

**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)	IM DR231-01E
or	
DR232/DR242 Hybrid Recorder (Expandable model)	IM DR232-01E

Note

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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.

TABLE OF CONTENTS

INTRODUCTION	1
CONFIGURATION AND USE OF THIS MANUAL	2
CHAPTER 1 OVERVIEW AND SPECIFICATIONS OF GP-IB INTERFACE	
1.1 Description of Functions (GP-IB)	1-1
1.2 Setting of Address of GP-IB Interface	1-3
1.3 Specifications	1-4
CHAPTER 2 OVERVIEW AND SPECIFICATIONS OF RS-232-C INTERFACE	
2.1 Description of Functions (RS-232-C)	2-1
2.2 Specifications	2-3
2.3 RS-232-C Interface Connection	2-4
2.4 Handshake Format Selection	2-6
2.5 Communication Data Format	2-8
2.6 RS-232-C Interface Parameter Setting Procedure	2-9
CHAPTER 3 OVERVIEW AND SPECIFICATIONS OF RS-422-A/RS-485 INTERFACE	
3.1 Description of Functions (RS-422-A/RS-485)	3-1
3.2 Specifications	3-2
3.3 RS-422-A/RS-485 Interface Connection	3-3
3.4 Communication Data Format	3-8
3.5 RS-422-A/RS-485 Interface Parameter Setting Procedure	3-9
CHAPTER 4 OVERVIEW AND SPECIFICATIONS OF ETHERNET INTERFACE	
4.1 Introduction of Functions (Ethernet)	4-1
4.2 Specifications	4-3
4.3 Names and Functions of Each Section	4-4
4.4 Setting the IP Address	4-6
4.5 Connection Methods	4-8
4.6 Checking the Connection (Loopback test)	4-9
4.7 Transferring the Instantaneous Values	4-10
4.8 Displaying the Communication Information	4-12
4.9 Setting the Timeout	4-14
CHAPTER 5 COMMAND FORMAT	
5.1 Command Format	5-1
5.2 Command Syntax	5-3
5.3 Setting a Channel No., and Alarm Output Relay No.	5-4
5.4 Command List	5-5
5.5 Input Range Parameter	5-7
5.6 ASCII Code Table	5-10
CHAPTER 6 COMMANDS	
6.1 Setting the Input	6-1
Range Setting (SR)	
Unit Setting (SN)	
Filter Setting (XQ)	
Measurement Period Setting (XV)	
A/D Integration Setting (XI)	
6.2 Setting Alarms	6-4
Alarm Setting (SA)	
Performs Alarm-related Settings (XA)	
Relay Reflash Setting (XY)	
Relay AND/OR Setting (XN)	
Relay Energizing/Deenergizing Setting (XD)	
Relay Hold/Non-hold Setting (XH)	

TABLE OF CONTENTS

6.3	Setting the Display	6-5
	Setting the display mode on the upper part of the display (UD)	
	Setting the display mode on the middle part of the display (MD)	
	Setting the display mode on the lower part of the display (LD)	
	Setting the switching time for the displayed channel (XW)	
6.4	Setting the Recording	6-6
	Chart speed setting (SC)	
	Second chart speed setting (SE)	
	Select the trend records/logging records (SS)	
	Recording zone setting (SZ)	
	Partially expanded recording setting (SP)	
	Message setting (SG)	
	Tag setting (ST)	
	Header setting (SH)	
	Title setting (SJ)	
	Format for list printing setting (SF)	
	Interpolation setting (SB)	
	Trend recording ON/OFF (PT)	
	Digital recording ON/OFF (PD)	
	Manual printing ON/OFF (PM)	
	Alarm printing ON/OFF (PA)	
	Scale printing ON/OFF (PC)	
	List printing ON/OFF (PL)	
	Performs settings related to records (XR)	
	Dot printing colors setting (XC)	
6.5	Other Settings	6-10
	Date and time setting (SD)	
	Moving average setting (SV)	
	Copy between channels (SY)	
	Group setting (SX)	
	Timer setting (SI)	
	Match time setting (SQ)	
	Event/action setting (SL)	
	Computation Expression Setting (SO : with optional computation function or floppy disk drive function)	
	Computation Constant Setting (SK : with optional computation function)	
	Communication Input Data Setting (CM : with optional computation function)	
	Setting the channel for setting data that are stored on a RAM disk (MH : floppy disk drive function)	
	Setting hourly/daily/monthly report to ON/OFF and the time to create the report (RO : with optional report function)	
	Setting report channel to ON/OFF and the report computation type (RM : with optional report function)	
	Setting the automatic print at the time when the report is created to ON/OFF (RI : with optional report function)	
	Summer/winter time (SW)	
	Key lock setting (XK)	
	Function screen setting (XF)	
	Setting screen setting (XS)	
	Burnout setting (XB)	
	Reference junction compensation setting (XJ)	
	Setting of Computation Error Handling Method (XG : with optional computation function)	
	Setting of temperature unit (XT)	
	Setting of language (XL)	
	Setup setting data (XE)	
	Setting for execution, data modification, and data storage in A/D calibration (XZ)	
6.6	Control and Execution Command	6-14
	Recording start/stop(PS)	
	Manual printing start/stop (MP)	
	List printing start/stop (LS)	
	Header printing start/stop (HD)	
	Setup list printing start/stop (SU)	
	Message printing start (MS)	
	Acknowledgment of alarm status (AK)	
	Alarm reset (AR)	
	Timer reset (IR)	

Alarm buffer clear (AC)	
Message buffer clear (MC)	
Computation start/stop (EX : with optional computation function or floppy disk drive function)	
Storing measured data on a RAM disk (MW : floppy disk drive function)	
Reading measured data on a RAM disk (MR : floppy disk drive function)	
Storing set data on a RAM disk (MV : floppy disk drive function)	
Reading setting data on a RAM disk (ML : floppy disk drive function)	
Deleting files on a RAM disk (ME : floppy disk drive function)	
Copying a file (MY : floppy disk drive function)	
Storing set data on a floppy disk (FV : floppy disk drive function)	
Reading setting data on a floppy disk (FL : floppy disk drive function)	
Deleting a file on a floppy disk (FE : floppy disk drive function)	
Storing set data in setup mode (YV : floppy disk drive function)	
Reading set data, which have been stored, in setup mode (YL : floppy disk drive function)	
Deleting a file in setup mode (YE : floppy disk drive function)	
Executes the initial balancing of the strain input channel (BL)	
Report start/stop (DR : with optional report function)	
Report printing start/stop (RP : with optional report function)	
System reconstruction (RS)	
RAM clear (RC)	
Setting mode selection (DS)	
6.7 Data Output Request Command	6-17
Selection of talker output data (TS)	
Measured data output request (FM)	
Format specification for measured data on the RAM disk (MF : floppy disk drive function)	
Report data output request (RF : with optional report function)	
Setting data output request (LF)	
System configuration data output request (CF)	
Byte output order specification (BO)	
Interrupt mask specification (IM)	
Auxiliary mask specification (SM)	

CHAPTER 7 OUTPUT FORMAT

7.1 Functions as Talker	7-1
7.2 Measured/Computed Data Output Format (ASCII code)	7-2
7.3 Measured/Computed Data Output Format (Binary code)	7-3
7.4 Setting Data Output Format (Operation mode)	7-4
7.5 Setting Data Output Format (Setup mode)	7-6
7.6 Output Format for Unit and Decimal Point Position	7-7
7.7 System Configuration Output Format	7-8
7.8 A/D Calibration Data Output Format	7-9
7.9 RAM Disk Output Format (File Directory Output)	7-10
7.10 RAM Disk Output Format (ASCII Code)	7-11
7.11 RAM Disk Output Format (Binary Code)	7-13
7.12 RAM Disk Output Format (Channel On/Off)	7-15
7.13 Report Output Format	7-16

CHAPTER 8 SAMPLE PROGRAM

8.1 GP-IB Sample Programs	8-1
8.2 RS-232-C Sample Programs	8-4
8.3 RS-422-A/RS-485 Sample Programs	8-7
8.4 Ethernet Program	8-13

APPENDIX

App. 1 Computing Equation	App-1
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INDEX

General index	Index-1
Command Index	Index-4



1.1 Description of Functions (GP-IB)

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
- Data on RAM disk
- Report data
- Computed data
- System configuration
- Data for operation mode setting
- Data for setup mode setting

For measured data, data on RAM disk and computed data, either binary output or ASCII output can be selected. Report data are output in binary format. 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.

Note when dividing and reading in data output from DR with the personal computer:

The data group being read in after ATN* has just become TRUE may miss its first bite.

Example of N88-BASIC (Standard language for PC9801 series)

Dividing and reading in measured data by every line

```
70 PRINT @1; "FM0, 001,010"
80 LINE INPUT @1; D$: PRINT D$
90 LINE INPUT@1; D$: PRINT D$
100 IF MID$ (D$, 2, 1)<>"E" THEN 90
```

Because the specification of talker address is repeated in the line 90 LINE INPUT@1; D\$:PRINT D\$, ATN becomes TRUE before the third data group being read in.

Precaution:

```
70 PRINT @1; "FM0, 001,010"
80 LINE INPUT @1; D$: PRINT D$
90 LINE INPUT@; D$:PRINT D$
100 IF MID$ (D$,2,1)<>"E" THEN 90
```

The command is changed into LINE INPUT@; D\$:PRINT D\$ in the line 90.

ATN won't become TRUE if the specification of talker address is not repeated.

It's unnecessary to repeat the specification when reading in data from the same address.

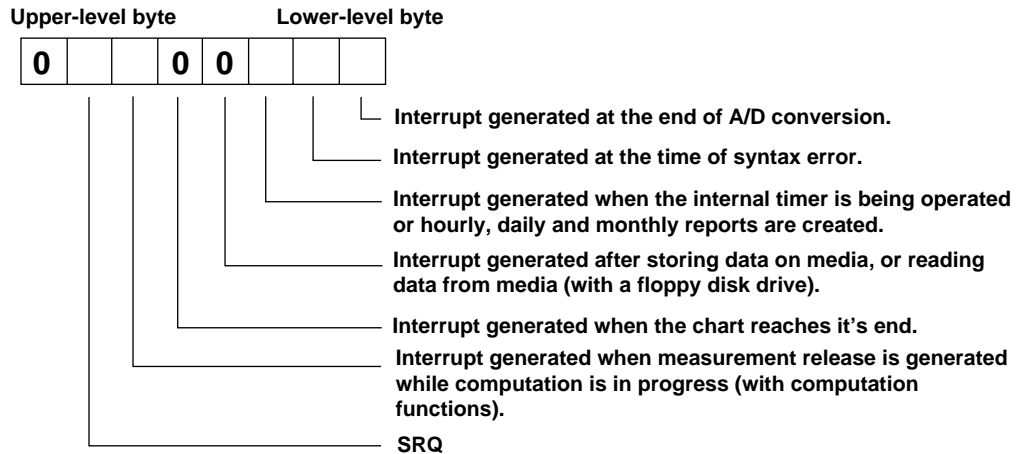
* ATN is a signal for data distinction:

TRUE (0) Device message

FALSE (1) Interface message

Status Byte Format

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



Bit 8: Not used. Always 0.

Bit 7: SRQ

This bit changes to 1 when any cause of the bits 1 to bit 6 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 responding to serial polling, this bit is set to 0.

Bit 2: This bit changes to 1 when a syntax error occurs in a command and is normally 0. If there is an error in a command description, this changes to 1. After responding to serial polling, this bit is set to 0.

Bit 1: This bit changes to 1 at the end of an A/D conversion; otherwise, it is 0. When the A/D conversion of measured data is terminated, this changes to 1. After responding to serial polling, this bit is set to 0.

Status byte and serial polling

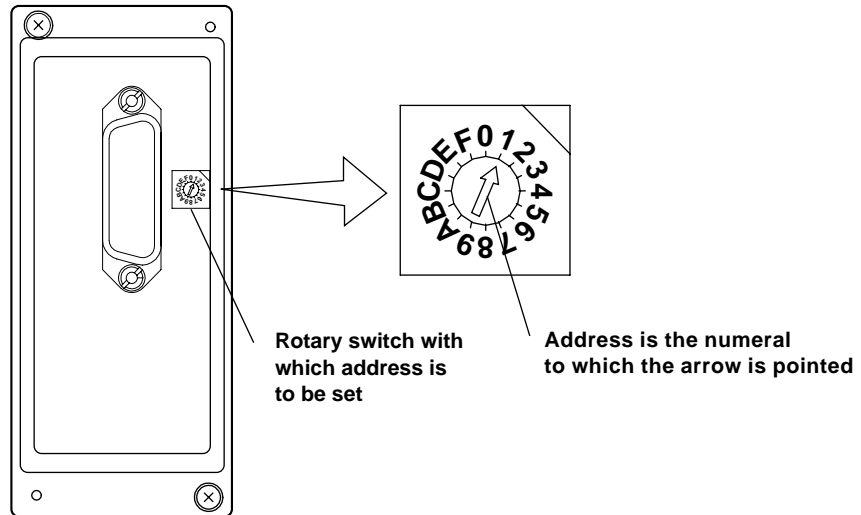
- In IM commands, the bit status that is to be made effective must be specified. The status of unspecified bits does not change to 1.
- If a new cause is generated before reading out a status byte for which a cause has already been generated, the existing cause remains in the status byte as is and the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

The initial value

The initial value is 'IM2'.

1.2 Setting of Address of GP-IB Interface

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



1.3 Specifications

Electrical and mechanical specifications: Conforming to IEEE St'd 488-1975

Code to be used: ISO (ASCII) code

Function specifications

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

2.1 Description of Functions (RS-232-C)

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
- Data on RAM disk
- Report data
- Computed data
- System configuration
- Data for operation mode setting
- Data for setup mode setting

For measured data, data on RAM disk and computed data, either binary output or ASCII output can be selected. Report data are output in binary format. 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, CF, MF or RF 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 in parentheses 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, CF, RF and BL commands, whose ACK output will be described later on.

E0 : Commands are processed successfully

E1 : Commands are not processed successfully

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

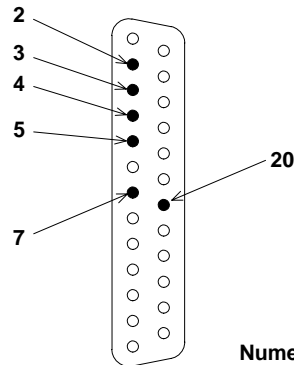
2.2 Specifications

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

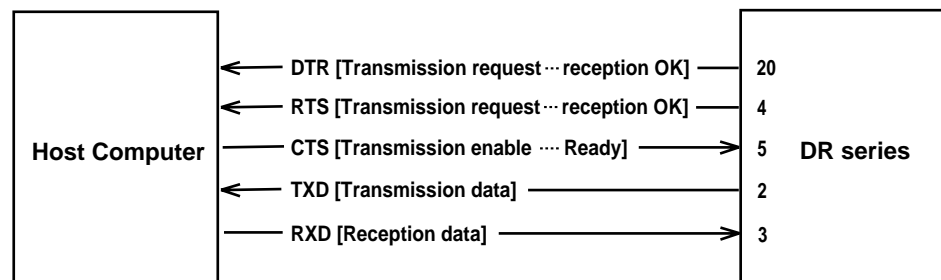


Numeric values in the above figure indicate Pin Nos.

- | | |
|---------------------------------|---|
| 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

2.4 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 receipt becomes possible DTR becomes TRUE.	When reception of data becomes impossible RTS becomes FALSE, when data receipt 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 receipt of data becomes impossible, an 'RTS=False' status will be established. When data receipt 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 receipt of data becomes impossible, an 'DTR=False' status will be established. When data receipt become possible, an 'DTR=True' status will be established. RTS=True (Fixed).

CTS-RTS

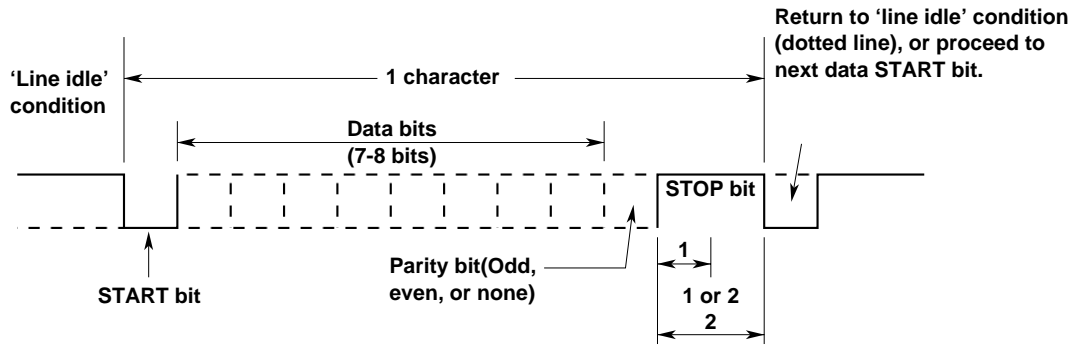
- Transmission data control : A hardware handshake status is established between the recorder and the host computer. The recorder will stop a data transmission if a 'CTS=False' status is established, and will resume the transmission when a 'CTS=True' status is established. The X-OFF and X-ON signals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

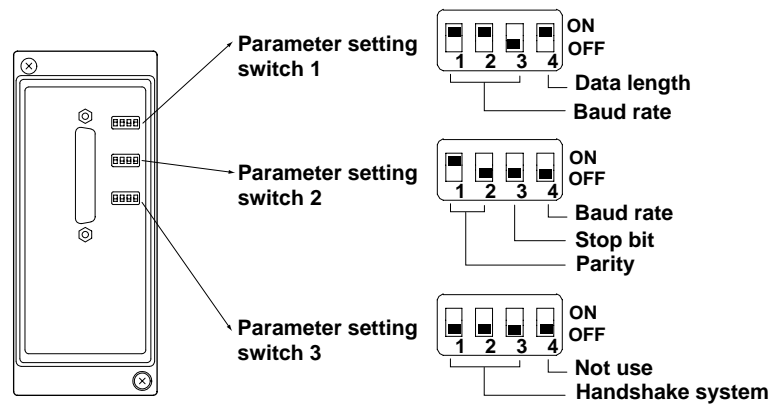
2.5 Communication Data Format

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



2.6 RS-232-C Interface Parameter Setting Procedure

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



Baud rate (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 (RS-422-A/RS-485)

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
- Data on RAM disk
- Report data
- System configuration
- Data for operation mode setting
- Data for setup mode setting

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

Data Output

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

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

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

ESC O Open Command (address a communication destination)

Setting ESC O xx<terminator>

xx : address, 01 to 31

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

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

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

Setting ESC C xx<terminator>

xx : address, 01 to 31

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

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

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

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

Note

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

3.2 Specifications

Electrical & mechanical specs	: Conform to the EIA RS-422-A and EIA RS-485 Standard
Connection format	: Multi-drop 1:n (n=16 for RS-422-A, n=31 for RS-485)
Communication format	: Half duplex
Synchronizing format	: Start-stop asynchronous transmission (synchronized by start/stop bit)
Baud rate (bps)	: 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.

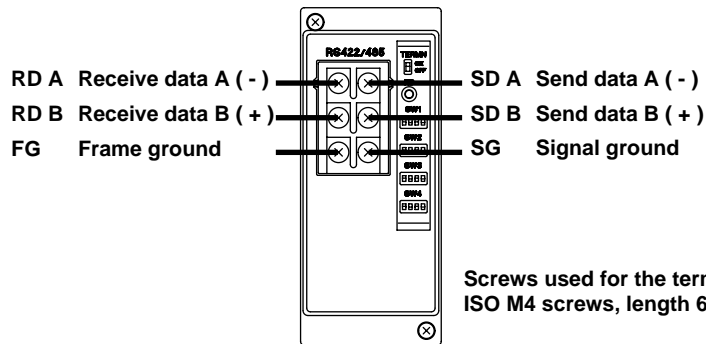
Cable Used

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 minimum (four-wire)
- Characteristic impedance : 100 ohm
- Capacitance : 50 pF/m
- Length of cable : 1.2 km maximum *

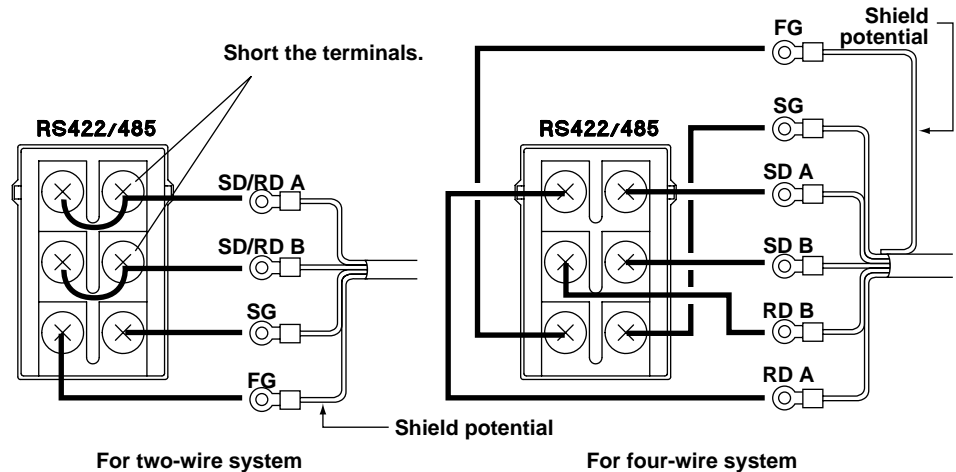
* Communication distance of the RS-422-A/RS-485 interface is not the linear distance, but the total length of the cable (shielded twisted pair cable).

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



Connecting the Cable

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



WARNING

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

Note

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

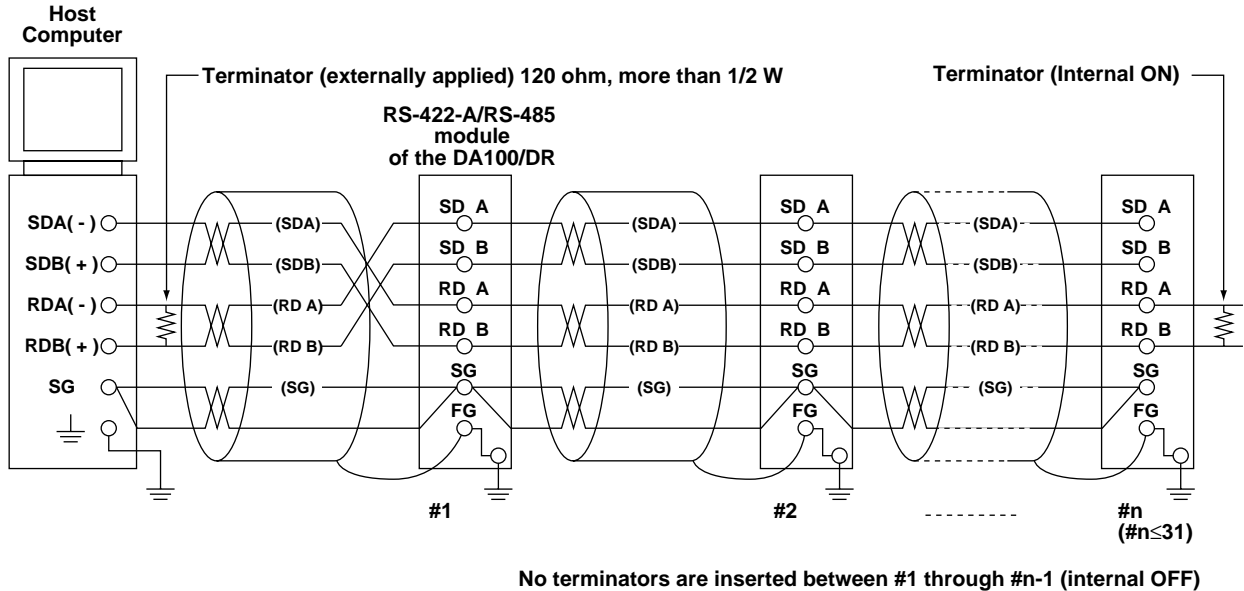
Connecting to the Host Computer

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

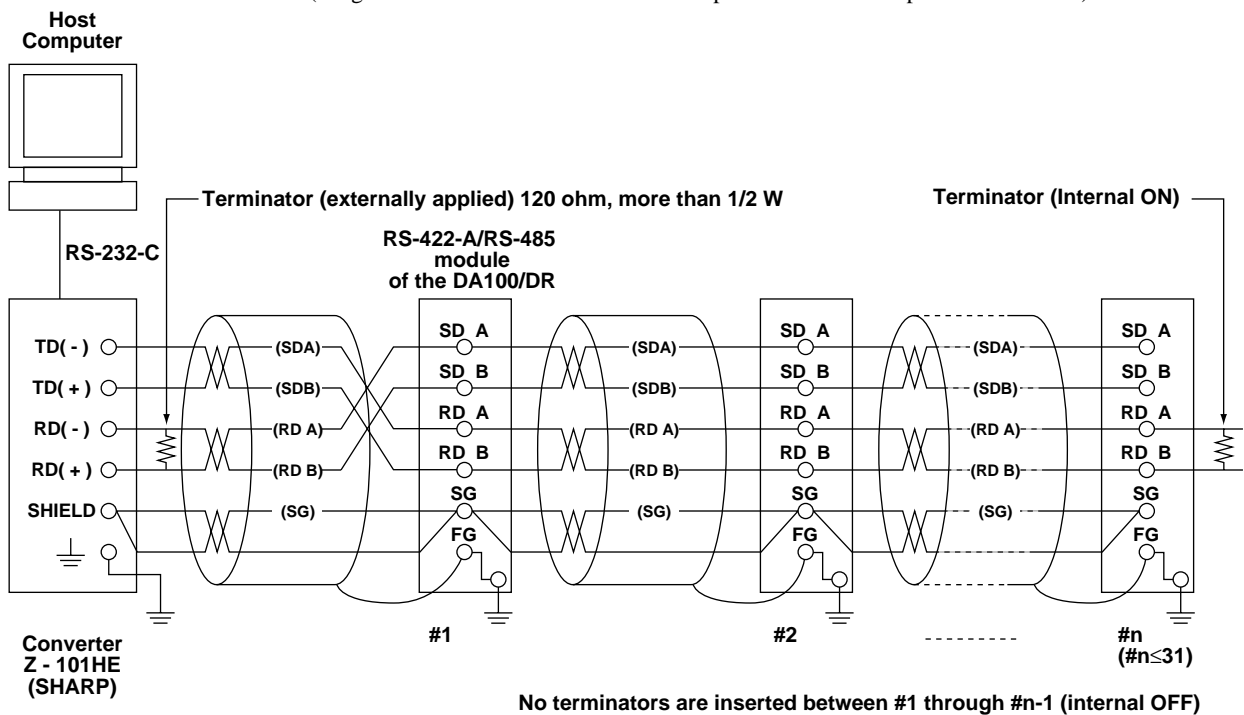
- In the case of RS-232-C, a converter is used as shown in the diagram below.
- For information on recommended converters, refer to “Converters” in the latter.
- Dip switch needs to be changed depending on whether it is a two-wire system or four-wire system. Refer to “3.5 RS-422-A/RS-485 Interface Parameter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

In the case of four-wire system

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

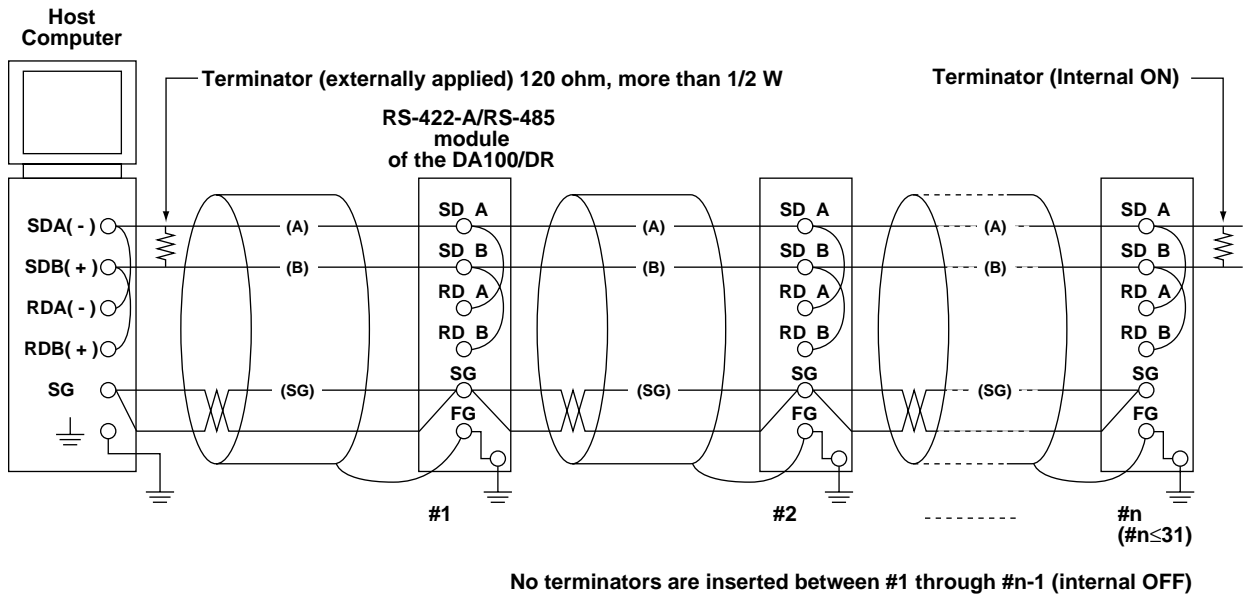


(Diagram below shows the case when the port of the host computer is RS-232-C)

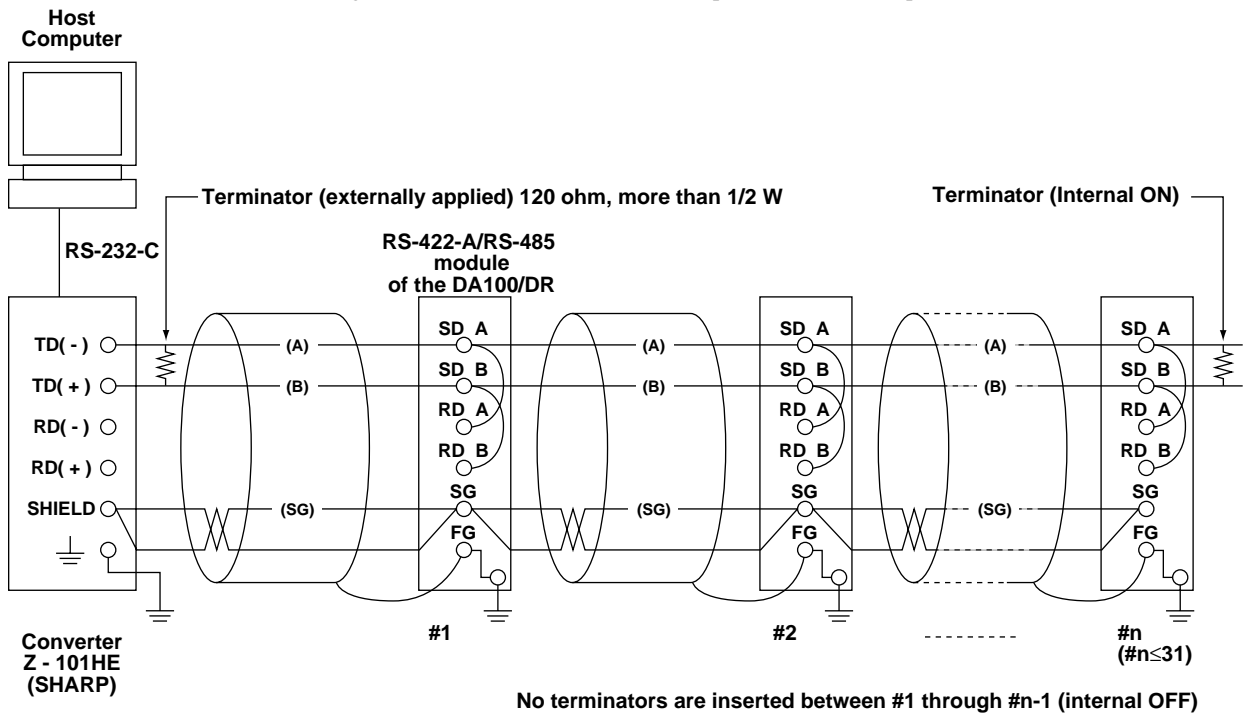


In the case of two-wire system

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 terminals insulated. In such cases, do not connect as in the diagram on the previous page (do not connect anything to the FG and SG terminals of the converter). Especially when it is long distance, the potential difference may damage the devices or the communication may become unreliable.

Also, converters without the SG terminal can be used without grounding. For details, refer to the converter's manual.

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

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

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

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

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

Note

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

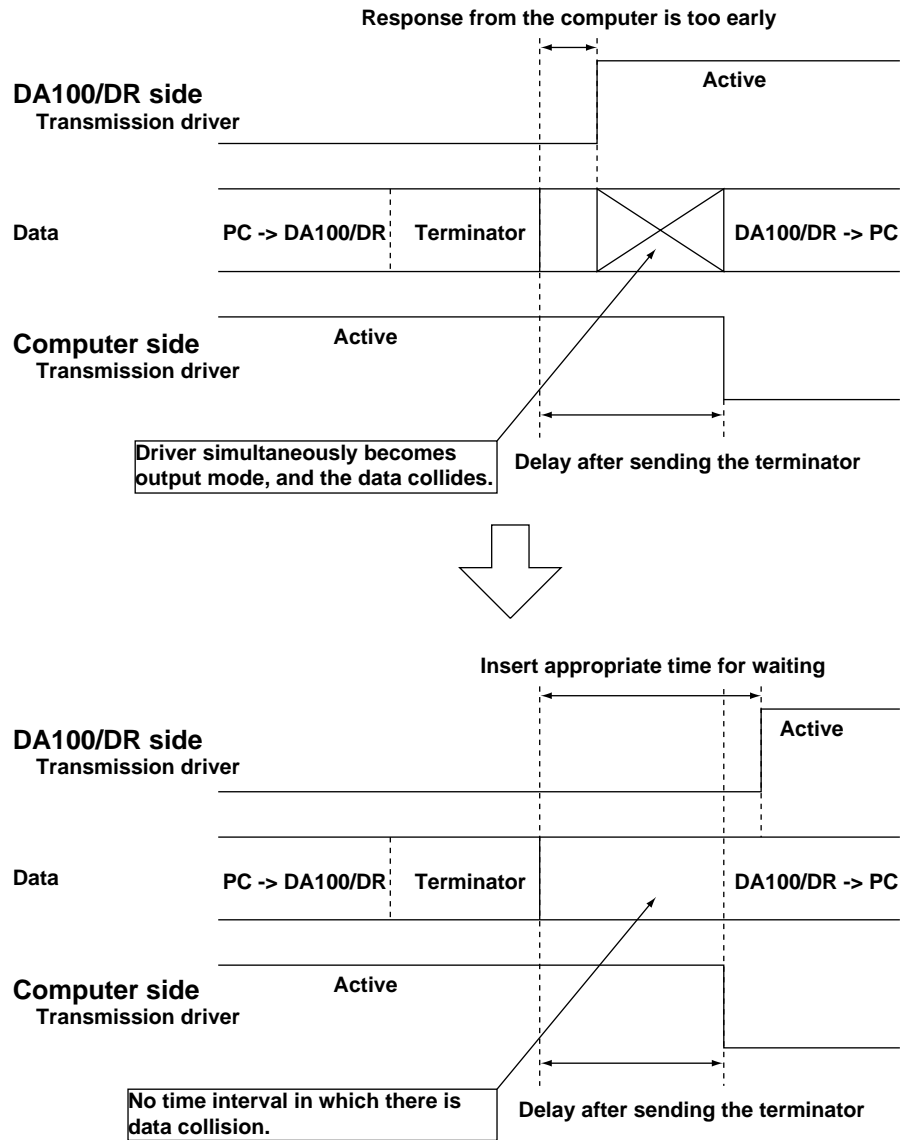
Terminator

When devices are connected in multi-drop configuration (includes point-to-point connections), turn the terminators of the modules on the extreme ends ON. All modules in between should have them turned off. Terminators are turned ON/OFF using the TERMIN switch on the front panel.

Also, turn ON the terminator on the host computer (refer to the computer's manual). When converters are used, turn their terminators ON also. The recommended converter needs an external terminator to be installed, but some converters are internal types.

Minimum Response Time

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

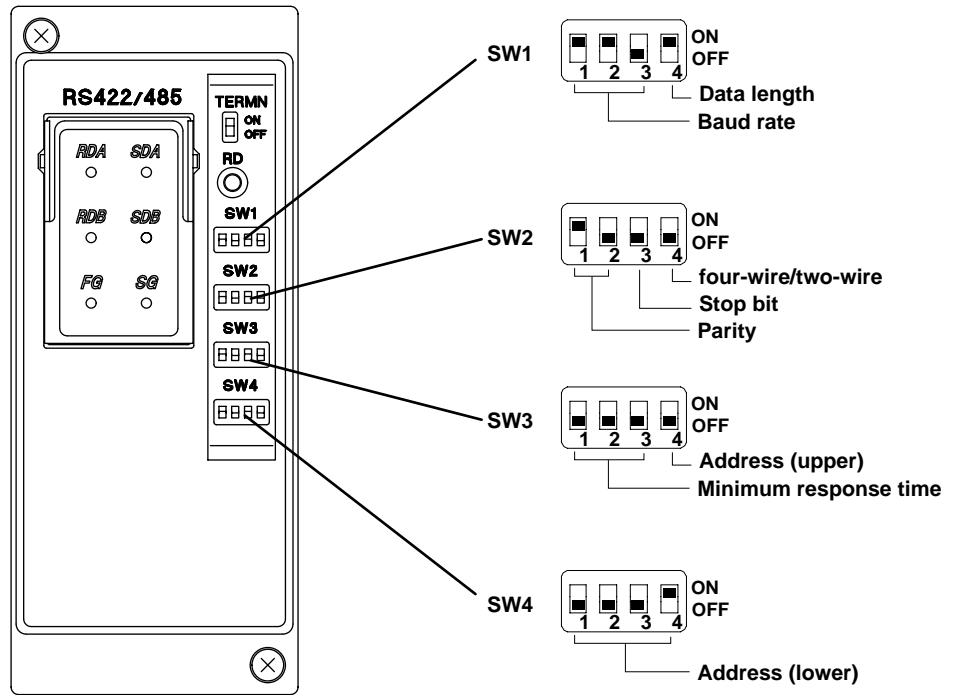


3.4 Communication Data Format

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

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

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



Baud rate (No.1 to 3 of SW1)

Baud rate	No.1	No.2	No.3	
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	

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

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 (Ethernet)

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.

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

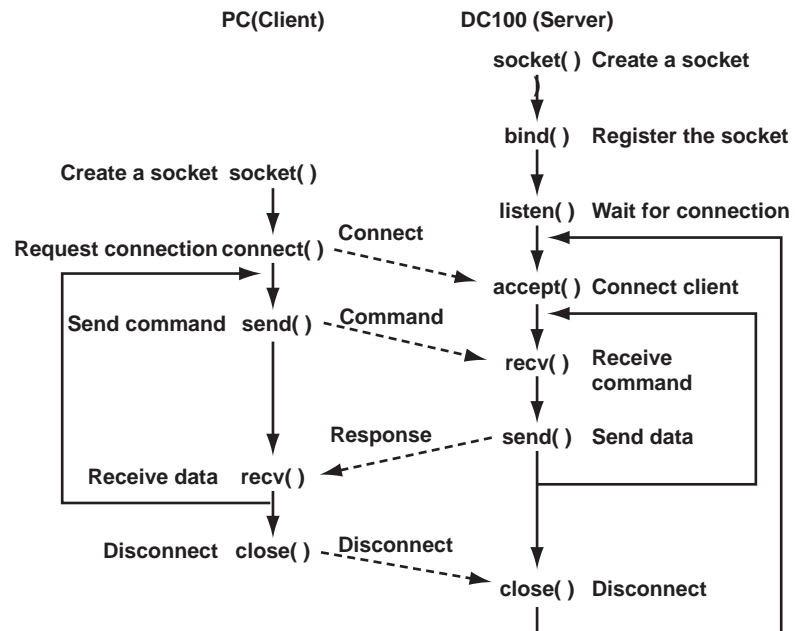
About the Ports

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

Communication Operation

The flow of the communication is indicated below.



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	
Physical layer	Ethernet (10BASE-T)

IP: Internet Protocol

TCP: Transmission Control Protocol

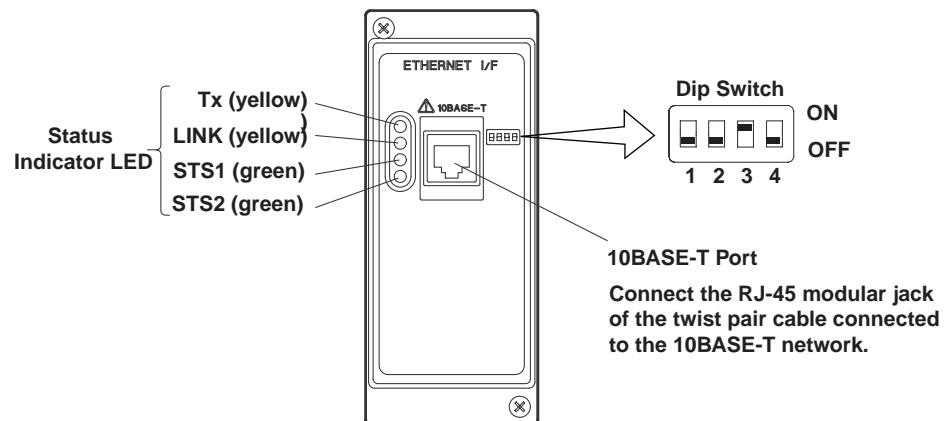
UDP: User Datagram Protocol

ICM: FInternet Control Message Protocol

ARP: Address Resolution Protocol

Part of the software which belongs to the regents of University of California is introduced here.

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 the DR.

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.

Setting are effective only after the DR is reboot.

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

An error occurs when the communication fails. When communication error or EEPROM error occurs, the DR must be repaired.

STS1, STS2 Indication	Type of Error	Cause
Number of blinks by STS1 is 1 and by STS2 is 1	Configuration error	IP address is not set.
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

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.

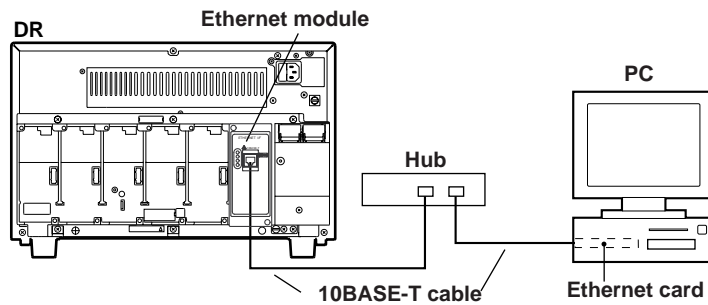
Configuration procedures

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=xxx.xxx.xxx.xx."
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=xxx.xxx.xxx.xxx" 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=xxx.xxx.xxx.xxx" 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.

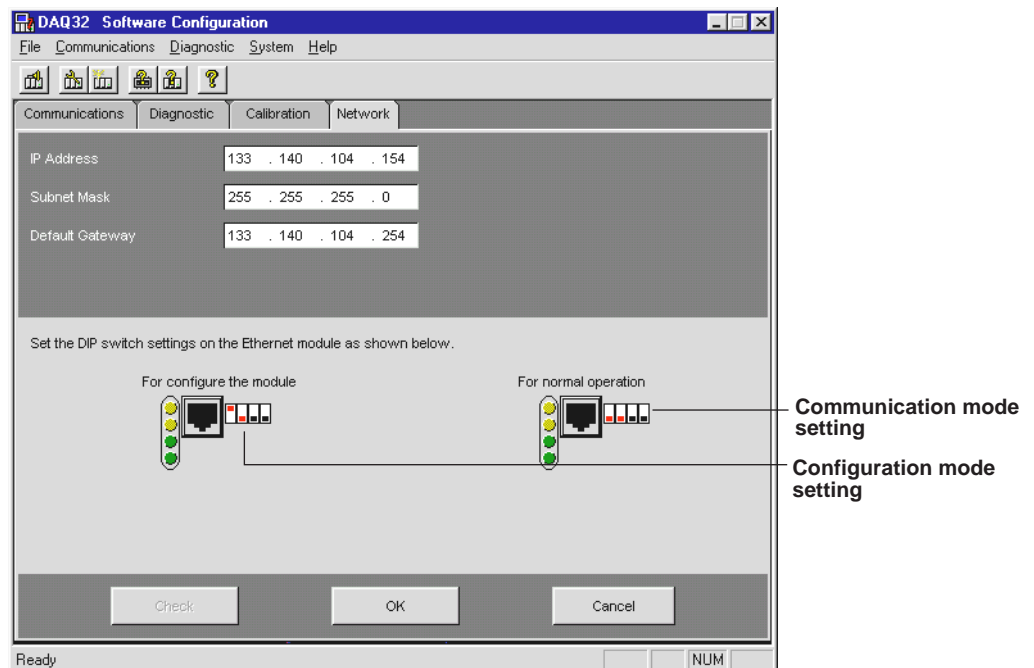
Set the mode of the Ethernet module to configuration mode.



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.

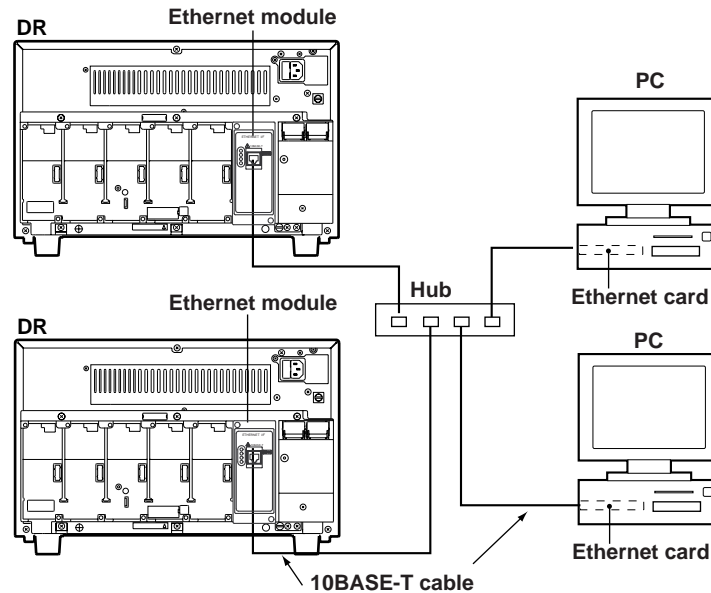


3. Click the Check button to get the currently used settings. If this is the first time you use the DR, initial values will get displayed.
4. If you click the digits in the IP address, Subnet Mask, or Default Gateway setting boxes, the clicked part will be invertedly displayed, allowing you to change 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.

4.5 Connection Methods

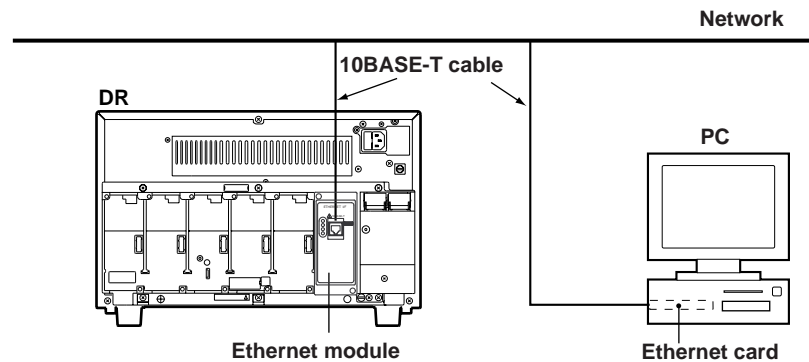
When Directly Connecting to the PC

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).

Functions of the Ethernet module are suspended while in test mode. Therefore, it's necessary to set the dip switch to communication mode after testing.

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.

4.7 Transferring the Instantaneous V alues

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	<ul style="list-style-type: none"> • 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

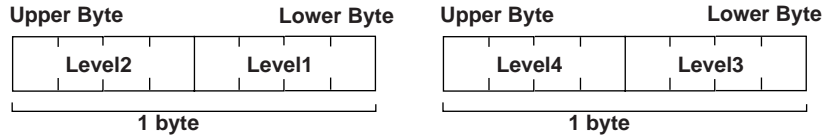
3: Upper difference limit alarm

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.



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 unit and decimal information is not determined if measurement channels are skipped or if abnormal data exist.
- 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 0000

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

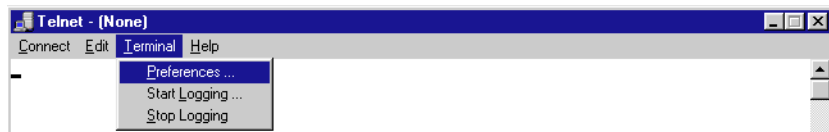
4.8 Displaying the Communication Information

The following information can be displayed by using Telnet.

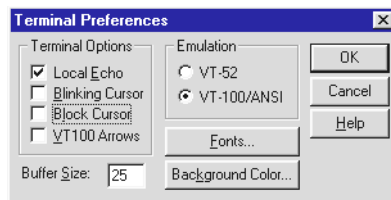
- Warning information
- Connection information
- Network information
- The timeout for the information display application is 15 minutes.

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

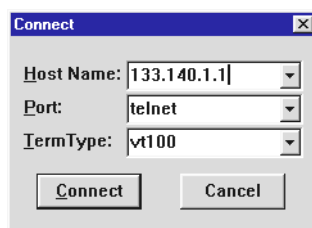
Others : OFF

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

- 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.

- 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

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

The following information is displayed.

Warning indication

wlog warning Log	Command
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	

Warning codes 1□□: Internal buffer is overflowed
 2□□: 16 collision occurred
 3□□: Part of EEPROM is invalid

Connection information

con Active connections	Command
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 Network Status	Command
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
TCP:keep alive = 1	Keep alive check cycle
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:sndrexitpack = 1	Total number of packets retransmitted
TCP:sndrexitbyte = 209	Total number of bytes retransmitted
TCP:rcvtotal = 150	Total number of packets received
TCP:rcvbyte = 128	Total number of bytes received
DLC:16 collisons = 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 in succession is called 16

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 without any access
	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 without any operation.
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.

5.1 Command Format

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 divided 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 use and remarks in more detail	_____	Comments • The formats of p1 and p2 are fixed to 8 characters. 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.
To confirm the settings, execute the XESTORE command. See the description for the XE command.
- 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

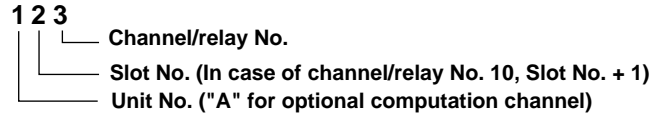
The configurable numbers of measurement and computation channels vary, from recorder to recorder, between model DR130, stand-alone models of the DR230/240, and expandable models of the DR230/240, as shown below:

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



Channel Number

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

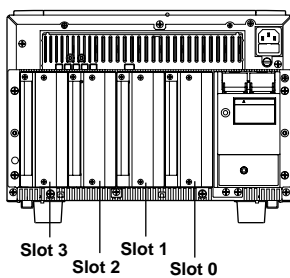
*1: If the recorder comprises any communication module, no alarm-output relay module can be mounted on the recorder's main unit. The unit number "I," therefore, is not usable in setting up the recorder using communication commands.

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

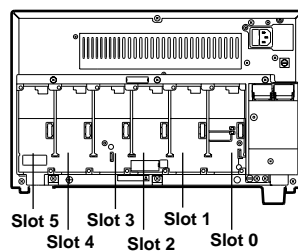
Example

- 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

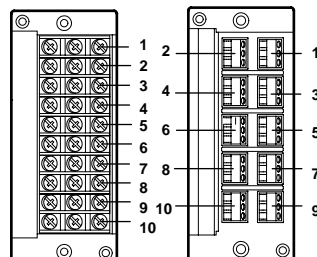
● Stand alone model (DR130)



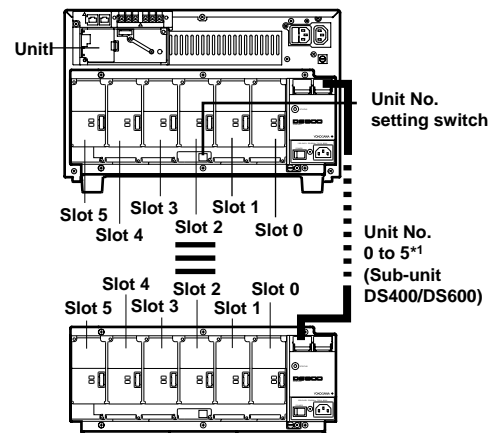
● Stand alone model (DR231/DR241)



● Module



● Expandable model (DR232/DR242)



*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 conform 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

5.4 Command List

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	PT50	-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

5.5 Input Range Parameter

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 Vi (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 Ii (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 PFi(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 PHi(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 2000με (1/4 bridge) - 1000 to 1000με (1/2 bridge) - 500 to 500με (full bridge)
20k	20k	- 20000 to 20000με (1/4 bridge) - 10000 to 10000με (1/2 bridge) - 5000 to 5000με (full bridge)
200k	200k	- 200000 to 200000με (1/4 bridge) - 100000 to 100000με (1/2 bridge) - 50000 to 50000με (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

5.5 Input Range Parameter

Single-phase two-wire configuration

CH1	CH2	CH3	CH4	CH5	CH6
P1	VA1	V1	I1	PF1	PH1
				Var1	PF1
				FREQ	V1

Select from these combinations

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
P3	VA3	V3	I3	PF3	PH3
P13	VA13			PF13	PH13
				V1	I1
				V3	I3
				V13	I13
				FREQ	V1
				Var1	PF1
				Var3	PF3
				Var13	PF13

Select from these combinations

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

Select from either of the two groups of combinations

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

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

Select from either of the two groups of combinations

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

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							ϖ	
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

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.
 • The measurement range cannot be changed while executing a report or computation, or when a file is written.

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.
- The measurement range cannot be changed while executing a report or computation, or when a file is written.

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.

6.1 Setting the Input

- 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.
- The measurement range cannot be changed while executing a report or computation, or when a file is written.

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	<ul style="list-style-type: none"> • 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 or computation, or when a file is written.

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	<ul style="list-style-type: none"> • 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 or computation, or when a file is written.

Setting Scaling

Setting	SRp1, p2, p3, p4, p5, p6, p7, p8, p9<terminator>
	p1 Channel number (001 to 560) Computation 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	<ul style="list-style-type: none"> • 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 or computation, or when a file is written.

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	<ul style="list-style-type: none"> • 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 or computation, or when a file is written.

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 2k for subunit 0 and channel 01, and convert 0 $\mu\epsilon$ to 0.00 and 1000 $\mu\epsilon$ to 100.00.

- 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 or computation, or when a file is written.

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	<ul style="list-style-type: none"> • 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

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, ENER
- 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, or if a pulse module is installed, 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.

- 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, or if a pulse module is installed, 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, 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 SSs1, p2<terminator>

p1 TREND (analog trend record)
 LOGGING (logging record)
 p2 Dot printing period
 AUTO (automatic selection)
 FIX

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

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

SZ Sets the recording zone.

Mode	Operation mode
Setting	SZp1, p2, p3<terminator>
	p1 Channel number (001 to 560) Computation channel number (A01 to A60)
	p2 Lower limit of zone (0 to 245 mm, or 0 to 145 mm for the DR130)
	p3 Upper limit of zone (5 to 250 mm, or 5 to 150 mm for the DR130)
Example	Set the recording zone of channel 6 in slot 3 of subunit 4 to 10 to 50 mm. SZ436, 10, 50
Comments	<ul style="list-style-type: none"> Set p2 smaller than p3. This is effective for analog recording. The optional computation channel number for a stand-alone model is A01 to A30.

SP Sets partially expanded recording.

Mode	Operation mode
Setting	SPp1, p2, p3, p4<terminator>
	p1 Channel number (001 to 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	<ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.

SG Sets or copies a message.
Message setting

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

Example	Set the message "test" to message No. 5. SG05, test
Comments	<ul style="list-style-type: none"> 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

ST 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	<ul style="list-style-type: none"> 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.

SH Sets a header.

Mode	Operation mode
Setting	SHp1, p2<terminator>
	p1 Setting line number (1 to 5)
	p2 Header character string
Example	Set the line of number 2 to "TEST RECORDE." SH2, TEST RECORDE
Comments	<ul style="list-style-type: none"> 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 the DR130 and no more than 80 characters for the DR230/240.

SJ Sets a title.

Mode	Operation mode
Setting	SJp1<terminator>
	p1 Title character string (up to 32 characters)
Example	Set the title to "TEST RECORDE." SJTEST RECORDE
Comments	<ul style="list-style-type: none"> 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.

SF Sets the format for list printing.

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

6.4 Setting the Recording

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. XR TAG, 7, ALARM1, OFF, OFF, 4, 12.5 mm, 600 mm, OFF, HORIZON, MULTIPLE
Comments	<ul style="list-style-type: none"> • 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 is automatically determined according to the chart speed, and the number of channels and rows in which numeric values are printed. For details, see the 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.

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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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, 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	<ul style="list-style-type: none"> 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)	
		<ul style="list-style-type: none"> • 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.
		<ul style="list-style-type: none"> • For p4=FLOPY
	LD_TRG1	Setting data are read.
	LD_TRG2	Setting data are read.
	LD_TRG3	Setting data are read.
		<ul style="list-style-type: none"> • 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.
		<ul style="list-style-type: none"> • For p4=REPORT
	START	Report starts.
	STOP	Report stops.
		<ul style="list-style-type: none"> • For p4=FLAG
	F01 to F16:	Specified flag number is set to 1.
p5	Auxiliary action information (for p3=LEVL)	
		<ul style="list-style-type: none"> • For p4=MEMRY
	PAUSE	Stops or restarts writing of measured/computed data.
		<ul style="list-style-type: none"> • For p4=FLAG
	F01 to F16:	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
	<ul style="list-style-type: none"> • 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)	
		<ul style="list-style-type: none"> • 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.
		<ul style="list-style-type: none"> • For p5=FLOPY
	LD_TRG1	Setting data are read.
	LD_TRG2	Setting data are read.
	LD_TRG3	Setting data are read.
		<ul style="list-style-type: none"> • 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.
		<ul style="list-style-type: none"> • For p5=REPORT
	START	Report starts.
	STOP	Report stops.
		<ul style="list-style-type: none"> • For p5=FLAG
	F01 to F06:	Specified flag number is set to 1.
p6	Auxiliary action information (for p4=LEVEL)	
		<ul style="list-style-type: none"> • For p5=GR_TREND, group number (G01 to G07) • For p5=FLAG
	F01 to F16:	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 continues even if the event action is over.

6.5 Other Settings

- 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 or with a pulse module installed.
 - 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.
- If pulse modules are installed and there is no computation function, TLOG.PSOM will be the only valid operator.
- If you wish to omit either p4, p5, or p6, omit them all together.
- 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		<ul style="list-style-type: none"> • 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		<ul style="list-style-type: none"> • 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.

RM 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 $\sum(\text{measured values})$
/sec $\sum(\text{measured values}) \times \text{measurement interval}$
/min $\sum(\text{measured values}) \times \text{measurement interval}/60$
/hour $\sum(\text{measured values}) \times \text{measurement interval}/3600$
/day $\sum(\text{measured values}) \times \text{measurement interval}/86400$
- The unit of the measurement interval is seconds.

RI 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**
- This command is effective only with optional report function.
 - 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..

SW Set the summer-winter time

- Mode** Operation mode
- Setting** SWp1,p2<terminator>
- p1 Summer time or Winter time
SUMMER Summer time
WINTER Winter time
- p2 Changing time
- Example** Change to summer time at 12clock 15th June 1996
SWSUMMER,96/06/15 12

XK Sets the key lock.

- Mode** Setup mode
- Setting** XKp1, p2, p3, p4, p5, p6, p7, p8<terminator>
- p1 USE Uses the key lock.
NOT Does not use the key lock.
- p2 RECORD key (LOCK, FREE)
- p3 FEED key (LOCK, FREE)
- p4 PRINT key (LOCK, FREE)
- p5 FUNC key (LOCK, FREE)
- p6 P.FUNC1 key (LOCK, FREE)
- p7 P.FUNC2 key (LOCK, FREE)
- p8 Pass number (0 to 9999)
- Example** Lock the RECORD, FEED, PRINT keys and set the password number to 123.
XKUSE, LOCK, LOCK, LOCK, FREE, FREE, FREE, 123

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

- Mode** Setup mode
- Setting** XFp1, p2<terminator>
- p1 Content to be displayed on the function screen.
ALARM_ACK
Acknowledgment of current alarm status
ALARM_RESET
Alarm is reset.
TIMER_RESET
Timer is reset.

	KEY_LOCK_ON	Key lock is turned on.
	MATH_START	Starts computation.
	MATH_CLR_START	Clears computation results then re-start computation.
	MATH_STOP	Stops computation.
	MATH_ACK	Clears the computation status indication.
	REPORT_START	Starts report.
	REPORT_STOP	Stops report.
	REP_RECALL_START	Starts printing the report.
	REP_PRINT_STOP	Stops printing 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	<ul style="list-style-type: none"> 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

	FLOPPY	saving/reading in the built-in RAM disk
	ZONE	Settings relating to data saving/reading on floppy disks
	PARTIAL	Zone recording settings
	CHART2	partially expanded record settings
	TAG	Second chart speed settings
	TIMER	Tag settings
	LOGIC	Timer settings
	MESSAGE	Logic settings
	GROUP	Message settings
	TREND	Group settings
	DIGITAL_PR	Turning on or off analog records for each channel
	LIST_PR	Turning on or off digital records for each channel
	MANUAL_PR	Turning on or off list printing for each channel
	SCALE_PR	Turning on or off manual printing for each channel
	ALARM_PR	Turning on or off scale printing for each channel
	HEADER	Turning on or off alarm printing for each channel
	TITLE	Header settings
	MOVE_AVE	Title settings
	INTERPOL	Moving average settings
	MATCH_TIME	Step interpolation settings
	LIST_FMT	Match time settings
	COPY	List printing format settings
	DST	Copy contents settings
	ALL_ITEM	Summer/winter time
p2	Type of screen	All items of parameter p1
	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	<ul style="list-style-type: none"> 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 μ V XJ001, EXT, 1000
Comments	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> This command is effective only with the optional computation functions. p2 is effective for the totalization of flow signals, which are expressed in engineering units — /s, /min, /h. If p2 is set according to the input unit, the measurement data are computed based on that unit at the specified measurement intervals. For example, set the measurement interval to 2s, the

input value to 100 m3/min, and p2 to /MIN. By doing this, because 2s/60s is multiplied for each measurement interval, then after 1 minute, approximate actual input values are obtained.

XT Sets the temperature unit

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

XL Sets the language

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

XE Establishes the contents of the setup mode setting.

Mode	Setup mode
Setting	XEp1<terminator>
	p1 Selection of establishment or destruction
	STORE Establishment
	ABORT Destruction
Example	Store a parameter set in the setup mode in NVRAM. XESTORE
Comments	<ul style="list-style-type: none"> 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

6.5 Other Settings

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

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 6V 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 XZ 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 or with a pulse module installed.
- 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.

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%.

Comments

- MWTRIGGER, TEST, 2 min, 3K, 10
- 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.
- 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.

Comments

- MRDIRECT, TEST, YES
- 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 setting in the setup mode, use a YV command.

ML Reads set data from the RAM disk.

Mode Operation mode

Setting MLp1, p2<terminator>

p1 Method of reading the set data:

DIRECT Starts reading immediately after sending an ML command.

TRIG1 to 3 Starts reading at the same time as an event occurrence in event/action functions.

p2 File name (up to eight characters)

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

Comments

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

ME Deletes a file on a RAM disk.

Mode Operation mode

Setting MEp1, p2<terminator>

p1 Type of file

DATA measured/computed data

PANEL Setting data

p2 File name (up to eight characters)

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

Comments

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

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

Mode Operation mode

Setting MYp1, p2, p3, p4, p5, p6, p7, p8<terminator>

p1 Copy destination/copy source

TO_FDD Copies a file from the RAM disk to the floppy disk.

FROM_FDD Copies a file from the floppy disk to the RAM disk.

p2 Type of file

DATA Measured/computed data

PANEL Setting 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.

FL 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.
TRIG_1 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 TRIG_1 to TRIG_3 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 of setting data.

- 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 DDCLf
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

## 6.6 Control and Execution Command

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | 0: Start the report<br>1: Stop the report                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example  | Start the report.<br>DR0                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Comments | <ul style="list-style-type: none"> <li>• Effective only on instruments with the optional report function.</li> <li>• Measurement range, date, time cannot be changed during a report. Copy using the range copy ON also cannot be executed during a report.</li> <li>• All report data up to that point are cleared when a report is started.</li> <li>• This setting is effective when one of hourly, daily and monthly reports is ON.</li> </ul> |

### **RP** Start/stop the report printing

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode     | Operation mode                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Setting  | Rpp1<terminator><br>p1 Start/stop the report printing<br>0: Start the report printing<br>1: Stop the report printing                                                                                                                                                                                                                                                                                                                               |
| Example  | Start the report printing.<br>RP0                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Comments | <ul style="list-style-type: none"> <li>• Effective only on instruments with the optional report function.</li> <li>• Measurement range, date, time cannot be changed during a report. Copy using the range copy ON also cannot be executed during a report.</li> <li>• All report data up to that point are cleared when a report is started.</li> <li>• This setting is effective when one of hourly, daily and monthly reports is ON.</li> </ul> |

### **RS** Reconstruct the system.

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode     | Operation mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Setting  | RSp1<terminator><br>p1 0 The system is reconstruct.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Example  | Reconstruct the system.<br>RS0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Comments | <ul style="list-style-type: none"> <li>• Reconstruct the system. Execute this command if a subunit or a module is newly added or a module in a slot is replaced.</li> <li>• 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.<br/>E0Cr+Lf The received command was normally processed.<br/>E1Cr+Lf There is an error in the received command.</li> <li>• After executing the command, the clock is initialized to 96/01/01 00:00:00.</li> </ul> |

### **RC** Initialize the set values.

|          |                                                                                                                                                                                                                                        |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode     | Operation mode                                                                                                                                                                                                                         |
| Setting  | RCp1<terminator><br>p1 0 The set values are initialized.                                                                                                                                                                               |
| Example  | Initialize the operation mode parameters (measuring range, unit, alarm, date & time, and moving average).<br>RC0                                                                                                                       |
| Comments | <ul style="list-style-type: none"> <li>• 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</li> </ul> |

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><br>p1 0 Transfers to operation mode.<br>1 Transfers to setup mode.<br>2 Transfers to A/D calibration mode.                                                                                                                                                                                                                                                                                                         |
| Example  | Transfer the DR230/DR240 mode to the setup mode.<br>DS1                                                                                                                                                                                                                                                                                                                                                                             |
| Comments | <ul style="list-style-type: none"> <li>• 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.<br/>E0Cr+Lf The received command was normally processed.<br/>E1Cr+Lf There is an error in the received command.</li> </ul> |

## 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<br>1 Setting data output<br>2 Unit data output<br>4 Report data output<br>5 System configuration data output<br>8 A/D calibration data output<br>9 Setting data output in setup mode                                                                                                                                                                                                                                                                                                                 |
| Comments | <ul style="list-style-type: none"> <li>The setting for p1=0, 1 or 2 is effective only in the operation mode.</li> <li>The setting for p1=8 is effective only in the A/D calibration mode.</li> <li>The setting "p1=3" is valid only for recorders with a floppy disk drive function .</li> <li>Do not output data from the RAM disk using a TS3 command during computation.</li> <li>The setting, p1=4 is effective when the instrument has the report function and one of hourly, daily and monthly reports is ON.</li> </ul> |

### **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.<br>1 Outputs measured data in binary format.<br>2 Outputs computed data in ASCII format.<br>3 Outputs computed data in binary format.<br>p2 First output channel (001 to 560)<br>First output computed channel (A01 to A60)<br>p3 Last output channel (001 to 560)<br>Last output computed channel (A01 to A60)                                                                                                                                                                                                                                                                                                                           |
| Comments | <ul style="list-style-type: none"> <li>You must specify data to be output with the TS command and execute "GET" or "ESC T" before sending the FM command.</li> <li>The command selects the output format of measured/computed data, either ASCII or binary, and the output channel.</li> <li>If no input channel is recognized by the DR130/DR230/DR240 among the specified channels, a syntax error occurs.</li> <li>The setting "p1=2" or "p1=3" is valid only for recorders with the optional computing function or floppy disk drive function or with pulse modules installed.</li> <li>The optional computation channel number for a stand-alone model is A01 to A30.</li> </ul> |

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

|         |                                                                                                                                                |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode    | Operation mode                                                                                                                                 |
| Setting | MFp1, p2, p3, p4, p5, p6<terminator>                                                                                                           |
|         | p1 Output contents<br>0 File directory<br>1 Measured/computed data output in ASCII format.<br>2 Measured/computed data output in binary format |

|    |                                                                |
|----|----------------------------------------------------------------|
|    | 3 On/off information on channel on which specified file exists |
| p2 | File name (up to eight characters)                             |
| p3 | First output channel number                                    |
| p4 | Last output channel number                                     |
| p5 | First output data number                                       |
| p6 | Last output data number                                        |

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

### **RF** Selects the output format of the report.

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode     | Operation mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Setting  | RFp1, p2, p3<terminator>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|          | p1 0 Output hourly report data<br>1 Output daily report data<br>2 Output monthly report data<br>3 Output the status of the hourly/<br>daily/monthly data<br>p2 First channel for output (R01 to R60)<br>p3 Last channel for output (R01 to R60)                                                                                                                                                                                                                                                                                                                                                                                                       |
| Comments | <ul style="list-style-type: none"> <li>Before transmitting the RF command, be sure to specify the data to output using the TS command and execute "GET" or "ESC T."</li> <li>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.</li> <li>If there is no valid data within the specified report channel range, "FFFFH" is output.</li> </ul> |

### **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)<br>First output computed channel (A01 to A60)<br>p2 Last output channel (001 to 560)<br>Last output computed channel (A01 to A60)                                                                                                                                                                                                          |
| Comments | <ul style="list-style-type: none"> <li>You must specify data to be output with the TS command and execute "GET" or "ESC T" before sending the LF command.</li> <li>If no input channel is recognized by the DR230/DR240 among the specified channels, a syntax error occurs.</li> <li>The optional computation channel number for a stand-alone model is A01 to A30.</li> </ul> |

## 6.7 Data Output Request Command

### **CF** Specifies the system configuration output format.

|          |                                                                                                                                                                    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode     | All modes                                                                                                                                                          |
| Setting  | CFp1<terminator>                                                                                                                                                   |
|          | p1 0 Information on system-configured modules                                                                                                                      |
|          | 1 Current status module information (real-time information)                                                                                                        |
| Comments | <ul style="list-style-type: none"><li>You must specify data to be output with the TS command and execute "GET" or "ESC T" before sending the CF command.</li></ul> |

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

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

### **IM** Specifies the mask of a status byte.

|          |                                                                                                                                                                                                                                                                                                                                                             |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode     | Operation mode                                                                                                                                                                                                                                                                                                                                              |
| Setting  | IMp1<terminator>                                                                                                                                                                                                                                                                                                                                            |
|          | p1 First numerical value of the items (or combination of those values) shown below                                                                                                                                                                                                                                                                          |
|          | 0 All interrupts are OFF.                                                                                                                                                                                                                                                                                                                                   |
|          | 1 Interrupt occurs at the end of an A/D conversion.                                                                                                                                                                                                                                                                                                         |
|          | 2 Interrupt occurs at the time of a syntax error.                                                                                                                                                                                                                                                                                                           |
|          | 4 Interrupt occurs when internal timer is being operated or the time for hourly, daily and monthly reports arrives.                                                                                                                                                                                                                                         |
|          | 8 Interrupt generated after storing data on media, or reading data from media.                                                                                                                                                                                                                                                                              |
|          | 16 Interrupt occurs at the time of a chart end.                                                                                                                                                                                                                                                                                                             |
|          | 32 Interrupt generated when measurement release is generated while computation is in progress.                                                                                                                                                                                                                                                              |
| Comments | <ul style="list-style-type: none"><li>Masks the causes of interrupt in the status byte.</li><li>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.</li><li>For detailed instructions on the status byte, see Pages 1-2 and 2-2.</li></ul> |

### **SM** Sets the auxiliary mask of the status byte.

|         |                                                      |
|---------|------------------------------------------------------|
| Mode    | Operation mode                                       |
| Setting | SMP1<terminator>                                     |
|         | p1 A figure determined by the following calculation: |
|         | $p1 = a + b + c + d + e + f + g$                     |
|         | a=1 Interrupt occurs when timer No. 1 operates.      |
|         | =0 No interrupt occurs.                              |
|         | b=2 Interrupt occurs when timer No. 2 operates.      |
|         | =0 No interrupt occurs.                              |
|         | c=4 Interrupt occurs when timer No. 3 operates.      |
|         | =0 No interrupt occurs.                              |
|         | d=8 Interrupt occurs when timer No. 4 operates.      |
|         | =0 No interrupt occurs.                              |

|      |                                                                               |
|------|-------------------------------------------------------------------------------|
| e=16 | Interrupt occurs when timer No. 5 operates.                                   |
| =0   | No interrupt occurs.                                                          |
| f=32 | Interrupt occurs when timer No. 6 operates.                                   |
| =0   | No interrupt occurs.                                                          |
| g=64 | Interrupt occurs when the time for hourly, daily and monthly reports arrives. |
| =0   | No interrupt occurs.                                                          |

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

## 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:

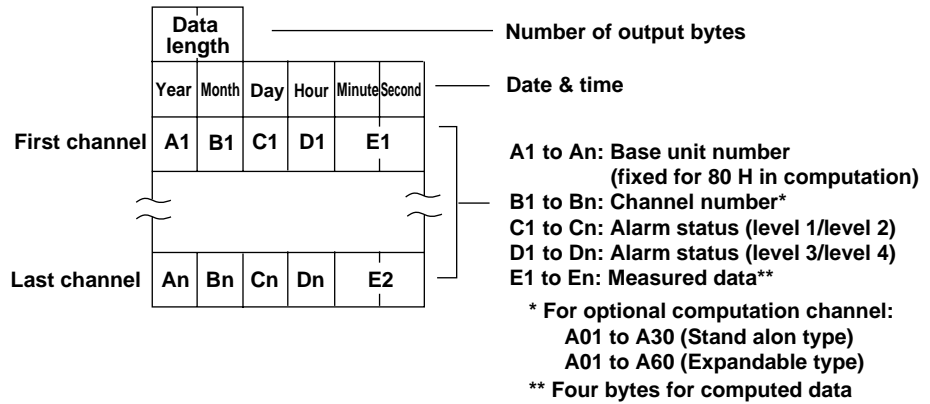
YY: Year  
MM: Month  
DD: Day  
hh: Hour  
mm: Minute  
ss: Second  
S1: Data status 1  
    E ----- Abnormal  
    N ----- Normal  
    D ----- Differential input  
    O ----- Over  
    S ----- Measuring range is "skip" or computation channel is "off"  
S2: Data status 2  
    Space ----- Interim 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.

$$\text{Number of output bytes} = 6 \times N + 6 \quad (N = \text{number of output channels})$$

$$\text{Number of output bytes} = 8 \times M + 6 \quad (M = \text{number of output channels})$$

### 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

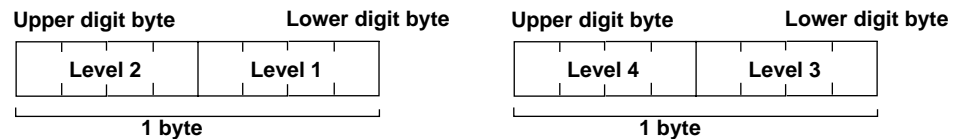
### Measured data (E1 to En)

- 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 | SG | Setting data for No. 1 message                                      | CrLf |
| SR | Measurement range setting data for the first channel                  | CrLf | SG | Setting data for No. 20 message                                     | CrLf |
| SR | Measurement range setting data for the last channel                   | CrLf | SH | Header setting data for the first line                              | CrLf |
| SO | Computation expression setting data for the first computation channel | CrLf | SH | Header setting data for the last line                               | CrLf |
| SO | Computation expression setting data for the last computation channel  | CrLf | SJ | Setting data for the title                                          | CrLf |
| SN | Scaling unit setting data for the first channel                       | CrLf | SI | Setting data for No.1 timer                                         | CrLf |
| SN | Scaling unit setting data for the last channel                        | CrLf | SI | Setting data for No.6 timer                                         | CrLf |
| SA | Alarm setting data for the first channel                              | CrLf | SQ | Setting data for No.1 match time                                    | CrLf |
| SA | Alarm setting data for the last channel                               | CrLf | SQ | Setting data for No.3 match time                                    | CrLf |
| SC | Setting data for the chart speed                                      | CrLf | SF | Setting data for the format for list printing                       | CrLf |
| SS | Setting data for the recording type(trend/digital)                    | CrLf | SL | Setting data for No.1 event action                                  | CrLf |
| ST | Tag setting data for the first channel                                | CrLf | SL | Setting data for No.30 event action                                 | CrLf |
| ST | Tag setting data for the last channel                                 | CrLf | SE | Setting data for the second chart speed                             | CrLf |
| SZ | Zone recording setting data for the first                             | CrLf | SB | Interpolation ON/OFF setting data for the first channel             | CrLf |
| SZ | Zone recording setting data for the last                              | CrLf | SB | Interpolation ON/OFF setting data for the last channel              | CrLf |
| SP | Patial expanded recording setting data for the first channel          | CrLf | SV | Moving average setting data for the first channel                   | CrLf |
| SP | Patial expanded recording setting data for the last channel           | CrLf | SV | Moving average setting data for the last channel                    | CrLf |
| PT | Trend recording ON/OFF setting data for the first channel             | CrLf | SX | Setting data for No. 1 group                                        | CrLf |
| PT | Trend recording ON/OFF setting data for the last channel              | CrLf | SX | Setting data for No. 1 group                                        | CrLf |
| PD | Digital recording ON/OFF setting data for the first channel           | CrLf | SW | Setting data for summer/winter time                                 | CrLf |
| PD | Digital recording ON/OFF setting data for the last channel            | CrLf | SK | Constant setting data for the first constant number                 | CrLf |
| PM | Manual printout ON/OFF setting data for the first channel             | CrLf | SK | Constant setting data for the last constant number                  | CrLf |
| PM | Manual printout ON/OFF setting data for the last channel              | CrLf | MH | Data storage ON/OFF setting data for the first channel              | CrLf |
| PA | Alarm printout ON/OFF setting data for the first channel              | CrLf | MH | Data storage ON/OFF setting data for the last channel               | CrLf |
| PA | Alarm printout ON/OFF setting data for the last channel               | CrLf | UD | Setting data for the display mode on the upper part of the display  | CrLf |
| PC | Scale printout ON/OFF setting data for the first channel              | CrLf | MD | Setting data for the display mode on the middle part of the display | CrLf |
| PC | Scale printout ON/OFF setting data for the last channel               | CrLf | LD | Setting data for the display mode on the lower part of the display  | CrLf |
| PL | List printout ON/OFF setting data for the first channel               | CrLf | EN | Output completed                                                    | CrLf |
| PL | List printout ON/OFF setting data for the last channel                | 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 |

## 7.5 Setting Data Output Format (Setup mode)

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

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

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.

## 7.7 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  
    mA ----- mA-input module  
    AC ----- Power monitor module  
    STRAIN ----- Strain input module  
    PULS ----- Puls input module  
    DI ----- Digital 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.

|           |                                                |             |
|-----------|------------------------------------------------|-------------|
| <b>XZ</b> | <b>A/D calibration data for the first slot</b> | <b>CrLf</b> |
| ⋮         | ⋮                                              | ⋮           |
| <b>XZ</b> | <b>A/D calibration data for the last slot</b>  | <b>CrLf</b> |
| <b>EN</b> | <b>Output completion</b>                       | <b>CrLf</b> |

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.

---

## 7.9 RAM Disk Output Format (File Directory Output)

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

```
_FFFFFFF, YY/MM/DD hh:mm, NNNNNN, CCC, MMCrLf

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

Each symbol denotes the following:

FFFFFFF: 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 S1S2UUUUUUUCCCC, ±DDDDDE-EpCrLf

Last Data Number *SNNNNNCrLf
Date and Time YY-MM-DD hh:mm:ssCrLf
Last Data S1S2UUUUUUUCCCC, ±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

```

## 7.10 RAM Disk Output Format (ASCII Code)

---

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,  
FFFFGGGCrLf

YY-MM-DD hh:mm:ssCrLf

**Channel information** S1S2CCUUUUUU, PCrLf

Each symbol denotes the following:

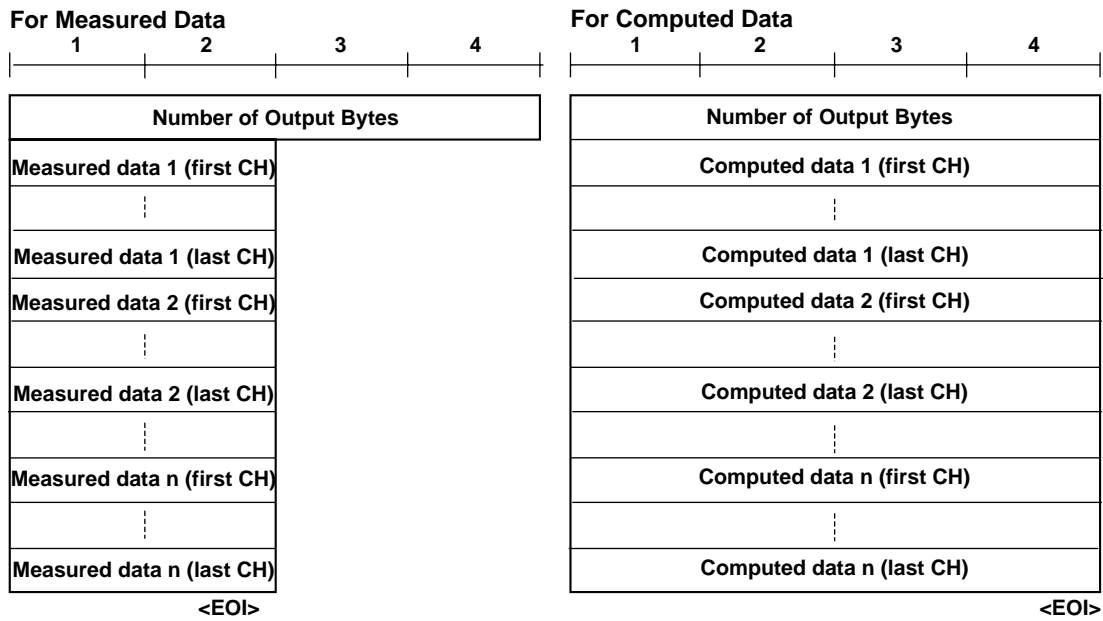
### Header

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. AAAAA

## 7.11 RAM Disk Output Format (Binary Code)



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                                                          |

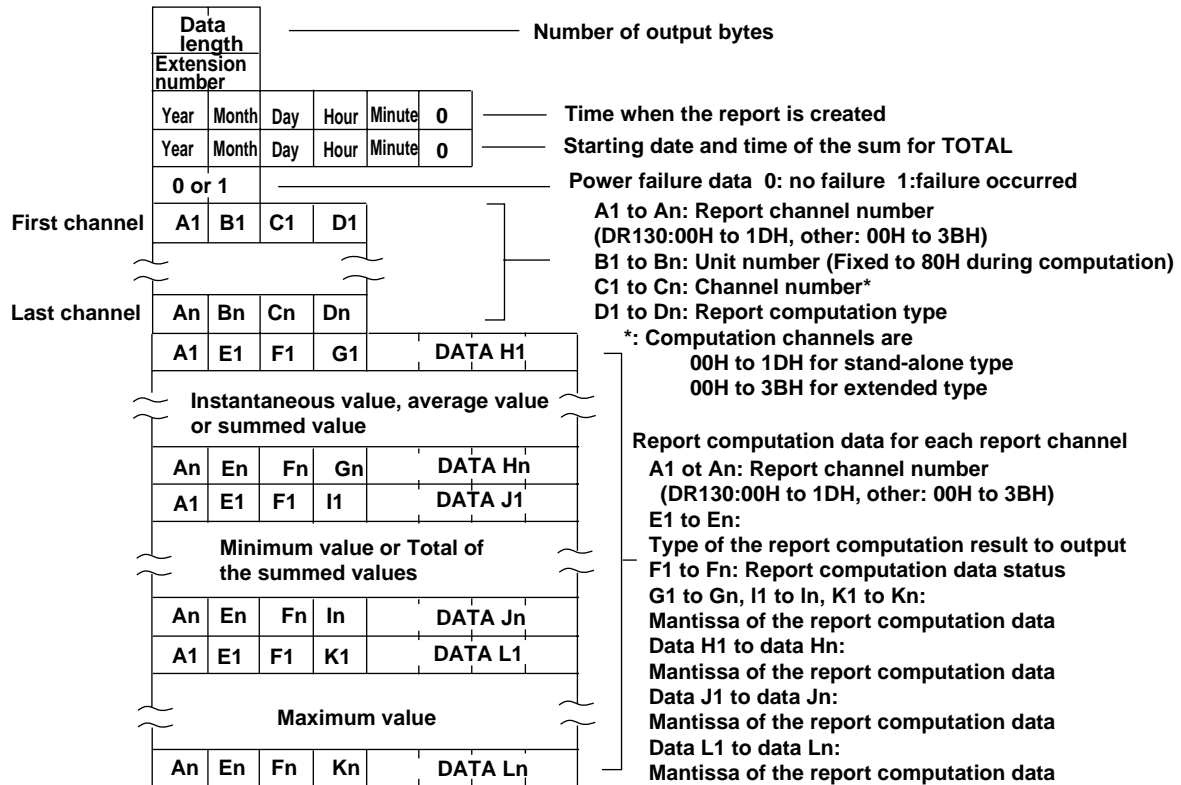
### Note

- 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.

## 7.13 Report Output Format

### Hourly report

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



### Note

- RF0 outputs data on the specified report channels.

### Data length

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

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

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

I1 to In, 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

I1 to In, 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

I1 to In, 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

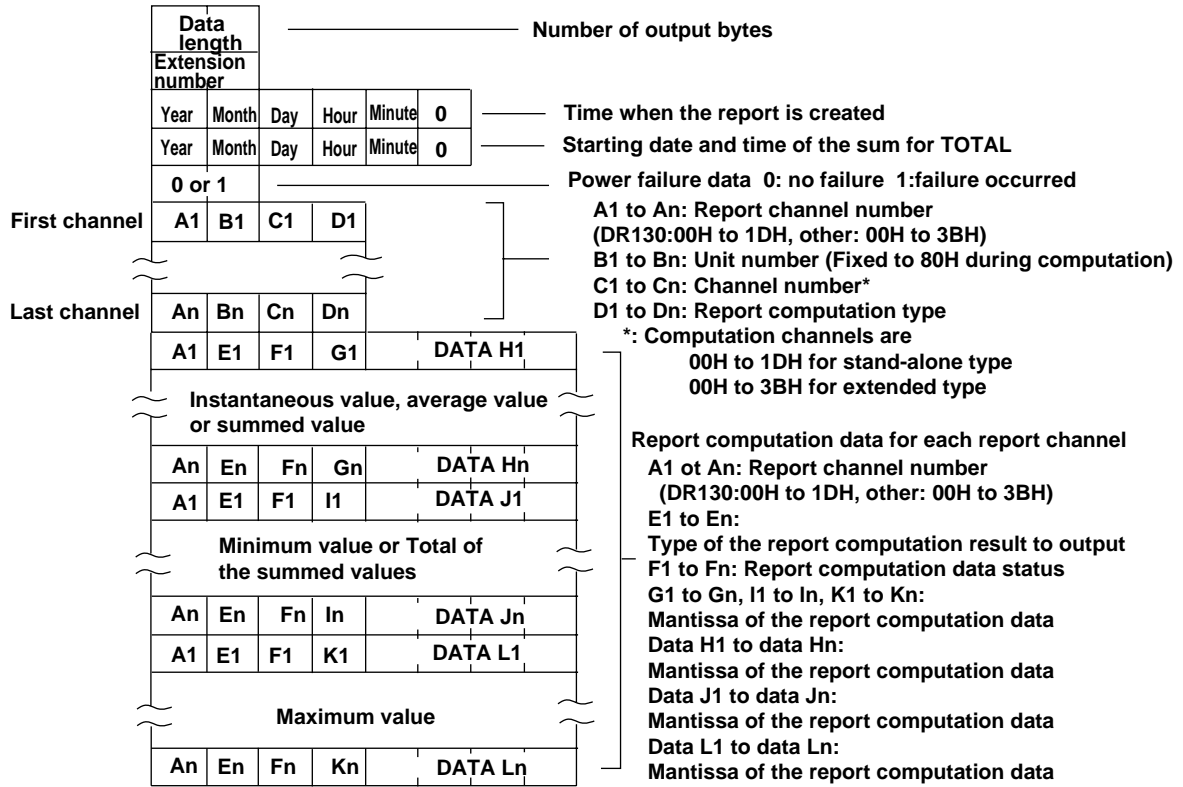
80058005H: Data output not possible

**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

**Daily Report**

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



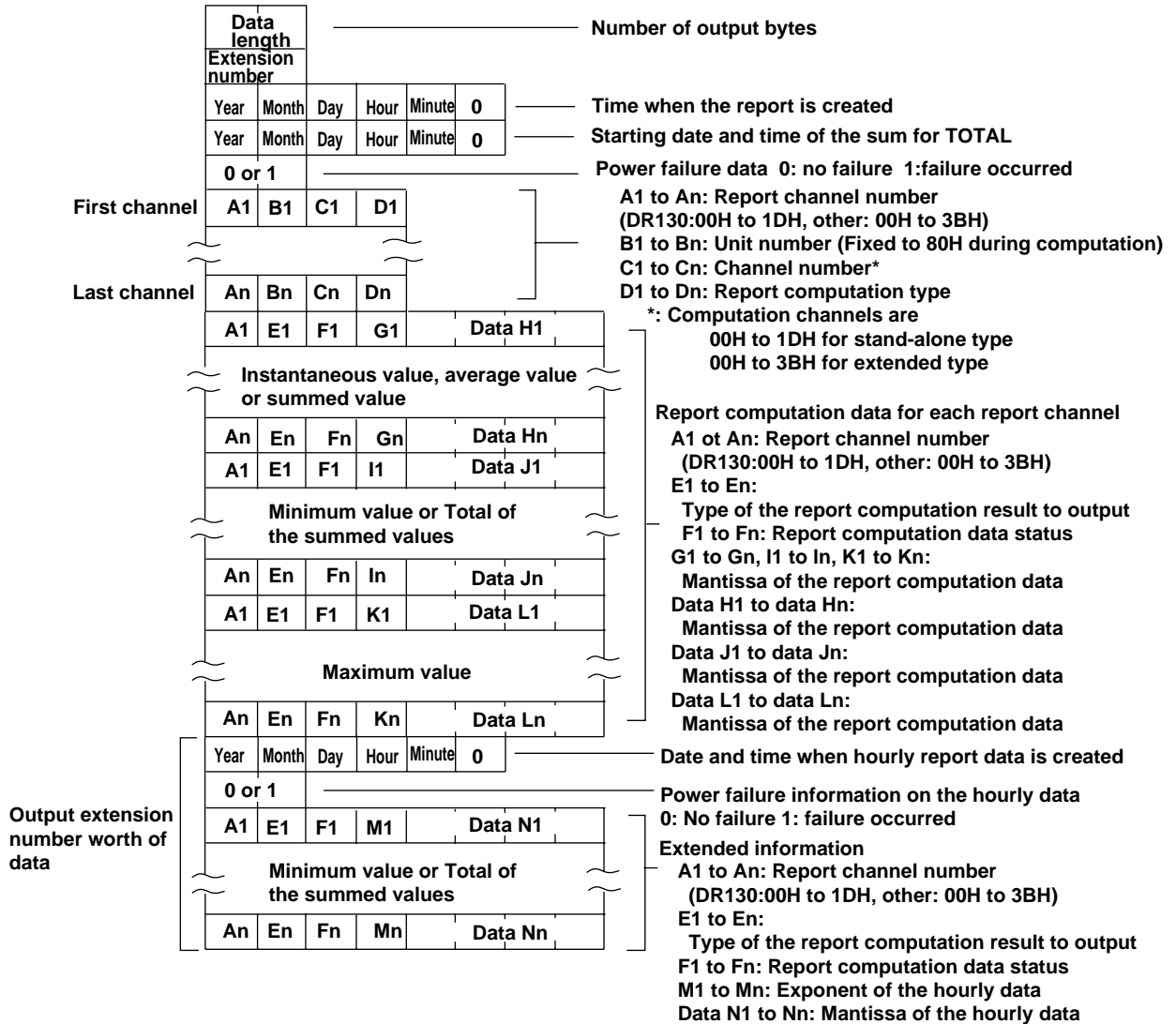
The meaning of each data is the same as the hourly report.

**Note**

- RF1 outputs data on the specified report channels.

**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.



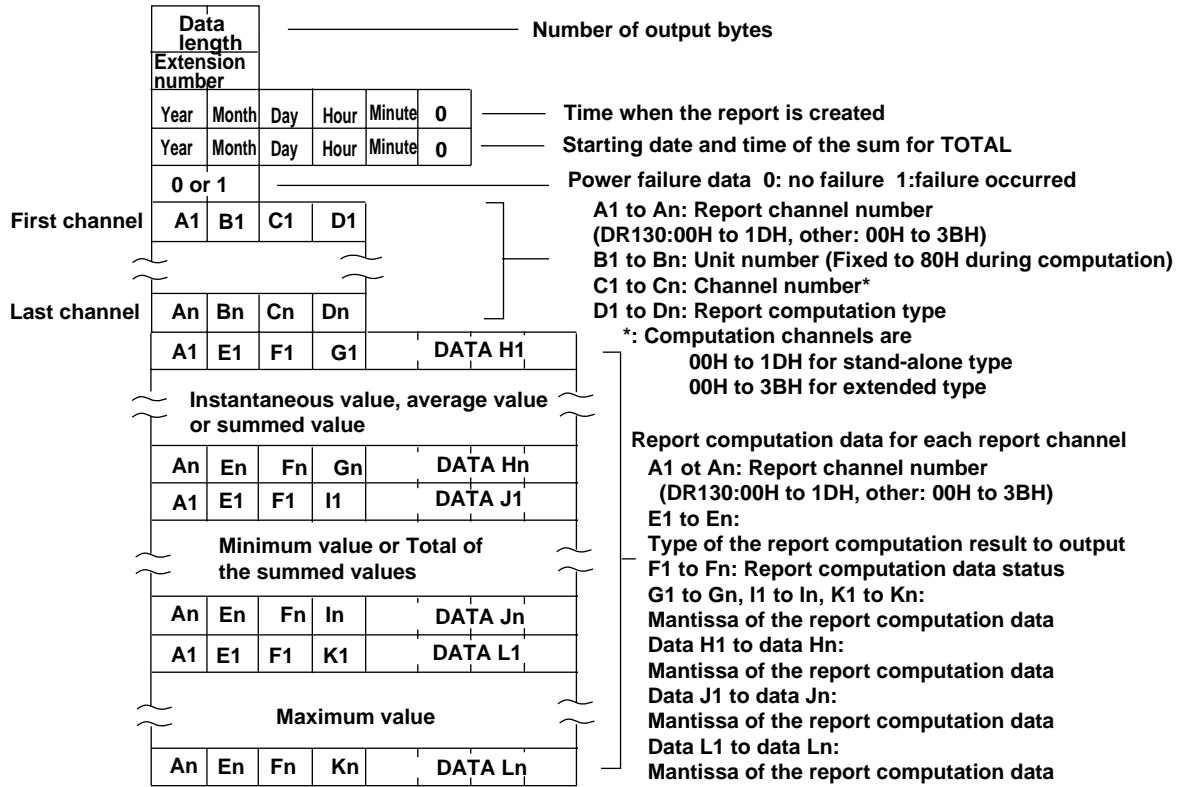
**Note**

- RF1 outputs data on the specified report channels.

## 7.13 Report Output Format

### Monthly Report

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



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

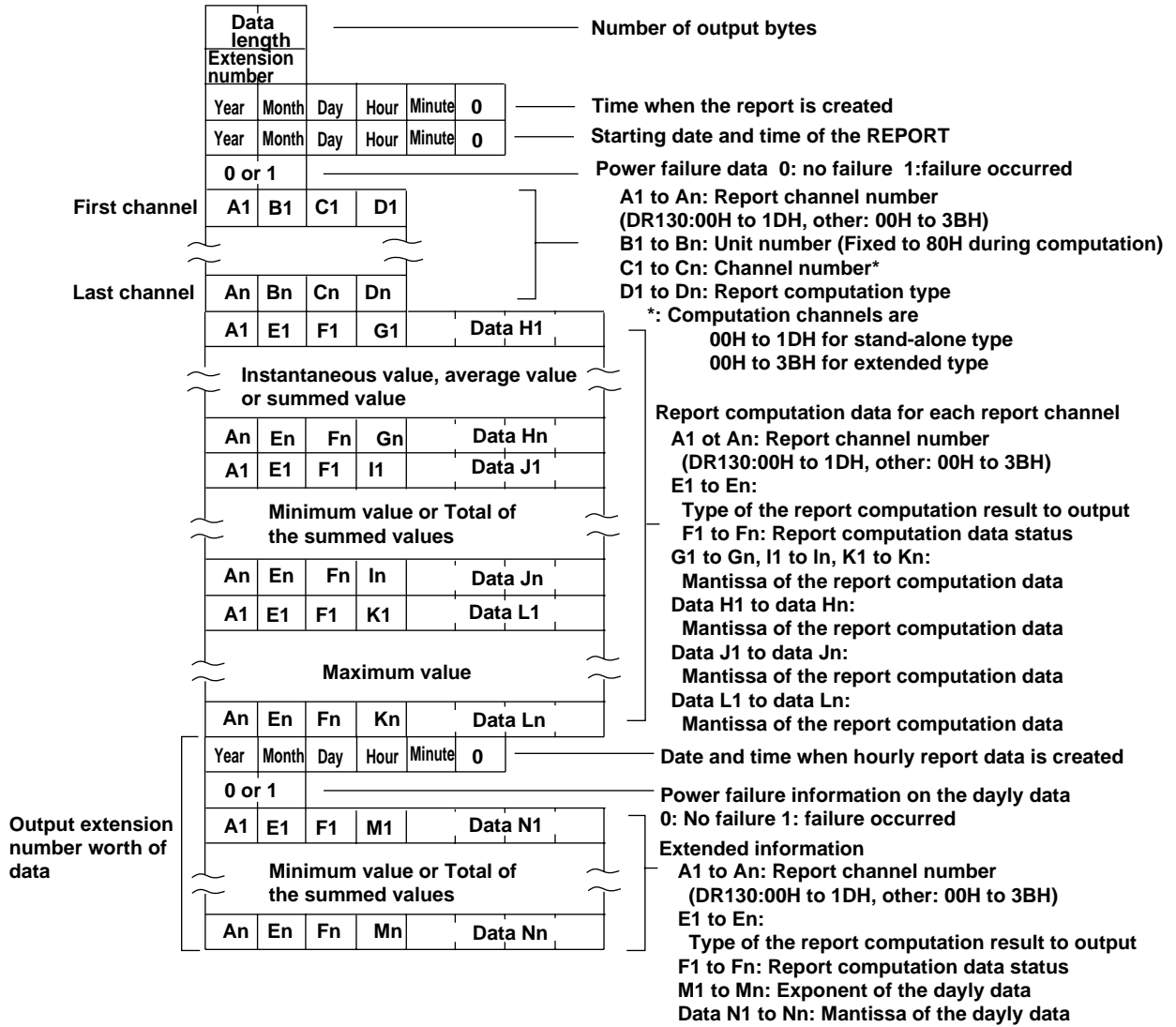
### Note

- RF2 outputs data on the specified report channels.



**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.



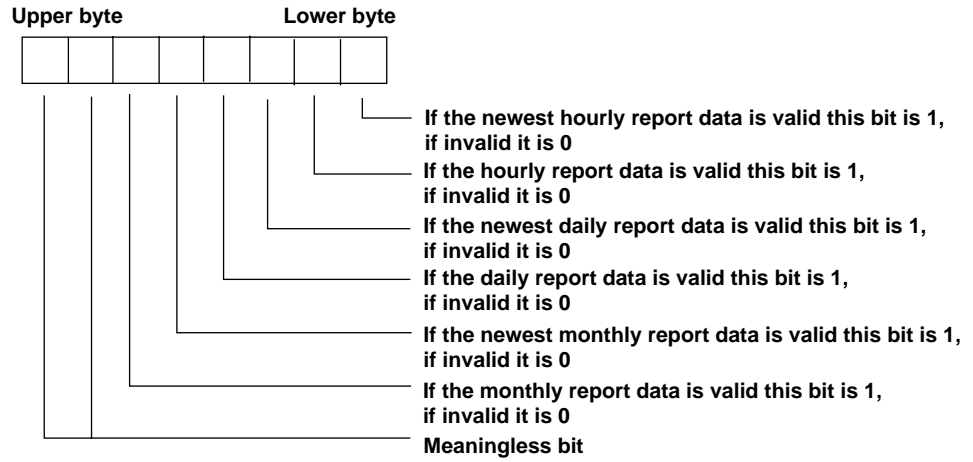
The meaning of each data is the same as the hourly report.

**Note**

- RF2 outputs data on the specified report channels.

**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.



**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 written 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=L+1
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

```

## 8.2 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 written 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 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 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=L+1
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
```

**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
```

**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 *RRECIIVE :PRINT D$
80 D$="TS0"
90 GOSUB *RPRINT :GOSUB *RRECIIVE :PRINT D$
100 D$=CHR$(&H1B)+"T"
110 GOSUB *RPRINT :GOSUB *RRECIIVE :PRINT D$
120 '
130 D$="FM0,001,010" :GOSUB *RPRINT
140 GOSUB *RRECIIVE
150 PRINT D$
160 PRINT #2,D$
170 IF MID$(D$,2,1)<>"E" GOTO 140
180 '
190 D$=CHR$(&H1B)+"C 01" :GOSUB *RPRINT :GOSUB *RRECIIVE
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 *RRECIIVE
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

```

### ***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 |
| Language | Visual-C  |

### Output the measurement data (ASCII)

```
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 "TSO",
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 }
```

```

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(!strcmp(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 `buf[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 <sup>x</sup> .             |

\* +/- 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".<br>when channel 001=nonzero and channel 002=0, "0".<br>when channel 001=0 and channel 002=nonzero, "0".<br>when both channel 001 and channel 002 are nonzero, "1". |
| Logical sum      | OR       | 001OR002  | when channel 001=0 and channel 002=0, "0".<br>when channel 001=nonzero and channel 002=0, "1".<br>when channel 001=0 and channel 002=nonzero, "1".<br>when both channel 001 and channel 002 are nonzero, "1". |
| Exclusive OR     | XOR      | 001XOR002 | when channel 001=0 and channel 002=0, "0".<br>when channel 001=nonzero and channel 002=0, "1".<br>when channel 001=0 and channel 002=nonzero, "1".<br>when both channel 001 and channel 002 are nonzero, "0". |
| Logical negation | NOT      | NOT001    | when channel 001=0, "1".<br>when channel 001=nonzero, "0".                                                                                                                                                    |

## Relational operators

| Type                     | Operator | Example    | Description                                                                    |
|--------------------------|----------|------------|--------------------------------------------------------------------------------|
| Equal                    | .EQ.     | 001.EQ.002 | when channel 001 = channel 002, "1".<br>when channel 001 ≠ channel 002, "0".   |
| Not equal                | .NE.     | 002.NE.001 | when channel 001 ≠ channel 002, "1".<br>when channel 001 = channel 002, "0".   |
| Greater than             | .GT.     | 003.GT.K1  | when channel 003 > constant K1, "1".<br>when channel 003 ≤ constant K1, "0".   |
| Less than                | .LT.     | 004.LT.K10 | when channel 004 < constant K10, "1".<br>when channel 004 ≥ constant K10, "0". |
| Greater than or equal to | .GE.     | 003.GE.K1  | when channel 003 ≥ constant K1, "1".<br>when channel 003 < constant K1, "0".   |
| Less than or equal to    | .LE.     | 004.LE.K10 | when channel 004 ≤ constant K10, "1".<br>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 applicable for computation**

The following data is used for computation.

- Measured data: Specified by channel No. (DR130: 001 to 020; DR231/DR241: 001 to 030; DR232/DR242: 001 to 300)
- Computed data: Specified by computation channel No. (DR130: A01 to A30; DR231/DR241: A01 to A30; DR232/DR242: A01 to A60)
- Constant: Value specified for DR130: K01 to K30; DR231/DR241: K01 to K30; DR232/DR242: K01 to K60.
- Group data: Measured data of channels belonging to a group. Specified by group No. (G01 to G07). This is applicable only for CLOG.
- Communication input data: Data written to the instrument's memory via communication interface. Specified by data No. (DR130: C01 to C30; DR231/DR241: C01 to C30; DR232/DR242: C01 to C60)
- Data on internal RAM disk: Measured/computed data saved in the internal RAM disk. Use the following numbers to specify data.  
 Measured data:  
 DR130: M001 to M020; DR231/DR241: M001 to M030; DR232/DR242: M001 to M300  
 Computed data:  
 DR130: MA01 to MA30; DR231/DR241: MA01 to MA30; DR232/DR242: MA01 to MA030

**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**

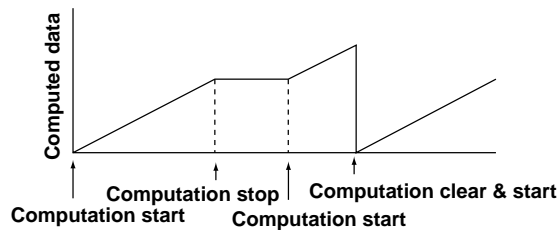
Multiple operators can be used in 1 computing equation. But, there are following limitations.

- 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).

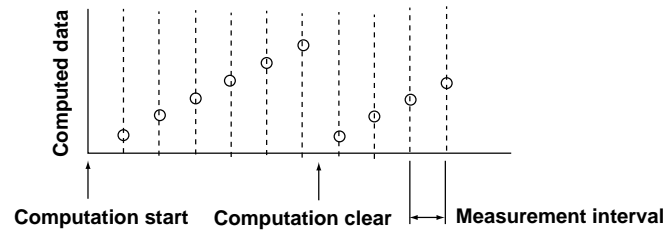


- Control using the event/action function

Can start/stop computations or clear/reset computed results by an event occurring. This function distinguishes clear and reset as shown below.

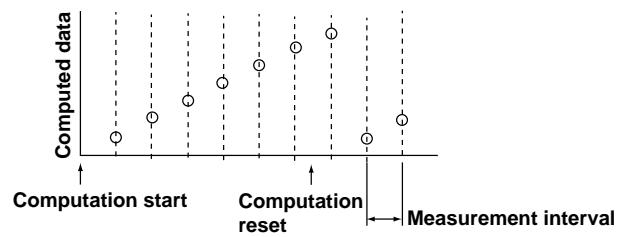
- Clear

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).

# Index

| <b>A</b>                                           | <b>Page</b> |
|----------------------------------------------------|-------------|
| A/D calibration                                    |             |
| data output format .....                           | 7-8         |
| execution .....                                    | 6-15        |
| mode .....                                         | 5-3         |
| A/D integration time .....                         | 6-3         |
| AC .....                                           | 6-1, 6-2    |
| ACK output .....                                   | 2-2         |
| alarm                                              |             |
| alarm for limit of increasing rate-of-change ..... | 6-4         |
| alarm for limit of decreasing rate-of-change ..... | 6-4         |
| alarm for lower limit difference .....             | 6-4         |
| alarm for upper limit difference .....             | 6-4         |
| lower limit alarm .....                            | 6-4         |
| printing .....                                     | 6-8         |
| reset .....                                        | 6-17        |
| setting .....                                      | 6-4         |
| upper limit alarm .....                            | 6-4         |
| alarm for lower limit difference .....             | 6-4         |
| alarm for upper limit difference .....             | 6-4         |
| alarm output relay                                 |             |
| AND/OR .....                                       | 6-4         |
| energizing/deenergizing .....                      | 6-5         |
| hold/non-hold .....                                | 6-5         |
| relay No. ....                                     | 5-4         |
| ASCII code table .....                             | 5-9         |

| <b>B</b> | <b>Page</b> |
|----------|-------------|
|----------|-------------|

|                 |          |
|-----------------|----------|
| baud rate ..... | 2-9, 3-9 |
| burnout .....   | 6-14     |

| <b>C</b>                          | <b>Page</b> |
|-----------------------------------|-------------|
| CCITT .....                       | 2-5         |
| channel No.                       |             |
| setting .....                     | 5-4         |
| printing .....                    | 6-9         |
| printing interval .....           | 6-9         |
| chart speed .....                 | 6-6         |
| chart speed change printing ..... | 6-9         |
| computation .....                 | 6-12        |
| communication input data .....    | 6-12        |
| constant .....                    | 6-12        |
| control execution command .....   | 5-6, 6-17   |
| copying setting parameters .....  | 6-10        |
| CTS-DTR .....                     | 2-6, 2-7    |
| CTS-RTS .....                     | 2-6, 2-7    |

| <b>D</b>                     | <b>Page</b> |
|------------------------------|-------------|
| daily report                 |             |
| format .....                 | 7-18, 7-19  |
| ON/OFF .....                 | 6-12        |
| date and time .....          | 6-10        |
| data length .....            | 2-9, 3-9    |
| difference computation ..... | 6-1         |
| digital printing .....       | 6-8         |
| display mode .....           | 6-5         |
| dot printing colors .....    | 6-9         |

| <b>E</b>                                            | <b>Page</b> |
|-----------------------------------------------------|-------------|
| established content of the setup mode setting ..... | 6-15        |
| ethernet                                            |             |
| connection .....                                    | 4-8         |
| IP address .....                                    | 4-6         |
| keepalive .....                                     | 4-4         |
| setting .....                                       | 4-4         |
| specification .....                                 | 4-3         |
| event/action .....                                  | 6-10        |

| <b>F</b>                        | <b>Page</b> |
|---------------------------------|-------------|
| filter .....                    | 6-1         |
| floppy disk .....               | 6-18, 6-19  |
| four-wire/two-wire system ..... | 3-9         |
| function screen .....           | 6-13        |

| <b>G</b>            | <b>Page</b> |
|---------------------|-------------|
| GP-IB               |             |
| address .....       | 1-3         |
| specification ..... | 1-4         |
| group .....         | 6-10        |

| <b>H</b>                | <b>Page</b> |
|-------------------------|-------------|
| handshake               |             |
| CTS-DTR .....           | 2-6, 2-7    |
| CTS-RTS .....           | 2-6, 2-7    |
| OFF-OFF .....           | 2-6         |
| system .....            | 2-6, 2-9    |
| XON-RTS .....           | 2-6         |
| XON-DTR .....           | 2-6, 2-7    |
| header                  |             |
| printing interval ..... | 6-9         |
| setting .....           | 6-7         |
| start/stop .....        | 6-17        |
| hysteresis .....        | 6-4         |

| <b>I</b>                                               | <b>Page</b> |
|--------------------------------------------------------|-------------|
| initializing .....                                     | 6-20        |
| interpolation .....                                    | 6-8         |
| interrupt generated at the end of A/D conversion ..... | 1-2         |
| interrupt generated at the time of syntax error .....  | 1-2         |
| interval for limit of decreasing rate-of-change .....  | 6-4         |
| interval for limit of increasing rate-of-change .....  | 6-4         |
| lower limit alarm .....                                | 6-3         |

| <b>K</b>        | <b>Page</b> |
|-----------------|-------------|
| keepalive ..... | 4-3         |
| key lock .....  | 6-13        |

| <b>M</b>                         | <b>Page</b> |
|----------------------------------|-------------|
| mask of a status byte .....      | 6-22        |
| measurement period .....         | 6-3         |
| measured data                    |             |
| output format(ASCII code) .....  | 7-2         |
| output format(binary code) ..... | 7-3         |
| output request .....             | 6-21        |
| measurement range .....          | 6-1         |
| message                          |             |
| setting .....                    | 6-7         |
| start/stop .....                 | 6-17        |
| minimum response time .....      | 3-7, 3-10   |
| monthly report                   |             |
| format .....                     | 7-20, 7-21  |
| ON/OFF .....                     | 6-12        |
| moving average .....             | 6-10        |

| <b>L</b>                | <b>Page</b> |
|-------------------------|-------------|
| list printing           |             |
| format .....            | 6-8         |
| ON/OFF .....            | 6-9         |
| start/stop .....        | 6-17        |
| listener function ..... | 1-1, 2-1    |
| logging record          |             |
| format .....            | 6-9         |
| ON/OFF .....            | 6-8         |
| printing interval ..... | 6-9         |
| selection .....         | 6-6         |
| start/stop .....        | 6-17        |

| <b>M</b>   | <b>Page</b> |
|------------|-------------|
| math ..... | 6-12        |

| <b>O</b>                   | <b>Page</b> |
|----------------------------|-------------|
| OFF-OFF .....              | 2-6         |
| operation mode .....       | 5-3         |
| order of byte output ..... | 6-22        |

|                              |                        |
|------------------------------|------------------------|
| output format                |                        |
| A/D calibration .....        | 7-9                    |
| Channel ON/OFF .....         | 7-15                   |
| decimal point position ..... | 7-7                    |
| file directory .....         | 7-10                   |
| measurement data .....       | 7-2, 7-3, 7-11 to 7-14 |
| setting data .....           | 7-4 to 7-6             |
| system configuration .....   | 7-8                    |
| unit .....                   | 7-7                    |

| <b>P</b>                         | <b>Page</b> |
|----------------------------------|-------------|
| parity .....                     | 2-9, 3-9    |
| partial expanded recording ..... | 6-7         |
| power monitor .....              | 6-1, 6-2    |
| pulse .....                      | 6-2         |

| <b>R</b>                              | <b>Page</b> |
|---------------------------------------|-------------|
| RAM disk .....                        | 6-17, 6-18  |
| read                                  |             |
| measured data .....                   | 6-18        |
| setting data .....                    | 6-18, 6-19  |
| re-alarm for a re-failure .....       | 6-4         |
| reference channel .....               | 6-1         |
| reference junction compensation ..... | 6-14        |
| reflash .....                         | 6-4         |
| report                                |             |
| ON/OFF .....                          | 6-12        |
| print ON/OFF .....                    | 6-12        |
| print start/stop .....                | 6-20        |
| output format .....                   | 7-16        |
| output request .....                  | 6-21        |
| start/stop .....                      | 6-19        |
| RJC .....                             | 6-12        |
| RRJC .....                            | 6-1         |
| RS-232-C                              |             |
| data format .....                     | 2-8         |
| Parameter setting .....               | 2-9         |
| pin No. ....                          | 2-4         |
| signal name .....                     | 2-4         |
| RS-422-A/RS-485                       |             |
| data format .....                     | 2-8, 3-8    |
| interface connection .....            | 3-3         |
| Parameter setting .....               | 3-9         |
| specifications .....                  | 3-2         |

| <b>S</b>                 | <b>Page</b>      |
|--------------------------|------------------|
| save                     |                  |
| measured data .....      | 6-17, 6-18       |
| setting data .....       | 6-18, 6-19       |
| scaling .....            | 6-2              |
| scale printing .....     | 6-8              |
| second chart speed ..... | 6-6              |
| serial polling .....     | 1-2              |
| setting command .....    | 5-5, 6-1 to 6-16 |

|                                                |          |
|------------------------------------------------|----------|
| setting data                                   |          |
| output format(operation mode) .....            | 7-4, 7-5 |
| output format(setup mode) .....                | 7-6      |
| output request .....                           | 6-21     |
| setting screen .....                           | 6-13     |
| setup mode .....                               | 5-3      |
| skip .....                                     | 6-1      |
| SRQ .....                                      | 1-2      |
| status byte .....                              | 1-2, 2-2 |
| status byte format .....                       | 2-2      |
| stop bit .....                                 | 2-9, 3-9 |
| sub-delimita .....                             | 5-2      |
| switching time for the displayed channel ..... | 6-6      |
| system configuration                           |          |
| data output request .....                      | 6-22     |
| output format .....                            | 7-8      |
| system reconstruction .....                    | 6-20     |

## **T** **Page**

|                                  |                    |
|----------------------------------|--------------------|
| tag .....                        | 6-7                |
| talker function .....            | 1-1, 2-1, 3-1, 7-1 |
| terminator .....                 | 5-2                |
| timeout .....                    | 4-14               |
| timer .....                      | 6-10               |
| title                            |                    |
| printing interval .....          | 6-9                |
| setting .....                    | 6-7                |
| transfers the setting mode ..... | 6-20               |
| trend record                     |                    |
| mode .....                       | 6-9                |
| ON/OFF .....                     | 6-8                |
| selection .....                  | 6-6                |
| start/stop .....                 | 6-17               |

## **U** **Page**

|                         |     |
|-------------------------|-----|
| unit .....              | 6-3 |
| upper limit alarm ..... | 6-4 |

## **W** **Page**

|               |           |
|---------------|-----------|
| warning ..... | 4-5, 4-13 |
|---------------|-----------|

## **X** **Page**

|               |          |
|---------------|----------|
| XON-RTS ..... | 2-6      |
| XON-DTR ..... | 2-6, 2-7 |

## **Z** **Page**

|            |     |
|------------|-----|
| Zone ..... | 6-7 |
|------------|-----|

# Command Index

## **A** **Page**

|          |      |
|----------|------|
| AC ..... | 6-17 |
| AK ..... | 6-17 |
| AR ..... | 6-17 |

## **B** **Page**

|          |      |
|----------|------|
| BL ..... | 6-19 |
| BO ..... | 6-22 |

## **C** **Page**

|          |      |
|----------|------|
| CF ..... | 6-22 |
| CM ..... | 6-12 |

## **D** **Page**

|          |      |
|----------|------|
| DR ..... | 6-19 |
| DS ..... | 6-20 |

## **E** **Page**

|             |      |
|-------------|------|
| ESCC .....  | 3-1  |
| ESC L ..... | 2-2  |
| ESCO .....  | 3-1  |
| ESC R ..... | 2-2  |
| ESC S ..... | 2-2  |
| ESC T ..... | 2-2  |
| EX .....    | 6-17 |

## **F** **Page**

|          |      |
|----------|------|
| FE ..... | 6-19 |
| FL ..... | 6-19 |
| FM ..... | 6-21 |
| FV ..... | 6-19 |

## **H** **Page**

|          |      |
|----------|------|
| HD ..... | 6-17 |
|----------|------|

## **I** **Page**

|          |      |
|----------|------|
| IM ..... | 6-22 |
| IR ..... | 6-17 |

## **L** **Page**

|          |      |
|----------|------|
| LD ..... | 6-6  |
| LF ..... | 6-21 |
| LS ..... | 6-17 |

## **M** **Page**

|          |      |
|----------|------|
| MC ..... | 6-17 |
| MD ..... | 6-5  |
| ME ..... | 6-18 |
| MF ..... | 6-21 |
| MH ..... | 6-12 |
| ML ..... | 6-18 |
| MP ..... | 6-17 |
| MR ..... | 6-18 |
| MS ..... | 6-17 |
| MV ..... | 6-18 |
| MW ..... | 6-17 |
| MY ..... | 6-18 |

## **P** **Page**

|          |      |
|----------|------|
| PA ..... | 6-8  |
| PC ..... | 6-8  |
| PD ..... | 6-8  |
| PL ..... | 6-9  |
| PM ..... | 6-8  |
| PS ..... | 6-17 |
| PT ..... | 6-8  |

## **R** **Page**

|          |      |
|----------|------|
| RC ..... | 6-20 |
| RF ..... | 6-21 |
| RI ..... | 6-13 |
| RM ..... | 6-13 |
| RO ..... | 6-12 |
| RP ..... | 6-20 |
| RS ..... | 6-20 |

## **S** **Page**

|          |      |
|----------|------|
| SA ..... | 6-4  |
| SB ..... | 6-8  |
| SC ..... | 6-6  |
| SD ..... | 6-10 |
| SE ..... | 6-6  |
| SF ..... | 6-7  |
| SG ..... | 6-7  |
| SH ..... | 6-7  |
| SI ..... | 6-10 |
| SJ ..... | 6-7  |
| SK ..... | 6-12 |
| SL ..... | 6-10 |
| SM ..... | 6-22 |
| SN ..... | 6-3  |
| SO ..... | 6-12 |
| SP ..... | 6-7  |
| SQ ..... | 6-10 |



|          |      |
|----------|------|
| SR ..... | 6-1  |
| SS ..... | 6-6  |
| ST ..... | 6-7  |
| SU ..... | 6-17 |
| SV ..... | 6-10 |
| SW ..... | 6-13 |
| SX ..... | 6-10 |
| SY ..... | 6-10 |
| SZ ..... | 6-7  |

**T** **Page**

---

|          |      |
|----------|------|
| TS ..... | 6-21 |
|----------|------|

**U** **Page**

---

|          |     |
|----------|-----|
| UD ..... | 6-5 |
|----------|-----|

**X** **Page**

---

|          |      |
|----------|------|
| XA ..... | 6-4  |
| XB ..... | 6-14 |
| XC ..... | 6-9  |
| XD ..... | 6-5  |
| XE ..... | 6-15 |
| XF ..... | 6-13 |
| XG ..... | 6-15 |
| XH ..... | 6-5  |
| XI ..... | 6-3  |
| XJ ..... | 6-15 |
| XK ..... | 6-13 |
| XL ..... | 6-15 |
| XN ..... | 6-4  |
| XQ ..... | 6-3  |
| XR ..... | 6-9  |
| XS ..... | 6-14 |
| XT ..... | 6-15 |
| XV ..... | 6-3  |
| XW ..... | 6-6  |
| XY ..... | 6-4  |
| XZ ..... | 6-15 |

**Y** **Page**

---

|          |      |
|----------|------|
| YE ..... | 6-19 |
| YL ..... | 6-19 |
| YV ..... | 6-19 |