User's Manual

Models SR10001/SR10002/SR10003/SR10004/
SR10006

SR10000
Communication Interface

vigilantplant.™

YOKOGAWA ◆

Yokogawa Electric Corporation

Foreword

Thank you for purchasing the YOKOGAWA SR10000 (hereafter referred to as the recorder).

This user's manual describes the functions of the Ethernet interface and the RS-422A/485 communication interface. To ensure correct use, please read this manual thoroughly before beginning operation. After reading the manual, keep it in a convenient location for quick reference whenever a question arises during operation.

The following three manuals, including this one, are provided as manuals for the recorder. Please read all of them.

- **Paper Manual**

Manual Title	Manual No.	Description
SR10000 Operation Guide	IM 04P03B01-02E	Explains the basic operations of the SR10000. It is also provided in the CD.

- **Electronic Manuals Provided on the Accompanying CD-ROM**

Manual Title	Manual No.	Description
SR10000 User's Manual	IM 04P03B01-01E	Explains the convenient functions and procedures of the SR10000.
SR10000 Operation Guide	IM 04P03B01-02E	This is the electronic version of the paper manual.
SR10000 Communication Interface User's Manual	IM 04P03B01-17E	This manual. Explains the functions of the Ethernet interface and the RS-422A/485 communication interface.

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions. The figures given in this manual may differ from those that actually appear on your screen.
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How to Use This Manual

Structure of the Manual

This user's manual consists of the following sections.

This manual does not cover error messages. See the *SR10000 User's Manual (IM04P03B01-01E)*.

Chapter 1 Overview of the Communication Functions
Gives an overview of the communication functions.

Chapter 2 Using the Ethernet Interface (/C7 Option)
Explains the specifications of the Ethernet interface and how to use the interface.

Chapter 3 Using the RS-422A/485 Communication Interface (/C3 Option)
Explains the specifications of the RS-422A/485 communication interface and how to use the interface.

Chapter 4 Commands
Explains each command that is available.

Chapter 5 Responses
Explains the responses that the recorder returns and the output format of the setup data and measured data.

Chapter 6 Status Information
Explains the registers that indicate the recorder statuses.

Appendix
Provides an ASCII character code table, flow charts for outputting data from the recorder, and login procedure. Describes the difference of communication commands between SR10000 and SR1000.

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Index of contents.

Conventions Used in This Manual

- **Unit**
  - k: Denotes 1000. Example: 5 kg, 100 kHz
  - K: Denotes 1024. Example: 640 KB

- **Note**

  The following markings are used in this manual.

  ⚠ *Improper handling or use can lead to injury to the user or damage to the instrument.* This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

  WARNING Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

  CAUTION Calls attentions to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

  Note Calls attention to information that is important for proper operation of the instrument.

- **Subheadings**

  On pages that describe the operating procedures in Chapter 2 and 3, the following symbols are used to distinguish the procedures from their explanations.

  Explanation This subsection describes the setup parameters and the limitations on the procedures.

  Procedure Follow the numbered steps. All procedures are written with inexperienced users in mind; depending on the operation, not all steps need to be taken.

Names of Parts and Basic Key Operations

Display and Keys

You use the panel keys and the display to configure the communication functions. For a description of other parts of the recorder, see section 3.1 in the *SR10000 User's Manual (IM04P03B01-01E)*.

Front

Rear panel

Optional terminal block

Display
Keys

Power switch

Indicator
Ethernet port

RS-422A/485 communication terminals
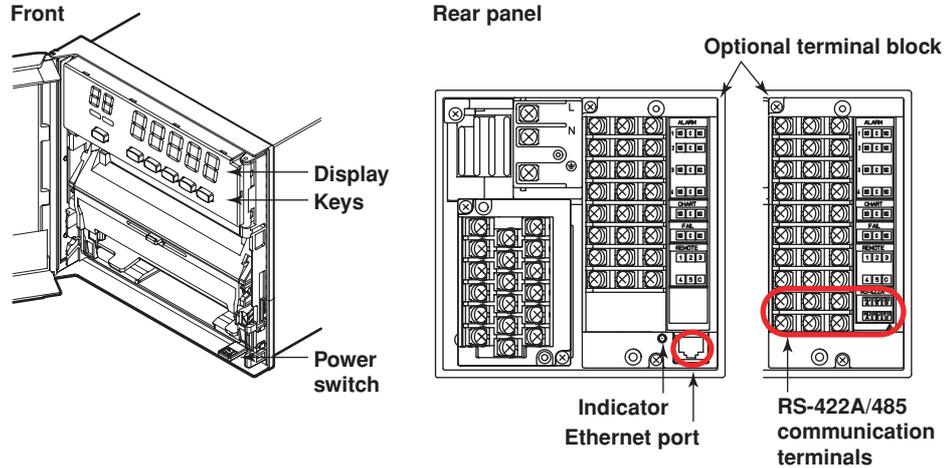
Keys

<When setting functions or when the FUNC key is pressed>

ESC key
Cancels the operation.

UP key
Switches the setup item or the value.

RIGHT key
Moves the cursor to the right when entering a value or character.

DOWN key
Switches the setup item or the value.

ENTER key
Confirms the setup item or value.

CH   DATA

RCD   ALM

ESC   △   ▷   ▽   ↵

RCD   MENU   DISP   FUNC   FEED   CH UP

<During normal operation>

CH UP key
Switches the displayed channel. (when manual switching is specified)

FEED key
Feeds the chart paper.

FUNC key
Executes manual printout, message printout, etc.

DISP key
Switches the display.

MENU key
Hold this key down for 3 seconds to enter Setting mode. Hold this key down for 3 seconds also to exit from Setting mode.

RCD key
Starts/stops recording.

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App

Index

1.1 Communication Functions Using the Ethernet Interface (/C7 Option)

The recorder can be equipped with an optional Ethernet interface. For details on how to use the Ethernet interface, see chapter 2.

Functional Construction

The following figure shows the relationship between the communication function of the recorder and the Ethernet interface. Perform communication according to the respective protocol.

> * Protocol *is a set of rules that two computers use to communicate via a communication line (or network).*

	Communication functions of the recorder		
Application	Setting/ Measurement Server	Maintenance/ Test Server	Instrument Information Server
	Login (user authentication/access privileges granting)		
Upper layer protocol	Dedicated protocol		
Lower layer protocol	TCP		UDP
	IP		
Interface	Ethernet (10BASE-T)		

Connect the recorder and the PC using an Ethernet cable.

PC
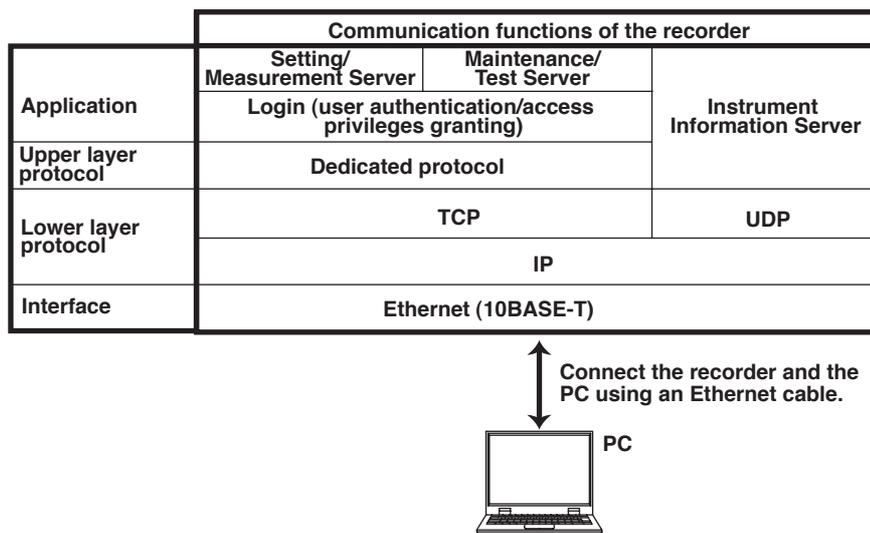
TCP (Transmission Control Protocol)
UDP (User Datagram Protocol)
IP (Internet Protocol)

Setting/Measurement Server

- You can specify settings that are approximately equivalent to those specified by front panel key operations. However, you cannot turn the power ON/OFF, set the user name and password for communications, or set the customize menu or the key lock.
- The data below can be output.

Data Type	Output Format
Measured data	BINARY/ASCII
Setup data	ASCII
Most recent data of the periodic printout	ASCII
Status information	ASCII
Information on connected users	ASCII

- The commands that can be used are Setting commands, Basic Setting commands, Control commands, and Output commands.

<Related Topics>
- Commands: Section 4.2
- Data output format: Chapter 5

Maintenance/Test Server

- Outputs Ethernet communication information such as connection information and network statistics from the recorder.
- The commands that can be used Maintenance/Test commands.

<Related Topics>
- Commands: Section 4.2

Instrument Information Server

- Outputs the serial number, model name, and other information about the recorder connected via the Ethernet network.
- The commands that can be used Instrument Information Output commands.

<Related Topics>
- Commands: Section 4.2

Other Functions

- **Login Function**
  Only users that are registered in advance can access the Setting/Measurement and Maintenance/Test servers.
  - Users are identified by their user name and password.
  - You can register one administrator and six users.
    Administrator privileges
    The administrator can use all the functions on the Setting/Measurement and Maintenance/Test servers
    User Privileges
    - Setting/Measurement server
      Users can output measured data, setup data, and the most recent data of the periodic printout. Users cannot control the recorder.
    - Maintenance/Test server
      Users cannot disconnect communications between the recorder and other PCs. All other operations are allowed.
  - There is a maximum number of simultaneous connections that can be established with the recorder.

<Related Topics>
- Login function settings: Section 2.6
- Maximum number of simultaneous connections: Section 2.1
- Commands available to the administrator and users: Section 4.2

- **Communication Timeout**
  This function drops the connection with the PC if there is no data transmission for a given time at the application level (see "Functional Construction"). For example, this function prevents a PC from being connected to the recorder indefinitely which would prohibit other users from making new connections for data transfer.

<Related Topics>
- Communication timeout setting using communication comands: Section 4.2

- **Keepalive**
  This function drops the connection if there is no response to the inspection packet that is periodically transmitted at the TCP level.

<Related Topics>
- Keepalive setting using communication comands: Section 4.2

1.2 Communication Functions Using the RS-422A/485 Communication Interface (/C3 Option)

The recorder can be equipped with an optional RS-422A/485 communication interface. For details on how to use the RS-422A/485 communication interface, see chapter 3.

Functional Construction

The following figure shows the relationship between the communication function of the recorder and the RS-422A/485 communication interface. Perform communication according to the respective protocol.

> * Protocol *is a set of rules that two computers use to communicate via a communication line (or network).*

	Communication functions of the recorder	
Application	Setting/Measurement Server	Modbus Slave
Protocol	Dedicated protocol	Modbus protocol
Interface	RS-422A/485	

Connect the recorder and the PC using a serial cable.

PC
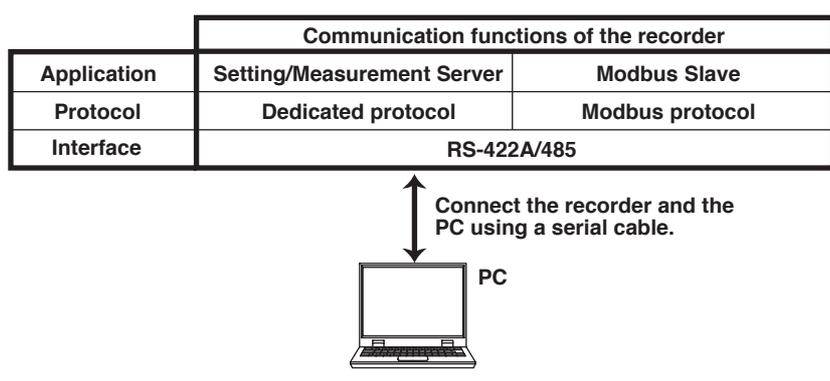
Setting/Measurement Server

The functions are the same as those of the Setting/Measurement server of the Ethernet interface. See page 1-1.

<Related Topics>
- Commands: Section 4.2
- RS-422A/485 dedicated commands: Section 4.8
- Data output format: Chapter 5

Modbus Slave

- The Modbus protocol can be used to read the measured data on your PC by reading the input registers of the recorder. The communication input data can be written or read by writing/reading the hold register of the recorder.
- For details on the Modbus function codes that the recorder supports, see section 3.4.
- This function can be used only when communicating via the serial interface (option).

Modbus master device

Data from slave device

Serial communication

Data to slave device

Recorder Modbus slave device
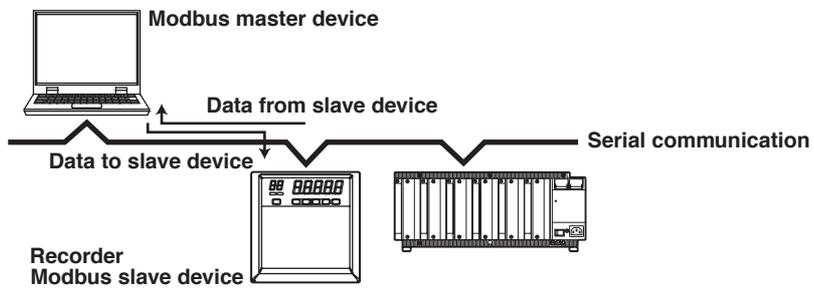
<Related Topics>
- Settings for using the Modbus: Section 3.5

2.1   Ethernet Interface Specifications

Basic Specifications

Item	Specifications
Electrical and mechanical specifications	Conforms to IEEE 802.3 (Ethernet frames are of DIX specification)
Transmission medium type	10BASE-T
Protocol	TCP, IP, UDP, ICMP, and ARP

The Maximum Number of Simultaneous Connections and the Number of Simultaneous Use

The following table shows the maximum number of simultaneous connections, the number of simultaneous users, and the port numbers of the recorder.

Function	Maximum Number of Connections	Number of Simultaneous Users <Administrators>	<Users>	Port Number[†]
Setting/Measurement server	3	1	2[††]	34260/tcp
Maintenance/Test server	1	1	1[††]	34261/tcp
Instrument Information server	-	-	-	34264/udp

[†]   The port numbers are fixed.

[††] For details on administrator and user privileges, see "Login Function" in section 1.1.

2.2 Connecting the Ethernet Interface

When Connecting Only the Recorder and a PC

Connect the recorder and the PC via a HUB as in the following figure.

Recorder

10BASE-T straight cable

Recorder

Hub

PC

10BASE-T straight cable
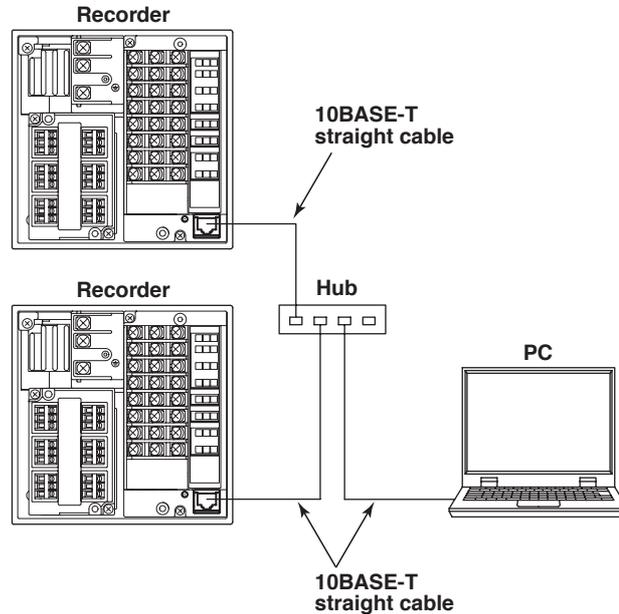
When Connecting to a Preexisting Network

The following figure illustrates an example in which a recorder and a PC are connected to the network. When connecting the recorder or the PC to a preexisting network, the transfer rate, connector type, etc. must be matched. For details, consult your system or network administrator.

Network

Hub, router, etc.

Recorder

PC

10BASE-T straight cable
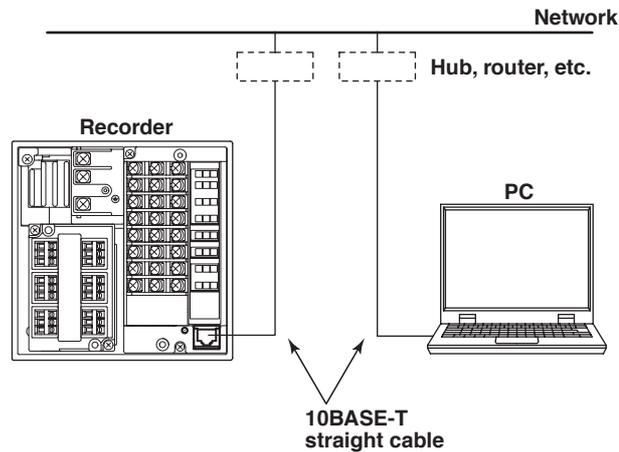
Note

- Depending on the reliability of the network or the volume of network traffic, all the transferred data may not be retrieved by the PC.
- Communication performance deteriorates if multiple PCs access the recorder simultaneously.

2.3   Configuring the Ethernet Interface

Setup Items and Setup Procedure

Some setup items of the Ethernet interface can be configured using keys, while others cannot. The items that are listed as Yes can be configured using keys.

Setup Items	Setup Procedure	
	Keys (reference section)	Communication commands (section 4.2)
Host name and domain name	–	Yes
IP address	Yes (section 2.4)	Yes
DNS	–	Yes
Login function enable/disable	Yes (section 2.5)	Yes
User registration	Yes (section 2.5)	–
Communication timeout	–	Yes
Keepalive	–	Yes

For items that can only be set using communication commands, assign an IP address to the recorder, connect to the PC, and then set the items.

Connection Example with a PC

Below is a setup example in which the PC and the recorder are connected in a one-to-one relationship via a hub.

Recorder

PC

HUB

Ethernet
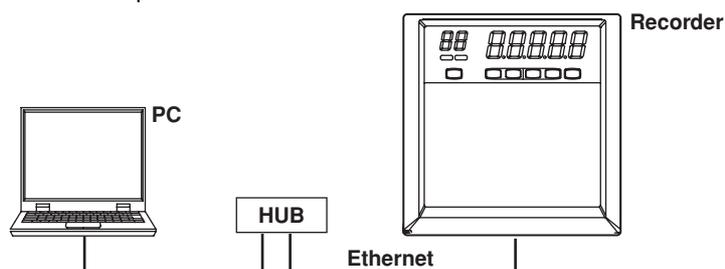
Setting Example

Setup Item	Recorder	PC
IP address	192.168.1.101	192.168.1.100
Subnet mask	255.255.255.0	255.255.255.0

PC
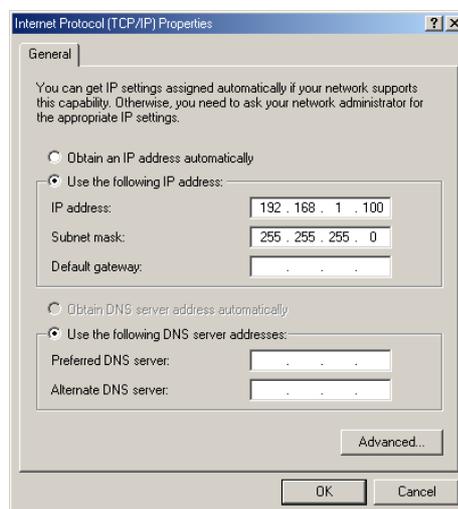
2.4 Setting the IP Address

The IP address must be assigned to the recorder.

Setup Items

BS	COMM		IP	A1	255	A2	255	A3	255	A4	255

IP address   **IP address**

END

M1	255	M2	255	M3	255	M4	255

Subnet mask

G1	255	G2	255	G3	255	G4	255

Default gateway

Procedure

1. Hold down the [MENU] key for 3 seconds to display the Setting mode screen.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Use the △, ▽, or ▷ key to select values.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.

(COMM)

(IP address)   Select IP.

A1   255
IP address

A2   255

A3   255   Set the IP address.

A4   255

M1   255
Subnet mask

M2   255

M3   255   Sets the subnet mask.

M4   255

(To the next page)

(From the previous page)

| G1 | | | 2 | 5 | 5 |

↑ Default gateway

| G2 | | | 2 | 5 | 5 |

Set the default gateway.

| G3 | | | 2 | 5 | 5 |

| G4 | | | 2 | 5 | 5 |

ESC

| | | o | k | | |

(OK)

The settings are activated.
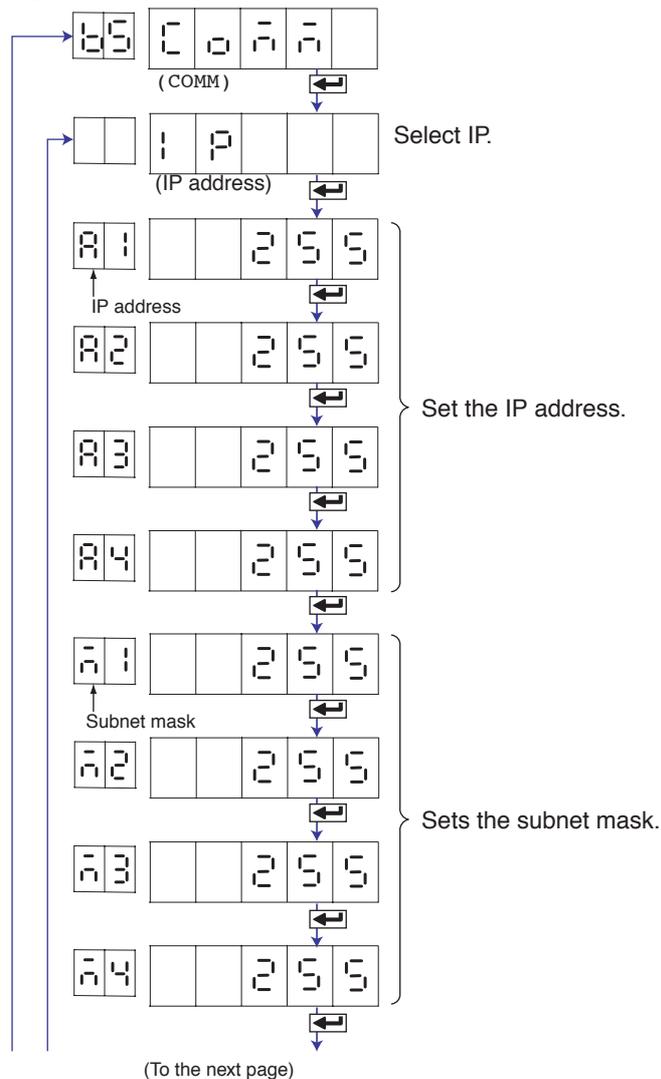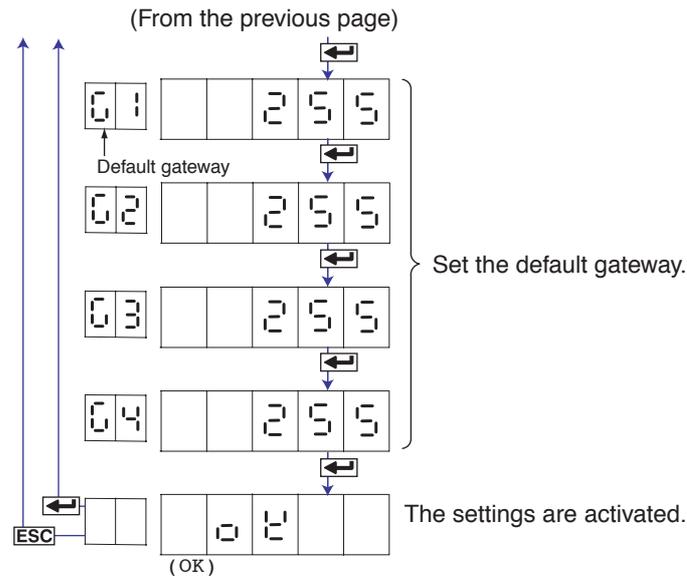
4.   If you are done, press the **ESC** key.

5.   To return to the Operation mode,

    1. Press the **ESC** key, use the △ or ▽ key to select E n d, and press the ↵ key.

    2. Press the △ or ▽ key to select S t o r E or A b o r t, and press the ↵ key.

Explanation

For details on the settings, consult your system or network administrator.

- **IP address (A 1 to A 4)**
  - Set the IP address to assign to the recorder. The default value is 0.0.0.0.
  - The IP address is used to distinguish between the various devices connected to the Internet when communicating using the TCP/IP protocol. The address is a 32-bit value expressed using four octets (each 0 to 255), each separated by a period as in [192.168.111.24].

- **Subnet mask (n 1 to n 4)**
  - Specify the mask that is used to determine the network address of the subnet from the IP address. The default value is 0.0.0.0.
  - Set this value according to the system or the network to which the recorder belongs. In some cases, this setting may not be necessary.

- **Default Gateway (G 1 to G 4)**
  - Set the IP address of the gateway (router, etc.) used to communicate with other networks. The default value is 0.0.0.0.
  - Set this value according to the system or the network to which the recorder belongs. In some cases, this setting may not be necessary.

- **Saving the Settings**
  To activate the settings made in the Basic Setting mode, the settings must be saved.

2.5 Checking the Connection Status

The connection status of the Ethernet interface can be confirmed with the indicator that is located to the left of the Ethernet port on the recorder.

Indicator	Connection Status of the Ethernet Interface
ON (Green)	The Ethernet interface is electrically connected.
Blinking (Green)	Transmitting data.
OFF	The Ethernet interface is not electrically connected.

Optional terminal block

Indicator

Ethernet port
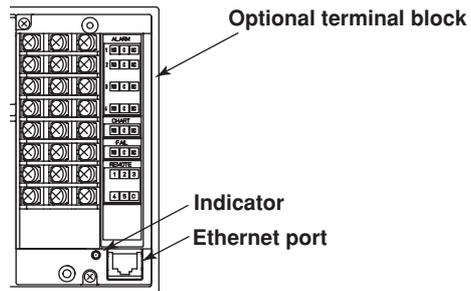
2.6   Registering Users

Users that are allowed to access the recorder via the Ethernet network must be registered. This function is called login function.

Setup Items
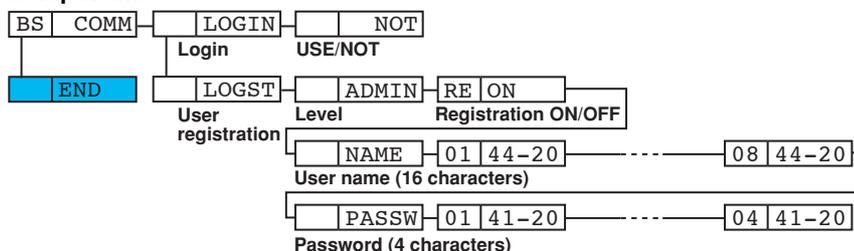
BS	COMM		LOGIN		NOT

Login   **USE/NOT**

END		LOGST		ADMIN	RE	ON

User **Level**   **Registration ON/OFF**
registration

| | | NAME | 01 | 44-20 | - - - - | 08 | 44-20 |

User name (16 characters)

| | | PASSW | 01 | 41-20 | - - - - | 04 | 41-20 |

Password (4 characters)

Procedure

1.   Hold down the [MENU] key for 3 seconds to display the Setting mode screen.
2.   Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.

Enabling/Disabling the Login Function

3.   Carry out the procedure shown in the figure below.
     Use the △, ▽, or ▷ key to select values.
     If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

(COMM)

(LOGIN)   Select LOGIN.

(USE/NOT)   Select USE or NOT.

(OK)   The settings are activated.

ESC
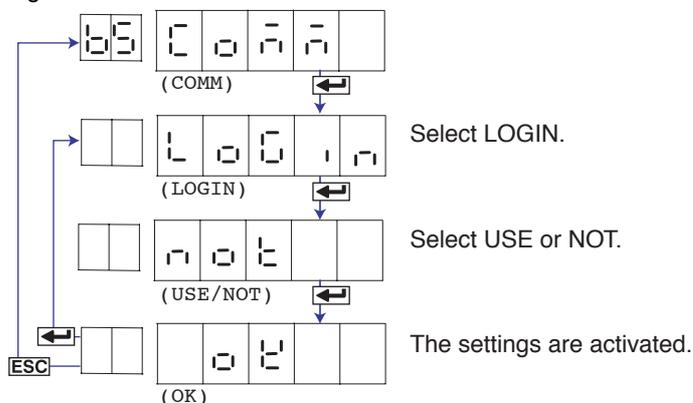
If you selected NOT, you are done with the settings. Proceed to step 6.
If you select USE, proceed to "Registering Users" below.

Registering Users

4.   Carry out the procedure shown in the figure on the next page.
     Use the △, ▽, or ▷ key to select values.
     If you press the **ESC** key, the operation is cancelled, and the display returns to a higher level menu.

bS | Co nn
(COMM)

LoGSt — Select LOGST.

Ad nin
(ADMIN) — Select the user level.

rE on
(ON/OFF) — Select ON to register.

n A n E
(NAME) — User name.

01 | 44 - 20
1st char | 1st character code

02 | 40 - 41
2nd char | 2nd character code
⋮

16 | 44 - 45
16th character code

Set the user name (up to 16 characters). For the characters that can be used, see appendix 1.

PASSY
(PASSW) — Password.

01 | 44 - 20
1st char | 1st character code

02 | 44 - 20
2nd char | 2nd character code
⋮

04 | 44 - 45
4th character code

Set the password (up to 4 characters). For the characters that can be used, see appendix 1.

ESC

o U
(OK) — The settings are activated.

5   Press the ← key to register other users.
    If you are done, press the **ESC** key.
6. To return to the Operation mode,
    1. Press the **ESC** key, use the △ or ▽ key to select End, and press the ← key.
    2. Press the △ or ▽ key to select StorE or Abort, and press the ← key.

Explanation

You can limit the users that can access the Setting/Measurement and Maintenance/Test servers on the recorder via the Ethernet interface.

· **Enabling/Disabling the Login Function**
Enable ($U5E$)
Disable (not)

· **Registering Users**
  · **User Level**
  Select administrator ($Admin$) or user ($USEr\ 1$ to $USEr\ 6$).
  · **Administrator**
  One administrator can be registered. An administrator has the authority to use all Setting/Measurement server and Maintenance/Test server commands of the recorder.
  · **User**
  Six users can be registered. A user has limited authority to use the commands. See section 4.2.
  · **Selecting Whether to Register (on/oFF) the User**
  When registering a user, set the user name and password.
  · **User name ($nAmE$)**
    · Set the user name using up to 16 alphanumeric characters. Use ASCII character codes for the characters. For the characters that can be used, see appendix 1.
    · The same user name cannot be registered.
    · Since the word "quit" is reserved as a command on the recorder, the user name "quit" is not allowed.
  · **Password ($PA55Y$)**
  Enter the password using up to 4 characters. Alphanumeric characters and space can be used. Specify using ASCII character codes..

Note _____

· The relationship between the login function and the user name that is used when accessing the recorder is as follows:
  · When the login function is set to "USE"
    · The registered user name and password can be used to login to the recorder.
    · The user level is the level that was specified when the user name was registered.
  · When the login function is set to "NOT"
    · The user name "admin" can be used to login to the recorder as an administrator. Password is not necessary.
    · The user name "user" can be used to access the recorder as a user. Password is not necessary.
· There are limitations on the number of simultaneous connections or simultaneous uses of the recorder from the PC (see section 2.1).
· For a description of the login process of the Setting/Measurement server and Maintenance/Test server, see appendix 3.

· **Saving the Settings**
To activate the settings made in the Basic Setting mode, the settings must be saved.

3.1　RS-422A/485 Communication Interface Specifications

This section describes the RS-422A/485 communication interface specifications.

Item	Specifications
Terminal block type	Number of terminals: 6, terminal attachment screws: ISO M4/nominal length of 6 mm
Electrical and mechanical specifications	Complies with the EIA-422A(RS-422A) and EIA-485(RS-485) standards
Connection	Multidrop Four-wire system　　1:32 　　　　　　Two-wire system　　1:31 (Modbus slave protocol)
Transmission mode	Half-duplex
Synchronization	Start-stop synchronization
Baud rate	Select from 1200, 2400, 4800, 9600, 19200, and 38400 [bps].
Start bit	Fixed to 1 bit
Data length	Select 7 or 8 bits
Parity	Select Odd, Even, or None (no parity).
Stop bit	Fixed to 1 bit
Received buffer length	2047 bytes
Escape sequence	Open and close
Electrical characteristics	6 points consisting of FG, SG, SDB, SDA, RDB, and RDA The SG, SDB, SDA, RDB, and RDA terminals and the internal circuitry of the recorder are functionally isolated. The FG terminal is the frame ground.
Communication distance	Up to 1.2 km
Terminal resistance	120 Ω, 1/2 W

3.2 Terminal Arrangement and Signal Names and the Connection Procedure of the RS-422A/485 Communication Interface

Terminal Arrangement and Signal Names

Rear panel
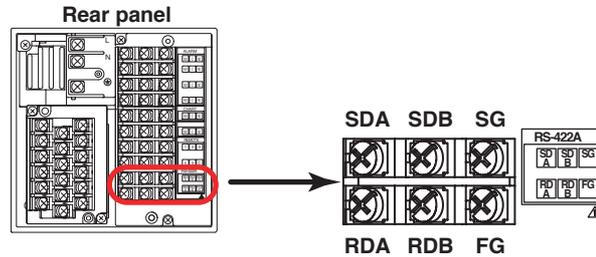
Terminal Name	Description
FG (Frame Ground)	Case ground of the recorder.
SG (Signal Ground)	Signal ground.
SDB (Send Data B)	Send data B (+).
SDA (Send Data A)	Send data A (–).
RDB (Received Data B)	Receive data B (+).
RDA (Received Data A)	Receive data A (–).

Connection Procedure

- **Cable**

  Use the cable that meets the conditions below.

Item	Conditions
Cable	Shielded twisted pair cable 3 pairs AWG24-14 (Four-wire system), 2 pairs 24 AWG or more (Two-wire system)
Characteristic impedance	100 Ω
Capacitance	50 pF/m
Cable length	Up to 1.2 km*

* The transmission distance of the RS-422A/485 interface is not the straight-line distance, but rather the total length of the (shielded twisted-pair) cable.

- **Connecting the Cable**

  As shown in the following figure, attach a crimp-on lug with isolation sleeves for 4 mm screws to the end of the cable. Keep the exposed section from the end of the shield within 5 cm.

Four-wire system
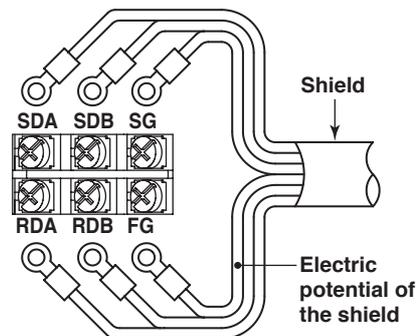
Two-wire system

⚠
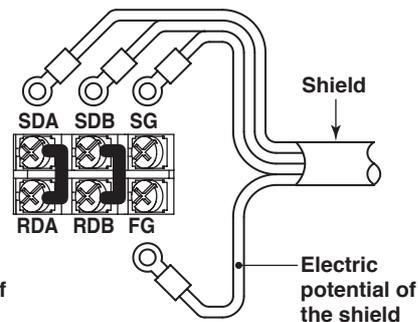
WARNING

To prevent the possibility of electric shock, connect the cables with the power turned OFF.

Note

- Connect the RD pin to the SD (TD) pin on the PC (converter) end and the SD pin to the RD pin on the PC end.
- The two-wire system can be used only when using the Modbus protocol.

Connection Example with a Host Computer

A connection can be made with a host computer having a RS-232, RS-422A, or RS-485 port.

- In the case of RS-232, a converter is used.
- For recommended converters, see "Serial Interface Converter" on the next page.
- The two-wire system can be used only when using the Modbus protocol. For the configuration procedure, see section 3.5

- **Four-Wire System**
  Generally, a four-wire system is used to connect to a host computer. In the case of a four-wire system, the transmission and reception lines need to be crossed over.
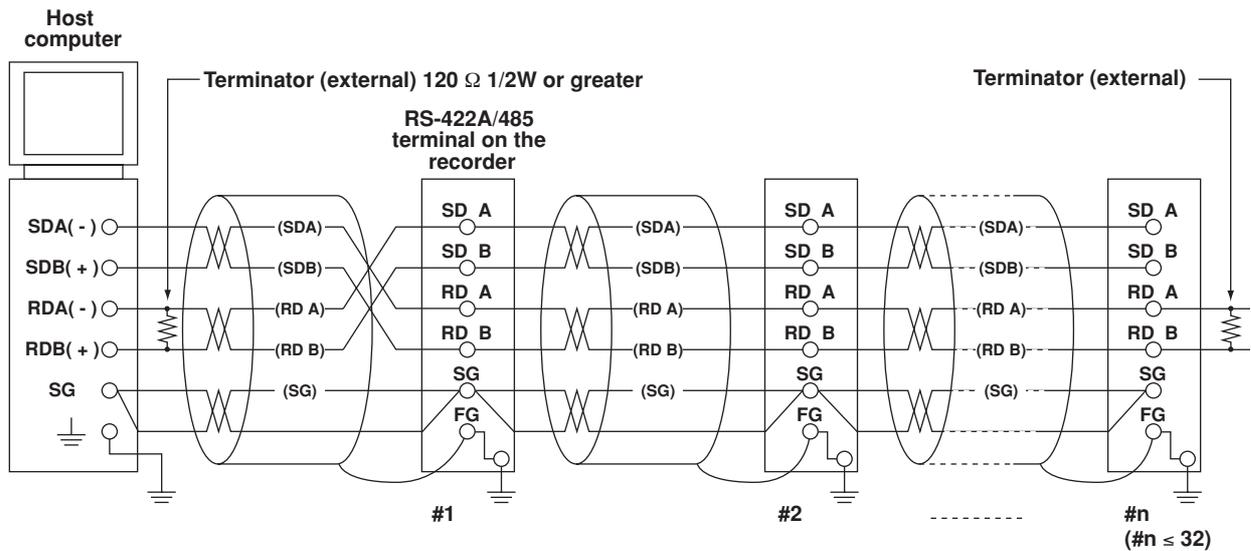
Host computer

Terminator (external) 120 Ω 1/2W or greater

RS-422A/485 terminal on the recorder

Terminator (external)

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

#1   #2   #n (#n ≤ 32)

Do not connect terminators to #1 through #n-1.

3

Using the RS-422A/485 Communication Interface (/C3 Option)

(The following figure illustrates the case when the host computer's interface is RS-232.)
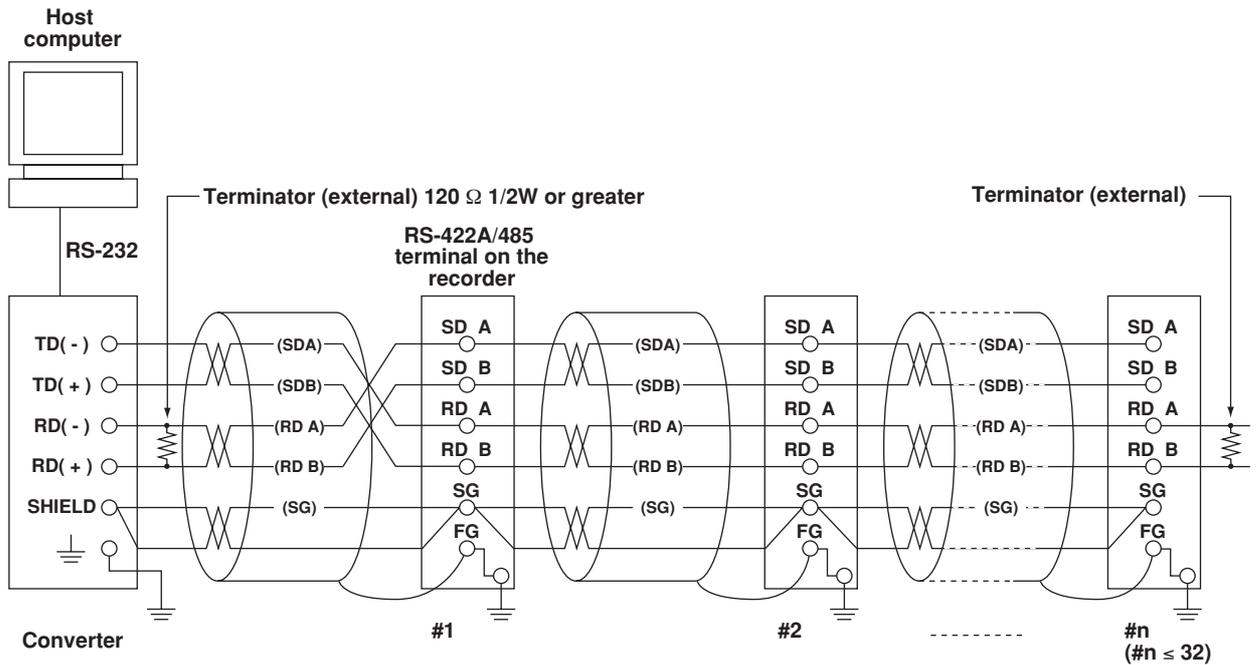
Do not connect terminators to #1 through #n-1.

- **Two-Wire System**

  Connect the transmission and reception signals with the same polarity on the RS-422A/485 terminal block. The two-wire system can be used only when using the Modbus protocol.
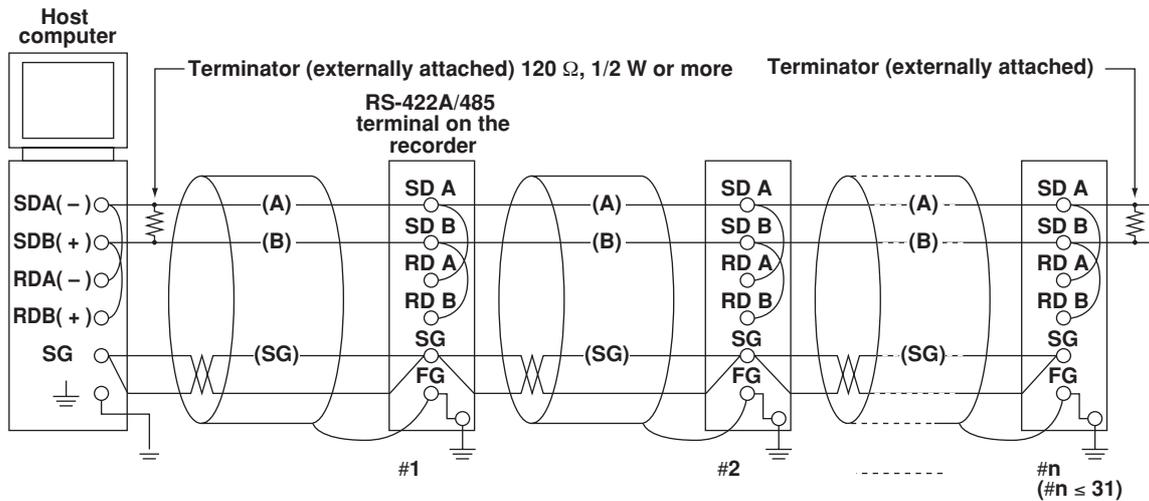
Do not connect terminator to #1 to #n–1

(The following figure illustrates the case when the host computer's interface is RS-232.)

Do not connect terminator to #1 to #n–1
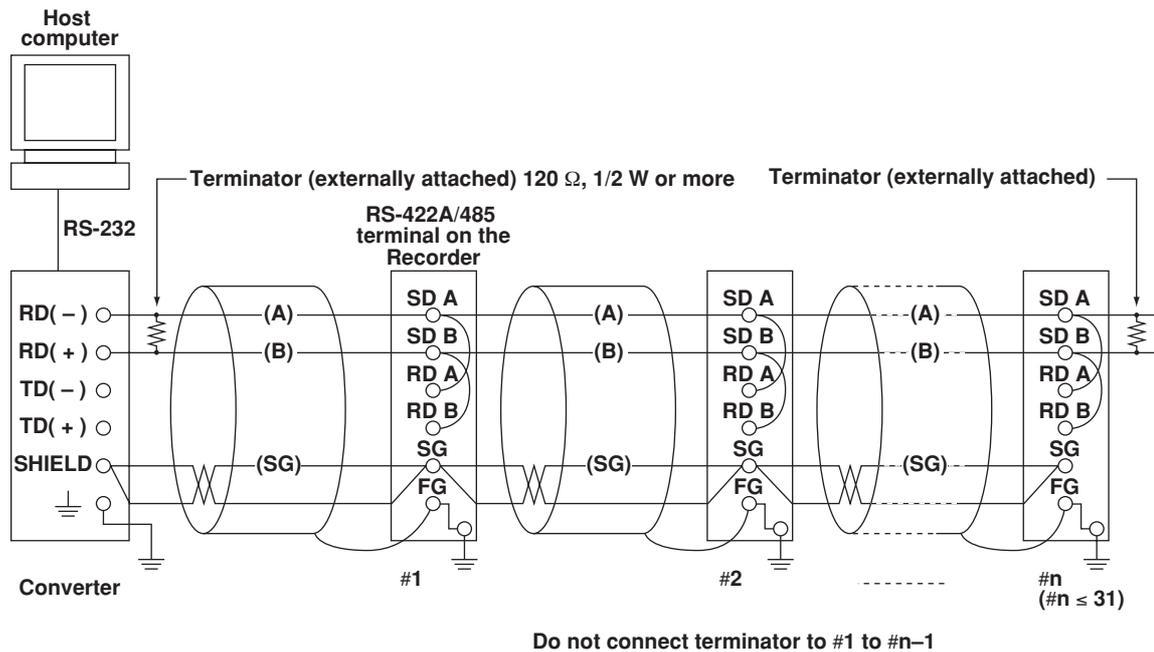
Note

- The method used to eliminate noise varies depending on the situation. In the connection example, the shield of the cable is connected only to the recorder's ground (one-sided grounding). This is effective when there is a difference in the electric potential between the computer's ground and the recorder's ground. This may be the case for long distance communications. If there is no difference in the electric potential between the computer's ground and the recorder's ground, the method of connecting the shield also to the computer's ground may be effective (two-sided grounding). In addition, in some cases, using two-sided grounding with a capacitor connected in series on one side is effective. Consider these possibilities to eliminate noise.
- When using the two-wire type interface (Modbus protocol), the 485 driver must be set to high impedance within 3.5 characters after the last data byte is sent by the host computer.

- **Serial Interface Converter**
  Recommended converter
  MODEL RC-57 by RA SYSTEMS CORP.

⚠ CAUTION

Some converters not recommended by Yokogawa have FG and SG pins that are not isolated. In this case, do not connect anything to the converter's FG and SG pins (unlike the figure on the previous page). Especially in the case of long distance communications, the potential difference that appears may damage the recorder or cause communication errors. For converters that do not have the SG pin, they can be used without using the signal ground. For details, see the manual that came with the converter.

On some non-recommended converters, the signal polarity may be reversed (A/B or +/- indication). In this case, reverse the connection.

For a two-wire system, the host computer must control the transmission driver of the converter in order to prevent collisions of transmit and received data. When using the recommended converter, the driver is controlled using the RS (RTS) signal on the RS-232.

•   **When Instruments That Support Only the RS-422A Interface Exist in the System**
When using the four-wire system, up to 32 recorders can be connected to a single host computer. However, this may not be true if instruments that support only the RS-422A interface exist in the system.

When the instrument that support only the RS-422A interface exist in the system
The maximum number of connection is 16. Some of YOKOGAWA's conventional recorder only support the RS-422A driver. In this case, only up to 16 units can be connected.

Note

In the RS-422A standard, 10 is the maximum number of connections that are allowed on one port (for a four-wire system).

•   **Terminator**
When using a multidrop connection (including a point-to-point connection), connect a terminator only to the recorder on the end of the chain. In addition, turn the terminator on the host computer ON (see the computer's manual). If a converter is being used, turn ON its terminator. The terminator must be attached externally to the recommended converters.

3.3 The Bit Structure of One Character and the Operation of the Receive Buffer

The Bit Structure of One Character

The serial interface on the recorder communicates using start-stop synchronization. In start-stop synchronization, a start bit is added every time a character is transmitted. The start bit is followed by the data bits, parity bit, and stop bit. (See the figure below.)
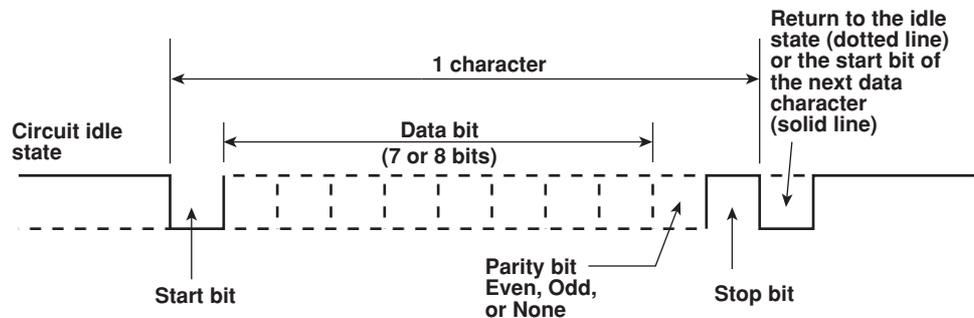
Receive Buffer and Received Data

The data received from the PC is first placed in the receive buffer of the recorder. When the received buffer becomes full, all of the data that overflow are discarded.

3.4 Modbus Slave Protocol Specifications

The Modbus slave protocol specifications of the recorder are as follows:

Item	Specifications
Transmission medium	RS-422A/485
Flow control	None only
Baud rate	Select from 1200, 2400, 4800, 9600, 19200, or 38400 [bps]
Start bit	Fixed to 1 bit
Stop bit	Fixed to 1 bit
Parity check	Select odd, even, or none (no parity).
Transmission mode	RTU (Remote Terminal Unit) mode only • Data length: 8 bits • Data interval: 24 bits or less* • Error detection: Uses CRC-16 * Determines message termination with a time interval to 3.5 characters or more.
Maximum number of connected units	Four-wire system: 32 slave devices Two-wire system: 31 slave devices

The function codes of the Modbus slave protocol that the recorder supports are shown below. The recorder does not support broadcast commands.

Function Code	Specifications	Operation
4	Read the input register (3xxxx).	The master device loads the measured, alarm, and time data of the recordr.
8	Loopback test	The master device performs a loopback test of the recorder. The recorder only supports message return (test code 0x00*)

* Hexadecimal "00"

Registers

The registers for using the Modbus slave protocol are listed below.

The register data does not contain unit and decimal point position information. Set them on the Modbus master. Binary values are stored to the register in order from the highest byte.

Input register	Data
30001	Measured data of CH01
:	:
30006	Measured data of CH06

- The data is a 16-bit signed integer. The value is the same as the measured data in binary output format (see page 5-13).
- The decimal point and unit information varies depending on the range setting of each channel.
- Valid channels vary depending on the device. An error response (code 2) occurs when an invalid channel is read.

Input register	Data
31001	Alarm status of the measured data of CH01
:	:
31006	Alarm status of the measured data of CH06

- The data is a 16-bit signed integer. The value is the same as the alarm status in binary output format (see page 5-12). The data is entered in the "A2A1A4A3" order in the register.
- Valid channels vary depending on the device. An error response (code 2) occurs when an invalid channel is read.

Input register	Data
36001	List of alarms of the measured data of CH01 to CH04
36002	List of alarms of the measured data of CH05 to CH08

Example of Register 36001

The bit is set to 1 when an alarm occurs.

Input register	Data
36003 to 36020	Always 0
39001	Year (4 digits)
39002	Month
39003	Day
39004	Hour
39005	Minute
39006	Second
39007	Millisecond
39008	Summer/Winter time

Modbus Error Response

The recorder returns the following error codes to the master device. For the error messages related to communications that the recorder displays, see appendix 4.

Code	Meaning	Cause
1	Bad function code	Unsupported function request.
2	Bad register number	Attempted to read/write to a register that has no corresponding channel.
3	Bad number of registers	The specified number of registers is less than or equal to 0 or greater than or equal to 126 (when reading)/124 (when writing).

However, no response is returned for the following cases.
- CRC error
- Errors other than those in the table above.

3.5   Setting the Serial Interface

The serial interface must be configured.

Setup Items
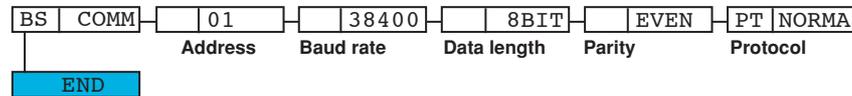
BS	COMM	01	38400	8BIT	EVEN	PT NORMA
		Address	Baud rate	Data length	Parity	Protocol

END

Procedure

1. Hold down the [MENU] key for 3 seconds to display the Setting mode screen.
2. Hold down the △ and ▷ keys simultaneously for 3 seconds to display the Basic Setting mode screen.
3. Carry out the procedure shown in the figure below.
   Use the △, ▽, or ▷ key to select values.
   If you press the ESC key, the operation is cancelled, and the display returns to a higher level menu.
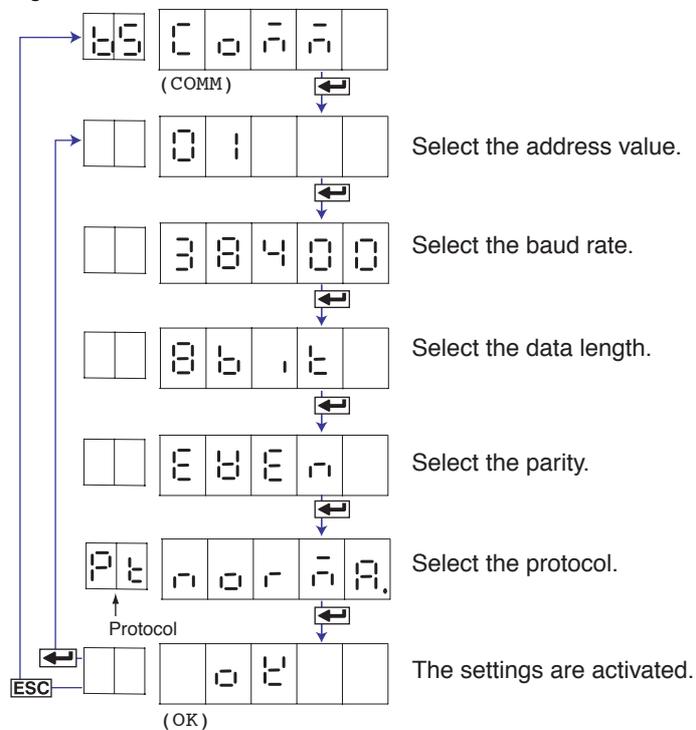
4. If you are done, press the ESC key.
5. To return to the Operation mode,
   1. Press the ESC key, use the △ or ▽ key to select E n d, and press the ⏎ key.
   2. Press the △ or ▽ key to select St o r E or Ab o r t, and press the ⏎ key.

Explanation

- **Address**
  Select the address from the following range.
  01 to 32

- **Baud rate**
  Select the baud rate from the following:
  1200, 2400, 4800, 9600, 19200, or 38400

- **Data length**
  Select the data length from below. To output data in BINARY format, be sure to set the data length to 8 bits.
  7 or 8

- **Parity (Parity check method)**
  Select the parity check from the following:
  Odd (odd), Even (EuEn), or None (nonE)

- **Protocol**
  Select the protocol when using the Modbus slave protocol.
  NORMAL (norñA): Standard protocol
  MODBUS (ñ_bUS): Modbus slave protocol

- **Saving the Settings**
  To activate the settings made in the Basic Setting mode, the settings must be saved.

4.1   Command Syntax

The syntax of the setting/basic setting/output commands (see sections 4.4 to 4.7) of the instrument is given below. ASCII codes (see appendix 1) are used for the character codes.
For the Maintenance/Test command syntax, see section 4.9.
For the Instrument Information server command syntax, see section 4.10.

Command example

```
SR 02,SKIP;SR 03,VOLT,2V,−1500,1800
```

──────── **Parameter** (`02 SKIP·····1800`)
──────── **Delimiter** (`,`)
──────── **Command name** (`SR`)
──────── **Sub delimiter** (`;`)
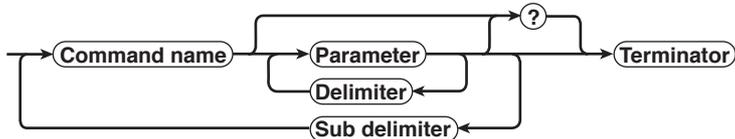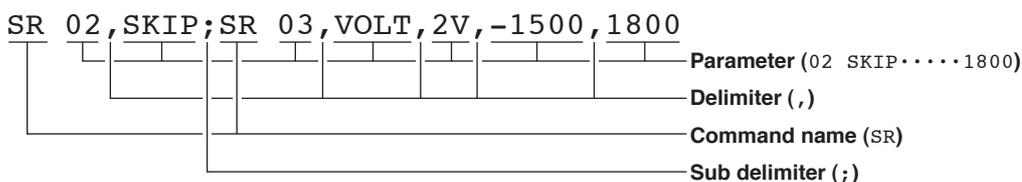
- **Command Name**
  Defined using two alphabet characters.

- **Parameter**
  - Command parameters.
  - Set using alphabet characters or numerical values.
  - Parameters are separated by delimiters (commas).
  - When the parameter is a numerical value, the valid range varies depending on the command.
  - Spaces before and after of the parameter are ignored (except for parameters that are specified using an ASCII character string (unit, tag, and message string), when spaces are valid.)
  - You can omit the parameters that do not need to be changed from their current settings. However, delimiters cannot be omitted.
        Example   `SR 01,,2V<terminator>`
  If multiple parameters are omitted and delimiters occur at the end of the command, those delimiters can be omitted.
        Example   `SR 01,VOLT,,,<terminator> → SR 01,VOLT<terminator>`
  - The number of digits of the parameters below is fixed. If the number of digits is not correct when entering the command, a syntax error results.
    - Date   `YY/MM/DD` (8 characters)
              `YY`: Year (Enter the lower two digits of the year.)
              `MM`: Month
              `DD`: Day
    - Time   `HH:MM:SS` (8 characters)
              `HH`: Hour
              `MM`: Minute
              `SS`: Second
    - Channel number: 2 characters (Example: 01)
    - Relay number: 3 characters (Example: I01)

- **Query**
  - A question mark is used to specify a query.
  - By placing a query after a command or parameter, the setting information of the corresponding command can be queried. Some commands cannot execute queries. For the query syntax of each command, see sections 4.4 to 4.7.

    Example 1   `SR[ p1]?`   `SR?` or `SR p1?` can be executed.

    Example 2   `SA[ p1[,p2]]?`   `SA?`, `SA p1?`, or `SA p1,p2?` can be executed.

- **Delimiter**
  - A comma is used as a delimiter.
  - Parameters are separated by delimiters.

- **Sub Delimiter**
  - A semicolon is used as a sub delimiter.
  - By separating each command with a sub delimiter, up to 10 commands can be specified one after another. However, the following commands and queries cannot be specified one after another. Use them independently.
    - Output commands other than `BO`, `CS`, and `IF` commands.
    - `YE` command
    - Queries
  - * If there are consecutive sub delimiters, they are considered to be single. In addition, sub delimiters at the front and at the end are ignored.

    Example   `;SR01,VOLT;;;SR02,VOLT;<terminator>` is taken to be
    `SR01,VOLT;SR02,VOLT<terminator>`.

- **Terminator (Terminating Character)**

  Use either of the following two characters for the terminator.
  - CR + LF (`0DH 0AH` in ASCII code.)
  - LF (`0AH` in ASCII code.)

Note

- The total data length from the first character to the terminator must be less than 2047 bytes. In addition, the character string length of 1 command must be less than 512 bytes.
- Commands are not case sensitive (with the exception of user-specified character strings).
- All the commands that are listed using sub delimiters are executed even if one of the commands is erroneous.
- Spaces that are inserted before and after a parameter are ignored. However, if spaces are inserted before a command, after a sub delimiter, or after a query, an error occurs.

Response

The recorder returns a response (affirmative/negative response) to a command that is separated by a single terminator.* The controller should follow the one command to one response format. When the command-response rule is not followed, the operation is not guaranteed.

For the response syntax, see section 5.1.

    * The exceptions are the RS-422A/485 dedicated commands (see section 4.8).

Note

When using the RS-422A/485 interface, allow at least 1 ms before sending the next command after receiving a response. Otherwise, the command may not be processed correctly.

4.2 A List of Commands

Execution Modes and User Levels

Execution Modes

The recorder has two execution modes. Each command is specified to be used in a particular execution mode. If you attempt to execute a command in a mode that is different from the specification, a syntax error occurs. Use the DS command to switch to the appropriate mode, and then execute the command. Query commands can be executed in either mode.

- Basic Setting mode
  Measurement is stopped and settings are changed in this mode.
- Run mode
  Run mode collectively refers to Operation mode and Setting mode of the recorder.

User Levels

The administrator and user specifications in the table indicate the user level that is specified using the login function for Ethernet communications. For details, see section 1.1.

Setting Commands

Name	Function	Execution Mode	Administrator	User	Page
SR	Sets the input range.	Run mode	Yes	No	4-10
VB	Sets the bias.	Run mode	Yes	No	4-11
VL	Sets the calibration correction (/CC1 option).	Run mode	Yes	No	4-11
SA	Sets the alarm.	Run mode	Yes	No	4-11
SN	Sets the unit.	Run mode	Yes	No	4-12
SC	Sets the chart speed.	Run mode	Yes	No	4-12
SD	Sets the date and time.	Run mode	Yes	No	4-12
VT	Sets the dot printing interval (dot model).	Run mode	Yes	No	4-12
SZ	Sets zone recording.	Run mode	Yes	No	4-12
SP	Sets the partial expanded recording.	Run mode	Yes	No	4-13
VR	Turns ON/OFF the recording on each channel.	Run mode	Yes	No	4-13
ST	Sets the tag.	Run mode	Yes	No	4-13
SG	Sets the message.	Run mode	Yes	No	4-13
SE	Sets the secondary chart speed (used by the remote control function (/R1 option)).	Run mode	Yes	No	4-13
SV	Sets the moving average (dot model).	Run mode	Yes	No	4-13
SF	Sets the input filter (pen model).	Run mode	Yes	No	4-13
TD	Sets the DST.	Run mode	Yes	No	4-14
FR	Sets the acquiring interval to the FIFO buffer.	Run mode	Yes	No	4-14

Yes: Command usable
No: Command not usable

Basic Setting Commands

Note

- In order to activate the settings that are changed using the basic setting commands, the settings must be saved using the YE or XE command.
- The settings that are returned in response to a query in the basic setting mode will contain the new settings even if they are not saved.
- When the settings are saved with the XE command, communication is not dropped. The settings that are changed using the YS/YB/YA/YN/YD/YQ/YK command are activated after power-cycling the recorder.
- When the YE command is executed, communication is dropped. The response to the YE command is not returned.

Name	Function	Execution Mode	Administrator	User	Page
XA	Sets alarm related settings.	Basic Setting mode	Yes	No	4-14
XI	Sets the A/D integral time.	Basic Setting mode	Yes	No	4-14
XB	Sets the burnout detection.	Basic Setting mode	Yes	No	4-14
XJ	Sets the RJC.	Basic Setting mode	Yes	No	4-15
UC	Changes the dot color (dot model).	Basic Setting mode	Yes	No	4-15
UO	Sets the pen offset compensation (pen model).	Basic Setting mode	Yes	No	4-15
UP	Sets the items to be printed.	Basic Setting mode	Yes	No	4-15
UR	Sets the periodic printout interval.	Basic Setting mode	Yes	No	4-15
UI	Sets whether to use moving average (dot model).	Basic Setting mode	Yes	No	4-16
UJ	Sets whether to use the input filter (pen model).	Basic Setting mode	Yes	No	4-16
UK	Sets whether to use of partial expanded recording.	Basic Setting mode	Yes	No	4-16
UL	Selects the printout font.	Basic Setting mode	Yes	No	4-16
XN	Selects the date format.	Basic Setting mode	Yes	No	4-16
XT	Selects the temperature unit.	Basic Setting mode	Yes	No	4-16
UF	Sets whether to use the extended functions.	Basic Setting mode	Yes	No	4-16
UT	Selects the time printout format.	Basic Setting mode	Yes	No	4-16
XR	Sets the remote control input (/R1 option).	Basic Setting mode	Yes	No	4-17
YS	Sets the RS-422A/485 interface (/C3 option).	Basic Setting mode	Yes	No	4-17
YB	Sets the host name and domain name (/C7 option).	Basic Setting mode	Yes	No	4-17
YA	Sets the IP address (/C7 option).	Basic Setting mode	Yes	No	4-17
YN	Sets the DNS (/C7 option).	Basic Setting mode	Yes	No	4-17
YD	Sets whether to use the login function via communication (/C7 option).	Basic Setting mode	Yes	No	4-17
YQ	Sets the communication timeout (/C7 option)	Basic Setting mode	Yes	No	4-18
YK	Sets keepalive (/C7 option).	Basic Setting mode	Yes	No	4-18
UQ	Sets the calibration correction setting mode and the number of correction points (/CC1 option).	Basic Setting mode	Yes	No	4-18
UG	Shows/Hides setting mode menu items.	Basic Setting mode	Yes	No	4-18
UH	Show/Hides FUNC key menu items.	Basic Setting mode	Yes	No	4-18
UA	Sets the record position.	Basic Setting mode	Yes	No	4-18
UY	Stops the record position adjustment.	Basic Setting mode	Yes	No	4-19
YC	Initializes the settings.	Basic Setting mode	Yes	No	4-19
YE	Exits from Basic Setting mode.	Basic Setting mode	Yes	No	4-19
XE	Exits from Basic Setting mode.	Basic Setting mode	Yes	No	4-19

Yes: Command usable

No: Command not usable

Control Commands

Key	Name	Function	Execution Mode	Administrator	User	Page
-	DS	Switches the execution mode.	All modes	Yes	No	4-20
RCD	PS	Starts/Stops recording.	Run mode	Yes	No	4-20
DISP	UD	Switches the screen/switches the channel.	Run mode	Yes	No	4-20
FUNC	MP	Starts/Stops manual print.	Run mode	Yes	No	4-20
FUNC	LS	Starts/Stops the list (setting information) printout.	Run mode	Yes	No	4-20
FUNC	SU	Starts/Stops the setup list (basic setting information) printout.	Run mode	Yes	No	4-20
FUNC	MS	Executes the message printout.	Run mode	Yes	No	4-20
FUNC	AC	Clears the alarm printout buffer.	Run mode	Yes	No	4-20
FUNC	MC	Clears the message printout buffer.	Run mode	Yes	No	4-20

Yes: Command usable

No: Command not usable

Output Commands

Type	Name	Function	Execution Mode	Administrator	User	Page
Control						
	BO	Sets the byte output order.	All modes	Yes	Yes	4-21
	CS	Sets the check sum (usable only during serial communications).	All modes	Yes	Yes	4-21
	IF	Sets the status filter	All modes	Yes	Yes	4-21
	CC	Disconnects an Ethernet connection (usable only during Ethernet communications)	All modes	Yes	Yes	4-21
Setup and measurement data output						
	FE	Outputs decimal point position, unit information, and setup data.	All modes	Yes	Yes	4-21
	FD	Outputs the most recent measured data.	Run mode	Yes	Yes	4-21
	FY	Outputs the most recent data of the periodic printout.	Run mode	Yes	Yes	4-21
	FF	Outputs FIFO data.	Run mode	Yes	Yes	4-21
	IS	Outputs status information.	All modes	Yes	Yes	4-22
	FU	Outputs user information.	All modes	Yes	Yes	4-22

Yes: Command usable

RS-422A/485 Dedicated Commands

Name	Function	Execution Mode	Administrator	User	Page
Esc O	Opens the instrument.	All modes	Yes	Yes	4-23
Esc C	Closes the instrument.	All modes	Yes	Yes	4-23

Yes: Command usable

Maintenance/Test Commands

These commands can be used only when using Ethernet communications.

Name	Function	Execution Mode	Administrator	User	Page
close	Disconnects the connection between other instruments.	All modes	Yes	No	4-24
con	Outputs connection information.	All modes	Yes	Yes	4-24
eth	Output Ethernets statistical information.	All modes	Yes	Yes	4-24
help	Outputs help.	All modes	Yes	Yes	4-24
net	Outputs network statistical information.	All modes	Yes	Yes	4-24
quit	Disconnects the connection of the instrument being operated.	All modes	Yes	Yes	4-24

Yes: Command usable

No: Command not usable

4

Commands

Instrument Information Output Commands

These commands can be used only when using Ethernet communications.

Parameter	Function	Page
serial	Outputs the serial number.	4-25
host	Outputs the host name.	4-25
ip	Outputs the IP address.	4-25

4.3 Parameter Values

This section explains frequently used parameters.

Input Range

The following tables show the input types (VOLT, TC, RTD, DI, and 1-5V), range types, and the ranges for the leftmost and rightmost values of the span.

- **DC Voltage (VOLT), Square Root (SQRT), Difference between Channels (DELTA)**

Range Type	Parameter for the SR Command	Range of Leftmost and Rightmost Values of Span	Selectable Range of Leftmost and Rightmost Values of Span
20 mV	20 mV	–20.00 to 20.00 mV	–2000 to 2000
60 mV	60 mV	–60.00 to 60.00 mV	–6000 to 6000
200 mV	200 mV	–200.0 to 200.0 mV	–2000 to 2000
2 V	2 V	–2.000 to 2.000 V	–2000 to 2000
6 V	6 V	–6.000 to 6.000 V	–6000 to 6000
20 V	20 V	–20.00 to 20.00 V	–2000 to 2000
50 V	50 V	–50.00 to 50.00 V	–5000 to 5000

- **1-5V**

Range Type	Parameter for the SR Command	Range of Leftmost and Rightmost Values of Span	Selectable Range of Leftmost and Rightmost Values of Span
1-5V	1-5V	Leftmost value: 0.8000 to 1.200 V	800 to 1200
		Rightmost value: 4.8000 to 5.200 V	4800 to 5200

- **Thermocouple (TC)**

Range Type	Parameter for the SR Command	Range of Leftmost and Rightmost Values of Span	Selectable Range of Leftmost and Rightmost Values of Span
R	R	0.0 to 1760.0°C	0 to 17600
S	S	0.0 to 1760.0°C	0 to 17600
B	B	0.0 to 1820.0°C	0 to 18200
K	K	–200.0 to 1370.0°C	–2000 to 13700
E	E	–200.0 to 800.0°C	–2000 to 8000
J	J	–200.0 to 1100.0°C	–2000 to 11000
T	T	–200.0 to 400.0°C	–2000 to 4000
N	N	0.0 to 1300.0°C	0 to 13000
W	W	0.0 to 2315.0°C	0 to 23150
L	L	–200.0 to 900.0°C	–2000 to 9000
U	U	–200.0 to 400.0°C	–2000 to 4000
WRe	WRe	0.0 to 2400.0°C	0 to 24000
Difference between channels (DELTA)			
R	-	–1760.0 to 1760.0°C	–17600 to 17600
S	-	–1760.0 to 1760.0°C	–17600 to 17600
B	-	–1820.0 to 1820.0°C	–18200 to 18200
K	-	–1570.0 to 1570.0°C	–15700 to 15700
E	-	–1000.0 to 1000.0°C	–10000 to 10000
J	-	–1300.0 to 1300.0°C	–13000 to 13000
T	-	–600.0 to 600.0°C	–6000 to 6000
N	-	–1300.0 to 1300.0°C	–13000 to 13000
W	-	–1999.9 to 2315.0°C	–19999 to 23150
L	-	–1100.0 to 1100.0°C	–11000 to 11000
U	-	–600.0 to 600.0°C	–6000 to 6000
WRe	-	–1999.9 to 2400.0°C	–19999 to 24000

- **Resistance Temperature Detector (RTD)**

Range Type	Parameter for the SR Command	Range of Leftmost and Rightmost Values of Span	Selectable Range of Leftmost and Rightmost Values of Span
Pt100	PT	−200.0 to 600.0°C	−2000 to 6000
JPt100	JPT	−200.0 to 550.0°C	−2000 to 5500
Difference between channels (DELTA)			
Pt100	-	−800.0 to 800.0°C	−8000 to 8000
JPt100	-	−750.0 to 750.0°C	−7500 to 7500

- **ON/OFF input (DI)**

Range Type	Parameter for the SR Command	Range of Leftmost and Rightmost Values of Span	Selectable Range of Leftmost and Rightmost Values of Span
Level	LEVEL	0 to 1[†]	0 to 1
Contact	CONT	0 to 1[††]	0 to 1

[†] "0" when less than 2.4 V, "1" when greater than or equal to 2.4 V.

[††] "0" when contact is OFF, "1" when contact is ON.

- **/N1 Option**

Range Type	Parameter for the SR Command	Range of Leftmost and Rightmost Values of Span	Selectable Range of Leftmost and Rightmost Values of Span
Cu10 (GE)	CU1	-200.0 to 300.0°C	-2000 to 3000
Cu10 (L&N)	CU2	-200.0 to 300.0°C	-2000 to 3000
Cu10 (WEED)	CU3	-200.0 to 300.0°C	-2000 to 3000
Cu10 (BAILEY)	CU4	-200.0 to 300.0°C	-2000 to 3000
Cu10: α=0.00392 at 20°C	CU5	-200.0 to 300.0°C	-2000 to 3000
Cu10: α=0.00393 at 20°C	CU6	-200.0 to 300.0°C	-2000 to 3000
Cu25: α=0.00425 at 0°C	CU25	-200.0 to 300.0°C	-2000 to 3000
Difference between channels (DELTA)			
Cu10 (GE)	CU1	-500.0 to 500.0°C	-5000 to 5000
Cu10 (L&N)	CU2	-500.0 to 500.0°C	-5000 to 5000
Cu10 (WEED)	CU3	-500.0 to 500.0°C	-5000 to 5000
Cu10 (BAILEY)	CU4	-500.0 to 500.0°C	-5000 to 5000
Cu10: α=0.00392 at 20°C	CU5	-500.0 to 500.0°C	-5000 to 5000
Cu10: α=0.00393 at 20°C	CU6	-500.0 to 500.0°C	-5000 to 5000
Cu25: α=0.00425 at 0°C	CU25	-500.0 to 500.0°C	-5000 to 5000

· **/N3 Option**

Range Type	Parameter for the SR Command	Range of Leftmost and Rightmost Values of Span	Selectable Range of Leftmost and Rightmost Values of Span
Kp vs Au7Fe	Kp	0.0 to 300.0 K	0 to 3000
PLATINEL	PLATI	0.0 to 1400.0°C	0 to 14000
PR40 - 20	PR	0.0 to 1900.0°C	0 to 19000
NiNiMo	NiMo	0.0 to 1310.0°C	0 to 13100
W/WRe26	W/WRe	0.0 to 2400.0°C	0 to 24000
Type N (AWG14)	N2	0.0 to 1300.0°C	0 to 13000
JPt50	PT3	-200.0 to 600.0°C	-2000 to 6000
Ni100 (SAMA)	Ni1	-200.0 to 250.0°C	-2000 to 2500
Ni100 (DIN)	Ni2	-60.0 to 180.0°C	-600 to 1800
Ni120	Ni3	-70.0 to 200.0°C	-700 to 2000
J263*B	J263	0.0 to 300.0 K	0 to 3000
Cu53	CU8	50.0 to 150.0°C	500 to 1500
Cu100	CU9	-50.0 to 150.0°C	-500 to 1500
JPt25	PT4	-200.0 to 550.0°C	-2000 to 5500
Difference between channels (DELTA)			
Kp vs Au7Fe	Kp	-300.0 to 300.0 K	-3000 to 3000
PLATINEL	PLATI	-1400.0 to 1400.0°C	-14000 to 14000
PR40 - 20	PR	-1900.0 to 1900.0°C	-19000 to 19000
NiNiMo	NiMo	-1310.0 to 1310.0°C	-13100 to 13100
W/WRe26	W/WRe	-1999.9 to 2400.0°C	-19999 to 24000
Type N (AWG14)	N2	-1300.0 to 1300.0°C	-13000 to 13000
JPt50	PT3	-800.0 to 800.0°C	-8000 to 8000
Ni100 (SAMA)	Ni1	-450.0 to 450.0°C	-4500 to 4500
Ni100 (DIN)	Ni2	-240.0 to 240.0°C	-2400 to 2400
Ni120	Ni3	-270.0 to 270.0°C	-2700 to 2700
J263*B	J263	-300.0 to 300.0 K	-3000 to 3000
Cu53	CU8	-200.0 to 200.0°C	-2000 to 2000
Cu100	CU9	-200.0 to 200.0°C	-2000 to 2000
JPt25	PT4	-750.0 to 750.0°C	-7500 to 7500

Miscellaneous

Channel Number
· **Pen model**
  01 to 04
· **Dot model**
  01 to 06

Relay Number (/A1, /A2, and /A3 Options)
· Models with the /A1 option: I01, I02
· Models with the /A2 option: I01 to I04
· Models with the /A3 option: I01 to I06

Chart Speed
· Pen model: See the table below.
  Dot model: Chart speeds in the thick frame in the table below.

mm/h

10	15	20	25	30	40	50	60	75	80
90	100	120	150	160	180	200	240	300	360
375	450	600	720	750	900	1200	1500	1800	2400
3000	3600	4500	4800	5400	6000	7200	9000	10800	12000

4

Commands

4.4   Setting Commands

SR   Sets the input range.

When setting channels to skip

Syntax   SR p1,p2<terminator>

    p1   Channel number

    p2   Measurement mode (SKIP)

Query   SR[p1]?

Example   Set channel 01 to skip.

    SR 01,SKIP

Description   Measurements are not made on channels that are set to SKIP.

When setting channels to voltage, TC, RTD, or ON/OFF input

Syntax   SR p1,p2,p3,p4,p5<terminator>

    p1   Channel number

    p2   Measurement mode (Input type)

        VOLT   DC voltage

        TC   Thermocouple

        RTD   Resistance temperature detector

        DI   ON/OFF input

    p3   Range type

    p4   Leftmost value of span

    p5   Rightmost value of span

Query   SR[p1]?

Example   Measure 0°C to 1760.0°C on channel 01 using thermocouple type R.

    SR 01,TC,R,0,17600

Description   ·   Set p3 according to the table in section 4.3.

    ·   For p4 and p5, enter an integer value of 5 digits or less according to the table in section 4.3. The decimal position is fixed to the position indicated in the table in section 4.3.

When setting channels to 1-5V range

Syntax   SR p1,p2,p3,p4,p5,p6,p7,p8<terminator>

    p1   Channel number

    p2   Measurement mode (Input type) (1-5V)

    p3   Leftmost value of span

    p4   Rightmost value of span

    p5   Leftmost value of scaling (−19999 to 30000)

    p6   Rightmost value of scaling (−19999 to 30000)

    p7   Scale decimal point position (0 to 4)

    p8   Whether to use 1-5V low-cut function (ON, OFF)

Query   SR[p1]?

Example   Set channel 01 to 1-5V range and scale the input value in the range 0.0 to 1200.0. Do not use the low-cut function.

    SR 01,1-5V,1000,5000,0,12000,1,OFF

Description   ·   For p3 and p4, enter an integer value of 5 digits or less according to the table in section 4.3. The decimal position is fixed to the position indicated in the table in section 4.3.

·   Be sure that p6 is greater than p5.

·   Parameter p8 is valid only when the low-cut function is enabled (see the UF command).

When computing the difference between channels

Syntax   SR p1,p2,p3,p4,p5<terminator>

    p1   Channel number

    p2   Measurement mode (DELTA)

    p3   Reference channel

    p4   Leftmost value of span

    p5   Rightmost value of span

Query   SR[p1]?

Example   Set channel 03 to channel difference computation with respect to channel 01 (reference channel). Set the leftmost and rightmost values of span to −200.0 and 200.0, respectively.

    SR 03,DELTA,01,-2000,2000

Description   ·   The reference channel must be a channel that is smaller in channel number than itself.

    ·   The range type is the same as that of the reference channel.

    ·   For p4 and p5, enter an integer value of 5 digits or less according to the table in section 4.3. The decimal position is fixed to the position indicated in the table in section 4.3.

When setting the linear scaling

Syntax   SR p1,p2,p3,p4,p5,p6,p7,p8,p9 <terminator>

    p1   Channel number

    p2   Measurement mode (SCALE)

    p3   Input type

        VOLT   DC voltage

        TC   Thermocouple

        RTD   Resistance temperature detector

        DI   ON/OFF input

    p4   Range type

    p5   Leftmost value of span

    p6   Rightmost value of span

    p7   Leftmost value of scaling (−19999 to 30000)

    p8   Rightmost value of scaling (−19999 to 30000)

    p9   Scaling decimal point position (0 to 4)

Query   SR[p1]?

Example   Scale channel 02 whose input range is 0 to 10 V to −100.0 to 500.0.

    SR 02,SCALE,VOLT,20V,0,1000,-1000, 5000,1

Description   ·   Set p4 according to the table in section 4.3.

    ·   For p5 and p6, enter an integer value of 5 digits or less according to the table in section 4.3. The decimal position is fixed to the position indicated in the table in section 4.3.

    ·   Be sure that p8 is greater than p7.

When setting the square root

Syntax
SR p1,p2,p3,p4,p5,p6,p7,p8,p9,p10
<terminator>

p1 Channel number
p2 Measurement mode (SQRT)
p3 Range type
p4 Leftmost value of span
p5 Rightmost value of span
p6 Leftmost value of scaling (–19999 to 30000)
p7 Rightmost value of scaling (–19999 to 30000)
p8 Scaling decimal point position (0 to 4)
p9 Low-cut function (ON, OFF)
p10 Low-cut value

Query
SR[p1]?

Example
Given channel 01 whose input range is 0 to 10 V,
take the square root of the input value and scale
the result in the range 0.00 (m^3/s) to 100.00 (m^3/
s). When the input value is less than or equal to
5.0% of the recording span, use the low-cut
function.
SR 01,SQRT,20V,0,1000,0,10000,2,ON,
50

Description
• Set p3 according to the table in section 4.3.
• For p4 and p5, enter an integer value of 5
digits or less according to the table in section
4.3. The decimal position is fixed to the
position indicated in the table in section 4.3.
• Be sure that p7 is greater than p6.
• Parameters p9 and p10 is valid only when the
low-cut function is enabled (see the UF
command).

VB   Sets the bias.

Syntax
VB p1,p2,p3<terminator>
p1 Channel number
p2 Bias ON/OFF (ON, OFF)
p3 Bias value

Query
VB[p1]?

Example
Given channel 03 whose range type is 2V
(measurable range: –2.000 to 2.000 V), add a
bias of 0.1 V.
VB 03,ON,100

Description
• Set p3 in the range of ±10% of the span of the
measurable range at the range type or ±10%
of the scaling span. Specify the value with an
integer (see section 4.3).
• The bias setting is valid only when the bias
function is enabled (see the UF command).

VL   Set the calibration correction (/CC1 option).

Syntax
VL p1,p2,p3,p4,...,p33,p34<terminator>
p1 Channel number
p2 Calibration correction function (ON, OFF)
p3 Correction point (datum)
p4 Correction value
· · · · · · · · ·

p33 Correction point (datum)
p34 Correction value

Query
VL[p1]?

Example
Set three sets of "correction points and
correction values" to channel 02 that is set to 2 V
range (measurable range: –2.000 V to 2.000 V).
"0.000/0.001)," "1.000/0.998," and "2.000/2.001"
• When the calibration correction setting mode
is revise value
VL 02,ON,0,1,1000,-2,2000,1
• When the calibration correction setting mode
is absolute value
VL 02,ON,0,1,1000,998,2000,2001

Description
• Calibration correction is valid on models with
the calibration correction (/CC1 option) when
the calibration correction function is enabled
(UF command).
• The number of parameters p3 to p34 varies
depending on the number of points specified
by the basic setting command UQ.
• If the input type of the source channel is
VOLT, TC, or RTD, the range of the correction
points and correction values is the same as
the range of the range type (see section 4.3).
• If the measurement mode of the source
channel is SCALE or 1-5V, the range of the
correction points and correction values is –5%
to 105% of the scaling range or –19999 to
30000.
• The following limitations exist.
  • p3 < p5 ≤ ... ≤ p31 ≤ p33
  • During revise value mode
    p3+p4 < p5+p6 < ... < p33+p34
  • During absolute value mode
    p4 < p6 < ... < p32 < p34

SA   Sets the alarm.

When not using the alarm

Syntax
SA p1,p2,p3<terminator>
p1 Channel number
p2 Alarm number (1 to 4)
p3 Alarm ON/OFF state (OFF)

Query
SA[p1[,p2]]?

Example
Do not use alarm number 4 of channel 01.
SA 01,4,OFF

When using the alarm

Syntax
SA p1,p2,p3,p4,p5,p6,p7<terminator>
p1 Channel number
p2 Alarm number (1 to 4)
p3 Alarm ON/OFF state (ON)
p4 Alarm type
  H High limit alarm
  L Low limit alarm
  h Difference high limit alarm
  l Difference low limit alarm
  (Characters are case-sensitive.)

p5   Alarm value

p6   Relay output

    ON   Relay ON

    OFF   Relay OFF

p7   Relay number

Query   `SA[ p1[,p2]]?`

Example   Set a high limit alarm (alarm value = 1000) on alarm number 1 of channel 02 and output to relay I01.

    `SA 02,1,ON,H,1000,ON,I01`

Description · When the input range is set to SKIP (SR command), p3 cannot be turned ON.

    · The alarm settings are all turned OFF for the following cases.

        · When the input type is changed (VOLT, TC, etc).

        · When the range type is changed.

        · When the span and scaling values are changed during linear scaling (includes changing the decimal position).

    · The h and l settings of p4 are valid only when the measurement range is set to computation between channels.

    · The hysteresis of alarm ON/OFF (valid when p4 is H or L) is set using the XA command.

    · For p5 for the high limit alarm/low limit alarm, enter an integer value in the range below.

        · For DC voltage, TC, and RTD input: Values within the measurable range in the specified range (example: –2.000 to 2.000 V for the 2 V range).

        · For ON/OFF input (DI): 0 or 1.

        · For scaling (1-5V, scaling, and square root): –5 to 105% of the scale span (except within –19999 to 30000).

    · For p5 for the difference high limit alarm/ difference low limit alarm, values in the measurable range can be specified (example: –1760.0 to 1760.0°C for the TC type R).

SN   Sets the unit.

Syntax   `SN p1,p2<terminator>`

p1   Channel number

p2   Unit string (up to 6 characters)

Query   `SN[ p1]?`

Example   Set the unit of channel 02 to M/H.

    `SN 02,M/H`

Description · The unit setting is valid on channels set to 1-5V, scaling, or square root.

    · For the characters that can be used for the units, see appendix 1, "ASCII Character Codes."

SC   Sets the chart speed.

Syntax   `SC p1<terminator>`

p1   Chart speed

Query   `SC?`

Example   Set the chart speed to 25 mm/h.

    `SC 25`

Description Select the chart speed from the list of choices below.

Pen model

10 to 12000 mm/h (40 levels, see section 4.3)

Dot model

10 to 1500 mm/h (28 levels, see section 4.3)

SD   Sets the date and time.

Syntax   `SD p1<terminator>`

p1   Date and time (fixed to the YY/MM/DD HH:MM:SS format)

    YY   Year (00 to 99, the lower 2 digits)

    MM   Month (01 to 12)

    DD   Day (01 to 31)

    HH   Hour (00 to 23)

    MM   Minute (00 to 59)

    SS   Second (00 to 59)

Query   `SD?`

Example   Set the recorder clock to 13:00:00, December 1, 2005.

    `SD 05/12/01 13:00:00`

Description The format of p1 is fixed to 17 characters. An error results if a space is inserted in positions other than the specified positions.

VT   Sets the dot printing interval (dot model).

Syntax   `VT p1<terminator>`

p1   Dot printing interval setting.

    AUTO   Automatically adjust the dot printing interval according to the chart speed.

    FIX   Record at the fastest printing interval.

Query   `VT?`

Example   Record at the fastest printing interval.

    `VT FIX`

Description When trend recording is performed on 6 channels, the fastest printing interval is 10 seconds.

SZ   Sets zone recording.

Syntax   `SZ p1,p2,p3<terminator>`

p1   Channel number

p2   Leftmost position of the zone (0 to 95) [mm]

p3   Rightmost position of the zone (5 to 100) [mm]

Query   `SZ[ p1]?`

Example   Display channel 02 in a zone between 30 and 50 mm.

    `SZ 02,30,50`

Description Be sure that p3 is greater than p2 and that the zone width (p3 – p2) is greater than or equal to 5 mm.

SP Sets the partial expanded recording.

Syntax `SP p1,p2,p3,p4<terminator>`

p1 Channel number

p2 Partial expanded recording ON/OFF (ON, OFF)

p3 Boundary position (1 to 99) [%]

p4 Boundary value

Query `SP[ p1]?`

Example Set the 25% position of channel 01 to 1.000 V.

`SP 01,ON,25,1000`

Description • When the input range is set to SKIP (SR command), p2 cannot be turned ON.

• Set p3 as a percentage where 100 mm is assumed to be 100%.

• Parameter p4 can be set in the range (leftmost value of span + 1) to (rightmost value of span – 1). If scaling is enabled, the range is (leftmost value of scaling – 1) to (rightmost value of scaling + 1). Set the parameter using an integer.

• This setting is possible when partial expanded recording is enabled (UK command).

• This command cannot be used if the partial expanded recording range does not exist (when the span width is set to 1, for example).

VR Turns ON/OFF the recording on each channel.

Dot model

Syntax `VR p1,p2,p3<terminator>`

p1 Channel number

p2 Trend recording ON/OFF (ON, OFF)

p3 Periodic printout ON/OFF (ON, OFF)

Query `VR[ p1]?`

Example Turn trend recording ON and turn periodic printout OFF on channel 06.

`VR 06,ON,OFF`

Pen model

Syntax `VR p1,p2<terminator>`

p1 Channel number

p2 Periodic printout ON/OFF (ON, OFF)

Query `VR[ p1]?`

Example Turn periodic printing ON on channel 01.

`VR 01,ON`

ST Sets the tag.

Syntax `ST p1,p2<terminator>`

p1 Channel number

p2 Tag string (up to 7 characters)

Query `ST[ p1]?`

Example Set the tag of channel 02 to TI-2.

`ST 02,TI-2`

Description For the characters that can be used for the tags, see appendix 1, "ASCII Character Codes."

SG Sets the message.

Syntax `SG p1,p2<terminator>`

p1 Message number (1 to 5)

p2 Message string (up to 16 characters)

Query `SG[ p1]?`

Example Set character string "START" in message number 1.

`SG 1,START`

Description For the characters that can be used for the messages, see appendix 1, "ASCII Character Codes."

SE Sets the secondary chart speed (used by the remote control function (/R1 option)).

Syntax `SE p1<terminator>`

p1 Secondary chart speed

See the explanation.

Query `SE?`

Example Set the chart speed to 50 mm/h.

`SE 50`

Description Select the chart speed from the list of choices below.

Pen model

10 to 12000 mm/h (40 levels, see section 4.3)

Dot model

10 to 1500 mm/h (28 levels, see section 4.3)

SV Sets the moving average (dot model).

Syntax `SV p1,p2<terminator>`

p1 Channel number

p2 Number of samples for computing the moving average (OFF, 2 to 16) [times]

Query `SV[ p1]?`

Example Set the number of samples for computing the moving average of channel 02 to 12.

`SV 02,12`

Description • This setting is available on the dot model.

• This setting is possible when moving average is enabled (UI command).

SF Sets the input filter (pen model).

Syntax `SF p1,p2<terminator>`

p1 Channel number

p2 Filter time constant (OFF, 2s, 5s, 10s)

Query `SF[ p1]?`

Example Set the filter of channel 02 to 2 s.

`SF 02,2s`

Description This setting is possible when the input filter is enabled (UJ command).

4

Commands

TD   Sets the DST.

Syntax   TD p1,p2,p3,p4,p5,p6,p7,p8,p9<terminator>

p1   Use/Not use DST (USE, NOT)

p2   DST start time: month (Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, or Dec)

p3   DST start time: number of the week in the month (1st, 2nd, 3rd, 4th, or Last)

p4   DST start time: day of the week (Sun, Mon, Tue, Wed, Thu, Fri, or Sat)

p5   DST start time: hour (0 to 23)

p6   DST end time: month (Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, or Dec)

p7   DST end time: number of the week in the month (1st, 2nd, 3rd, 4th, or Last)

p8   DST end time: day of the week (Sun, Mon, Tue, Wed, Thu, Fri, or Sat)

p9   DST end time: hour (0 to 23)

Query   TD[p1]?

Example   Enable DST and set the DST start time to hour 0 on the 2nd Sunday of June and the DST end time to hour 0 on the 2nd Sunday of December.

TD Use,Jun,2nd,Sun,0,Dec,2nd,Sun,0

Description   The DST start time and end time cannot be set to the same time.

FR   Sets the interval for acquiring data to the FIFO buffer

Syntax   FR p1<terminator>

p1   Pen model: 125ms, 250ms, 500ms, 1s, 2s, 2.5s, 5s, 10s

Dot model: 1s, 2s, 2.5s, 5s, 10s

Query   FR?

Example   Set the acquiring interval to the FIFO buffer to 1 s.

FR 1s

Description · Set the acquiring interval to an integer multiple of the scan interval that is greater than the scan interval.

· The scan interval on the pen model is 125 ms.

· The scan interval on the dot model varies depends on the integration time of the A/D converter as follows:

When the integration time is 16.7 ms or 20 ms: 1 s

When the integration time is 100 ms: 2.5 s

4.5   Basic Setting Commands

· In order to activate the settings that are changed using the basic setting commands, the settings must be saved using the YE or XE command.

· The settings that are returned in response to a query in the basic setting mode will contain the new settings even if they are not saved.

Note

· The settings that are changed using the YS/YB/YA/YN/YD/YQ/YK command and saved using the XE command are activated after power-cycling the recorder.

· When the YE command is executed, communication is dropped.

XA   Sets alarm related settings.

Syntax   XA p1,p2,p3
<terminator>

p1   Fault diagnosis output ON/OFF (ON, OFF)

p2   Energize/De-energize the relay

ENERGIZE   Energize the relay when an alarm is detected

DE_ENERGIZE   De-energize the relay when an alarm is detected

p3   Alarm hysteresis on measurement channels (OFF, 0.1%, 0.2%, 0.3%, 0.4%, 0.5%, 0.6%, 0.7%, 0.8%, 0.9%, or 1.0%)

Query   XA?

Example   Enable fault diagnosis output. Set the relay operation to energize. Set the alarm status display to hold. Set the measurement alarm hysteresis to 0.5%.

XA ON,ENERGIZE,0.5%

Description   For the details on the settings, see the *SR10000 Recorder User's Manual*.

XI   Sets the A/D integral time.

Syntax   XI p1<terminator>

p1   Integration time of the A/D converter

AUTO   Automatically set in synch with the power supply frequency.

50HZ   12.5 ms

60HZ   16.7 ms

100MS   100 ms (dot model)

Query   XI?

Example   Set the A/D integral time to 50 Hz.

XI 50HZ

Description   100 ms is available only on the dot model.

XB   Sets the burnout detection.

Syntax   XB p1,p2<terminator>

p1   Channel number

p2 The procedure taken when a sensor burnout is detected

OFF Disable the burnout detection.

UP Set the recording off the scale to the right when a burnout is detected.

DOWN Set the recording off the scale to the left when a burnout is detected.

Query XB[p1]?

Example Set the recording off the scale to the right when a sensor burnout is detected on channel 01.

XB 01,UP

XJ — Sets the RJC.

When using the internal compensation circuit

Syntax XJ p1,p2<terminator>

p1 Channel number

p2 Reference junction compensation selection (INTERNAL)

Query XJ[p1]?

Example Use the internal compensation circuit on channel 01.

XJ 01,INTERNAL

When using an external RJC

Syntax XJ p1,p2,p3<terminator>

p1 Channel number

p2 Reference junction compensation selection (EXTERNAL)

p3 Compensation voltage (–19999 to 20000) [μV]

Query XJ[p1]?

Example Set the reference junction compensation of channel 02 to external and set the compensation voltage to 0 μV.

XJ 02,EXTERNAL,0

Description The unit of p3 is μV (microvolts).

UC — Changes the dot color (dot model).

Syntax UC p1,p2<terminator>

p1 Channel number

p2 Dot color

PURPLE

RED

GREEN

BLUE

BROWN

BLACK

Query UC[p1]?

Example Set the dot color of channel 06 to purple.

UC 06,PURPLE

UO — Sets the pen offset compensation (pen model).

Syntax UO p1<terminator>

p1 Pen offset compensation ON/OFF (ON, OFF)

Query UO?

Example Use the pen offset compensation.

UO ON

UP — Sets the items to be printed.

Pen model

Syntax UP p1,p2,p3,p4,p5,p6<terminator>

p1 Channel number/tag selection

CHANNEL Print the channel number

TAG Print the tag

p2 Alarm printout

ON1 Print at alarm occurrence and release

ON2 Print at alarm occurrence

OFF Do not print

p3 Record start time printout ON/OFF (ON, OFF)

p4 New chart speed printout ON/OFF (ON, OFF)

p5 Scale printout ON/OFF (ON, OFF)

p6 Recording color printout ON/OFF (ON, OFF)

Query UP?

Example Print tags. Print all items.

UP TAG,ON1,ON,ON,ON,ON

Dot model

Syntax UP p1,p2,p3,p4,p5,p6<terminator>

p1 Channel number/tag selection

CHANNEL Print the channel number

TAG Print the tag

p2 Channel number printout ON/OFF (ON, OFF) by the trend recording

p3 Alarm printout

ON1 Print at alarm occurrence and release

ON2 Print at alarm occurrence

OFF Do not print

p4 Record start time printout ON/OFF (ON, OFF)

p5 New chart speed printout ON/OFF (ON, OFF)

p6 Scale printout ON/OFF (ON, OFF)

Query UP?

Example Print the channel numbers. Print all items.

UP CHANNEL,ON,ON1,ON,ON,ON

UR — Sets the periodic printout interval.

Syntax UR p1,p2,p3,p4<terminator>

p1 Print interval mode

Auto Automatically set the interval according to the chart speed

Manual Specify the interval

p2 Reference time (00 to 23 [hour])

p3 Interval (10min, 12min, 15min, 20min, 30min, 1h, 2h, 3h, 4h, 6h, 8h, 12h, 24h) (when p1 is Manual)

p4 Periodic printout mode

OFF Disable periodic printout

INST Print instantaneous values.

Query UR?

Example Carry out periodic printout every 2 hours with hour 0 as the reference. Print the measured values (instantaneous values) at each interval.

UR Manual,00,2h,INST

Description When p1 is set to Auto, the periodic printout interval synchronizes to the chart speed.

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UI — Sets whether to use moving average (dot model).

Syntax UI p1<terminator>
　　　　p1 Use/Not use moving average (USE, NOT)
Query   UI?
Example Use moving average.
　　　　UI USE

UJ — Sets whether to use the input filter (pen model).

Syntax UJ p1<terminator>
　　　　p1 Use/Not use the input filter (USE, NOT)
Query   UJ?
Example Use the input filter.
　　　　UJ USE

UK — Sets whether to use of partial expanded recording.

Syntax UK p1<terminator>
　　　　p1 Use/Not use partial expanded recording
　　　　　　(USE, NOT)
Query   UK?
Example Use partial expanded recording.
　　　　UK USE

UL — Selects the printout font.

Syntax UL p1<terminator>
　　　　p1 Font (ENGLISH, GERMAN, FRENCH,
　　　　　　JAPANESE)
Query   UL?
Example Use English.
　　　　UL ENGLISH

XN — Selects the date format.

Syntax UL p1<terminator>
　　　　p1 Date format for displaying and printing
　　　　　　Y/M/D: (example) 2005/08/31
　　　　　　M/D/Y: (example) 08/31/2005
　　　　　　D/M/Y: (example) 31/08/2005
　　　　　　D.M.Y: (example) 31.08.2005
　　　　　　M.D.Y: (example) Aug.31.2005
Query   XN?
Example Set to the "2005/08/31" format.
　　　　XN Y/M/D
Description This setting applies to the format of the date
　　　　shown on the display and the date printed on the
　　　　periodic printout, manual printout, alarm printout,
　　　　message printout, recording start printout, and
　　　　new chart speed printout.

Note

How this setting applies to the time printout format of the alarm printout, message printout, recording start printout, and new chart speed printout: The setting specifies the format of the "M/D" and "Y/M/D" section when the time printout format is set to "M/D H:M," "M/D H:M:S," or "Y/M/ D H:M:S."

XT — Selects the temperature unit.

Syntax XT p1<terminator>
　　　　p1 Temperature unit
　　　　　　C °C
　　　　　　F °F
Query   XT?
Example Use °F.
　　　　XT F

UF — Sets whether to use the extended functions.

Syntax UF p1,p2,p3,p4<terminator>
　　　　p1 Bias function (USE, NOT)
　　　　p2 Square root low-cut function (USE, NOT)
　　　　p3 1-5V input low-cut function (USE, NOT)
　　　　p4 Calibration correction function (USE, NOT).
　　　　　　Cannot be used simultaneously with the
　　　　　　bias function.
Query   UF?
Example Use all the extended functions.
　　　　UF USE,USE,USE,USE
Description • The input offset is set using the VB command.
　　　　• The low-cut function is set using the SR
　　　　　 command.
　　　　• Parameter p4 can be specified on models with
　　　　　 the calibration correction (/CC1 option). Use
　　　　　 the UQ and VL commands to set the
　　　　　 correction values.

UT — Selects the time printout format.

Syntax UT p1,p2,p3,p4<terminator>
　　　　p1 Time printout format of the alarm printout
　　　　　　The available selections are the same as
　　　　　　those of p2. None is not available.
　　　　p2 Time printout format of the message printout
　　　　　　HH:MM   Hour:Minute
　　　　　　HH:MM:SS Hour:Minute:Second
　　　　　　M/D H:M   Month Day Hour:Minute
　　　　　　M/D H:M:S Month Day Hour:Minute:
　　　　　　　　　　　　Second
　　　　　　YMD H:M:S Month Day Year Hour:Minute:
　　　　　　　　　　　　Second
　　　　　　None   No time printout
　　　　p3 Time printout format of the record start time
　　　　　　printout
　　　　　　The available selections are the same as
　　　　　　those of p2. None is not available.
　　　　p4 Time printout format of the new chart speed
　　　　　　printout
　　　　　　The available selections are the same as
　　　　　　those of p2. None is not available.
Query   UT?
Example Set the all time printouts to Hour:Minute format.
　　　　UT HH:MM,HH:MM,HH:MM,HH:MM

XR — Sets the remote control input (/R1 option).

Syntax   XR p1,p2<terminator>
p1   Remote control input terminal number (1 to 5)
p2   Action
NONE   No action
Record On/Off   Start/Stop recording.
Chart speed   Change the chart speed.
Time adjust   Reset the internal clock to the nearest hour.
Manual print   Execute manual print.
Message1   Print message 1
Message2   Print message 2
Message3   Print message 3
Message4   Print message 4
Message5   Print message 5

Query   XR[p1]?
Example Assign the printout of message 2 to the remote control input of terminal number 1.
XR 1,Message2

YS — Sets the RS-422A/485 interface (/C3 option).

Syntax   YS p1,p2,p3,p4,p5<terminator>
p1   Address (1 to 32)
p2   Baud rate (1200, 2400, 4800, 9600, 19200, 38400)
p3   Data length (7, 8)
p4   Parity check (ODD, EVEN, NONE)
p5   Protocol (NORMAL, MODBUS)
Query   YS?
Example Set the address to 2, the baud rate to 9600, the data length to 8, the parity check to ODD, and the NORMAL protocol.
YS 2,9600,8,ODD,NORMAL
Description · The settings specified by this command and saved using the XE command take effect after the recorder is power cycled.
· If p5 is set to MODBUS, Modbus slave is selected.

YB — Sets the host name and domain name (/C7 option).

Syntax   YB p1,p2<terminator>
p1   Host name (up to 64 characters)
p2   Domain name (up to 64 characters)
Query   YB?
Example Set the host name to "ABC" and the domain name to "recorder.co.jp."
YB ABC,recorder.co.jp
Description The settings specified by this command and saved using the XE command take effect after the recorder is power cycled.

YA — Sets the IP address (/C7 option).

Syntax   YA p1,p2,p3<terminator>
p1   IP address (0.0.0.0 to 255.255.255.255)
p2   Subnet mask (0.0.0.0 to 255.255.255.255)
p3   Default gateway (0.0.0.0 to 255.255.255.255)
Query   YA?
Example Set the IP address to 192.168.111.24, the subnet mask to 255.255.255.0, and the default gateway to 0.0.0.0.
YA 192.168.111.24,255.255.255.0,0.0.0.0
Description The settings specified by this command and saved using the XE command take effect after the recorder is power cycled.

YN — Sets the DNS (/C7 option).

When not using the DNS
Syntax   YN p1<terminator>
p1   Use/Not use the DNS (OFF)
Query   YN?
Example Do not use the DNS.
YN OFF

When using the DNS
Syntax   YN p1,p2,p3,p4,p5<terminator>
p1   Use/Not use the DNS (ON)
p2   Address of the primary DNS server (0.0.0.0 to 255.255.255.255)
p3   Address of the secondary DNS server (0.0.0.0 to 255.255.255.255)
p4   Domain suffix 1 (up to 64 characters)
p5   Domain suffix 2 (up to 64 characters)
Query   YN?
Example Use the DNS server at 192.168.0.1.
YN ON,192.168.0.1
Description The settings specified by this command and saved using the XE command take effect after the recorder is power cycled.

YD — Sets whether to use the login function via communication (/C7 option).

Syntax   YD p1<terminator>
p1   Use/Not use the login function via communication (USE, NOT)
Query   YD?
Example Use the login function via communication.
YD USE
Description The settings specified by this command and saved using the XE command take effect after the recorder is power cycled.

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YQ — Sets the communication timeout (/C7 option).

When not using the timeout

Syntax   YQ p1<terminator>

           p1   Enable/Disable communication timeout (OFF)

Query   YQ?

Example   Disable timeout.

           YQ OFF

When using the timeout

Syntax   YQ p1,p2<terminator>

           p1   Enable/Disable communication timeout (ON)

           p2   Timeout time (1 to 120) [minutes]

Query   YQ?

Example   Enable communication timeout and set the timeout period to 3 min.

           YQ ON,3

Description   The settings specified by this command and saved using the XE command take effect after the recorder is power cycled.

YK — Sets keepalive (/C7 option).

Syntax   YK p1<terminator>

           p1   Enable/Disable keepalive (ON, OFF)

Query   YK?

Example   Disable keepalive.

           YK OFF

Description   The settings specified by this command and saved using the XE command take effect after the recorder is power cycled.

UQ — Sets the calibration correction setting mode and the number of correction points (/CC1 option).

Syntax   UQ p1,p2,p3<terminator>

           p1   Channel number

           p2   Setting mode

               ReviseValue   Specify revise value.

               Abs.Value   Specify absolute value.

           p3   Number of correction points (2 to 16)

Query   UQ[p1]?

Example   Set the setting mode to Abs.Value and the number of correction points to 2 on channel 01.

           UQ 01,ABS.VALUE,2

Description   •   This setting is valid when the calibration correction function is enabled (see the UF command).

           •   Use the VL command to set the correction points and correction values.

UG — Shows/Hides setting menu items.

Syntax   YN p1,p2,p3,p4,p5,p6,p7<terminator>

           p1   RANGE (ON, OFF)

           p2   BIAS (ON, OFF)

           p3   ALARM (ON, OFF)

           p4   UNIT (ON, OFF)

           p5   CHART (ON, OFF)

           p6   AUX (ON, OFF)

           p7   CALIBRATION (ON, OFF)

Query   UG?

Example   Hide the RANGE, BIAS, and ALARM menus.

           UG OFF,OFF,OFF

Description   Parameter p7 can be specified on models with the calibration correction (/CC1 option).

UH — Shows/Hides FUNC key menu items.

Syntax   UH p1,p2,p3,p4<terminator>

           p1   MANUAL PRINT (ON, OFF)

           p2   SETUP LIST (ON, OFF)

           p3   MESSAGE (ON, OFF)

           p4   BUFFER CLEAR (ON, OFF)

Query   UH?

Example   Do not show the buffer clear menu.

           UG ON,ON,ON,OFF

UA — Sets the record position.

Pen model

Syntax   UA p1,p2,p3<terminator>

           p1   Record position selection

               ZERO   0% position

               FULL   100% position

           p2   Pen number (1 to 4)

           p3   Record position adjustment value

               When p1 = ZERO   An integer between 0 and 70

               When p1 = FULL   An integer between −45 to 15 (reference value: 3026)

Example   Adjust the 0% position of pen 1. Set the record position adjustment value to 20.

           UA ZERO,1,20

Description   •   Check the recorded result and correct the record position adjustment value.

           •   To end the adjustment, execute the UY0 command. If you do not end the adjustment, you cannot change the execution mode.

           •   The unit for p3 is 1/30 mm.

Dot model

Syntax   UA p1,p2<terminator>

           p1   Record position selection

               ZERO 0% position

               FULL 100% position

               Hysteresis

                   The difference in the record position according to the operating direction of the printer carriage

           p2   Record position adjustment value

               When p1 = Hysteresis

An integer between –7 to 7
When p1 = ZERO
An integer between 0 and 15
When p1 = FULL
An integer between –30 to 30
(reference value: 1000)

Example   Adjust the 100% position. Set the record
position adjustment value to 25.
UA FULL,25

Description · Carry out the adjustment in the following
order: P1 = Hysteresis, ZERO, and then
FULL.
· Check the recorded result and correct the
record position adjustment value.
· To end the adjustment, execute the UY0
command. If you do not end the adjustment,
you cannot change the execution mode.
· The unit for p2 is dot (0.1 mm).

UY   Stops the record position adjustment.

Syntax   UY p1<terminator>
p1 Fixed to 0.
Query   UY?
Example   Stop the record position adjustment.
UY 0
Description Returns the execution status of the record
position adjustment in response to a query.
0: Stopped, 1: In progress

YC   Initializes settings.

Syntax   YC p1<terminator>
p1 Initialization type
0   Initialize the Setting mode and Basic
Setting mode settings.
1   Initialize the Setting mode settings.
Example   Initialize the Setting mode and Basic Setting
mode settings.
YC 0

YE   Exits from Basic Setting mode.

When the YE command is executed, communication is
dropped.
Syntax   YE p1<terminator>
p1 Apply/Discard the settings
STORE   Apply the settings
ABORT   Discard the settings
Example   Apply the basic settings.
YE STORE
Description Applies the settings changed with the basic
setting commands.

XE   Exits from Basic Setting mode.

Communication is not dropped when the XE command is
executed.
Syntax   XE p1<terminator>
p1 Apply/Discard the settings
STORE   Apply the settings
ABORT   Discard the settings
Example   Apply the basic settings.
XE STORE
Description The settings specified by the following
commands and saved using the XE command
take effect after the recorder is power cycled.
YS, YB, YA, YN, YD, YQ, and YK

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4.6 Control Commands

DS Switches the execution mode.

Syntax DS p1<terminator>
p1 Mode
    0 Run mode
    1 Basic Setting mode
Example Switch to Basic Setting mode.
    DS 1
Description The execution mode cannot be changed to Basic Setting Mode while recording is in progress.

PS Starts/Stops recording.

Syntax PS p1<terminator>
p1 Start/Stop recording.
    0 Start
    1 Stop
Example Start recording.
    PS 0

UD Switches the screen/switches the channel.

Returning to the data display screen
Returns from the Setting mode screen or the screen that appears when the FUNC key is pressed back to the measurement data display screen.
Syntax UD p1<terminator>
    p1 Fixed to 0.
Example Return to the data display screen.
    UD 0

Displaying the specified data display screen
Syntax UD p1,p2<terminator>
    p1 Fixed to 1.
    p2 Screen number (1 to 5)
Example Display data display screen 2.
    UD 1,2

Switching the display channel (manual switching)
Syntax UD p1<terminator>
    p1 Fixed to 2.
Example Switch the display channel.
    UD 2
Description UD2 is valid on screens whose display channel is set to manual switching.

MP Starts/Stops manual print.

Syntax MP p1<terminator>
p1 Operation type
    0 Manual print start
    1 Manual print stop
Example Start manual print.
    MP 0

LS Starts/Stops the list (setting information) printout.

Syntax LS p1<terminator>
p1 Operation type
    0 List print start
    1 List print stop
Example Start list print.
    LS 0
Description List print refers to printing of settings of Setting mode.

SU Starts/Stops the setup list (basic setting information) printout.

Syntax SU p1<terminator>
p1 Operation type
    0 Setup list print start
    1 Setup list print stop
Example Start setup list print.
    SU 0
Description Setup list print refers to printing of settings of Basic Setting mode.

MS Prints the message.

Syntax MS p1<terminator>
    p1 Message number (1 to 5)
Example Print the message of message number 3.
    MS 3
Description The message string is set with the SG command.

AC Clears the alarm printout buffer.

Syntax AC p1<terminator>
    p1 Clear the alarm printout buffer (0)
Example Clear the alarm printout buffer.
    AC 0

MC Clears the message printout buffer.

Syntax MC p1<terminator>
    p1 Clear the message printout buffer (0)
Example Clear the message printout buffer.
    MC 0

4.7 Output Commands

BO   Sets the byte output order.

Syntax	BO p1<terminator>
	p1 Byte order
	0 Outputs the data MSB first.
	1 Outputs the data LSB first.
Query	BO?
Example	Output the data MSB first.
	BO 0
Description	This command applies to the byte order of numerical data during BINARY output.

CS   Sets the checksum (/C3 option).

Syntax	CS p1<terminator>
	p1 Use/Not use the checksum
	0 Not use
	1 Use
Query	CS?
Example	Use the checksum.
	CS 1
Description	This command can be used only on the RS-422A/485 communication interface.

IF   Sets the status filter.

Syntax	IF p1<terminator>
	p1 Status filter value
	(0.0.0.0 to 255.255.255.255)
Query	IF?
Example	Set the status filter value to 1.0.4.0.
	IF 1.0.4.0
Description	For details, see chapter 6.

Note

Initialization of BO/CS/IF Command Settings

- **For serial communications**

  Settings entered using the BO/CS/IF commands revert to their initial values when the recorder is reset (when the recorder is power cycled, or the user exits the basic setting mode with the YE command).
  - Byte output order, checksum: 0
  - Status filter: 255.255.255.255

  If the recorder is reset, you must restore these settings.
- **For Ethernet communications**

  Settings entered using the BO/IF commands revert to their initial values when the connection to the recorder is cut. After reconnecting the recorder, you must reenter the settings.

CC   Disconnects an Ethernet connection (/C7 option).

Syntax	CC p1<terminator>
	p1 Disconnect the connection (0)
Example	Disconnect the connection.
	CC 0

FE   Outputs decimal point position, unit information, and setup data.

Syntax	FE p1,p2,p3<terminator>
	p1 Output data type
	0 Setup data of Setting mode
	1 Decimal point position and unit information
	2 Setup data of Basic Setting mode
	4 Setup data file
	p2 First output channel number
	p3 Last output channel number
Example	Output the setup data of the Setting commands of channel 01 through 04.
	FE 0,01,04
Description	• Be sure to set p2 and p3 so that p3 is greater than or equal to p2.
	• The settings of p2 and p3 are valid when p1 = 0, 1, or 2.

FD   Outputs the most recent measured data.

Syntax	FD p1,p2,p3<terminator>
	p1 Output data type
	0 Output the most recent measured data in ASCII format
	1 Output the most recent measured data in BINARY format
	p2 First output channel number
	p3 Last output channel number
Example	Output the most recent measured data from channel 01 to 04 in ASCII format.
	FD 0,01,04
Description	• The most recent measured data indicates the most recent measured data when the recorder receives the FD command.
	• Be sure to set p2 and p3 so that p3 is greater than or equal to p2.

FY   Outputs the most recent data of the periodic printout.

Syntax	FY p1,p2,p3<terminator>
	p1 Output data type
	Inst Output the most recent periodic printout data (instantaneous value)
	p2 First output channel number
	p3 Last output channel number
Example	Outputs the most recent periodic printout data of channel 01 to 04.
	FY Inst,01,04

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FF   Outputs the FIFO data.

Syntax	`FF p1,p2,p3,p4<terminator>`	
	p1	Operation type
	`GET`	Output the data starting from the next to the previous read position
	`RESEND`	Retransmit the previous output
	`RESET`	Set the read position (block) to the most recent acquire position (block)
	`GETNEW`	Output the most recent data
	p2	First output channel number
	p3	Last output channel number
	p4	The upper limit of number of blocks that are to be loaded

        Pen model
          1 to 240
        Dot model
          1 to 60
        If the measured data is less than the specified number of blocks, only the available data is transmitted.

Example   Output two blocks of FIFO data from channels 01 to 06.
`FF GET ,01,06,2`

Description · The FIFO buffer is of a circular type which overwrites from the oldest data when it is full.
    · The FR command is used to set the acquiring interval.
    · There are two FIFO data output formats.
    Logging output (GET)
    Output the specified number of blocks (p4) of FIFO data starting from the next to the previous read position (block).
    Make sure to read the data within the following buffer period to prevent data dropouts.
    Pen model
      FIFO buffer length   240 blocks
      Maximum buffer period 240 intervals
    Dot model
      FIFO buffer length   60 blocks
      Maximum buffer period 60 intervals
    Newest value output (GETNEW)
    Output the specified number of blocks (p4) of FIFO data back starting from the recent acquire position (block).
    · Parameters p2, p3, and p4 are valid when p1 is set to GET or GETNEW.
    · If p4 is omitted, all the data of all blocks acquired in the FIFO buffer are output.
    · Be sure to set p2 and p3 so that p3 is greater than or equal to p2.
    · For the output flow of FIFO data, see appendix 2.

IS   Outputs status information.

Syntax	`IS p1<terminator>`	
	p1	Output status information (0)
Example	Output status information.	
	`IS 0`	

Description The output status can be masked using the status filter (IF command).

FU   Outputs user information.

Syntax	`FU p1<terminator>`	
	p1	Output user information (0)
Example	Output user information.	
	`FU 0`	

Description Outputs the information of the user currently connected to the recorder.

4.8   RS-422A/485 Dedicated Commands

ESC O   Opens the instrument.

The ASCII code of ESC is 1BH.

Syntax   `ESC O p1<terminator:CR+LF>`

           `p1`   Instrument address (01 to 32)

Example   Open the instrument at address 01.

           `ESC O 01`

Description · Specifies the address of the instrument with which to communicate.
- Only one instrument can be opened at any given time.
- When an instrument is opened with the ESC O command, any other instrument that is currently open is automatically closed.
- When this command is received correctly, the recorder transmits the data "ESC 0 xx" (xx: Instrument's address).
- Use CR+LF for the terminator. LF cannot be used.

ESC C   Closes the instrument.

The ASCII code of ESC is 1BH.

Syntax   `ESC C p1<terminator:CR+LF>`

           `p1`   Instrument address (01 to 32)

Example   Close the instrument at address 01.

           `ESC C 01`

Description · Clears the current connection with the instrument.
- When this command is received correctly, the recorder transmits the data "ESC C xx" (xx: Instrument's address).
- Use CR+LF for the terminator. LF cannot be used.

4.9   Maintenance/Test Commands (Available when using the maintenance/test server function via Ethernet communications)

close   Disconnects the connection between other instruments.

Syntax   `close,p1,p2:p3<terminator>`

           `p1`   Port on the recorder side (0 to 65535)

           `p2`   IP address on the PC side (0.0.0.0 to 255.255.255.255)

           `p3`   Port on the PC side (0 to 65535)

Example   `close,34159,192.168.111.24:1054`

           `E0`

Description This command cannot be used to disconnect a server port. Also, it cannot disconnect the recorder being operated. Use the quit command for this purpose.

con   Outputs connection information.

Syntax   `con<terminator>`

Example

```
con
EA
04/10/01 12:34:56

Active connections

Proto Local Address      Foreign Address     State
TCP   192.168.111. 24:34159 192.168.111. 24:1053
                                        ESTABLISHED
TCP   0. 0. 0. 0:34155  0. 0. 0. 0:   0 LISTEN
TCP   0. 0. 0. 0:34159  0. 0. 0. 0:   0 LISTEN
TCP   0. 0. 0. 0:34150  0. 0. 0. 0:   0 LISTEN
EN
```

        `TCP`

          Protocol used.

        `Local Address`

          The recorder's socket address.

          Displays "IP address:port number."

        `Foreign Address`

          The destination socket address.

          Displays "IP address:port number."

        `State`

          Connection status.

        `ESTABLISHED`

          Connection established.

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Commands

eth — Outputs Ethernet statistical information.

Syntax   `eth<terminator>`

Example

```
eth
EA
04/10/01 12:34:56

Ethernet Statistics

Name  In Pkt  In Err  Out Pkt  Out Err  16 Coll
lo0   0       0       0        0        0
mb0   74      0       64       0        0
EN
```

help — Outputs help.

Syntax   `help [,p1]<terminator>`

          `p1` Command name

            (close, con, eth, help, net, quit)

Example

```
help
EA
con       - echo connection information
eth       - echo ethernet information
help      - echo help
net       - echo network status
quit      - close this connection
EN
```

net — Outputs network statistical information.

Syntax   `net<terminator>`

Example

```
net
EA
04/10/01 12:34:56

Network Status

APP: power on time = 00/00/00 12:34:56
APP: applalive     = disable
APP: genedrops     = 0
APP: diagdrops     = 0
APP: ftpsdrops     = 0
TCP: keepalive     = 30 s
TCP: connects      = 14
TCP: closed        = 0
TCP: timeoutdrop   = 0
TCP: keepdrops     = 0
TCP: sndtotal      = 53
TCP: sndbyte       = 0
TCP: sndrexmitpack = 0
TCP: sndrexmitbyte = 1
TCP: rcvtotal      = 0
TCP: rcvbyte       = 0
DLC: 16 collisions = 0
EN
```

`TCP: keepalive`
    Keepalive check cycle.

`TCP: connects`
    Total number of connections established.

`TCP: closed`
    Total number of dropped connections.

`TCP: timeoutdrop`
    Total number of dropped connections due to TCP retransmission timeout. When the transmitted packet (the unit of transmitted data) is not received, the packet is automatically retransmitted at a predetermined time interval. If the packet is not received after 14 retransmissions, timeout occurs and the connection is dropped.

`TCP: keepdrops`
    Total number of dropped connections due to TCP keepalive timeout.

`TCP: sndtotal`
    Total number of transmitted packets.

`TCP: sndbyte`
    Total number of transmitted bytes.

`TCP: sndrexmitpack`
    Total number of retransmitted packets.

`TCP: sndrexmitbyte`
    Total number of retransmitted bytes.

`TCP: rcvtotal`
    Total number of received packets.

`TCP: rcvbyte`
    Total number of received bytes.

`DLC: 16 collisions`
    Number of collision incidents. A collision occurs when two or more instruments on the network attempt to transmit simultaneously. The tendency for collisions to occur increases when the network is congested. 16 collisions would mean 16 consecutive collision incidents.

quit — Disconnects the connection of the instrument being operated

Syntax   `quit<terminator>`

4.10 Instrument Information Output Commands (Available when using the instrument information server function via Ethernet communications)

The instrument information server function interprets one UDP packet to be one command and returns a single packet (containing the recorder's information) in response to the command.

Port number	34264/udp
	(see section 2.1)
Transfer data	ASCII
Received buffer length	128
Transmit buffer length	512
Maximum number of parameters	32

In the command packet, parameters corresponding to the desired information are placed one after another.

Parameter	Description
serial	Outputs the serial number.
host	Outputs the host name (the host name specified in section 2.3).
ip	Outputs the IP address (the IP address specified in section 2.3).

Example   Query the IP address and host name. (Of the two frames below, the top frame represents the command packet, the bottom frame represents the response packet.)

```
ip host
```

```
EA
ip = 192.168.111.24
host =  ABC
EN
```

Description • Separate each parameter with one or more blanks (space, tab, carriage return, line feed).
 • Parameters are not case sensitive.
 • Undefined parameters are ignored.
 • Parameters beyond the 32nd parameter are ignored.

4

Commands

5.1   Response Syntax

The following table shows the types of responses for various commands described in the previous chapter.

The recorder returns a response (affirmative/negative response) to a command that is separated by a single terminator. The controller should follow the one command to one response format.

Function	Command		Response	
		Command Type	**Affirmation**	**Negation**
Setting/Measurement server	**Setting command**		**Affirmative response**	**Single negative response or Multiple negative responses**
	Basic setting command			
	Control command			
	Output command	**Setup and measured data output**	**ASCII output**	
			BINARY output	
		RS-422A/485 dedicated	Dedicated response	No response
Maintenance/Test Server	**See section 4.9.**			
Instrument Information server	**See section 4.10.**			

Note

The "*CRLF*" used in this section denotes a terminator.

Affirmative Response

When the command is processed correctly, an affirmative response is returned.

● **Syntax**

E0*CRLF*

● **Example**

E0

Single Negative Response

When the command is not processed correctly, a single negative response is returned.

● **Syntax**

E1_nnn_mmm•••m*CRLF*

    nnn   Error number (001 to 999)

    mmm•••m   Message (variable length, one line)

    _   Space

● **Example**

E1 001 "System error"

Multiple Negative Responses

· If there is an error in any one of the multiple commands that are separated by sub delimiters, multiple negative responses are returned.

· The response is generated for each erroneous command.

· If there are multiple commands that have errors, the negative responses are separated by commas.

· The error position number is assigned to the series of commands in order starting with "1" assigned to the first command.

● **Syntax**

E2_ee:nnn*CRLF*   (When there is only one error)

E2_ee:nnn,ee:nnn,•••,ee:nnn*CRLF*   (When there are multiple errors)

    ee   Error position (01 to 10)

    nnn   Error number (001 to 999)

    _   Space

5

Responses

● **Example**

```
E2 02:001
```

ASCII Output

The following types of ASCII data are available. For the data formats, see section 5.2.
Setting data, basic setting data, decimal position/unit information, measured data,
status information, and user information

● **Syntax**

EA*CRLF*

•••••••••••••••*CRLF*

　　：

•••••••••••••••*CRLF*

•••••••••••••••*CRLF*

EN*CRLF*

BINARY Output

● **Conceptual Diagram**
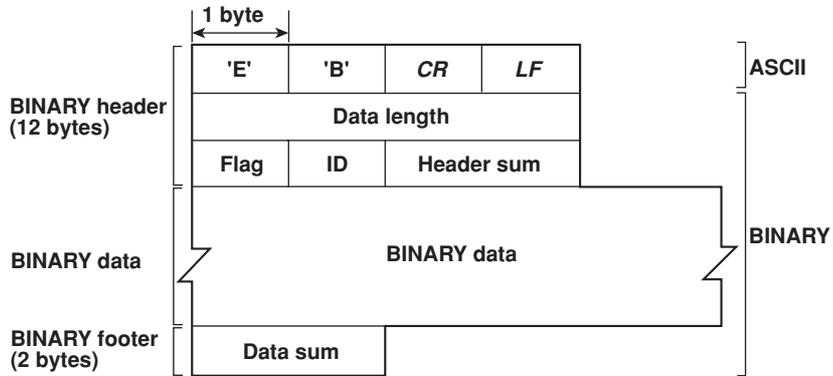
● **EB*CRLF***

Indicates that the data is BINARY.

● **Data Length**

The byte value of "flag + identifier + header sum + BINARY data + data sum."

● **Header Sum**

The sum value of "data length + flag + identifier."

● **BINARY Data**

For the output format of various data types, see section 5.3.

● **Data Sum**

The sum value of "BINARY data."

Note

The data length of the BINARY header section is output according to the byte order specified
with the BO command.

● **Flag**

Bit	Name (Abbreviation)	Flag 0	Flag 1	Meaning of the Flag
7	BO	MSB	LSB	Output byte order
6	CS	No	Yes	Existence of a checksum
5	–	–	–	
4	–	–	–	
3	–	–	–	
2	–	–	–	
1	–	–	–	
0	Reserved	–	–	Fixed to 1.

- When the BO flag is "0," the MSB is output first. When the BO flag is "1," the LSB is output first.
- If the check sum is enabled (parameter = 1) using the CS command parameter, each sum value is inserted in the header sum and data sum sections in the "Conceptual Diagram" on the previous page. If the check sum is disabled (parameter = 0), a zero is inserted in the header sum and data sum sections. For a sample program that calculates the sum value, see "Calculating the Sum Value" below.
- The bits that have "–" for the flag and flag are not used. The value is undefined.

● **Identifier**

ID Number	Binary Data Type	Format
0	Undefined file	–
1	Measured data	Section 5.3
1	FIFO data	Section 5.3
10	Setup data file	Undisclosed

- The table above shows the different types of BINARY Data.
- Measured data can be output using the FD command.
- FIFO data can be output using the FF command.
- The setup data file can be output using the FE command.
- The identifier section in the "Conceptual diagram" on the previous page contains the ID number shown above.

Note

BINARY data that are not indicated in the above table are considered undefined files.

● **Calculating the Sum Value**

If you set the parameter of the CS command to "1 (enabled)," the checksum value is output only during serial communications. The check sum is the same as that used in the TCP/IP and is derived according to the following algorithm.

Buffer on Which the Sum Value Is Calculated

- For the header sum, it is calculated from "data length + flag + identifier" (fixed to 6 bytes).
- For the data sum, it is calculated from "BINARY data."
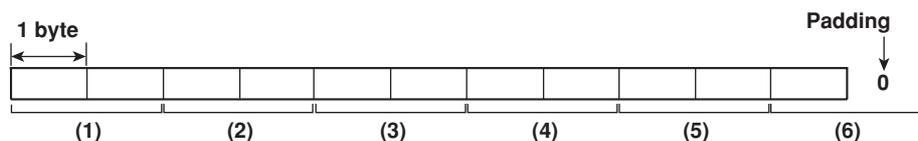
If the data length of the buffer is odd, a "0" is padded so that it is even. (1) through (6) are summed as unsigned two-byte integers (unsigned short). If the digit overflows a "1" is added. Finally, the result is bit-wise inverted.

Sample Program
The sum value is determined using the following sample program, and the calculated result is returned. The sum determined by the sample program can be compared with the header sum of the output BINARY header section and the data sum of the output BINARY footer section.

```
/*
 * Sum Calculation Function (for a 32-bit CPU)
 *
 * Parameters  buff: Pointer to the top of the data on which the sum is calculated
 *             len:  Length of the data on which the sum is calculated
 * Return value:     Calculated sum
 */

int cksum(unsigned char *buff, int len)
{
  unsigned short *p;        /* Pointer to the next two-byte data word in the buffer
                               that is to be summed. */
  unsigned int   csum;      /* Checksum value */
  int    i;
  int    odd;
  csum = 0;                 /* Initialize. */
  odd = len%2;              /* Check whether or not the number of data points is
                               even. */
  len >>= 1;                /* Determine the number of data points using a
                               "short" data type. */
  p = (unsigned short *)buff;

  for(i=0;i<len;i++)        /* Sum using an unsigned short data type. */
   csum += *p++;

  if(odd){                  /* When the data length is odd */
   union tmp{               /* Pad with a 0, and add to the unsigned short data.
                               */
   unsigned short s;
   unsigned char   c[2];
   }tmp;
   tmp.c[1] = 0;
   tmp.c[0] = *((unsigned char *)p);
   csum += tmp.s;
  }

  if((csum = (csum & 0xffff) + ((csum>>16) & 0xffff)) > 0xffff)
                            /* Add the overflowed digits */
   csum = csum - 0xffff;/* If the digit overflows again, add a 1. */

  return((~csum) &  0xffff); /* bit inversion */
}
```

RS-422A/485 Dedicated Commands and Responses

The following table shows dedicated commands for the RS-422A/485 interface and their responses.

Command Syntax	Meaning	Response
ESC O_xx *CRLF*	Open the instrument.	• Response from the instrument with the specified address
		ESC O xx *CRLF*
(⎵ space)		• Response when the instrument with the specified address does not exist*
ESC C_xx *CRLF*	Close the instrument.	• Response from the instrument with the specified address
		ESC C xx *CRLF*
(⎵ space)		• Response when the instrument with the specified address does not exist*

*   The causes that the condition become "The instrument with the specified address does not exist" is such as a command error, the address not matching that of the instrument, the instrument is not turned ON, and the instrument not being connected via the serial interface.

• The "xx" in the table indicates the instrument's address. Specify the address that is assigned to the instrument from 01 to 32.
• Only one instrument can be opened at any one time.
• When an instrument is opened with the ESC O command, all commands on the instrument become active.
• When an instrument is opened with the ESC O command, any other instrument that is open is automatically closed.
• Use CR+LF for the terminator. LF cannot be used.

Note

• The ASCII code of ESC is 1BH.

5

Responses

5.2 Output Format of ASCII Data

The following types of ASCII data are available.
- Setting data/Basic Setting data
- Decimal point position/unit information
- Measured data
- Status information
- User information

Note

The "*CRLF*" used in this section denotes a terminator.

Setting/Basic Setting data
- The FE command (FE0 or FE2) is used to output the data.
- The setting/basic setting data are output in the order of the listed commands in the table in section 4.2, "A List of Commands." However, the setting information for the following commands is not output.
  - Setting commands
    SD, CM, and FR
  - Basic Setting commands
    YE and XE
- The output format of the setting/basic setting data is the same as the syntax of each command.
- Some commands are output in multiple lines. (Example: Commands that are specified for each channel.)

● **Syntax**

The two-character command name and the succeeding parameters are output in the following syntax.

EA*CRLF*
ttsss•••s*CRLF*
•••••••••••••
EN*CRLF*

    tt   Command name (SR, SA•••, XA, XI•••)
    sss•••s Setting, basic setting data (variable length, one line)

● **Example**

EA
SR01,VOLT,20mV,0,20
SR02,VOLT,20mV,0,20
•••••••••••••••••
EN

Decimal Point Position/Unit Information

· The FE command (FE1) is used to output the data.

● **Syntax**

The data is output for each channel in the following syntax.

```
EACRLF
s_kccuuuuuu,ppCRLF
• • • • • • • • • • • • • • • • •
ENCRLF
```

s	Data status (N, D, S)
	N: Normal
	D: Differential input
	S: Skip (When the input range is set to SKIP)
k	Channel type
	0: Measurement channel
cc	Channel number (01 to 06)
uuuuuu	Unit information (6 characters, left-justified)
	mV_____: mV
	V_____: V
	^C____: °C
	xxxxxx: (User-defined character string)
pp	Decimal point position (00 to 04)
	No decimal (00000) for 00.
	One digit to the right of the decimal (0000.0) for 01.
	Two digits to the right of the decimal (000.00) for 02.
	Three digits to the right of the decimal (00.000) for 03.
	Four digits to the right of the decimal (0.0000) for 04.
_	Space

● **Example**

```
EA
N 001mV   ,01
N 002mV   ,01
EN
```

Measured Data

- The FD (FD0) or FY (FYInst) command is used to output the data.

● **Syntax**

The measured data are output in the following syntax along with the date and time information for each channel

EA*CRLF*
DATE_yy/mo/dd*CRLF*
TIME_hh:mi:ss.mmmt_$S_1S_2S_3S_4S_5S_6$*CRLF*
s_kcca$_1$a$_2$a$_3$a$_4$uuuuuuf$_1$dddddEf$_2$pp*CRLF*
● ●
EN*CRLF*

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mi	Minute (00 to 59)
ss	Second (00 to 59)
mmm	Millisecond (000 to 999. A period is placed between seconds and milliseconds.)
t	'S'(=summer) or ' ' space(=winter)
$S_1S_2S_3S_4S_5S_6$	Data status
	All spaces
s	Channel data status (N, D, S, O, B, E)
	N: Normal
	D: Differential input
	S: Skip
	O: Over
	B: Burnout
	E: Error
k	Channel type
	0: Measurement channel
cc	Channel number (01 to 06)
a$_1$a$_2$a$_3$a$_4$	a$_1$ Alarm status (level 1)
	a$_2$ Alarm status (level 2)
	a$_3$ Alarm status (level 3)
	a$_4$ Alarm status (level 4)
	Each status is set to H, L, h, l, or space.
	H: high limit alarm, L: low limit alarm, h: difference high-limit alarm, l: difference low-limit alarm, space: no alarm
uuuuuu	Unit information (6 characters, left-justified)
	mV_____: mV
	V_____: V
	^C_____: °C
	xxxxxx: (User-defined character string)
f$_1$	Sign (+, −) of mantissa
	· Positive over data, error data, and the burnout data when "up" is specified are positive.
	· Negative over data and the burnout data when "down" is specified are negaitive.

`ddddd`	Mantissa (00000 to 99999, 5 digits)
	· For error data (channel data status is E), over data (channel data status is O), or burnout data (channel status data is B), the mantissa is set to 99999.
f_2	Sign (+, −) of exponent
`pp`	Exponent (00 to 04)
_	Space

● **Example**

```
EA
DATE 99/02/23
TIME 19:56:32.500
N 001h   mV    +12345E-03
N 002    mV    -12345E-01
S 003
EN
```

Note ───────────────────────────────────────

· Data for non-existing channels are not output (not even the channel number).
· For channels set to skip, output values from alarm status to exponent are spaces.

Status Information

- The IS command is used to output the data.
- The operation status of the recorder is output
- For details on the status information, see section 6.2, "The Bit Structure of the Status Information."

● **Syntax**

EA*CRLF*
ddd.ccc.bbb.aaa*CRLF*
EN*CRLF*

aaa	Status information 1 (000 to 255)
bbb	Status information 2 (000 to 255)
ccc	Status information 3 (000 to 255)
ddd	Status information 4 (000 to 255)

● **Example**

EA
000.000.032.000
EN

User Information

- The FU command is used to output the data.
- User name, user level, and other information are output.

● **Syntax**

EA*CRLF*
p_l_uuu•••u*CRLF*
EN*CRLF*

p	Physical layer
	E: Ethernet
	S: RS-422A/485
l	User level
	A: Administrator
	U: User
uuu•••u	User name (up to 16 characters)
_	Space

● **Example**

EA
E A admin
EN

5.3 Output Format of BINARY Data

This section describes the output format of the BINARY data that is disclosed. For the BINARY output format, see "BINARY Output" on page 5-2. For other BINARY data types, see "Identifier" on page 5-3.

The measured data is output using signed 16-bit integer. These integers can be understood as physical values by adding the decimal point and the unit.

Typical Examples to Obtain Physical Values

BINARY Value	Decimal Position Code	Physical Value (Measured Value)
10000	0	10000
10000	1	1000.0
10000	2	100.00
10000	3	10.000
10000	4	1.0000

Measured Data and FIFO Data

- The FD (FD1) command is used to output the most recent measured data.
- The FF (FEGET, FERESEND, and FEGETNEW) command is used to output the FIFO data. The decimal point position and unit can be determined using the FE command.
- The ID number of the output format is 1. See "Identifier" on page 5-3.
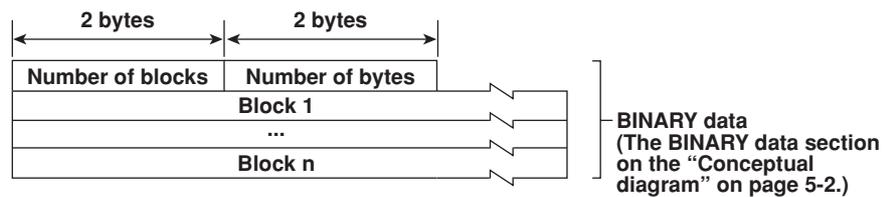
● **Number of Blocks**

This is the number of blocks.

● **Number of Bytes**

This is the size of one block in bytes.

● **Block**

1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes	1 byte	1 byte
Year	Month	Day	Hour	Minute	Second	Millisecond	(Reserved)*	Flag
Measured	Channel	A2A1	A4A3	Measured data				
...	...	...	...	...				
...	...	...	...	...				

* The sections indicated as (Reserved) are not used. The value is undefined.

· **Flag**

The meanings of the flags are given on the table below. The flags are valid during FIFO data output. The flags are undefined for other cases.

Bit	Flag 0	Flag 1	Meaning of the Flag
6	–	–	
5	–	–	
4	–	–	
3	–	–	
2	No	Yes	Indicates that the decimal position or unit information was changed during measurement.
1	No	Yes	Indicates that the FIFO acquiring interval was changed during measurement.
0	No	Yes	Indicates that the internal process took too much time and that FIFO dropout occurred.

The bits that have "–" for the flag column are not used. The value is undefined.

· **Block Member**

Name	BINARY Value
Year	0 to 99
Month	1 to 12
Day	1 to 31
Hour	0 to 23
Minute	0 to 59
Second	0 to 59
Millisecond	0 to 999
DST	1 (=summer) or 0 (=winter)
Unit	00H: measurement
Channel	01 to 06
Alarm status* A1 (Bit 0 to 3) A2 (Bit 4 to 7) A3 (Bit 0 to 3) A4 (Bit 4 to 7)	0 to 4
Measured data	0 to FFFFH

* BINARY value 0 to 4 is entered in the upper and lower 4 bits of a byte (8 bits) for the alarm status. The binary values 0 to 4 correspond to H (high limit alarm), L (low limit alarm), h (difference high-limit alarm), and l (difference low-limit alarm) as follows:
0: no alarm, 1: H, 2: L, 3: h, 4: l.

● **Special Data Value**

The measured data take on the following values under special conditions.

| Special Data Value	Measured Data
+ Over	7FFFH
– Over	8001H
Skip	8002H
Burnout (when "up" is set)	7FFAH
Burnout (when "down" is set)	8006H
Error	8004H
Undefined	8005H

Note

The number of blocks, number of bytes, and measured data are output according to the byte order specified with the BO command.

6.1   Status Information and Filter

The following figure illustrates the status information and filter on the recorder.

4 bytes

| 4 | 3 | 2 | 1 | **Status information** |

| | | | | | | | | **Filter** |

| 4 | 3 | 2 | 1 | **Condition register** |
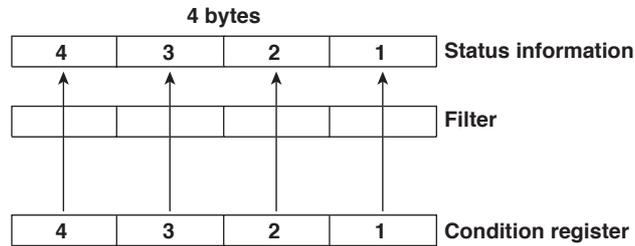
- When a status indicated on the following page is entered, the corresponding bit in the condition register is set to "1." The logical AND of the condition register and the filter becomes the status information.
- The IF command can be used to set the filter.
- The IS command is used to output the status information. Status information 1 and 2 are cleared when they are output. Status information 3 and 4 are not cleared when it is output, and remains at "1" while the event is occurring.
- When multiple connections are up, filters can be specified for the individual connection. Therefore, the status information can be held for each connection.

6

Status Information

6.2 The Bit Structure of the Status Information

The following four groups of status information are output in response to a status information output request using the IS command. For the output format, see "Status Information" in section 5.2, "Output Format of ASCII Data."

Status Information 1

Bit	Name	Description
0	A/D conversion complete	Set to "1" when the A/D conversion of the measurement is complete.
1	–	–
2	Periodic printout timeout	Set to "1" when the periodic printout timer expires.
3	–	–
4	–	–
5	–	–
6	–	–
7	–	–

Status Information 2

Bit	Name	Description
0	Measurement drop	Set to "1" when the measurement process could not keep up.
1	Decimal point/unit information change	Set to "1" when the decimal point/unit information is changed.
2	Command error	Set to "1" when there is a command syntax error.
3	Execution error	Set to "1" when an error occurs during command execution.
4	–	–
5	–	–
6	–	–
7	–	–

Status Information 3

Bit	Name	Description
0	–	–
1	–	–
2	–	–
3	–	–
4	–	–
5	Chart feeding	Set to "1" while the chart is being fed through the panel key.
6	–	–
7	–	–

Status Information 4

Bit	Name	Description
0	Basic setting	Set to "1" during Basic Setting mode.
1	Recording	Set to "1" while recording is in progress.
2	–	–
3	Alarm generating	Set to "1" while the alarm is occurring.
4	–	–
5	–	–
6	–	–
7	–	–

Appendix 1   ASCII Character Codes

The table below shows characters each command can use.

Command	Used for	Characters
SN	Unit	Alphanumeric characters, signs, and space
ST	Tag	Alphanumeric characters, signs, and space
SG	Message	Alphanumeric characters, signs, and space
YB	Host/Domain name	Alphanumeric characters and signs
YN	Domain suffix	Alphanumeric characters and signs

The table below contains the ASCII character codes of characters that can be used.

English

Note

"μ", "Ω", "²", "³" , and "° " are assigned to character codes as follows:

μ: 7BH ({), Ω 7CH (|), ²: 7DH (}), ³: 7EH (~) , ° : 5EH (^)

Characters in the parentheses are the characters assigned on the keyboard.

Lower / Upper	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
20	SP			#		%			(	)	∗	+		−	.	/
30	0	1	2	3	4	5	6	7	8	9						
40	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
50	P	Q	R	S	T	U	V	W	X	Y	Z				°	
60		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
70	p	q	r	s	t	u	v	w	x	y	z	μ	Ω	²	³	

German and French

Note

"Ω" is assigned to character code as follows:

Ω 7CH (|)

The character in the parentheses is the character assigned on the keyboard.

Lower / Upper	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
20	SP			#		%			(	)	∗	+		-	.	/
30	0	1	2	3	4	5	6	7	8	9						
40	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
50	P	Q	R	S	T	U	V	W	X	Y	Z				\	
60		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
70	p	q	r	s	t	u	v	w	x	y	z		Ω			
A0																
B0	°		²	³		μ										
C0					Ä			Ç					Ë			Ï
D0							Ö							Ü		ß
E0	à		â		ä			ç	è	é	ê	ë			î	ï
F0					ô		ö			ù		û	ü			

☐ Only German
☐ Only French

App

Appendix

Appendix 2   Output Flow of FIFO Data

The recorder has a dedicated internal memory for outputting measured data. This memory is structured as a FIFO (First-In-First-Out). Measured data are constantly acquired to the internal memory at the specified acquiring interval (FIFO acquiring interval, set with the FR command). By using this function, it is possible to read measured data that have been saved at the specified intervals regardless of the frequency at which the PC periodically reads the measured data.

The following example shows the case when the acquiring interval is 1 s and the buffer capacity is for 8 intervals.

Block 1
2
3
Previous read Position: RP1 → 4
5
Current read Position: RP2 → 6 ← Most recent acquire Position: WP
7
Block 8
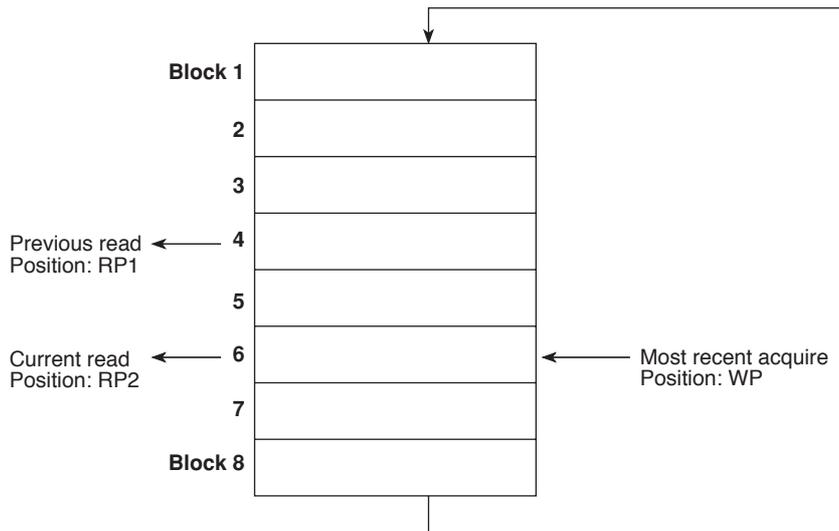
- **Acquiring of the measured data**
    - The measured data are acquired to the internal memory at 1 s intervals.
    - Measured data are acquired to blocks 1 through 8 in order. After acquiring to block 8, the next acquiring operation returns to block 1.

- **Reading the measured data (FF GET command is used, logging output)**
  Outputs the data from the next to the previous read position (RP1) to the most recent acquire position (WP).
  In this example, more than 2 s has elapsed from the previous read operation.
  Therefore, data in blocks 5 and 6 are output.

- **Reading the measured data (FF GETNEW command is used, output of the most recent value)**
  Output the specified number of blocks of FIFO data back starting from the recent acquire position (WP).
  In this example, if you specify the number of blocks to "5," data in blocks 2 to 6 are output.

The buffer capacity varies depending on the model.
    Pen model: 240 intervals (30 s at an acquiring interval of 125 ms)
    Dot model: 60 intervals (60 s at an acquiring interval of 1 s)

Example in which the FIFO acquiring interval on the recorder is set to 1 s and the measured data from channel 01 to 06 are continuously output (logging function)

```
                                                    ┌──────────┐
                                                    │          │  Command to send
                              ┌─────────┐           └──────────┘
                              │  START  │           ╭─         ─╮
                              └─────────┘           (           )  Command description
                                   │                ╰─         ─╯
                                   ▼                ┌ ─ ─ ─ ─ ─ ┐
                          ╭─────────────╮              Received response data
                          ( Send command)           └ ─ ─ ─ ─ ─ ┘
                          ╰─────────────╯
                          ┌─────────────┐    ╭
                          │ FF RESET    │     (Move the FIFO read position to the most recent acquire position.)
                          └─────────────┘    ╰
                          ╭─────────────╮
                          (Receive response)
                          ╰─────────────╯
                          ┌ ─ ─ ─ ─ ─ ─ ┐
                          │ E0          │
                          └ ─ ─ ─ ─ ─ ─ ┘
                                   │
          ┌────────────────────────┤
          │                        ▼
          │              ┌──────────────────┐
          │              │ Wait for the FIFO│
          │              │ acquiring interval (1 s)│
          │              └──────────────────┘
          │                        │
          │              ╭─────────────╮
          │              ( Send command)
          │              ╰─────────────╯
          │              ┌─────────────┐    ╭
          │              │ FF GET,01,06│     (Output the measured data using the FIFO.)
          │              └─────────────┘    ╰
          │              ╭─────────────╮
          │              (Receive response)  BINARY (see page 5-2 and 5-11)
          │              ╰─────────────╯
          │              ┌ ─ ─ ─ ─ ─ ─ ─ ┐
          │              │ ┌─────────────┐ │
          │              │ │BINARY header│ │
          │              │ ├─────────────┤ │
          │              │ │BINARY data  │ │
          │              │ │             │ │
          │              │ ├─────────────┤ │
          │              │ │BINARY footer│ │
          │              │ └─────────────┘ │
          │              └ ─ ─ ─ ─ ─ ─ ─ ┘
          │                        │
          │  NO                    ▼
          └──────────────◇─────────────────◇
                          ╲ Stop measurement? ╱
                            ◇───────────────◇
                                   │ YES
                                   ▼
                              ┌─────────┐
                              │   END   │
                              └─────────┘
```

Note

-   The FIFO acquiring interval must be set using the FR command beforehand.
-   The FIFO acquiring interval applies to both serial and Ethernet communications.

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Appendix

Appendix 3　　Login Procedure

When using the Setting/Measurement server or the Maintenance/Test server via the Ethernet interface (/C7 option), you must log into the recorder from the PC. If you complete the procedure successfully up to login complete in the following figure, the commands in chapter 4 become functional.

When using the login function
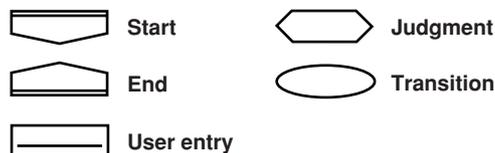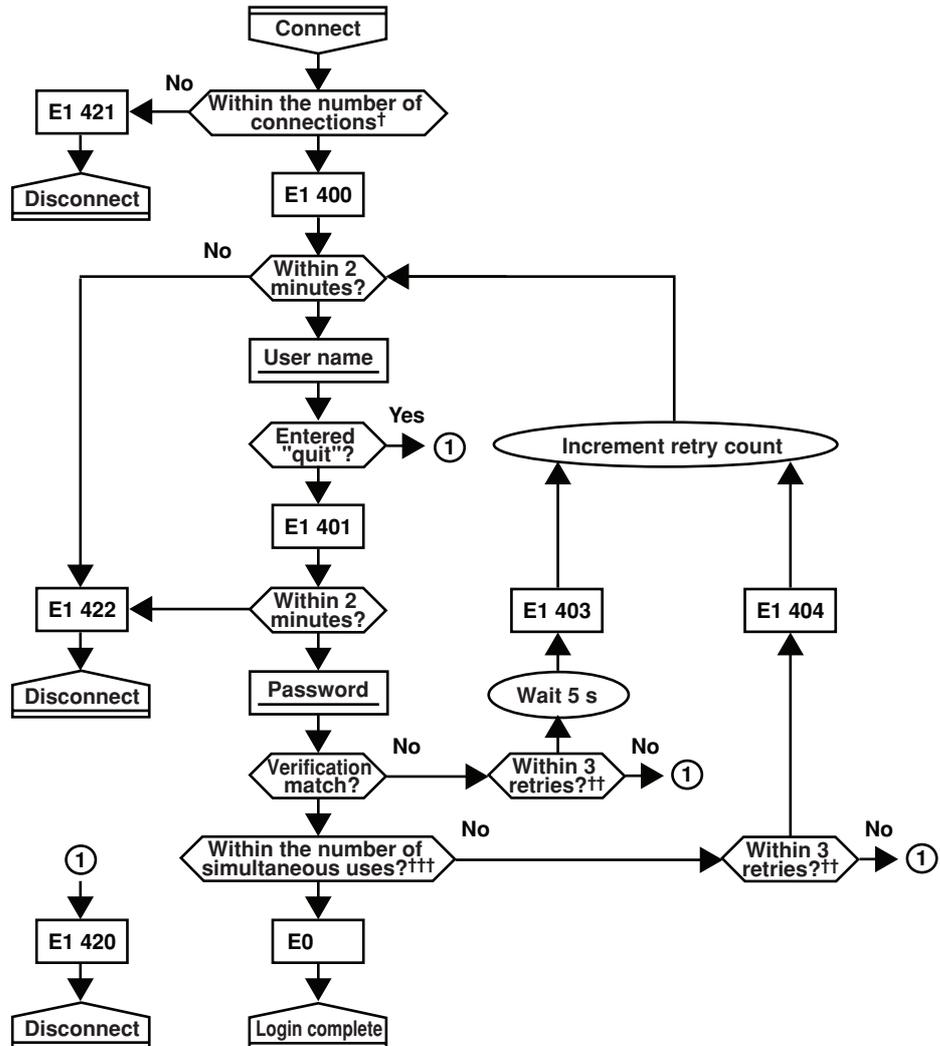
† Connections cannot exceed the maximum number of connections (see section 2.1).
†† If you attempt to log in using a wrong password four consecutive times, the communication is dropped (the number of retries for login is three).
††† If you attempt to log in causing the number of simultaneous uses at the administrator or user level to be exceeded (see section 2.1) four consecutive times, the communication is dropped (even if the password is correct).

When not using the login function

Login as "admin" or "user."
- The user name "admin" can be used to login to the recorder as an administrator.
- The user name "user" can be used to access the recorder as a user.

App
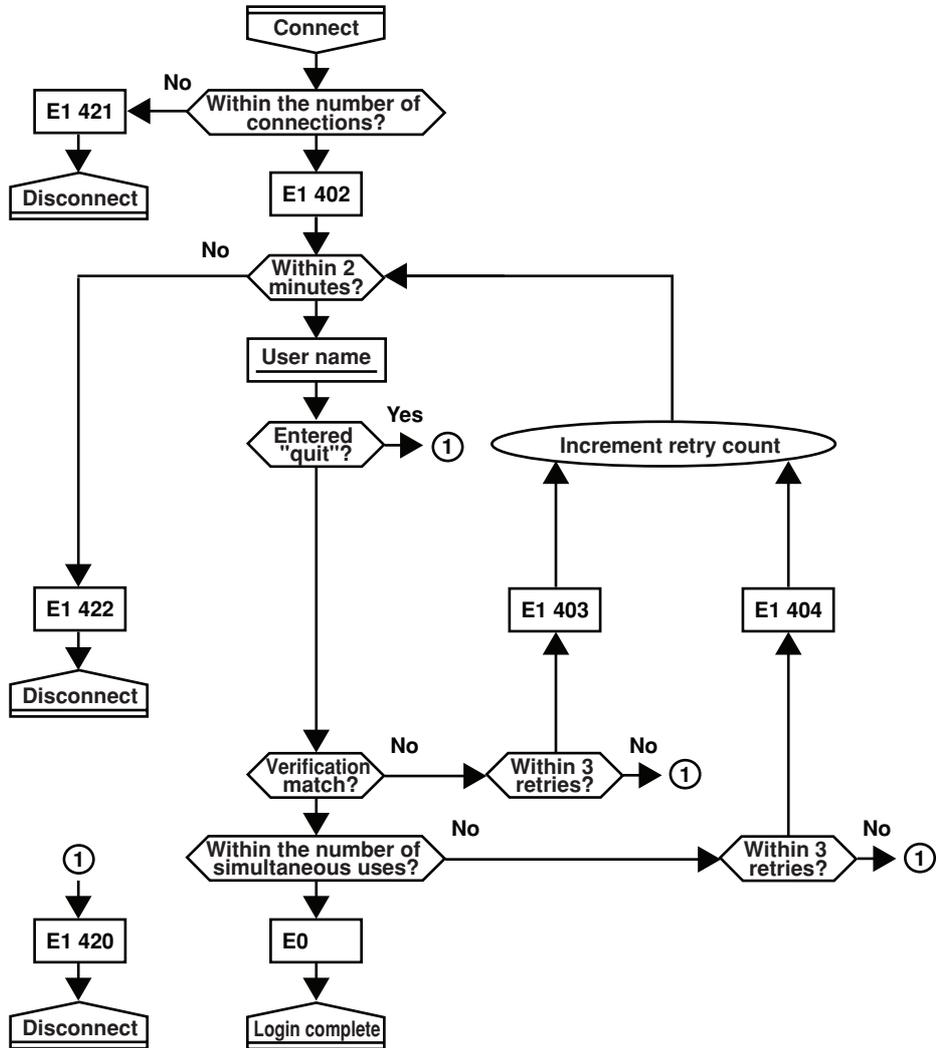
Appendix

Appendix 4   Communication Commands on the SR10000 and the SR1000

The communication commands on the SR10000 conform to the specifications of the DX series paperless recorders and are different from the conventional SR1000. The main differences are described below.

1. The command/response operation is different.

2. Output format specifications
    2-1 The procedure to switch the data output mode of the output format (ASCII or binary) is not necessary.
    2-2 The output format details have been changed.

3. New commands have been added. There are changes to the command details as a result of new functions that have been added.

1. Command/Response Operation

The structure of the command syntax is the same as shown below.

A command consists of a command name (two characters), parameters, delimiters, and a terminator in ASCII code.

Example) SR 01,VOLT,20mV,0,10000<terminator>
         ↑   ↑
         Command name   Parameters and delimiters

The operation of the response is different as follows:

After receiving a command and processing the command, the SR10000 always returns a response (affirmative/negative response) and notifies the status. Therefore, the PC must read this response. Conventionally, the response was returned in a status check command.

(For details, see section 5.1.)

2. Output Format Specifications

2-1 The procedure to switch the data output mode of the output format (ASCII or binary)

The procedure below was used to output the measured or setting values on the SR1000. However, the command has been simplified on the SR10000. The procedure is executed by sending an output request command directly.
(The transmission of the TSx and ECS T commands to switch the data output mode is not necessary.)

On the SR1000

Command sequence: TSx, ECS T, and output request command

On the SR10000

Command sequence: Output request command

2-2 Output format

The data output syntax is different on the SR10000. The data is output in the order header, data, and footer. In addition, the output data format is different.
For details, see sections 5.2 and 5.3 as well as chapter 3 in the *SR1000 Recorder/ C3RS-422-A Instruction Manual*   .)

Example)   When the setup data is output (ASCII data output)

```
EA   ←─────────────── Header
SR01,VOLT,20mV,0,20  ⎫
.................    ⎬ Setup data
EN   ←─────────────── Footer
```

3. New Commands

New commands have been added on the SR10000. In addition, the range of settings that can be specified via communication on the SR10000 has been expanded. (For example, remote control function and periodic printout interval settings. For details, see section 4.2.)

The following SR1000 commands in the table are the same on the SR10000.

Setting command	Control command
SN	PS
SC	MP
SD	LS
ST	SU
SG	MS
SZ	MC
SP	BO
SE	

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