR242 Hybrid Recorder (Expandable model)	IM DR232-01E

Note

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History

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Configuration and Use of This Manual

Configuration

This user's manual is composed of chapter 1 to chapter 8, Appendix, 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   Overview and Specifications of Ethernet Interface

Described the functions and specifications of the ethernet interface and the setting method.

Chapter 5   Command Format

Describes how to specify command formats and channel numbers.

Chapter 6   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 7   Output Format

Describes the output formats for set data, measured data, etc.

Chapter 8   Sample Program

Useful sample programs are presented.

Appendix   Computation Equation

Describes the optional computation equation.

Index   There are command and general indices.

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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 6-18)

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:

Upper-level byte   **Lower-level byte**

0							

Interrupt generated at the end of A/D conversion.

Interrupt generated at the time of syntax error.

Interrupt generated when the internal timer is being operated or hourly, daily and monthly reports are created.

Interrupt generated after storing data on media, or reading data from media (with a floppy disk drive).

Interrupt generated at the time of chart end.

Interrupt generated when measurement release is generated while computation is in progress (with computation functions).

SRQ

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 3   This bit changes to 1 when the internal timer is being operated or hourly, daily and monthly reports are created. Whenever one of the internal timers 1 to 6 is being used or reports are created, the bit changes to 1. After serial polling has been performed, this bit will be reset 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.

Rotary switch with which address is to be set

Address is the numeral to which the arrow is pointed
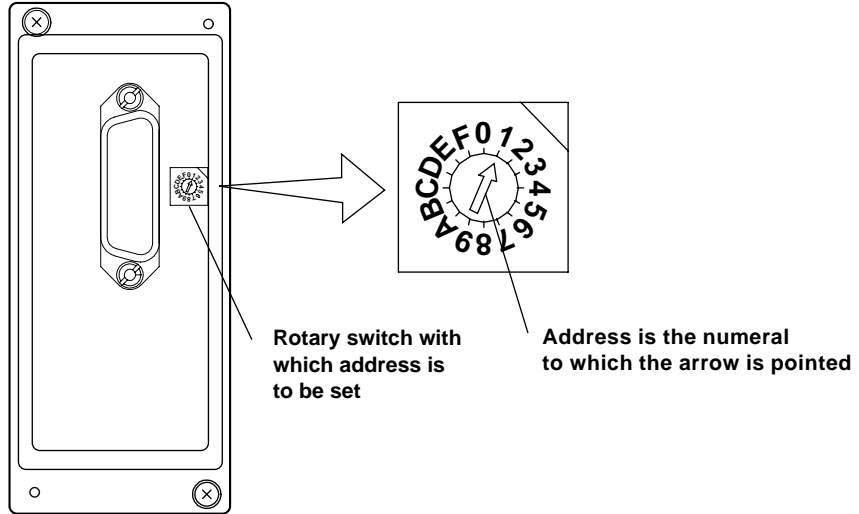
1.3 Specifications

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.

• **Internal timer or time when hourly, daily and monthly reports are created(4)**

If any of the 6 timers (1 to 6) or the time for hourly, daily and monthly reports arrives set with
an auxiliary mask operates, "4" 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, 38400
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
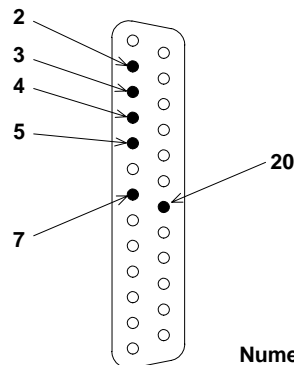
Numeric values in the above figure indicate Pin Nos.

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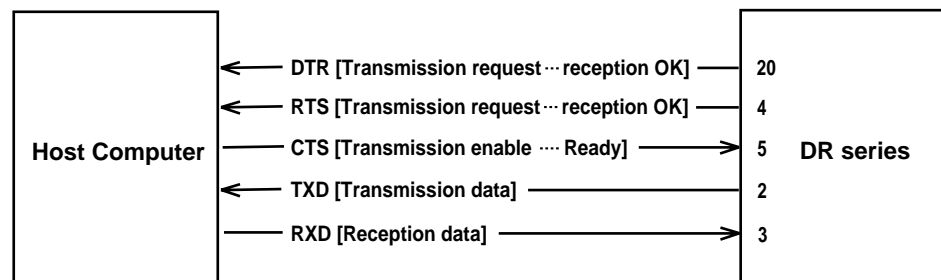
RS-232-C Signal List and Corresponding JIS & CCITT Abbreviation

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

Overview and Specifications of RS-232-C Interface

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	No Handshake	Hardware Handshake		No 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.		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.	
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

Overview and Specifications of RS-232-C Interface

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.)
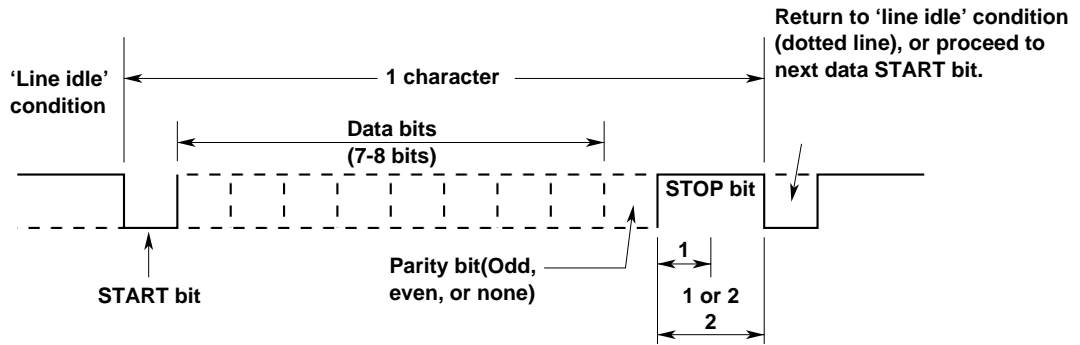
2.6 RS-232-C Interface Parameter Setting Procedure

Setting of the RS-232-C parameters must be carried out using the 3 dipswitches located next to the module connector.
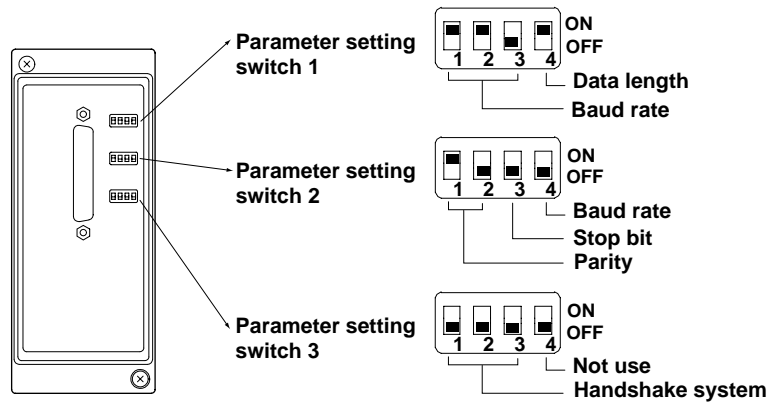
Baud rate (No.1 to 3 of setting switch 1 and No.4 of setting switch 2)

Baud rate	No.1	No.2	No.3	No.4 (switch 2)	
150	OFF	OFF	OFF	OFF	
300	OFF	OFF	ON	OFF	
600	OFF	ON	OFF	OFF	
1200	OFF	ON	ON	OFF	
2400	ON	OFF	OFF	OFF	
4800	ON	OFF	ON	OFF	
9600	ON	ON	OFF	OFF	←Default
19200	ON	ON	ON	OFF	
38400	OFF	OFF	OFF	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	

* When the baud rate is set to 38400, there is no handshaking.

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"."

Overview and Specifications of RS-422-A/RS-485 Interface

3

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)	:	300, 600, 1200, 2400, 4800, 9600, 19200, or 38400 (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.
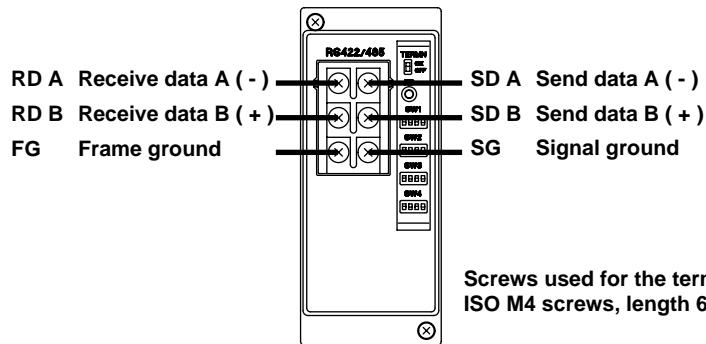
Cable Used

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 mini-
                                             mum (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

RD A Receive data A (-)   SD A Send data A (-)
RD B Receive data B (+)   SD B Send data B (+)
FG   Frame ground   SG   Signal ground

**Screws used for the terminals:
ISO M4 screws, length 6 mm**

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.

Short the terminals.

RS422/485

SD/RD A
SD/RD B
SG
FG
— Shield potential

For two-wire system

RS422/485

FG — Shield potential
SG
SD A
SD B
RD B
RD A

For four-wire system
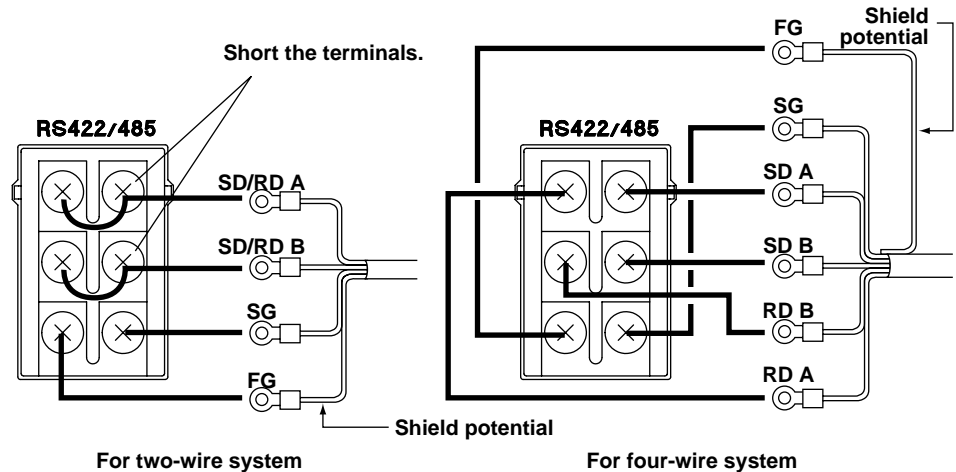
WARNING

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."
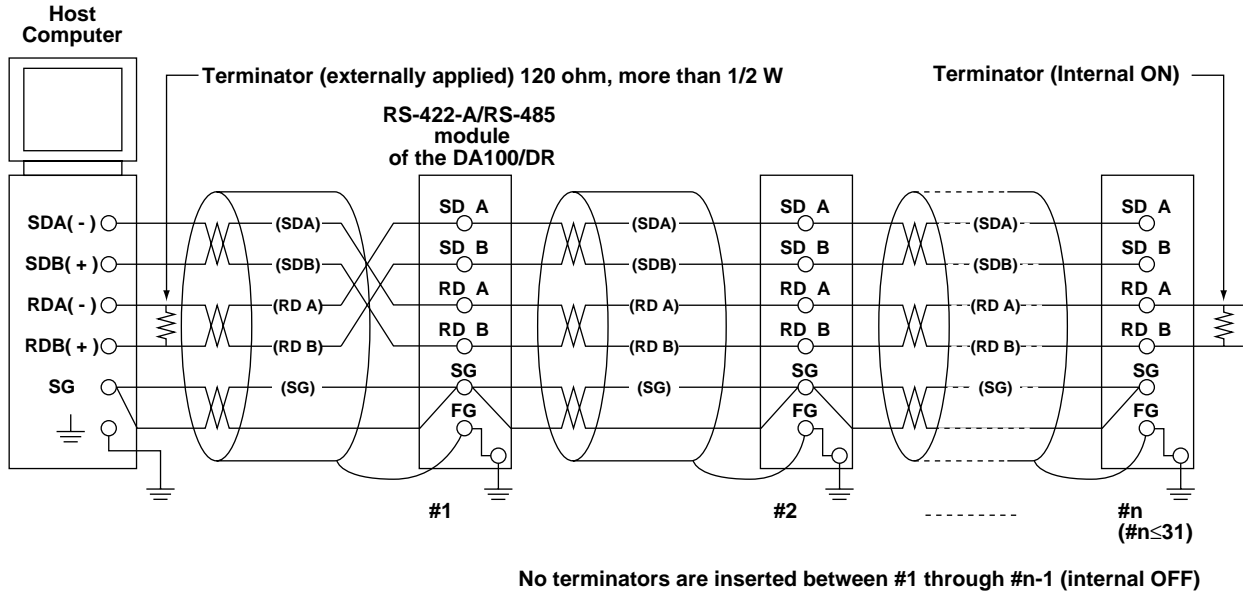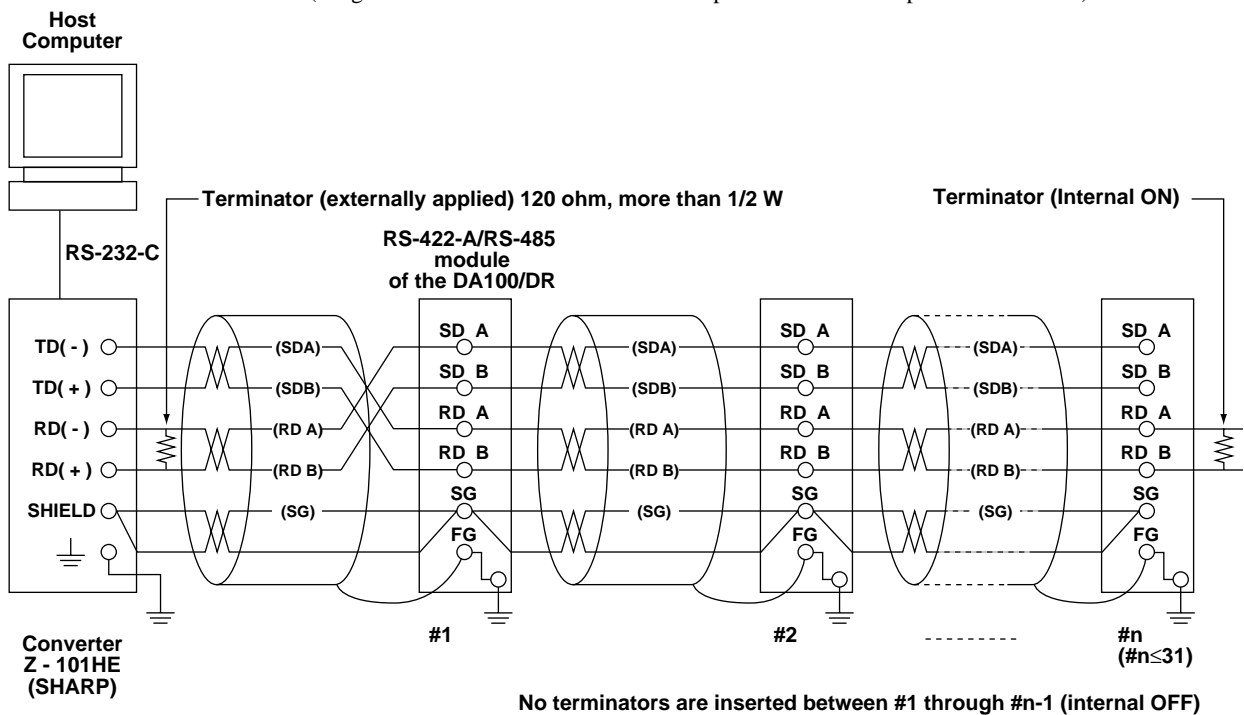
In the case of four-wire system

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.

Host Computer

Terminator (externally applied) 120 ohm, more than 1/2 W

Terminator (Internal ON)

RS-422-A/RS-485 module of the DA100/DR

SDA(-)	(SDA)	SD_A
SDB(+)	(SDB)	SD_B
RDA(-)	(RD A)	RD_A
RDB(+)	(RD B)	RD_B
SG	(SG)	SG
		FG

#1   #2   #n (#n≤31)

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)

Host Computer

Terminator (externally applied) 120 ohm, more than 1/2 W

Terminator (Internal ON)

RS-232-C

RS-422-A/RS-485 module of the DA100/DR

TD(-)	(SDA)	SD_A
TD(+)	(SDB)	SD_B
RD(-)	(RD A)	RD_A
RD(+)	(RD B)	RD_B
SHIELD	(SG)	SG
		FG

Converter Z - 101HE (SHARP)

#1   #2   #n (#n≤31)

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

In the case of two-wire system

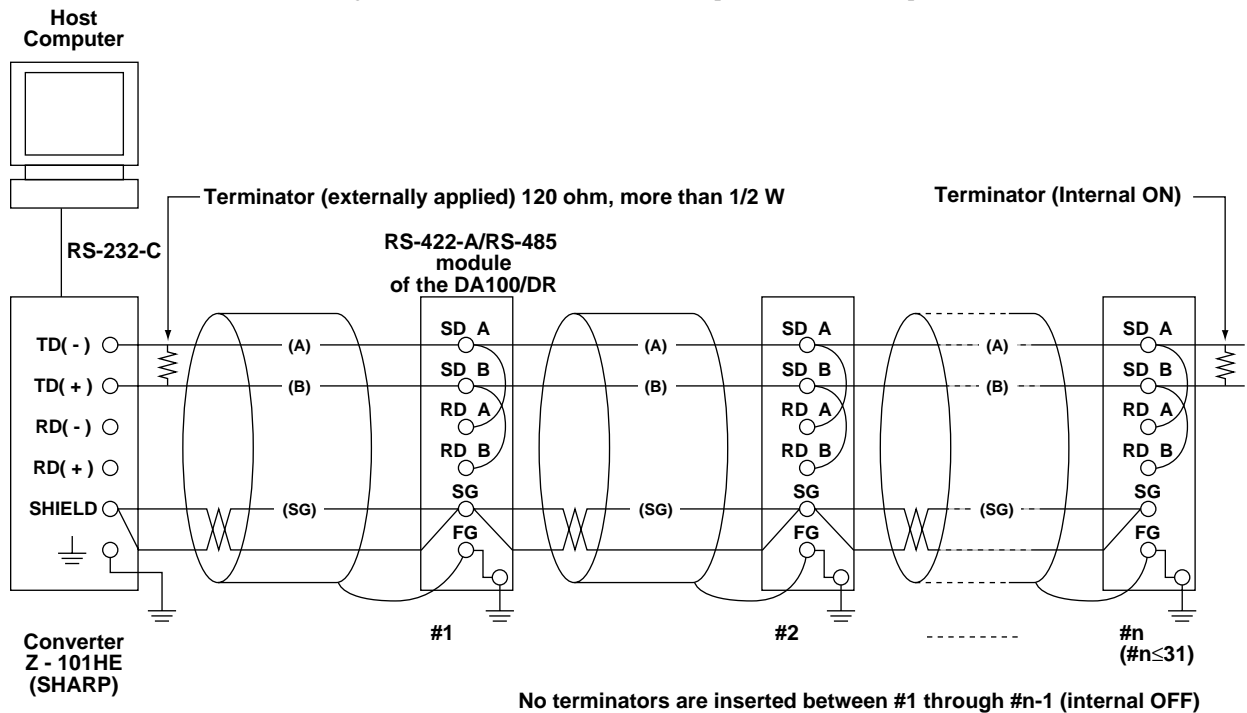Connect send and receive terminals with the same signal polarity on the terminal arrangement of the RS-422-A/RS-485 module. Only two wires are used in connecting to other units.
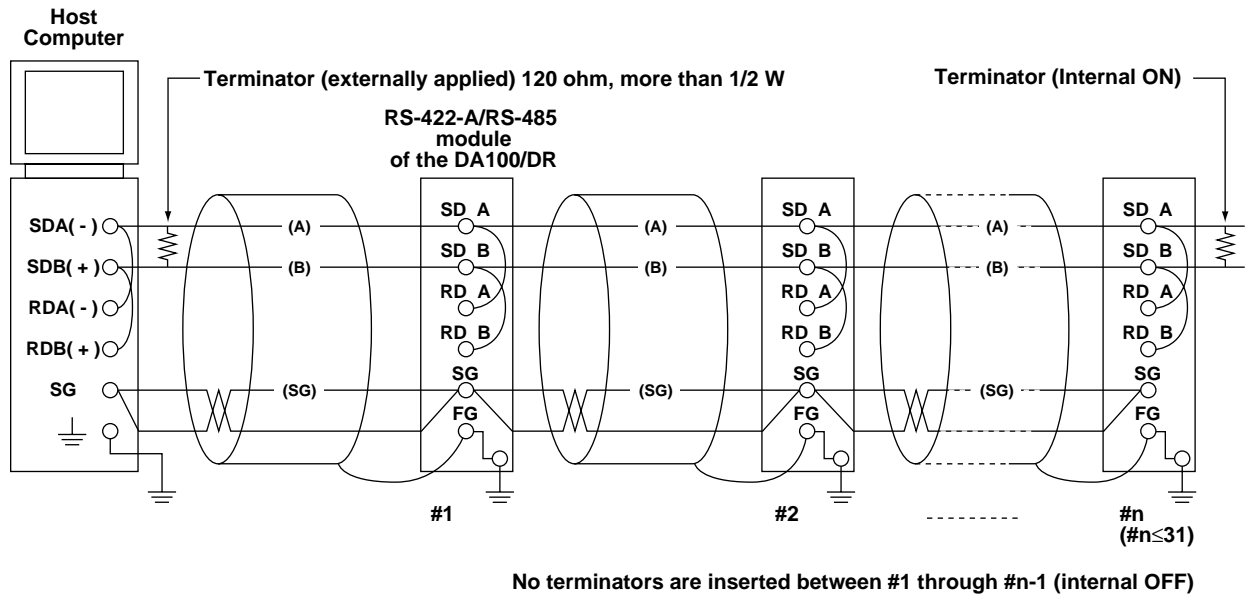
(Diagram below shows the case when the port of the host computer is RS-232-C)

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 termi-
nals 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). Es-
pecially 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 Yokogawa recorders are used together
  Some of the former Yokogawa 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).
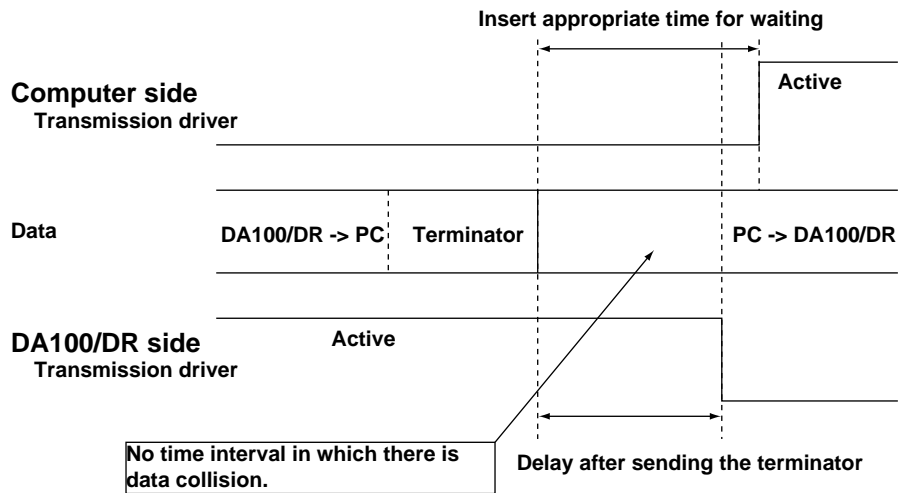───

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 convert-
ers are used, turn their terminators ON also. The recommended converter needs an external termi-
nator 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).

Response from the computer is too early

Computer side
Transmission driver

Active

Data

| DA100/DR -> PC | Terminator | | PC -> DA100/DR |

DA100/DR side   Active
Transmission driver

Driver simultaneously becomes output mode, and the data collides.

Delay after sending the terminator

Insert appropriate time for waiting

Computer side
Transmission driver

Active

Data

| DA100/DR -> PC | Terminator | | PC -> DA100/DR |

DA100/DR side   Active
Transmission driver

No time interval in which there is data collision.

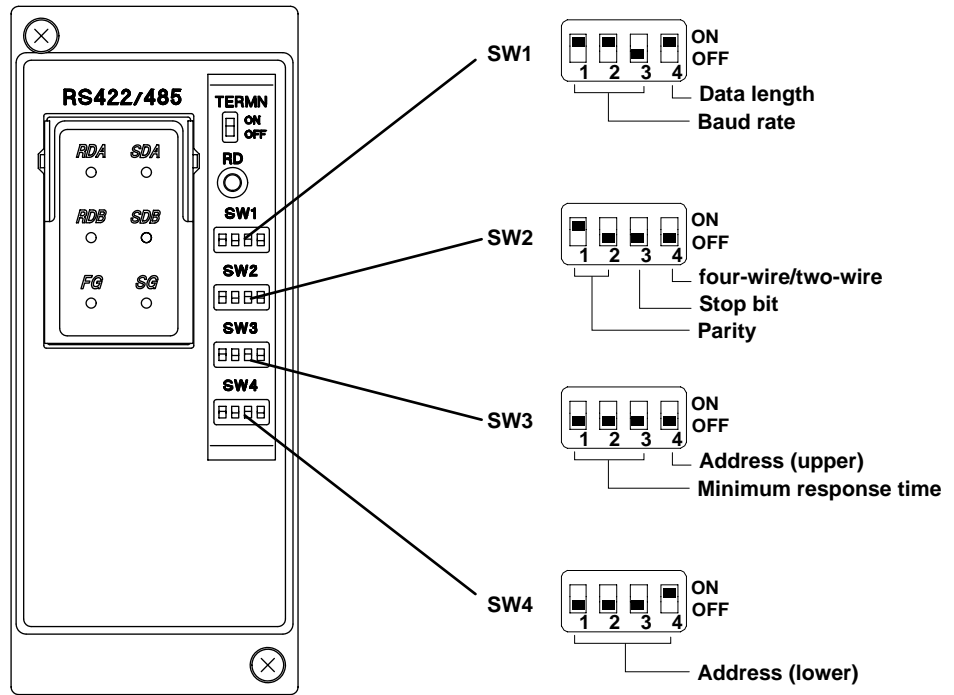Delay after sending the terminator

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	
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	
38400	OFF	OFF	OFF	

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 Introduction of Functions

Connecting to the Network

The Ethernet Module DT300-41 can connect to a network conforming to IEEE802.3 through a 10BASE-T.

By connecting to a network, a PC also connected to the same network will be able to read the data measured by the DR. However, to do so, the PC must have the following application software installed.

Data Acquisition Software 32 (DP120 comes with the DR)

Data Acquisition Software 32 Plus (DP320 sold separately)

These applications are used to set the IP address and other parameters, read in the measured data with the PC, and display various measurement information.

Note

• Because the IP address is not set at the time of shipment, an error will occur if you try to communicate without setting the IP address first.

What You Can Do with the Ethernet module

You can do the following things by using the Ethernet module.

Read in the DR measurement data with the PC, configure and control the DR from the PC (supports RS-232-C commands)

By using the Data Acquisition Software 32 or the Data Acquisition Software 32 Plus, you will be able to read in the DR measurement data with the PC and configure and control the DR from the PC. This is possible, because the Ethernet module supports all the commands that are supported by the RS-232-C module.

You can also create an original program using the RS-232-C commands.

For details on the commands, see chapter 6.

Read in instantaneous value data

You can read in the current measured data with the PC.

Check the communication conditions

The following information can be displayed on the computer screen by using Telnet that comes with Windows 95.

• Warning information.
• The socket address and connection state of the DR and the PC.
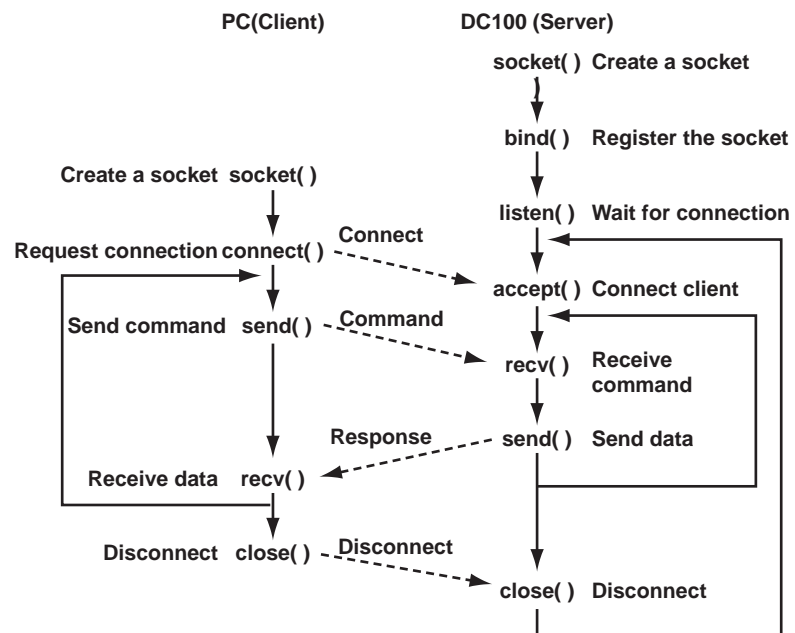• Information about the network.

About the Ports

The Ethernet module uses separate ports for the three functions mentioned above. The number of PCs that can connect (software connections) to each of the ports varies.

Function	Port	Number of Connections
RS-232-C command port	34150	1
Reading instantaneous value data	34151	4
Checking communication conditions	34159	1

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Overview and Specifications of Ethernet Interface

Communication Operation

The flow of the communication is indicated below.

```
                    PC(Client)              DC100 (Server)
                                       socket( )  Create a socket
                                          )

                                       bind( )    Register the socket

         Create a socket  socket( )
                                       listen( )  Wait for connection
                               Connect
  Request connection connect( )
                                       accept( )  Connect client
                               Command
      Send command  send( )
                                       recv( )    Receive
                                                  command

                              Response
                                       send( )    Send data
         Receive data   recv( )

                              Disconnect
         Disconnect  close( )
                                       close( )   Disconnect
```

4.2 Specifications

Communication Specifications

Transmission specifications	: 10BASE-T (CSMA/CD, 10Mbps, Baseband)
Electrical/Mechanical specifications	: Conforms to IEEE802.3 (Frames are not supported.)
Protocols	: TCP, IP, UDP, ARP, ICMP

When supporting RS-232-C commands

Communication format	: TCP/IP
Keepalive	: Turn ON/OFF using dip switch 3. When turned ON, it detects timeouts and disconnects communication
Command data	: ASCII
Response data	: ASCII, BINARY
Receive buffer length	: 200 bytes
Maximum number of connections	: 1
Port No.	: 34150

When reading in instantaneous value data

Communication format	: TCP/IP
Keepalive	: Turn ON/OFF using dip switch 3. When turned ON, it detects timeouts and disconnects communication
Command data	: ASCII
Response data	: ASCII, BINARY
Receive buffer length	: 200 bytes
Maximum number of connections	: 4
Port No.	: 34151

When displaying communication conditions

Communication format	: TCP/IP
Command data	: ASCII
Response data	: ASCII
Receive buffer length	: 200 bytes
Maximum number of connections	: 1
Port No.	: 34159

Protocols

Application layer		DARWIN services
Transport layer		TCP UDP
Network layer		IP ICMP ARP
Data link layer		Ethernet (10BASE-T)
Physical layer		

IP: Internet Protocol

TCP: Transmission Control Protocol

UDP: User Datagram Protocol

ICM: FInternet Control Message Protocol

ARP: Address Resolution Protocol

4.3 Names and Functions of Each Section
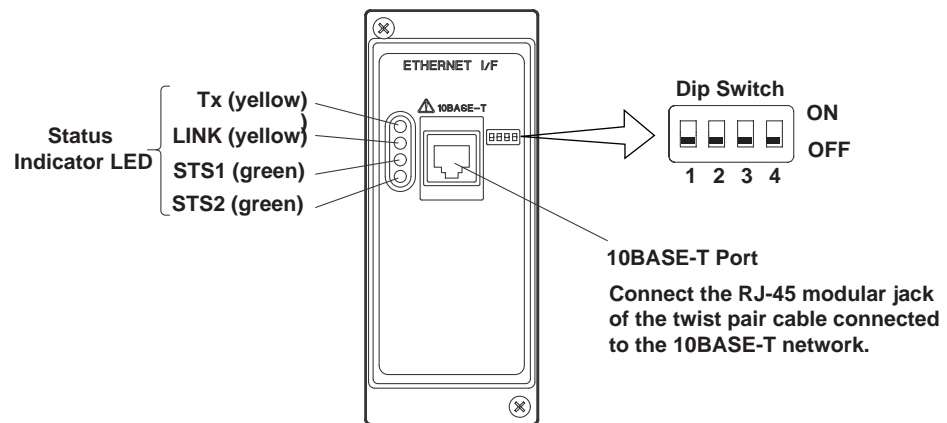
Setting the Dip Switch

You can select the following three modes by setting the dip switch.

Configuration mode: A mode in which the IP address, subnet mask, and default gateway are set for theDR.

Test mode: A mode in which the condition of the physical connection is tested.

Communication mode: A mode in which the DR is connected to the network to carry out communication. Use this mode to read in the DR measurement data with the PC.

In addition, you can turn ON/OFF the Keepalive function.

Mode Setting

Mode	Switch 1	Switch 2	
Configuration mode	ON	OFF	
Test mode	OFF	ON	
Communication mode	OFF	OFF	←Default setting

Do not set both dip switches, 1 and 2, to ON.

Keepalive Setting

Keepalive	Switch 3	
Enable	ON	←Default setting
Disable	OFF	

Keepalive is a function supported by TCP. It sends packets at constant time intervals and automatically disconnects when there is no corresponding response. This instrument sends packets at 30-second time intervals. If a response is not received, it sends 4 more packets at one-second intervals. If a response is still not received, the connection is dropped.

Have dip switch 4 turned OFF.

LED Indication

The LED indicates the communication conditions and errors of the DR.

Communication condition

LED(color)	Indication	Lit	Not lit	Blinking
Tx(yellow)	Data transmission state	Transmitting	No transmission	-
LINK(yellow)	Connection state (electronically, physically)	Connected	Not connected	-
STS1(green)	Communication mode: connection state	Established	Not established	Error
	Configuration mode: configuration state	Configuration updated	Configuration not updated	Error
	Test mode: test results	No errors	Testing	Error

Warning

A warning is being indicated when STS2 is lit. You can check the details of the warning by displaying the communication condition (see section 4.8 "Displaying the Communication Information").

Error

STS1, STS2 Indication	Type of Error	Cause
Number of blinks by STS1 is 1 and by STS2 is 1	Configuration error	Dip switch setting is incorrect.
Number of blinks by STS1 is 1 and by STS2 is 2	Communication error	Error occurred while processing TCP/IP.
Number of blinks by STS1 is 2 and by STS2 is 1	EEPROM error	EEPROM malfunction
Number of blinks by STS1 is 2 and by STS2 is 2	Hardware error	LAN controller malfunction

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Overview and Specifications of Ethernet Interface

4.4 Setting the IP Address

Before connecting to the network, you will set the IP address, subnet mask, and default gateway of the DR. There are two methods in setting these parameters.

Configure from the SET menu of the DR

Configuring from the PC

To configure from the PC, you will need the Data Acquisition Software 32 that came with the DR or the Data Acquisition Software 32 Plus that is sold separately.

Configuring from the SET menu of the DR

Set the IP address, subnetmask, and default gateway from the SET menu of the DR. After setting these parameters, the DR restarts. Please note that changing these parameters while the measurement is in progress all previous connection are cleared and stops the measurement.

You can set these parameters even if the mode is set to communication mode.

Configuration procedures

1. Turn ON the DR after inserting the Ethernet module into the DR.
2. Press the "SET" key for about three seconds to go to the SET3 menu.
3. Press either the "△" key or the "▽" key to display "SET=TCP/IP." Pressing the "ENTRY" key displays "IP=×××.×××.×××.××."
4. Set the IP address. Use the "△" and "▽" keys to select numbers and "◁" and "▷" keys to move between digits. Press the "ENTRY" key when you are finished. "SNM=×××.×××.×××.×××" is displayed.
5. Set the subnet mask. The procedure is the same as setting the IP address. Press the "ENTRY" key when you are finished. "DEF_GW SET=YES" is displayed.
6. Set whether or not to use the default gateway. Press the "△" key or the "▽" key to select "YES" or "NO," and then press the "ENTRY" key.
   If you select "NO," "TCP/IP=YES" is displayed. Continue to step 8.
   If you select "YES," "DEF_GW=×××.×××.×××.×××" is displayed.
7. Set the default gateway. The procedure is the same as setting the IP address. Press the "ENTRY" key when you are finished. "TCP/IP=YES" is displayed.
8. Select whether or not to keep the new configuration. To keep the configuration select "YES." To reconfigure select "NO." Use the "△" and "▽" keys to select "YES" or "NO."
   If you select "YES," the DR restarts after you press the "ENTRY" key.
   If you select "NO", "SET=TCP/IP" is displayed after you press the "ENTRY" key. Reconfigure the parameters from step 4.

Configuring from the PC

Connect the PC and the DR as shown below. The PC must have the Data Acquisition Software 32 or the Data Acquisition Software 32 Plus installed.

Set the mode of the Ethernet module to configuration mode.
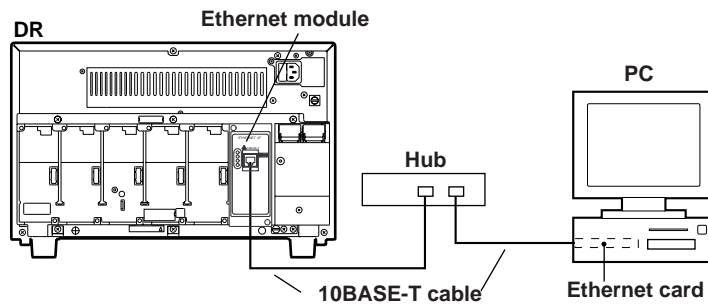
Setting procedures

Start the Data Acquisition Software 32 (comes with the DR) or the Data Acquisition Software 32 Plus (sold separately).

1 Switch on power of your PC and the DR, Startup DAQ 32 and select Software Configurator with the Launcher toolbar.
2 Click the Network tab to display the setting screen for IP address, Subnet Mask, and Default Gateway.
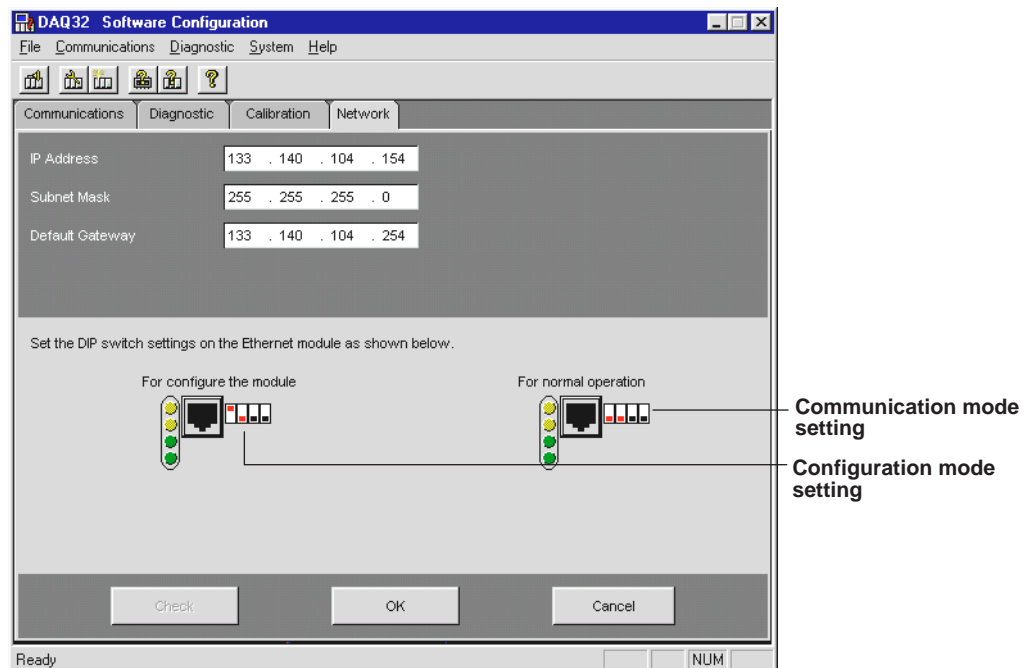
3 Click the Check button to get the currently used settings. If this is the first time you use the DR, initial values will get displayed.
4 If you click the digits in the IP address, Subnet Mask, or Default Gateway setting boxes, the clicked part will be invertedly displayed, allowing you to change the value.
5 Enter the appropriate setting values for IP address, Subnet Mask, and Default Gateway.
6 After making the settings click OK, and again OK when a reconfirmation message appears, to activate the new network address (IP address, Subnet Mask, and Default Gateway). Click Cancel to return
7 Click OK when asked Close Network? to finish the setting.

4

Overview and Specifications of Ethernet Interface
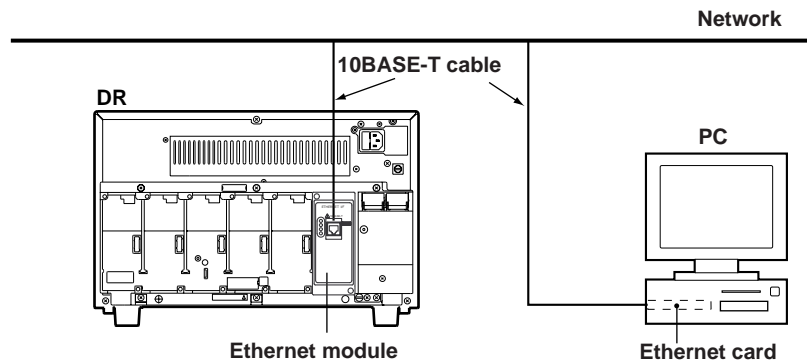
4.5 Connection Methods

When Directly Connecting to the PC

If you are directly connecting the DR and the PC to read in the measured data, connect them through a hub as follows.
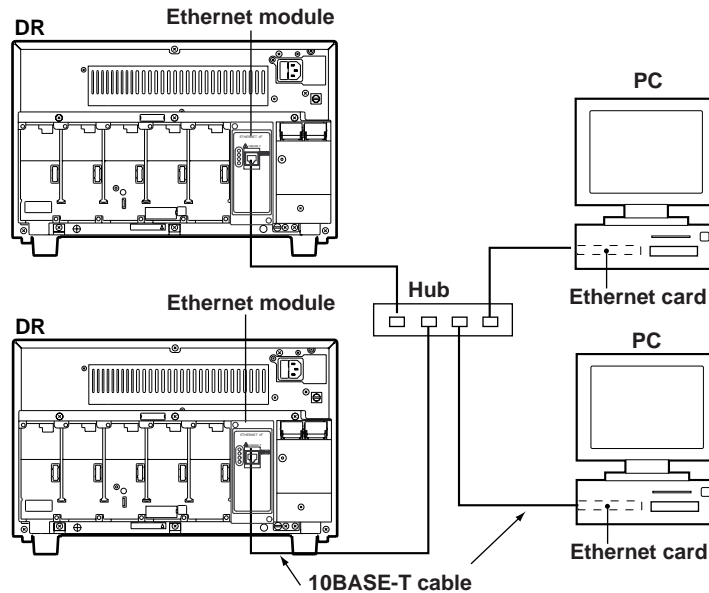
When Connecting to the Network

An example in which one DR and one PC are connected to the network is shown below.

Note

- Depending on the condition of the network, the PC may not be able to read in all of the measured data.
- You can connect between networks over a router.
- Accessing a DR from multiple PCs at once will lower the communication performance.

4.6 Checking the Connection (Loopback test)

Automatically tests the condition of the physical connection of the DR to the network.

Mode Setting

Set the dip switch of the Ethernet module to test mode (switch 1: OFF, switch 2: ON).

Note

- After testing, set the dip switch to communication mode and reboot the DR.

Test description

Sends a test packet to the network, and tests whether or not the sent packet can be received.

Testing

After connecting the DR to the network, turn ON the DR.

The connection test is automatically started.

Test Results

The test results are indicated by the LED on the Ethernet module.

Normal: STS1 is lit.

Error: STS1 and STS2 blinks alternately.

If the test result is abnormal

Connect the DR and PC through a hub, independent from the network, as described in "Connecting only the DR and PC" (page 4-8) and test the connection status again.

If the result is normal: The problem is with the network. Consult your network administrator.

If the result is abnormal: The DR must be repaired.

4

Overview and Specifications of Ethernet Interface

4.7 Transferring the Instantaneous Values

The instantaneous values of the data measured on the DR (current measured data) are transmitted to the PC that is connected through port No. 34151.

Note

- Up to four PCs can connect to port No. 34151 of one DR.
- The commands described here do not affect the status byte.
- EF, EL, and EB command do not support sub-delimiters.

The measured data are transmitted using the following command.

EF	**Outputs the measured/computed data in binary format.**
Mode	Operation mode
Syntax	EFp1, p2, p3<terminator>
p1	Data to be output
	0 Output only the measured/computed data.
	1 Output the measured/computed data and alarm data
p2	First channel to output (001 to 560, or A01 to A60)
p3	Last channel to output (001 to 560, or A01 to A60)
Description	• A01 to A60 in p2 and p3 correspond to computation channels (A01 to A30 for the stand-alone type).
	• The data of expansion type channels that are not connected are not output.
	• The data are output in the byte order specified by the EB command.
	• Measured data and computed data are output simultaneously.
	• If a parameter is omitted, the parameter specified previously is used.
	• If a specified channel cannot output data, 2-byte data with a data length of zero are output.
	• The output format is as follows.

Data length							
Year	Month	Day	Hour	Min	Sec	MS	DM
A1	B1	C1	D1	Measured data			

Am	Bm	Cm	Dm	Measured data		
E1	F1	G1	H1	Computed data		

En	Fn	Gn	Hn	Computed data		

Data length: When p1=0: 8 + measurement ch × 4 + computation ch × 6

When p1=1: 8 + measurement ch × 6 + computation ch × 8

MS: Value in units of 0.1 s. 0 or 5.

DM: Dummy (undefined).

A1 to An: Unit number. Computation channel is fixed to 0×80.

B1 to Bn: Measurement channel number

C1 to Cn, G1 to Gn: Alarm status (level 1, 2)

(No output when p1 is 0)

0: No warning

1: Upper limit alarm
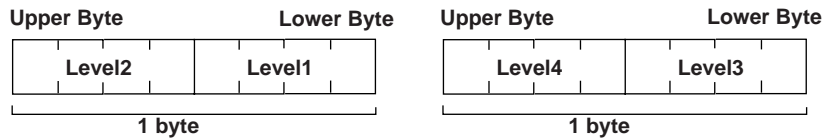
2: Lower limit alarm

3: Upper difference limit alarm

4: Lower difference limit alarm

5: Rate-of-change upper-limit alarm

6: Rate-of-change lower limit alarm

The alarm status indicates two levels with one byte.

Upper Byte	Lower Byte	Upper Byte	Lower Byte
Level2	Level1	Level4	Level3
1 byte		**1 byte**	

D1 to Dn, H1 to Hn: Alarm status (level 3, 4) (No output when p1 is 0)

Contents and format are the same as level 1 and 2.

E1 to En: Fixed to 80H

F1 to Fn: Computation channel number

The measured/computed data are output in the order specified by the EB command.

Measured data

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.

EL   **Specifies the channel for outputting unit and decimal point information and outputs it in ASCII format**

Mode   Operation mode

Syntax   ELp1, p2<terminator>

p1   First channel to output (001 to 560, or A01 to A60)

p2   Last channel to output (001 to 560, or A01 to A60)

Description   • A01 to A60 correspond to computation channels (A01 to A30 for the stand-alone type).

• The data of expansion type channels that are not connected are not output.

• If there are no corresponding channels, E1 is returned.

• The output format is as follows.

S1S2CCCUUUUUU, PCrLf

S1: Space (fixed)

S2: Data status

Space	Intermediate data
E	Last data

CCC: Channel number (3 characters)

001 to 560 or A01 to A60

UUUUUU: Unit(6 characters)

P: Decimal point position

0	00000
1	0000.0
2	000.00
3	00.000
4	0.0000

EB   **Specifies the byte order of output.**

Mode   Operation mode

Syntax   EBp1<terminator>

p1   Byte order of output

0 MSB first (Default setting)

1 LSB first

Description   • Sets the byte order of the binary data of the measured/computed data that are output with the EF command.

• Since the DR determines the upper byte and lower byte in units of two bytes, four-byte data are output as follows.

MSB first: ABCD

LSB first: BADC

4

Overview and Specifications of Ethernet Interface

4.8 Displaying the Communication Information

The following information can be displayed by using Telnet.
- Warning information
- Connection information
- Network information
- The timeout for the information display application is 15 minutes.

The operating procedures on Windows 95 Telnet are shown below.

1. Set the mode of the Ethernet module to communication mode and connect the DR and the PC.
2. Start the Telnet application that comes with Windows 95.
3. Select "Terminal" - "Preferences" from the menu bar.
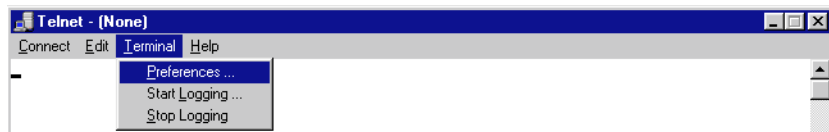
The following dialog box opens.
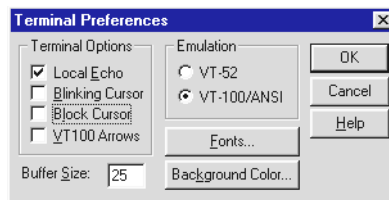
4. Set the parameters as shown below and click "OK."
   Terminal Options
      Local Echo: ON
      Others   : OFF
   Emulation: VT-100/ANSI
5. Select "Connect" - "Remote System" from the men bar.

A dialog box for setting the connection destination opens.
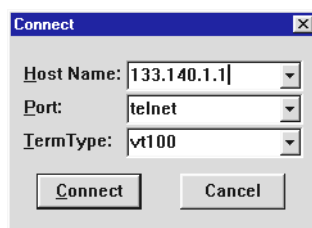
6. Set the parameters as shown below and click "Connect."
   Host Name: DR's IP address
   Port: 34159
   Term Type: vt100

7. Enter any of the following commands to display the various information.

wlog: Warning information

con: Connection information

net: Network information

quit: Terminate the information display and disconnect the connection

If you are using UNIX, follow the directions below.

1. telnet 133.140.1.1 34159 **<Enter>**
     └ **Port**
    └ **DR's IP address**

or

telnet **<Enter>**
open 133.140.1.1 34159 **<Enter>**
     └ **Port**
    └ **DR's IP address**

2. Enter any of the following commands: wlog, con, or net.

The following information is displayed.

Warning indication

```
wlog ─────────────────────────────────────────────── Command
warning Log

total      : 3 ──────────────────────────────────── Number of warning occurrences
current    : 3 ──────────────────────────────────── Most recent warning number
code       : 1:200   2:100   3:300   4:0   5:0   6:0   7:0   8:0 ── Eight most recent warning codes
END
```

Connection information

```
con ──────────────────────────────────────────────── Command
Active connections

Proto   Local Address           Foreign Address        State
TCP     133. 140. 104. 2:34150  133. 140. 104. 1:1026  ESTABLISHED
TCP     133. 140. 104. 2:34159  133. 140. 104. 1:1024  ESTABLISHED
TCP     0. 0. 0. 0:34159        0. 0. 0. 0:34159       LISTEN
TCP     0. 0. 0. 0:34151        0. 0. 0. 0:34151       LISTEN
TCP     0. 0. 0. 0:34150        0. 0. 0. 0:34150       LISTEN
END
```

Connection State
ESTABLISHED: Connection established

Socket address of the connection destination
Displayed as "IP address: port address"

Socket address of the DR
Displayed as "IP address: port address"

Protocol in use (supports only TCP)

Network information

```
net ──────────────────────── Command
Network Status

APP: timeout        = 15min ── Timeout setting (ET command)
APP:34150 timeout   = 1 ────── Total number of disconnection on port 34150 due to timeouts
APP:34151 timeout   = 1 ────── Total number of disconnection on port 34151 due to timeouts
APP:keep alive      = 1 ────── Keep alive chack sycle
TCP:connects        = 5 ────── Total number of times the connection has been established
TCP:closed          = 5 ────── Total number of times the connection has been disconnected
TCP:timeoutdrops    = 0 ────── Total number of times the connection has been disconnected due to TCP retransmission *1
TCP:keepdrops       = 0 ────── Total number of times the connection has been disconnected due to TCP Keepalive timeouts
TCP:sndtotal        = 121 ──── Total number of packets *2 transmitted
TCP:sndbyte         = 8552 ─── Total number of bytes transmitted
TCP:sndrexmitpack   = 1 ────── Total number of packets retransmitted
TCP:sndrexmitbyte   = 209 ──── Total number of bytes retransmitted
TCP:rcvtotal        = 150 ──── Total number of packets received
TCP:rcvtotal        = 128 ──── Total number of bytes received
DLC:16 COL          = 0 ────── Number of times 16 collision*3 occurred
```

*1: If the sent packet is not received, the packet is automatically retransmitted at a predetermined time interval. If the packet is not received after retransmitting 14 times from the DR, the connection is disconnected as a timeout.

*2: The unit (size) by which data are transmitted.

*3: Collisions occur when packets collide on the network. Collisions occur more frequently when the network is congested. The condition in which collisions occur 16 times times in succession is called 16

4

Overview and Specifications of Ethernet Interface

4.9   Setting the Timeout

A PC connected to the DR for a certain period of time is automatically disconnected.

ET	Sets the timeout.
Mode	Operation mode
Syntax	ETp1<terminator>
p1	Timeout time
	0 No timeouts (Default setting).
	1 Disconnect after one minute of no communication
	2 Disconnect after 15 minutes without any access
	3 Disconnect after 30 minutes without any access
	4 Disconnect after one hour without any access
	5 Disconnect after two hours without any access
	6 Disconnect after ten hours without any access
Description	• This command is common to both ports, 34150 and 34151.

Note

- The timeout set with the ET command is used for disconnecting a PC that stays connected for a certain period of time. KeepAlive is used for disconnecting a connection when the physical connection with the PC is disconnected or the PC goes down.
- ET command does not support sub-delimiters.

5.1　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 5-4.

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 5-4.

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, RF, RC, RS, BL, 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 ;.

5.2 Command Syntax

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

Command function ────────────────────┐
Command ────────────────┐   │
                            SD Set date & time.

Effective command mode ── **Mode**   Operation mode
Command syntax ────────── **Set**   SDp1, p2<terminator>
Parameter description ────────   ┌ p1 year, month, day
                                            └ p2 hour, min., sec.
Example of setting ──────── **Ex.**   Set the clock inside the DA to July 1, '96, 13:00:00
                                            SD96/07/01, 13:00:00
Explanation of the way to ── **Comments** • The formats of p1 and p2 are fixed to 8 characters.
use and remarks in more detail   Set them in the following manner.
                                               p1=YY/MM/DD
                                               p2=HH:MM:SS

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 6-20.

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, stand-alone models of the DR230/240, and expandable models of the DR230/240, as shown below:

Type of DR Recorder	Highest Measurement-channel Number	Highest Computation-channel Number
DR130	020	A30
Stand-alone models of DR230/240	030	A30
Expandable models of DR230/240	560	A60

5.3 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

1 2 3
- Channel/relay No.
- Slot No. (In case of channel/relay No. 10, Slot No. + 1)
- Unit No. ("A" for optional computation channel)
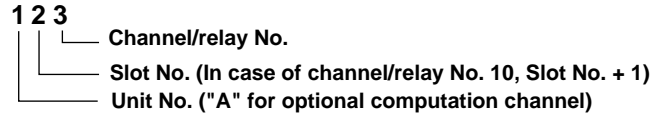
Channel Number

	DR130/DR231/DR241 (Stand-alone type)	DR232/DR242 (Expandable type)
Unit No.	0	0 to 5 (Subunit: DS400/DS600)
Slot No.	0 to2 (0 or 1 for DR130)	0 to 5
Channel No.	1 to 10 (CH10: 0)*	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.
- The input module cannot be mounted to the DR232/DR242 main unit.

Relay Number

	DR130/DR231/DR241 (Stand-alone type)	DR232/DR242 (Expandable type)
Unit No.	0	I (DR232/DR242 main unit)*1
	S(Internal switch)	S(Internal switch)
		0 to 5 (Subunit: DS400/DS600)
Slot No.	1 to 5 (1 to 3 for DR130)	0 to 5
Relay No.	1 to 10 (Relay No. 10: 0)*2	1 to 10 (Relay No. 10: 0)*2

*1: If the recorder comprises any communication module, no alarm-output relay module can be mounted on the recorder's main unit. The unit number "I," therefore, is not usable in setting up the recorder using communication commands.

*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 of the unit 3 of the extended model: 329
- Relay of No. 10 of the module mounted in slot 2 of the unit I of the extended model: I30

● Stand alone model (DR130)　● Stand alone model (DR231/DR241)　● Expandable model (DR232/DR242)
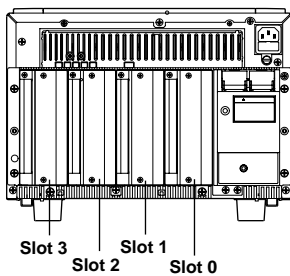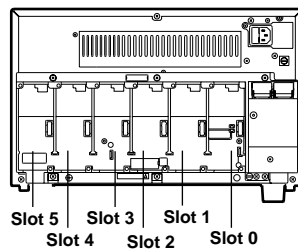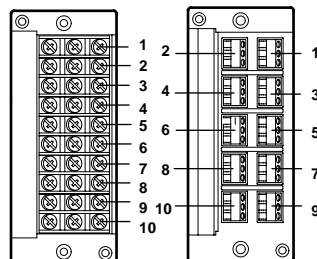
● Module
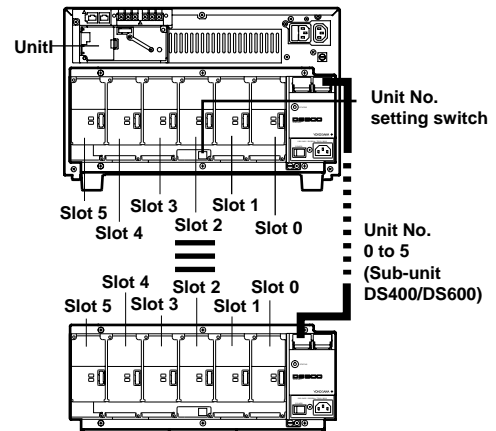
*1 : The unit number of the sub-unit is the number set by the switch located on each unit below slot 2.
Make sure the settings comform the switch setting.

5.4 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
RO	Setting the hourly, daily and monthly reports and the time to create the report (Option)	Setup mode
RM	Setting of the report channel (Option)	Setup mode
RI	Setting the print setting which is applied at report creation time	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
DR	Report start/stop (Option)	Operation mode
RP	Report printing start/stop (Option)	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 and report data	Operation mode
RF	Report output request	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.

5.5   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

Power Monitor

Input range

Nominal	Parameter input format	Setting range
25V-0.5A	25V-0.5A	25VAC, 0.5A
25V-5A	25V-5A	25VAC, 5A
250V-0.5A	250V-0.5A	250VAC, 0.5A
250V-.5A	250V-5A	250VAC, 5A

Measuring Range

	25V-0.5A	25V-5A	250V-0.5A	250V-5A
Root mean square voltage V_i (i=1,2,3,13,0)	0.00 to 25.00Vrms	0.00 to 25.00Vrms	0.0 to 250.0Vrms	0.0 to 250.0Vrms
Root mean square current I_i (i=1,2,3,13,0)	0.0000 to 0.5000Arms	0.000 to 5.000Arms	0.0000 to 0.5000Arms	0.000 to 5.000Arms
Active power P1,P2,P3	- 12.50 to 12.50W	- 125.0 to 125.0W	- 125.0 to 125.0W	- 1250 to 1250W
Active power P13	- 25.00 to 25.00W	- 250.0 to 250.0W	- 250.0 to 250.0W	- 2500 to 2500W
Active power P0	- 37.50 to 37.50W	- 375.0 to 375.0W	- 375.0 to 375.0W	- 3750 to 3750W
Apparent power VA1,VA2,VA3	0.00 to 12.50VA	0.0 to 125.0VA	0.0 to 125.0VA	0 to 1250VA
Apparent power VA13	0.00 to 25.00VA	0.0 to 250.0VA	0.0 to 250.0VA	0 to 2500VA
Apparent power VA0	0.00 to 37.50VA	0.0 to 375.0VA	0.0 to 375.0VA	0 to 3750VA
Reactive power Var1,Var2,Var3	0.00 to 12.50Var	0.0 to 125.0Var	0.0 to 125.0Var	0 to 1250Var
Reactive power Var13	0.00 to 25.00Var	0.0 to 250.0Var	0.0 to 250.0Var	0 to 2500Var
Reactive power Var0	0.00 to 37.50Var	0.0 to 375.0Var	0.0 to 375.0Var	0 to 3750Var
Power factor PF_i(i=1,2,3,13,0)	- 1.00 to 1.00	- 1.00 to 1.00	- 1.00 to 1.00	- 1.00 to 1.00
Phase angle PH_i(i=1,2,3,13,0)	- 80.0 to 80.0deg	- 80.0 to 80.0deg	- 80.0 to 80.0deg	- 80.0 to 80.0deg
Frequency FREQ	45.00 to 65.00Hz	45.00 to 65.00Hz	45.00 to 65.00Hz	45.00 to 65.00Hz

Strain Input

Nominal	Parameter input format	Setting range
2k	2k	- 2000 to 2000$\mu\varepsilon$ (1/4 bridge)
		- 1000 to 1000$\mu\varepsilon$ (1/2 bridge)
		- 500 to 500$\mu\varepsilon$ (full bridge)
20k	20k	- 20000 to 20000$\mu\varepsilon$ (1/4 bridge)
		- 10000 to 10000$\mu\varepsilon$ (1/2 bridge)
		- 5000 to 5000$\mu\varepsilon$ (full bridge)
200k	200k	- 200000 to 200000$\mu\varepsilon$ (1/4 bridge)
		- 100000 to 100000$\mu\varepsilon$ (1/2 bridge)
		- 50000 to 50000$\mu\varepsilon$ (full bridge)

Pulse Input

Nominal	Parameter input format	Setting range
RATE	RATE	0 to 30000
GATE	GATE	0 to 30000

Measuring Items of Power Monitor

V_i (i=1, 2, 3); Root mean square voltage

$V_{13} = (V_1+V_3)/2$

$V_0 = (V_1+V_2+V_3)/3$

I_i (i=1, 2, 3); Root mean square current

$I_{13} = (I_1+I_3)/2$

$I_0 = (I_1+I_2+I_3)/3$

P_i (i=1, 2, 3); Active power

$P_{13} = P_1+P_3$

$P_0 = P_1+P_2+P_3$

Var_i (i=1, 2, 3); Reactive power

$Var_{13} = Var_1+Var_3$

$Var_0 = Var_1+Var_2+Var_3$

VA_i (i=1, 2, 3); Apparent power

$VA_{13} = VA_1+VA_3$

$VA_0 = VA_1+VA_2+VA_3$

PF_i (i=1, 2, 3); Power factor

$PF_{13} = P_{13}/(P_{13}^2+Var_{13}^2)^{1/2}=P_{13}/VA_{13}$

$PF_0 = P_0/(P_0^2+Var_0^2)^{1/2}=P_0/VA_0$

PH_i (i=1, 2, 3); Phase angle

$PH_{13} = \tan^{-1}(Var_{13}/P_{13})$

$PH_0 = \tan^{-1}(Var_0/P_0)$

FREQ; Frequency

5

Command Format

Single-phase two-wire configuration

CH1	CH2		CH3	CH4		CH5	CH6	
P1	VA1		V1	I1		PF1	PH1	Select from these combinations
						Var1	PF1	
						FREQ	V1	

Single-phase three-wire/three-phase three-wire configurations (dual-voltage, dual-current; modules for three-phase use only)

CH1	CH2		CH3	CH4		CH5	CH6	
P1	VA1		V1	I1		PF1	PH1	Select from these combinations
P3	VA3		V3	I3		PF3	PH3	
P13	VA13					PF13	PH13	
						V1	I1	
						V3	I3	
						V13	I13	
						FREQ	V1	
						Var1	PF1	
						Var3	PF3	
						Var13	PF13	

Three-phase three-wire configuration (triple-voltage, triple-current; modules for three-phase use only)

CH1	CH2		CH3	CH4		CH5	CH6
P1	VA1		V1	I1		PF1	PH1
P2	VA2		V2	I2		PF2	PH2
P3	VA3		V3	I3		PF3	PH3
P13	VA13					PF13	PH13
						V1	I1
						V2	I2
						V3	I3
						V13	I13
						FREQ	V1
						Var1	PF1
						Var2	PF2
						Var3	PF3
						Var13	PF13

V0	I0		V1	I1		V1	I1
V1	I1		V2	I2		V2	I2
V2	I2		V3	I3		V3	I3
V3	I3						

Select from either of the two groups of combinations

Three-phase four-wire configuration (modules for three-phase use only)

CH1	CH2		CH3	CH4		CH5	CH6
P0	VA0		V1	I1		PF0	PH0
P1	VA1		V2	I2		PF1	PH1
P2	VA2		V3	I3		PF2	PH2
P3	VA3		P0	VA0		PF3	PH3
			P1	VA1		V1	I1
			P2	VA2		V2	I2
			P3	VA3		V3	I3
						FREQ	V1
						Var0	PF0
						Var1	PF1
						Var2	PF2
						Var3	PF3
						P0	VA0
						P1	VA1
						P2	VA2
						P3	VA3

V0	I0		V1	I1		V1	I1
V1	I1		V2	I2		V2	I2
V2	I2		V3	I3		V3	I3
V3	I3						

Select from either of the two groups of combinations

5.6   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							℧	
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

Command Format

6.1 Setting the Input

SR   Sets the range.
Mode   Operation mode

Setting the range to SKIP
Setting   SRp1, p2<terminator>
  p1 Channel number (001 to 560)
  p2 SKIP
Example Skip channel 01 of subunit 0.
  SR001, SKIP
  Skip channels 01 to 60 of subunit 0.
  SR001-60, SKIP
Comments • Channel(s) set to SKIP are not measured.

Setting voltage, thermocouple, RTD, contact or mA input
Setting SRp1, p2, p3<terminator>
  p1 Channel number (001 to 560)
  p2 Type of input
   VOLT DC voltage
   TC Thermocouple
   RTD Resistance temperature detector
   DI Contact
   mA DC current(DR232/DR242)
  p3 Measurement range
  p4 Span left value
  p5 Span right value
Example Set channel 01 of subunit 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, 17600
Comments • For the p3 measurement range, see the range parameter table on Pages 5-7 and 5-8.
  • Set the span in p4 and p5 within the setting range shown on pages 5-7 and 5-8.
  • 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 5-7 and 5-8.

Setting DELTA(difference between channels)/ RRJC(remote RJC)
Setting SRp1, p2, p3<terminator>
  p1 Channel number (001 to 560)
  p2 DELTA/RRJC
  p3 Reference channel (01 to 60)
  p4 Span left value
  p5 Span right value
Example Set channel 10 of subunit 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, -1000, 1000
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 5-7 and 5-8.
  • 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 5-7 and 5-8.
  • RRJC setup is valid only for recorders with the optional computing function.

Setting the power monitor
Setting SRp1, p2, p3, p4, p5, p6, p7<terminator>
  p1 Channel number(001 to 560)
  p2 AC
  p3 Wiring method
   1Ph2W: Single-phase two-wire system
   1Ph3W: Single-phase three-wire system (only on a three-wire system)
   3Ph3W-2I: Three-phase three-wire system (only on a two-voltage two-current three-wire system)
   3Ph3W-3I: Three-phase three-wire system (only on a three-voltage three-current three-wire system)
   3Ph4W: Three-phase four-wire system (only on a three-wire system)
  p4 Input range
   25 V - 0.5 A
   25 V - 5 A
   250 V - 0.5 A
   250 V - 5 A
  p5 Measurement item
  p6 Left value of span
  p7 Right value of span
Example Set subunit 1 and channel 01 to single-phase two-wire system, input range to 25 V - 0.5 A, measurement item to P1, left value of span to 0, and right value of span to 100.
  SR101, AC, 1Ph2W, 25V-0.5A, P1, 0, 100
Comments • Settings of p3 and p4 are common within one power monitor module. If the setting is changed, the settings on other channels also change.
  • For the measurement item p5, refer to the list of measurement items on page 5-9 and 5-10.
  • If the measurement item p5 is set on channels 1, 3 and 5, channels 2, 4 and 6 are set automatically and cannot be changed. If channels 1, 3 and 5 are set to SKIP, then channels 2, 4 and 6 can be set.
  • There is a limit on what can be set on the measurement item p5 depending on the wiring method and the settings on other channels. If a value outside the limit is set, settings on other channels may change automatically. Set the settings on each channel within the group indicated on page 5-10.
  • Set the span values, p6 and p7, within the measurement range indicated on page 5-8.
  • Input values within 6 digits disregarding the decimal point for p6 and p7. The decimal point position is fixed to the decimal point position of the setting range of page 5-8.
  • The measurement range cannot be changed while executing a report.

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Commands

Setting the strain input(DR232/DR242)

Setting   SRp1, p2, p3, p4, p5<terminator>

     p1   Channel number (001 to 560)
     p2   STRAIN
     p3   Measurement range
           2k/20k/200k
     p4   Left value of span
     p5   Right value of span

Example   Set the measurement range of subunit 1 and channel 01 to 20k, left value of span to 0, and right value of span to 100.
       SR101, STRAIN, 20k, 0, 100

Comments   • Even when the settings of p3 are the same parameters, the measurement range of the strain varies depending on the gauge method. For details, refer to page 5-9.
          • Set spans, p4 and p5, within the measurement range indicated in page 5-9.
          • Input values within 6 digits disregarding the decimal point for p4 and p5.
          • The measurement range cannot be changed while executing a report.

Setting the pulse input(DR232/DR242)

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

     p1   Channel number (001 to 560)
     p2   PULSE
     p3   Measuring mode
           RATE   momentary pulse count mode
           GATE   contact ON/OFF detection mode
     p4   Left value of span (0 to 30000)
     p5   Right value of span (0 to 30000)
     p6   Left value of scale (0 to 30000)
     p7   Right value of scale (0 to 30000)
     p8   Decimal point position of scale (0 to 4)
     p9   Filter (ON or OFF)

Example   Set subunit 1 and channel 01 to momentary pulse count mode, left value of span to 0, and right value of span to 1000.
       SR101, PULSE, RATE, 0, 1000, 0, 1000, 0

Comments   • When omitting p6, p7, or p8, omit all three.
          • When summing the count number or the ON time, set the computational expression with the SO command, then execute computation start with the EX command. When the pulse input module is installed, the use of computation channels become available without the math option. However, the only computational expression available in this case is TLOG.PSUM(XXX) for summing the count number or the ON time.
          • The measurement range cannot be changed while executing a report.

Setting Scaling

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

     p1   Channel number (001 to 560)
           Conputation channel number (A01 to A60)
     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 5-7 and 5-8.
          • For the p5 and p6 setting spans, set them in the ranges shown in the setting range on Pages 5-7 and 5-8.
          • 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.
          • The measurement range cannot be changed while executing a report.

Setting the power monitor scaling

Setting SRp1, p2, p3, p4, p5, p6, p7, p8, p9, p10, p11<terminator>

     p1   Channel number (001 to 560)
     p2   SCL
     p3   AC
     p4   Wiring method
           1Ph2W: Single-phase two-wire system
           1Ph3W: Single-phase three-wire system
                      (only on a three-wire system)
           3Ph3W-2I: Three-phase three-wire system
                      (only on a two-voltage two-current three-wire system)
           3Ph3W-3I: Three-phase three-wire system
                      (only on a three-voltage three-current three-wire system)
           3Ph4W: three-phase four-wire system
                      (only on a three-wire system)
     p5   Input range
           25 V - 0.5 A
           25 V - 5 A
           250 V - 0.5 A
           250 V - 5 A
     p6   Measurement item
     p7   Left value of span
     p8   Right value of span
     p9   Left value of scale (-30000 to 30000)
     p10   Right value of scale (-30000 to 30000)
     p11   Decimal point position of scale (0 to 4)

Example   Measure the active power on subunit 0 and channel 01, and convert 10W to 0.00 and 100W to 100.00.
       SR001, SCL, AC, 3Ph3W-2I, 250V-0.5A, P1, 10, 100, 000, 10000, 2

Comments   • Settings of p4 and p5 are common within one power monitor module. If the setting is changed, the settings on other channels also change.
          • For the measurement item p6, refer to the list of measurement items on page 5-9 and 5-10.
          • There are items that can not be set on the measurement item, p6, depending on the wiring method or the settings on other channels. Set within the group indicated on page 5-10.
          • Set the span values, p7 and p8, within the measurement range indicated on page 5-8.
          • Input values within 6 digits disregarding the decimal point for p7 and p8. The decimal point position is fixed to the decimal point position of the setting range of page 5-8.
          • For p9, p10, and p11, either set all the three parameters or omit all three.
          • The measurement range cannot be changed while executing a report.

Setting the strain input scaling(DR232/DR242)

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

      p1   Channel number (001 to 560)

      p2   SCL

      p3   STRAIN

      p4   Measurement range

            2k/20k/200k

      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   Measure using the measurement range of 20k for subunit 0 and channel 01, and convert 0μɛ to 0.00 and 1000μɛ to 100.00.

            SR001, SCL, STRAIN, 20k, 0, 1000, 000, 10000, 2

Comments   • Even when the settings of p4 are same parameters, the measurement range of the strain varies depending on the gauge method. For details, refer to page 5-8.

            • Set spans p5 and p6 within the measurement range indicated in page 5-8.

            • Input values up to 6 digits disregarding the decimal point for p5 and p6. The decimal point position is fixed to the decimal point position of the setting range of page 5-8.

            • For p7, p9, and p10, either set all the three parameters or omit all three.

            • The measurement range cannot be changed while executing a report.

SN   Sets the scaling unit.

Mode   Operation mode

Setting   SNp1, p2<terminator>

      p1   Channel number (001 to 560)

            Computation channel number (A01 to A60)

      p2   Unit character string (up to 6 characters)

Example   Set the scaling unit for channel 01 of subunit 0 to ABCDEF.

            SN001, ABCDEF

Comments   • For a character string that can be used as units, see the characters in Section 5.6, "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 (0.5, 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, or 60)

Example   Set the measurement period to 10 seconds.

            XV10

Comments   • 0.5s and 1s are only for DR232 and DR242.

            • 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	0.5 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

*: 2s if the power monitor module is installed

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

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Commands

6.2 Setting Alarms

SA   Sets the alarm.

Mode   Operation mode

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

     p1   Channel number (001 to 560)

           Computation channel number (A01 to A60)

     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 subunit 0 and use relay module 1 in slot 5 of subunit 0 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 5-7 to 5-9). 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 5-7 to 5-9.

        • 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 5-7 to 5-9.

• 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 5-4.

• 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 for a stand-alone model 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 or scaling 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 5-4.

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 0 to No.10 of slot 2 in the alarm
           output relay module connected to the main unit as
           AND relay outputs.
           XNI, 01-30
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 0 to No. 10 in slot 5 of
           the relay module connected to subunit 5 to
           energizing outputs.
           XD501-60, 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

6.3 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 560)
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 560)
               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 A60) can be
               set.
           p3 Display channel number (001 to 560)
Example   Display the alarm statuses for relay number 2 in slot
           1 of subunit 1.
           MD5, 112
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.

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Commands

• 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 560)
	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 A60) can be set.
	p3 Display channel number (001 to 560)
Example	Display the measured value of channel numbers 1 and 3 in slot 2 of subunit 2 in manual mode.
	LD1, 221,223
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.

6.4 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.

<u>**SZ**</u>　　　**Sets the recording zone.**
Mode　　　　Operation mode
Setting　　　SZp1, p2, p3<terminator>
　　　p1　　Channel number (001 to 560)
　　　　　　Computation channel number (A01 to A60)
　　　p2　　Lower limit of zone (0 to 245 mm, 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 of
　　　　　　subunit 4 to 10 to 50 mm.
　　　　　　SZ436, 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.

<u>**SP**</u>　　　**Sets partially expanded recording.**
Mode　　　　Operation mode
Setting　　　SZp1, p2, p3, p4<terminator>
　　　p1　　Channel number (001 to 560)
　　　　　　Computation channel number (A01 to A60)
　　　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 of
　　　　　　subunit 4 at the boundary recording position of 25%
　　　　　　for the boundary value 0 V.
　　　　　　SP436, 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 5-7 and 5-8). 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
　　　　　　 5-7 and 5-8.
　　　　　　• 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.

<u>**SG**</u>　　　**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 5-11.

　　　　　　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

<u>**ST**</u>　　　**Sets a tag.**
Mode　　　　Operation mode
Setting　　　STp1, p2<terminator>
　　　p1　　Channel number (001 to 560)
　　　　　　Computation channel number (A01 to A60)
　　　p2　　Tag character string (up to 16 characters)
Example　　Set "TEST" as the tag for channel 6 in slot 3 of
　　　　　　subunit 4.
　　　　　　ST436, 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 5-11.
　　　　　　• The optional computation channel number for a
　　　　　　 stand-alone model is A01 to A30.

<u>**SH**</u>　　　**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 5-11.
　　　　　　• Parameter p2 can have no more than 60 characters
　　　　　　 for theDR130 and no more than 80 characters for
　　　　　　 the DR230/240.

<u>**SJ**</u>　　　**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 6-9).
　　　　　　• For details of character strings that can be used as
　　　　　　 titles, see the characters in the table of ASCII
　　　　　　 codes on Page 5-11.

<u>**SF**</u>　　　**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)

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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 560)
	Computation channel number (A01 to A60)
	p2 ON/OFF
Example	Perform step interpolation for channel 6 in slot 3 of subunit 4.
	SB436, 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 560)
	Computation channel number (A01 to A60)
	p2 ON/OFF
Example	Turn on the analog recording of channel 6 in slot 3 of subunit 4.
	pT436, 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 560)
	Computation channel number (A01 to A60)
	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 of subunit 4 at the interval of timer 2.
	pD436, 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 560)
	Computation channel number (A01 to A60)
	p2 ON/OFF

Example	Perform manual printing for channel 6 in slot 3 of subunit 4.
	PM436, 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 560)
	Computation channel number (A01 to A60)
	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 of subunit 4 is generated, print the alarm and message No. 5.
	PA436, 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 560)
	Computation channel number (A01 to A60)
	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%.
	PC436, 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 560)
        Computation channel number (A01 to A60)
    p2   ON/OFF
Example   Perform list printing for channel 6 in slot 3 of subunit 4.
    PL436, ON
Comments • The optional computation channel number for a stand-alone model 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 6-10).
      • 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 isautomatically determined according to the chart speed, and the number ofchannels and rows in which numeric values are printed. For details, seethe separate manual (IM DR231-01E or IM DR232-01E).

XC   Sets dot printing colors.

Mode   Setup mode
Setting   XCp1, p2<terminator>
    p1   Channel number (001 to 560)
        Computation channel number (A01 to A60)
    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 of subunit 4 in red-purple.
    XC436, RED-PR
Comments • The optional computation channel number for a stand-alone model is A01 to A30.

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6.5 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 560)
	p2 Number of moving averages (0 to 64)
	0 = Off
Example	Take moving averages 64 times in the input of subunit 0, 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 560)
	Computation channel number (A01 to A60)
	p5 First channel number of copy destination (001 to 560)
	Computation channel number (A01 to A60)
	p6 Last channel number of copy destination (01 to 60)
Example	Copy only the range setting data in channel 01 of subunit 0, to channel 01 to channel 60 of subunit 1.
	SYON, OFF, OFF, 001, 101-60
	Copy only the range setting data in channel 02 of subunit 0, to channel 03 of subunit 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 of unit 4 to channel 10 in slot 3 of subunit 4 and channel 5 in slot 4 of unit 4 to group 3.
	SXG03, 411-440, 445

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/group reset
		REPORT	Report start/stop
		FLAG	Set flag to 1

p5　Auxiliary action information (for p3=EDGE)
　• 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.
	RST_G01 to RST_G07:	Computed data in the specified group are cleared.

　• For p4=REPORT

	START	Report starts.
	STOP	Report stops.

　• For p4=FLAG
　　F01 to F06: Specified flag number is set to 1.

p5　Auxiliary action information (for p3=LEVEL)
　• For p4=MEMRY

	PAUSE	Stops or restarts writing of measured/computed data.

　• For p4=FLAG
　　F01 to F06: Specified flag number is set to 1.

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/group reset
		REPORT	Report start/stop
		FLAG	Set flag to 1

p6　Auxiliary action information (for p4=EDGE)
　• 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.
	RST_G01 to RST_G07:	Computed data in the specified group are cleared.

　• For p4=REPORT

	START	Report starts.
	STOP	Report stops.

　• For p4=FLAG
　　F01 to F06: Specified flag number is set to 1.

p6　Auxiliary action information (for p4=LEVEL)
　• For p5=MEMRY

	PAUSE	Stops or restarts writing of measured/computed data.

　• For p5=FLAG
　　F01 to F06: Specified flag number is set to 1.

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

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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,REPORT, FLAG, 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 or IM DR232-01E).

SO   Sets the computational expression.

Mode Operation mode

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

     p1   Channel for computation:
        Stand-alone model - A01 to A30
        Expandable model - A01 to A60

     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 (stand-alone model)
       M001 to M300 (expandable model)
     Computation data
       MA01 to MA30 (stand-alone model)
       MA01 to MA60 (expandable model)

- 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:
        Stand-alone model - K01 to K30
        Expandable model - K01 to K60

     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:
        Stand-alone model — C01 to C30
        Expandable model — C01 to C60

     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.

RO   Setting hourly/daily/monthly report to ON/OFF and the time to create the report

Mode   Setup mode

Setting   ROp1, p2, p3, p4<terminator>

     p1   ON   Create hourly report
        OFF   Hourly report OFF

     p2   ON1   Create daily report in standard format
        ON2   Create daily report in extended format
        OFF   Daily report OFF

     p3   ON1   Create monthly report in standard format
        ON2   Create monthly report in extended format
        OFF   Monthly report OFF

     p4   Date and time to create the report
        DD HH
         DD: Date
         HH: Hour

Example   Do not create hourly reports and create daily and monthly reports in standard format. Create the monthly report at 10 O'clock on the first day of every month and the daily report at 10 O'clock everyday.

ROOFF, ON1, ON1, 01 10

Comments • Effective only on instruments with the optional report function.
• The report is output using TS4+device trigger (GET)+RF.
• Date is set between 01 and 28 and hour is set between 00 and 23 for p4.

<u>**RM**</u> **Setting report channel to ON/OFF and the report computation type**

Mode Setup mode
Setting RMp1, p2, p3, p4, p5<terminator>
p1 Report channel number (R01 to R60)
p2 Set the report channel to ON/OFF.
p3 Corresponding channel number
Measurement channel: 001 to 060 for stand-alone type, 001 to 560 for extended type
Computation channel: A01 to A30 for stand-alone type, A01 to A60 for extended type
p4 The type of computation
INST Instantaneous value at the time when the report is created.
AVE Average value
SUM Summed value
p5 Conversion of the standard unit of time
INTVL No conversion
/sec Convert as the summed value of the physical amount every second
/min Convert as the summed value of the physical amount every minute
/hour Convert as the summed value of the physical amount every hour
/day Convert as the summed value of the physical amount everyday

Example Set the summed value of the measurement channel 005 which is measuring the amount of flow in units of l/min to the report channel, R02.
RMR02, ON, 005, SUM, /min

Comments • Effective only on instruments with the optional report function.
• If average value (AVE) is set on p4, minimum and maximum values are also computed along with the average value.
• If SUM is set on p4, the following computations are carried out along with the summed value from the time when the report was created to the next report.
For hourly report: Total of the summed values up to the time the daily report is created.
For daily report: Total of the summed values up to the time the monthly report is created
Only summed value for monthly report
• The settings p3, p4 and p5 are effective when p2 is ON.
• The setting p5 is effective only when p4 is set to SUM.
• Since the sum is computed every measurement interval using the sampled data, there are cases when the physical amount per unit amount of time is measured, the computed result differs from the actual summed value (the measurement interval and the unit time are different). In this case, set the same unit used for the unit time of the physical amount being measured to p5. The summed values are computed using the following converting equations depending on the parameters.
INTVL Σ(measured values)
/sec Σ(measured values) x measurement

interval
/min Σ(measured values) x measurement interval/60
/hour Σ(measured values) x measurement interval/3600
/day Σ(measured values) x measurement interval/86400
The unit of the measurement interval is seconds.

<u>**RI**</u> **Setting the automatic print at the time when the report is created to ON/OFF**

Mode Setup mode
Setting RIp1<terminator>
p1 ON Print the report automatically at the time when the report is created.
OFF Do not print the report at the time when the report is created.
Example Print the report at the time when the report is created.
RION
Comments • If a report is being printed from the FUNC menu of the main unit or from the RP command, automatic printing does not take place at the time when the report is created..

<u>**SW**</u> **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

<u>**XK**</u> **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

<u>**XF**</u> **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

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computation.

MATH_STOP

Stops computation.

MATH_ACK

Clears the computation status indication.

REPORT_START

Starts report.

REPORT_STOP

Stops report.

REP_RECALL_START

Starts printing the report.

REP_PRINT_STOP

Stops printng the report.

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

RE_SYSTEM (DR232/DR242 only)

Reconstruction of a system

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 560)

 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 560)
    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
      STOREEstablishment
      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.

XZ   Performs A/D calibration of the input module.

Mode   A/D calibration mode
Calibration using the actual input value at the input terminal
Setting   XZp1, p2, p3, p4<terminator>
    p1   Subunit number (0 to 5)
    p2   Slot number (0 to 5)
    p3   CAL/EXEC
    p4   Calibration item
      For universal input module
      20 mV, 60 mV, 200 mV, 2 V, 6 V, 20 V, 50 V, pt:1 mA, Pt:2 mA, Pt:1 mA-H, Pt:2 mA-H, Cu:2 mA
      For DCV/TC/DI input module
      20 mV, 60 mV, 200 mV, 2 V, 6 V, 20 V, 50 V
      For mA input module
      20 mA
      For strain input module
      2k_ZERO, 2k_SPAN, 20k_ZERO, 20k_SPAN, 200k_ZERO, 200k_SPAN
      For digital input module
      60 mV, 6 V
Example   Calibrate the 20-mV range on the module in slot 1 of subunit 0.
    XZ0, 1, CAL/EXEC, 20 mV

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Correcting the calibration value manually (universal module)

Setting   XZp1, p2, p3, ... , p25<terminator>

	p1	Unit number (0 to 5)
	p2	Slot number (0 to 5)
	p3	DISPLAY
	p4	Zero calibration value for 20-mV range
	p5	Span calibration value for 20-mV range
	p6	Zero calibration value for 60-mV range
	p7	Span calibration value for 60-mV range
	p8	Zero calibration value for 200-mV range
	p9	Span calibration value for 200-mV range
	p10	Zero calibration value for 2-V range
	p11	Span calibration value for 2-V range
	p12	Zero calibration value for 6-V range
	p13	Span calibration value for 6-V range
	p14	Zero calibration value for 20-V range
	p15	Span calibration value for 20-V range
	p16	Zero calibration value for 50-V range
	p17	Span calibration value for 50-V range
	p18	Zero calibration value for Pt:1 mA
	p19	Span calibration value for Pt:1 mA
	p20	Zero calibration value for Pt:2 mA
	p21	Span calibration value for Pt:2 mA
	p22	Span calibration value for Pt:1 mA-H
	p23	Span calibration value for Pt:2 mA-H
	p24	Zero calibration value for Cu:2 mA
	p25	Span calibration value for Cu:2 mA

Correcting the calibration value manually (DCV/TC/DI input module)

Setting   XZp1, p2, ... , p17<terminator>

	p1	Unit number (0 to 5)
	p2	Slot number (0 to 5)
	p3	DISPLAY
	p4	Zero calibration value for 20-mV range
	p5	Span calibration value for 20-mV range
	p6	Zero calibration value for 60-mV range
	p7	Span calibration value for 60-mV range
	p8	Zero calibration value for 200-mV range
	p9	Span calibration value for 200-mV range
	p10	Zero calibration value for 2-V range
	p11	Span calibration value for 2-V range
	p12	Zero calibration value for 6-V range
	p13	Span calibration value for 6-V range
	p14	Zero calibration value for 20-V range
	p15	Span calibration value for 20-V range
	p16	Zero calibration value for 50-V range
	p17	Span calibration value for 50-V range

Correcting the calibration value manually (mA input module)

Setting   XZp1, p2, p3, p4, p5<terminator>

	p1	Unit number (0 to 5)
	p2	Slot number (0 to 5)
	p3	DISPLAY
	p4	Zero calibration value for 20-mA range
	p5	Span calibration value for 20-mA range

Correcting the calibration value manually (Strain input module)

Setting   XZp1, p2, p3, ..., p9<terminator>

	p1	Unit number (0 to 5)
	p2	Slot number (0 to 5)
	p3	DISPLAY
	p4	Zero calibration value for 2k range
	p5	Span calibration value for 2k range
	p6	Zero calibration value for 20k range
	p7	Span calibration value for 20k range
	p8	Zero calibration value for 200k range
	p9	Span calibration value for 200k range

Correcting the calibration value manually (Digital input module)

Setting   XZp1, p2, ... , p7<terminator>

	p1	Unit number (0 to 5)
	p2	Slot number (0 to 5)
	p3	DISPLAY
	p4	Zero calibration value for 60-mV range
	p5	Span calibration value for 60-mV range
	p6	Zero calibration value for 6-V range
	p7	Span calibration value for 6-V range

Example   Modify the span calibration value for the 60-mV range of the module in slot 1 of subunit 0 to 32000.

              XZ0, 1, DISPLAY, , , , 32000

Storage of A/D calibration data in a module (A/D calibration END processing)

Setting   XZp1, p2, p3, p4<terminator>

	p1	Unit number (0 to 5)
	p2	Slot number (0 to 5)
	p3	END
	p4	Storage selection (ABORT, STORE)

Example   Store the calibrated values for the module in slot 1 of subunit 0.

              XZ0, 1, END, STORE

Comments   • You must execute STORE using A/D calibration end processing each time after making an A/D calibration or adjustment for one module. If A/D calibration end processing (STORE) is not executed, the calibrated data will not take effect.
           • Since it takes an indefinite time to execute the XZ command, return an ACK after the processing ends.
           • On the controller side, execute the following processing after receiving an ACK after transmitting the XE command. The format of the ACK status is as follows:
           E0Cr+Lf The received command was normally processed.
           E1Cr+Lf There is an error in the received command.
           • If A/D calibration data are adjusted, inputting a numeric value which is out of the setting range disables the modules to be recognized. For details, see the separate manual (IM DR231-01E or IM DR232-01E).

6.6 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.
       TRIGGER   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.

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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 p1 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_TRIG1 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.
            • Initial balancing and initialization can not be executed during a report.
            • 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

DR   Start/stop the report
Mode   Operation mode
Setting   DRp1<terminator>
            p1   Start/stop the report
                  0: Start the report
                  1: Stop the report

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Example   Start the report.
            DR0

Comments   • Effective only on instruments with the optional
            report function.
          • Measurement range, date, time cannot be changed
            during a report. Copy using the range copy ON
            also cannot be executed during a report.
          • All report data up to that point are cleared when a
            report is started.
          • This setting is effective when one of hourly, daily
            and monthly reports is ON.

RP   Start/stop the report priting

Mode   Operation mode
Setting   RPp1<terminator>
          p1   Start/stop the report printing
               0: Start the report printing
               1: Stop the report printing
Example   Start the report printing.
            RP0
Comments   • Effective only on instruments with the optional
            report function.
          • Measurement range, date, time cannot be changed
            during a report. Copy using the range copy ON
            also cannot be executed during a report.
          • All report data up to that point are cleared when a
            report is started.
          • This setting is effective when one of hourly, daily
            and monthly reports is ON.

RS   Reconstruct the system.

Mode   Operation mode
Setting   RSp1<terminator>
          p1   0 The system is reconstruct.
Example   Reconstruct the system.
            RS0
Comments   • Reconstruct the system. Execute this command if
            a subunit or a module is newly added or a module
            in a slot is replaced.
          • Since it takes an indefinite time to execute the RS
            command, return an ACK after processing. On
            the controller side, execute the following
            processing after receiving an ACK after
            transmitting the RS 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.

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.

6.7 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 560)

           First output computed channel (A01 to A60)

     p3   Last output channel (001 to 560)

           Last output computed channel (A01 to A60)

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 number for a stand-alone model is A01 to A30.

MF — **Sets the output formats of the measured data/computed data, or report 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

       4   Specified report file output in binary format.

     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.
- p1=4 is effective only with an optional report function.
- 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 R60)

     p3   Last channel for output (R01 to R60)

Comments

- Before transmitting the RF command, be sure to specify the data to output using the TS command and execute "GET."
- The output format of the report file is specified by the "MF" command.
- 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 560)

           First output computed channel (A01 to A60)

     p2   Last output channel (001 to 560)

           Last output computedchannel (A01 to A60)

Comments

- You must specify data to be output with the TS command and execute "GET" or "ESC T" before sending the LF command.

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• If no input channel is recognized by the DR230/
  DR240 among the specified channels, a syntax
  error occurs.

• The optional computation channel number for a
  stand-alone model is A01 to A30.

<u>CF</u>   **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.

<u>BO</u>   **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)

<u>IM</u>   **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.

<u>SM</u>   **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.

7.1 Functions as Talker

There are the following seventeen 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
- Output the hourly report using the report function: TS4 + [GET] +RF0
- Output the daily report using the report function: TS4 + [GET] +RF1
- Output the monthly report using the report function: TS4 + [GET] +RF2
- Output the status of the hourly/daily/monthly report: TS4 + [GET] +RF3

Measured/computed or report 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.

Setting of 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.

Report output (TS4)

After transmitting the device trigger "GET " be sure to read the data using the RF command. Execution of "GET" alone without executing the RF command does not read the data. After reading all the specified data with the RF command, subsequent specification of another channel using the RF command without executing "GET" enables that data to be read.

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, MF, RF command before outputting data for specified channels.
- If an FM, LF, CF, MF, RF 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, MF, RF command or without completing the data output sets new data to the buffer. Be careful because old data are lost.

7.2 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:
  - Stand-alone model: A01 to A30
  - Expandable model: A01 to A60

7.3 Measured/Computed Data Output Format (Binary code)

The data are output in the following format by receiving TS0 + "Device Trigger (GET)" + FM1:
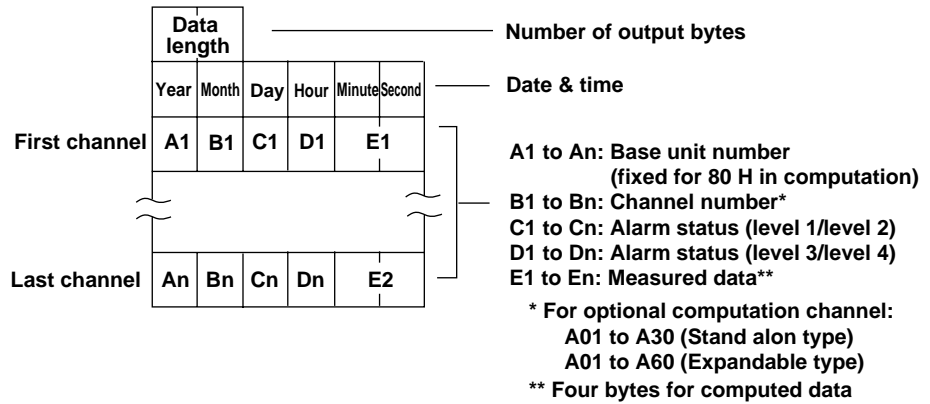
Data length

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

Number of output bytes = $6 \times N + 6$ (N = number of output channels)

Number of output bytes = $8 \times M + 6$ (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.
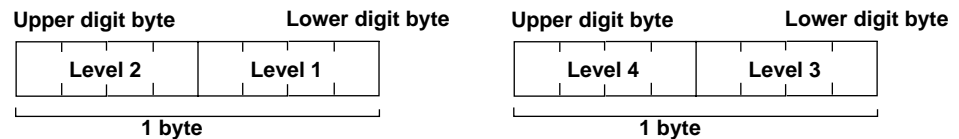
The status of two levels is output in hexadecimal notation. For example, if the level 1 alarm status is 2 (lower-limit alarm) and the level 2 alarm status is 4 (lower-differential-limit alarm), 42H is output.

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.

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

SG	Setting data for No. 1 message	CrLf
SG	Setting data for No. 20message	CrLf
SH	Header setting data for the first line	CrLf
SH	Header setting data for the last line	CrLf
SJ	Setting data for the title	CrLf
SI	Setting data for No.1 timer	CrLf
SI	Setting data for No.6 timer	CrLf
SQ	Setting data for No.1 match time	CrLf
SQ	Setting data for No.3 match time	CrLf
SF	Setting data for the format for list printing	CrLf
SL	Setting data for No.1 event action	CrLf
SL	Setting data for No.30 event action	CrLf
SE	Setting data for the second chart speed	CrLf
SB	Interpopation ON/OFF setting data for the first channel	CrLf
SB	Interpopation ON/OFF setting data for the last channel	CrLf
SV	Moving average setting data for the first channel	CrLf
SV	Moving average setting data for the last channel	CrLf
SX	Setting data for No. 1 group	CrLf
SX	Setting data for No. 1 group	CrLf
SW	Setting data for summer/winter time	CrLf
SK	Constant setting data for the first constant number	CrLf
SK	Constant setting data for the last constant number	CrLf
MH	Data storage ON/OFF setting data for the first channel	CrLf
MH	Data storage ON/OFF setting data for the flast channel	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 subunit.

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 the 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**

7

Output Format

7.5 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 the 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 042 to 236 are specified by the LF command, data from slot 4 of subunit 0 to slot 3 of subunit 2 are output.

Note

- Data which are output for burnout and reference junction compensation are those of the channel up to the maximum number connected for every subunit 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.

7.6 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 (DR130/231/241)

     A01 to A60 (expandable models)

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.

7

Output Format

7.7   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
	I ------------------ Main unit (DR232/DR242)
	0 ------------------ Subunit or DR130/DR231/DR241
	1 to 5 ------------ Subunit
	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)

Note

• The number and data of subunits not connected in the system settings are not output.

7.8 A/D Calibration Data Output Format

A/D calibration data are output in the following format by the TS8 + "Device Trigger (GET)" + LF command: This is effective only in the A/D calibration mode.

XZ	A/D calibration data for the first slot	CrLf
XZ	A/D calibration data for the last slot	CrLf
EN	Output completion	CrLf

Calibration data are output for every slot after the command to execute A/D calibration. The output format is the same form as in the XZ command setting shown below.

XZ subunit number, slot number, DISPLAY, calibration item CrLf

All calibration items are output.

Range of outputting

The number of slots to which A/D calibration data are output is determined by the channels specified by the LF command. For example, if channels 042 to 236 are specified by the LF command, data from subunit 0, slot 4 to subunit 2, slot 3 are output.

7

Output Format

7.9 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 (stand alone model)/A01 to A60 (expandable model)
MM: Memory in which data are stored
        Stand-alone: stand-alone models (including the DR130)
        Expandable: expandable models
        OTHER: other models

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.

7.10 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 (stand-alone model)
A01 to A60 (expandable model)

EEE: Last output channel (three characters)
Channel for computation
A01 to A30 (stand-alone model)
A01 to A60 (expandable model)

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 (stand-alone model)

A01 to A60 (expandable model)

±:   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.

7.11 RAM Disk Output Format (Binary Code)

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

Header information	**Same as for ASCII code**
Channel information	**<EOI>**
Data	**<EOI>**

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 (stand-alone model)/A01 to A60 (expandable model)
EEE:	Last output channel (three characters)
	Channel for computation
	A01 to A30 (stand alone model)/A01 to A60 (expandable model)
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 (stand alone model)/A01 to A60 (expandable model)
UUUUUU:	Units
P:	Position of decimal point (0 to 4)
	0 -------------------- AAAAA
	1 -------------------- AAAA. A
	2 -------------------- AAA. AA
	3 -------------------- AA. AAA
	4 -------------------- A. AAAA

For Measured Data

1	2	3	4
Number of Output Bytes			
Measured data 1 (first CH)			
⋮			
Measured data 1 (last CH)			
Measured data 2 (first CH)			
⋮			
Measured data 2 (last CH)			
⋮			
Measured data n (first CH)			
⋮			
Measured data n (last CH)			

<EOI>

For Computed Data

1	2	3	4
Number of Output Bytes			
Computed data 1 (first CH)			
⋮			
Computed data 1 (last CH)			
Computed data 2 (first CH)			
⋮			
Computed data 2 (last CH)			
⋮			
Computed data n (first CH)			
⋮			
Computed data n (last CH)			

<EOI>

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)
Power failure	7F7FH (7F7F7F7FH 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.
- One set of power failure information data are written when the power recovers from the power failure regardless of writing period.

7.12 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 (stand alone model)/A01 to A60 (expandable model)
  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.

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Output Format

7.13 Report Output Format

Hourly report

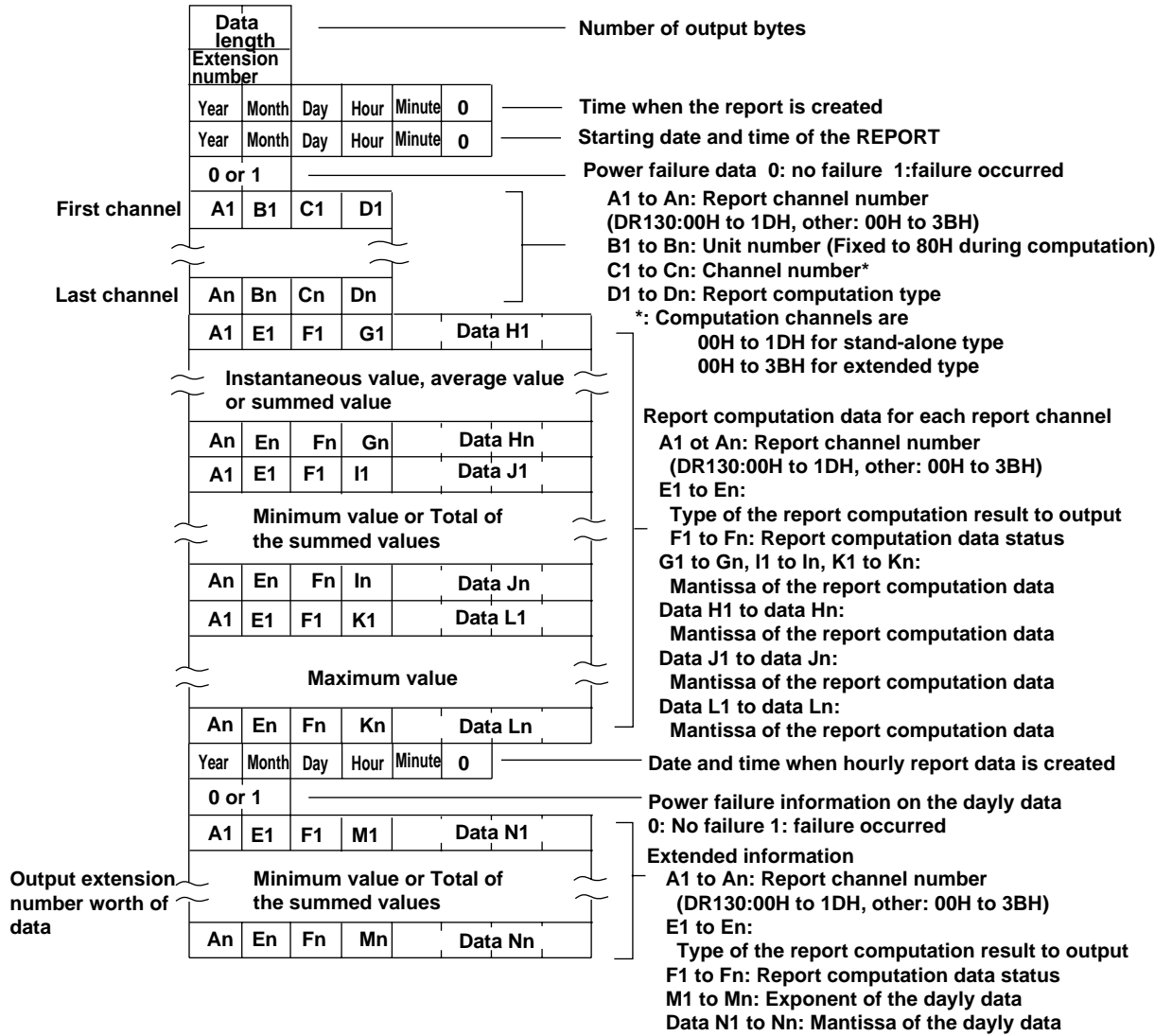The hourly report is output in the following format with the command, TS4+device trigger(GET)+RF0.

Data length						— Number of output bytes
Extension number						
Year	Month	Day	Hour	Minute	0	— Time when the report is created
Year	Month	Day	Hour	Minute	0	— Starting date and time of the sum for TOTAL
0 or 1						— Power failure data 0: no failure 1:failure occurred

First channel — A1 | B1 | C1 | D1

Last channel — An | Bn | Cn | Dn

A1 | E1 | F1 | G1 | DATA H1

Instantaneous value, average value or summed value

An | En | Fn | Gn | DATA Hn

A1 | E1 | F1 | I1 | DATA J1

Minimum value or Total of the summed values

An | En | Fn | In | DATA Jn

A1 | E1 | F1 | K1 | DATA L1

Maximum value

An | En | Fn | Kn | DATA Ln

A1 to An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
B1 to Bn: Unit number (Fixed to 80H during computation)
C1 to Cn: Channel number*
D1 to Dn: Report computation type
*: Computation channels are
00H to 1DH for stand-alone type
00H to 3BH for extended type

Report computation data for each report channel
A1 ot An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
E1 to En:
Type of the report computation result to output
F1 to Fn: Report computation data status
G1 to Gn, I1 to In, K1 to Kn:
Mantissa of the report computation data
Data H1 to data Hn:
Mantissa of the report computation data
Data J1 to data Jn:
Mantissa of the report computation data
Data L1 to data Ln:
Mantissa of the report computation data

Data length

The number of output bytes can be determined from the following expression.

Number of output bytes = $16 + 4 \times N + 8 \times N \times 3 + (8 + 8 + N)$ x extension number

N: Number of output channels

Report computation type

Output the type of computation set for each report channel.

00H: OFF
01H: INST (Instantaneous value)
02H: AVE (Average)
03H: SUM (Sum)

The type of report computation result to output

The report computation results vary depending on the report computation types. The following types of report computation results are output.

Output value	Type of report computation result to output	Report computation type
00H	Invalid data	OFF
01H	INST (instantaneous value)	INST
02H	AVE (average value)	AVE
03H	SUM (summed value)	SUM
04H	MIN (minimum value)	AVE
05H	MAX (maximum value)	AVE
06H	TOTAL (total of the summed values)	SUM

Data status

Outputs the status of the report computation result. The sum of the top numbers of the phenomena from the following items is output.

1H: Detected over-limit data during measurement

2H: Detected special data during sampling

4H: Power failure occurred during computation

80H: Numerical data valid

Output data

Depending on the type of report computation, the results are output in the following order.

Computation type: INST (instantaneous value)

   G1 to Gn, data H1 to data Hn: Instantaneous value during report creation

   l1 to ln, data J1 to data Jn: Meaningless data

   K1 to Kn, data L1 to Ln: Meaningless data

Computation type: AVE (average)

   G1 to Gn, data H1 to data Hn:

      Hourly report: Average value of the measured data over 1 hour

      Dayly report: Average value of the measured data over 1 day

      Monthly report: Average value of the measured data over 1 month

   l1 to ln, data J1 to data Jn:

      Hourly report: Minimum value of the measured data over 1 hour

      Dayly report: Minimum value of the measured data over 1 day

      Monthly report: Minimum value of the measured data over 1 month

   K1 to Kn, data L1 to Ln:

      Hourly report: Maximum value of the measured data over 1 hour

      Dayly report: Maximum value of the measured data over 1 day

      Monthly report: Maximum value of the measured data over 1 month

Computation type: SUM (sum)

   G1 to Gn, data H1 to data Hn:

      Hourly report: Summed value of the measured data over 1 hour

      Dayly report: Summed value of the measured data over 1 day

      Monthly report: Summed value of the measured data over 1 month

   l1 to ln, data J1 to data Jn: Total of the summed values since the start of the report

   K1 to Kn, data L1 to Ln: Meaningless data

If the data is abnormal, the following value is output at the mantissa of the computed data.

7FFF7FFFH: Positive over-limit data

80018001H: Negative over-limit data

80028002H: Measurement range setting skips

80038003H: The specified channel is not connected

80048004H: Data error

80058005H: Data output not possible

Note

- The mantissa of the data length, extension number, power failure information and data can be output from either the upper or the lower byte with the BO command.

- The report channels set to OFF are output in the following way.

  Type of report computation result: 00H (invalid)

  Data status: Meaningless data

  The exponent and mantissa of the data: Meaningless data

7

Output Format

Daily Report

The daily report is output in the following format with the command, TS4+device trigger(GET)+RF1.

Data length						→ Number of output bytes

Extension number						
Year	Month	Day	Hour	Minute	0	→ Time when the report is created
Year	Month	Day	Hour	Minute	0	→ Starting date and time of the sum for TOTAL

0 or 1 → Power failure data 0: no failure 1:failure occurred

First channel

A1	B1	C1	D1

~ ~

Last channel

An	Bn	Cn	Dn

- A1 to An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
- B1 to Bn: Unit number (Fixed to 80H during computation)
- C1 to Cn: Channel number*
- D1 to Dn: Report computation type
- *: Computation channels are
  - 00H to 1DH for stand-alone type
  - 00H to 3BH for extended type

A1	E1	F1	G1	DATA H1

Instantaneous value, average value or summed value

An	En	Fn	Gn	DATA Hn
A1	E1	F1	I1	DATA J1

Minimum value or Total of the summed values

An	En	Fn	In	DATA Jn
A1	E1	F1	K1	DATA L1

Maximum value

An	En	Fn	Kn	DATA Ln

Report computation data for each report channel
- A1 ot An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
- E1 to En: Type of the report computation result to output
- F1 to Fn: Report computation data status
- G1 to Gn, I1 to In, K1 to Kn: Mantissa of the report computation data
- Data H1 to data Hn: Mantissa of the report computation data
- Data J1 to data Jn: Mantissa of the report computation data
- Data L1 to data Ln: Mantissa of the report computation data

The meaning of each data is the same as the hourly report.

Extended format for the daily report

If the daily report is set to ON2, extended daily report is output in the following format with the command, TS4+device trigger(GET)+RF1.

Data length						Number of output bytes
Extension number						
Year	Month	Day	Hour	Minute	0	Time when the report is created
Year	Month	Day	Hour	Minute	0	Starting date and time of the sum for TOTAL
0 or 1						Power failure data 0: no failure 1:failure occurred

First channel

A1	B1	C1	D1

Last channel

An	Bn	Cn	Dn

A1 to An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
B1 to Bn: Unit number (Fixed to 80H during computation)
C1 to Cn: Channel number*
D1 to Dn: Report computation type
*: Computation channels are
00H to 1DH for stand-alone type
00H to 3BH for extended type

A1	E1	F1	G1	Data H1

Instantaneous value, average value or summed value

An	En	Fn	Gn	Data Hn
A1	E1	F1	I1	Data J1

Minimum value or Total of the summed values

An	En	Fn	In	Data Jn
A1	E1	F1	K1	Data L1

Maximum value

An	En	Fn	Kn	Data Ln
Year	Month	Day	Hour	Minute	0

Date and time when hourly report data is created

0 or 1

Power failure information on the hourly data 0: No failure 1: failure occurred

A1	E1	F1	M1	Data N1

Output extension number worth of data — **Minimum value or Total of the summed values**

An	En	Fn	Mn	Data Nn

Report computation data for each report channel
A1 ot An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
E1 to En: Type of the report computation result to output
F1 to Fn: Report computation data status
G1 to Gn, I1 to In, K1 to Kn: Mantissa of the report computation data
Data H1 to data Hn: Mantissa of the report computation data
Data J1 to data Jn: Mantissa of the report computation data
Data L1 to data Ln: Mantissa of the report computation data

Extended information
A1 to An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
E1 to En: Type of the report computation result to output
F1 to Fn: Report computation data status
M1 to Mn: Exponent of the hourly data
Data N1 to Nn: Mantissa of the hourly data

7

Output Format

Monthly Report

The monthly report is output in the following format with the command, TS4+device trigger(GET)+RF2.

Data length		—		Number of output bytes		
Extension number						
Year	Month	Day	Hour	Minute	0	— Time when the report is created
Year	Month	Day	Hour	Minute	0	— Starting date and time of the sum for TOTAL
0 or 1						— Power failure data 0: no failure 1:failure occurred

First channel — A1 | B1 | C1 | D1

Last channel — An | Bn | Cn | Dn

A1	E1	F1	G1	DATA H1

Instantaneous value, average value or summed value

An	En	Fn	Gn	DATA Hn
A1	E1	F1	I1	DATA J1

Minimum value or Total of the summed values

An	En	Fn	In	DATA Jn
A1	E1	F1	K1	DATA L1

Maximum value

An	En	Fn	Kn	DATA Ln

A1 to An: Report channel number
(DR130:00H to 1DH, other: 00H to 3BH)
B1 to Bn: Unit number (Fixed to 80H during computation)
C1 to Cn: Channel number*
D1 to Dn: Report computation type
*: Computation channels are
00H to 1DH for stand-alone type
00H to 3BH for extended type

Report computation data for each report channel
A1 ot An: Report channel number
(DR130:00H to 1DH, other: 00H to 3BH)
E1 to En:
Type of the report computation result to output
F1 to Fn: Report computation data status
G1 to Gn, I1 to In, K1 to Kn:
Mantissa of the report computation data
Data H1 to data Hn:
Mantissa of the report computation data
Data J1 to data Jn:
Mantissa of the report computation data
Data L1 to data Ln:
Mantissa of the report computation data

The meaning of each data is the same as the hourly report.

Extended format for the monthly report

If the monthly report is set to ON2, extended daily report is output in the following format with the command, TS4+device trigger(GET)+RF2.

Diagram column	Description
Data length / **Extension number**	Number of output bytes
Year · Month · Day · Hour · Minute · 0	Time when the report is created
Year · Month · Day · Hour · Minute · 0	Starting date and time of the REPORT
0 or 1	Power failure data 0: no failure 1:failure occurred
First channel A1 B1 C1 D1 ... **Last channel** An Bn Cn Dn	A1 to An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH) B1 to Bn: Unit number (Fixed to 80H during computation) C1 to Cn: Channel number* D1 to Dn: Report computation type *: Computation channels are 00H to 1DH for stand-alone type 00H to 3BH for extended type

A1 E1 F1 G1 Data H1
Instantaneous value, average value or summed value
An En Fn Gn Data Hn

A1 E1 F1 I1 Data J1
Minimum value or Total of the summed values
An En Fn In Data Jn

A1 E1 F1 K1 Data L1
Maximum value
An En Fn Kn Data Ln

Report computation data for each report channel
A1 ot An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
E1 to En: Type of the report computation result to output
F1 to Fn: Report computation data status
G1 to Gn, I1 to In, K1 to Kn: Mantissa of the report computation data
Data H1 to data Hn: Mantissa of the report computation data
Data J1 to data Jn: Mantissa of the report computation data
Data L1 to data Ln: Mantissa of the report computation data

Year · Month · Day · Hour · Minute · 0 — Date and time when hourly report data is created

0 or 1 — Power failure information on the dayly data 0: No failure 1: failure occurred

Output extension number worth of data
A1 E1 F1 M1 Data N1
Minimum value or Total of the summed values
An En Fn Mn Data Nn

Extended information
A1 to An: Report channel number (DR130:00H to 1DH, other: 00H to 3BH)
E1 to En: Type of the report computation result to output
F1 to Fn: Report computation data status
M1 to Mn: Exponent of the dayly data
Data N1 to Nn: Mantissa of the dayly data

The meaning of each data is the same as the hourly report.

Status output of hourly/daily/monthly report

The status of the hourly/daily/monthly report is output in the following format with the command, TS4+device trigger(GET)+RF3.

Upper byte　　　　　**Lower byte**

If the newest hourly report data is valid this bit is 1, if invalid it is 0

If the hourly report data is valid this bit is 1, if invalid it is 0

If the newest daily report data is valid this bit is 1, if invalid it is 0

If the daily report data is valid this bit is 1, if invalid it is 0

If the newest monthly report data is valid this bit is 1, if invalid it is 0

If the monthly report data is valid this bit is 1, if invalid it is 0

Meaningless bit

Valid/invalid bit for the newest data

Using this bit, you can check which report, hourly, daily or monthly report, was created when the internal timer of the status byte operated or when the bit which is generated at the time when the report is created, is turned ON. The report which has the valid/invalid bit set to 1 is the one created. For information on the status byte, refer to page 1-2 or 2-2.

Note

Valid/invalid bit for the newest data is reset one hour after the data becomes valid.

8.1 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
```

8

Sample Program

8.2 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 bit 1

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
```

8.3 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 120
160     '
170     PRINT #1,CHR$(&H1B)+"C 01"
180     LINE INPUT #1,D$  :PRINT D$
190     CLOSE
200     END
```

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Sample Program

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 150
90        PRINT #1,D$
100       PRINT D$
110       LINE INPUT #1,D$
120       IF LEFT$(D$,2)="E1" THEN PRINT "SYNTAX ERROR"
130       GOTO 70
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 120
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 120
160     '
170     PRINT #1,CHR$(&H1B)+"C 01"
180     LINE INPUT #1,D$  :PRINT D$
190     CLOSE
200     END
```

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Sample Program

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 140
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 280
290       RETURN
300     '
310     *RRECIVE
320       D$=""
330       INCHR$=INPUT$(1,#1)
340       D$=D$+INCHR$
350       IF ASC(INCHR$)<>&HA THEN GOTO 300
360       PRINT D$
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
```

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Sample Program

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 120
160     ‘
170     PRINT #1,CHR$(&H1B)+"C 01"
180     LINE INPUT #1,D$  :PRINT D$
190     CLOSE
200     END
```

8.4 Ethernet Program

Configuration

Model	IBM PC/AT
OS	Windows95
Lnguage	Visual-C

Output the measurement data (ASCI)

```
1    /*
2    * DARWIN - PC Communication Program for Winsock
3    */
4    #include <winsock.h>
5    #include <stdlib.h>
6    #include <stdio.h>
7
8    #define IP_ADDR       "133.140.104.204"
9    #define PORT_NUM    34150
10   #define BUF_MAX       4096
11
12   extern int recv_msg(SOCKET so, char *msg, char *buf, int max);
13
14   void main(void) {
15
16       static char * msg[] = {
17
18           "TS0",
19           "\x1bT",
20           "FM0,001,010",
21           NULL
22       };
23       WSADATA      wsa;
24       SOCKET        so;
25       struct sockaddr_in   addr;
26       char              buf[BUF_MAX];
27       int            i;
28
29       if(WSAStartup(MAKEWORD(1,1), &wsa) == 0) {
30
31         if((so = socket(AF_INET, SOCK_STREAM, IPPROTO_TCP)) != INVALID_SOCKET) {
32
33             memset(&addr, 0x00, sizeof(addr));
34             addr.sin_family = AF_INET;
35             addr.sin_addr.s_addr = inet_addr(IP_ADDR);
36             addr.sin_port        = htons(PORT_NUM);
37
38             if(connect(so, (void *)&addr, sizeof(addr)) != SOCKET_ERROR) {
39
40                 for(i = 0; msg[i] != NULL; i++) {
41
42                     sprintf(buf, "%s%s", msg[i], "\r\n");
43
44                     if(send(so, buf, strlen(buf), 0) == SOCKET_ERROR)
45                         break;
46
47                     printf("%s", buf);
48
49                     if(recv_msg(so, msg[i], buf, BUF_MAX) <= 0)
50                         break;
51
52                     printf("%s", buf);
53                 }
54             }
55             closesocket(so);
56         }
```

```
57          WSACleanup();
58      }
59  }
60
61  int recv_msg(SOCKET so, char *msg, char *buf, int max) {
62
63      int     sum = 0;
64      int     len;
65      int     pos;
66
67      for(;;) {
68
69          len = recv(so, &buf[sum], max - sum, 0);
70
71          if(len == SOCKET_ERROR || len == 0)
72              return(len);
73
74          sum += len;
75
76          buf[sum] = '\0';
77
78          if(buf[sum-1] != '\n')
79              continue;
80
81          for(pos = sum-1; pos > 0; pos—) {
82
83              if(buf[pos-1] == '\n')
84                  break;
85          }
86
87          if(!strcmp(msg, "TS0") || !strcmp(msg, "\x1bT")) {
88
89              if((pos < sum-1) && (buf[pos] == 'E'))
90                  break;
91          }
92          else if(!strncmp(msg, "FM", 2)) {
93
94              if((pos+1 < sum-1) && (buf[pos+1] == 'E'))
95                  break;
96          }
97          else break;
98      }
99      return(sum);
100 }
```

Line 8	Sets the DR's IP address.
Line 9	Specifies the port number to connect.
Line 16 to 21	Command
Line 29	Starts Windows socket (Winsock Ver. 1.1).
Line 31	Creates a socket.
Line 33 to 36	Sets connection destination. inet_addr() and htons() are functions used to convert to network format.
Line 38	Establishes connection.
Line 40 to 54	Sends a command and receives a response.
Line 55	Closes the socket.
Line 57	Terminates the use of the Windows socket.
Line 61	A function to receive ASCII data.
Line 69	Receives data from the destination. If the connection is down, recv() returns 0.
Line 78 to 79	Reads the response data by line.
Line 81 to 84	Determines the beginning of the last received line. The first character of the last line is buff[pos].
Line 87 to 97	If the response data are final (all responses have been received with respect to each command), return to main.

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 displaying 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 060) or the computation channel number (A01 to A60). 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 for the stand-alone type and "60" for the expandable type can be set. Each computing equation is assigned a number. The numbers are "A01" to "A30" for the stand-alone type and "A01" to "A60" for the expanded type. These numbers are called computation channel numbers.

Data to be computed

- Measured data

  Specified with channel numbers (example: 050).
- Computed data

  Specified with computation channel numbers.
- Constants

  "30" constants for the stand-alone type and "60" constants for the expanded type can be set. Each constant is expressed by a number from "K01" to "K60" ("K01" to "K30" for the stand-alone type).

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 $\pm 10^{308}$ 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).
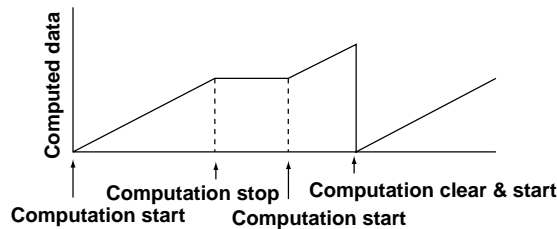
- Control using the event/action function
  Can start/stop computations or clear/reset computed results by an event occurring. This function distinguishes clear and reset as shown below.
  - Clear
    When issued during the computation, the measured data is reset before doing the first computation.
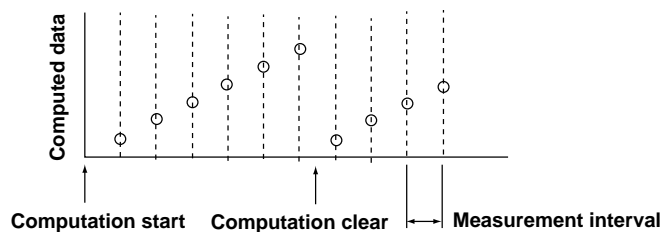
  - Reset
    When issued during the computation, the measured data is reset after doing the first computation.
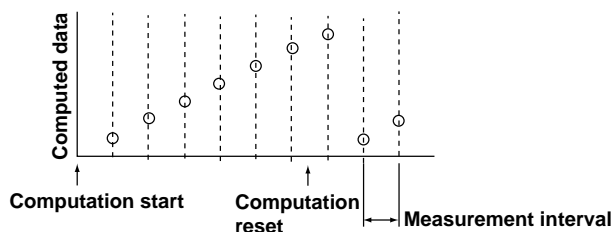
Alarm setting for the computation channel

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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