
User's Manual

Models RD-MV1004/RD-MV1006/RD-MV1008/RD-MV1012/
RD-MV1024
RD-MV2008/RD-MV2010/RD-MV2020/RD-MV2030/
RD-MV2040/RD-MV2048

RD-MV1000/RD-MV2000 Communication Interface

Foreword

Thank you for purchasing the RD-MV1000/RD-MV2000 (hereafter referred to as the MV). This Communication Interface User's Manual contains information about the Ethernet and serial interface communication functions. To ensure correct use, please read this manual thoroughly before beginning operation.

Keep this manual in a safe place for quick reference in the event a question arises. The following manuals, including this one, are provided as RD-MV1000/RD-MV2000 manuals. Please read all of them.

• Electronic Manuals Provided on the Accompanying CD-ROM

Manual Title	Manual No.	Description
RD-MV1000 First Step Guide	IM RD-MV1000-02E	Explains how to set up the RD-MV1000 for making measurements using the quick settings function. Connection diagrams are also provided to help you with the setup.
RD-MV2000 First Step Guide	IM RD-MV2000-02E	Explains how to set up the RD-MV2000 for making measurements using the quick settings function. Connection diagrams are also provided to help you with the setup.
RD-MV1000/RD-MV2000 User's Manual	IM RD-MV1000-01E	Explains all functions except communication functions and procedures of the RD-MV1000 and RD-MV2000.
RD-MV1000/RD-MV2000 Communication Interface User's Manual	M-4662	Explains the RD-MV1000 and RD-MV2000 Ethernet and serial interface communication functions.
DAQSTANDARD User's Manual	IM 04L41B01-61E	Explains the functions and operating procedures of DAQSTANDARD.

• Paper Manuals

Manual Title	Manual No.	Description
RD-MV1000 First Step Guide	IM RD-MV1000-02E	This guide is also provided in the CD-ROM.
RD-MV2000 First Step Guide	IM RD-MV2000-02E	This guide is also provided in the CD-ROM.
RD-MV1000/RD-MV2000 Control of Pollution Caused by the Product	IM RD-MV1000-91C	Provides information about pollution control.

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.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest Omega dealer.
- Copying or reproducing all or any part of the contents of this manual without Omega's permission is strictly prohibited.
- The TCP/IP software of this product and the document concerning the TCP/IP software have been developed/created by **OMEGA** based on the BSD Networking Software, Release 1 that has been licensed from the Regents of the University of California.

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Revisions

- 1st Edition: December 2007

How to Use This Manual

The following symbols are used in this manual.

Unit

- k stands for 1000. Example: 5 kg, 100 kHz
- K stands for 1024. Example: 640 KB

Markings

The following safety notations 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.

Bold Characters

Bold characters are used to indicate text that appears on the screen or operation keys. The ♦ symbol indicates key and menu operations.

Procedural Explanations

This manual mainly describes the RD-MV1000 procedures. Where procedures differ between the RD-MV2000 and RD-MV1000, the RD-MV2000 procedures are also provided.

High-Speed and Medium-Speed Model Groupings

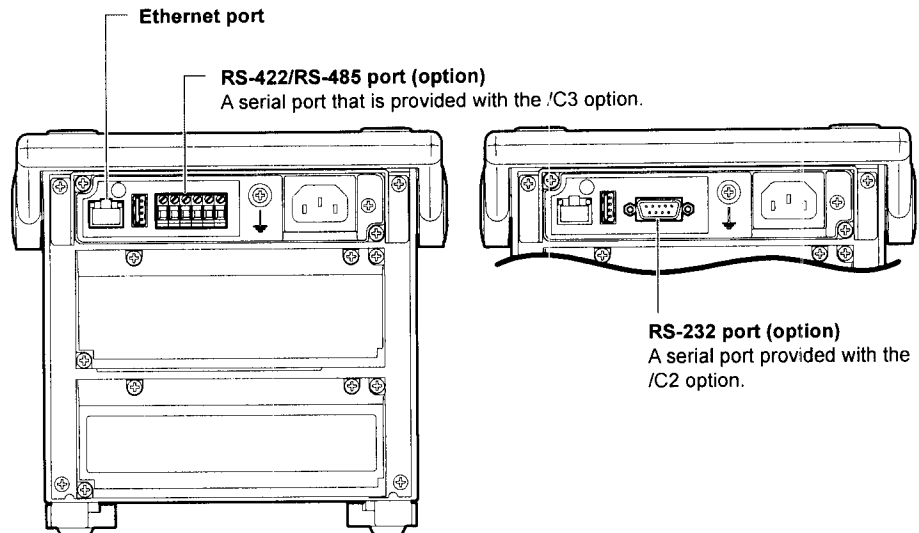
This manual uses the terms *high-speed input model* and *medium-speed input model* to distinguish between MV models as follows:

Model Type	Model
High-speed input model	RD-MV1004, RD-MV1008, and RD-MV2008
Medium-speed input model	RD-MV1006, RD-MV1012, RD-MV1024, RD-MV2010, RD-MV2020, RD-MV2030, RD-MV2040, and RD-MV2048

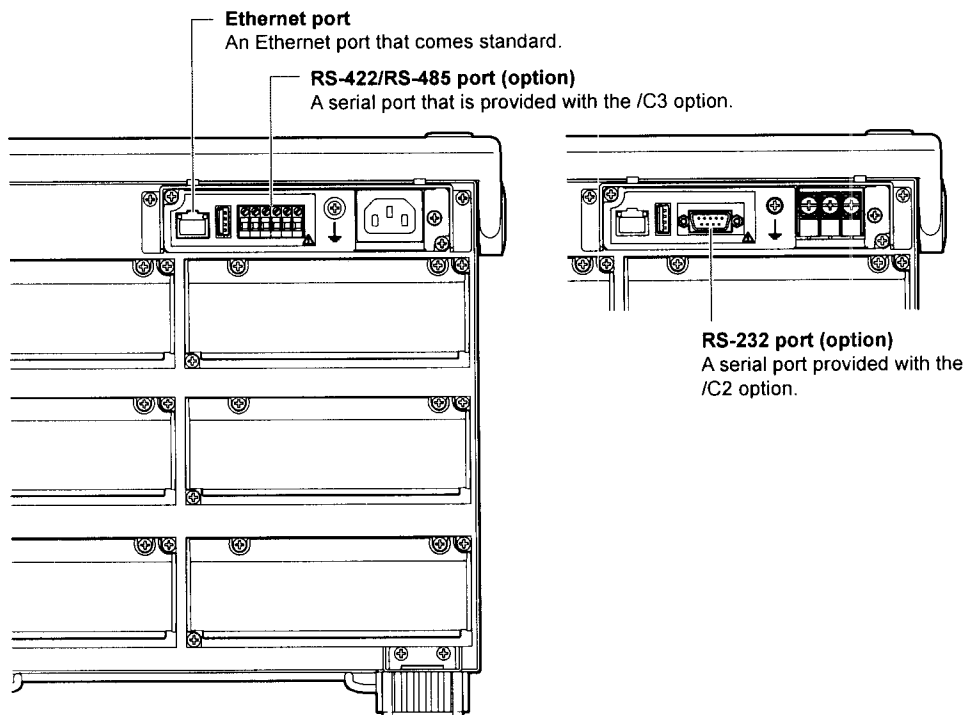
Communication Ports

Rear Panel

RD-MV1000



RD-MV2000



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1.1 Ethernet Interface

This chapter gives an overview of the MV Ethernet communication functions.

Modbus Communications

The MV can connect to a Modbus device and read and write to the device's internal registers. See section 1.3 for details.

Setting/Measurement Server

- You can use this feature to set almost all of the settings that can be configured from the front panel keys. However, you cannot use this feature to turn the power ON/OFF, register users, set the key lock password, or set the connection destination of the FTP client function.
- You can use this feature to transmit the following types of data.
 - Measured, computed¹, and external input data²
 - Files in the internal memory or files on an external storage medium
 - Setup information and status byte
 - Logs of operations errors, communications, etc.
 - Alarm summaries and message summaries
 - Relay status information

Measured, computed¹, and external input² data can be transmitted to a PC in binary or ASCII format. Other types of data are transmitted in text format. For a description of data output formats, see chapter 5.

1 /M1 option.

2 RD-MV2000 with the /MC1 option.

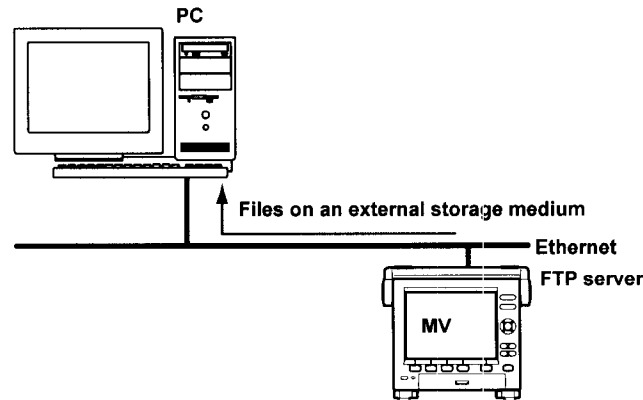
- You can use setting mode commands (see sections 4.4 and 4.5), basic setting mode commands (see section 4.6), and output commands (see sections 4.7 and 4.8) with this feature.
- You can use this feature via an Ethernet interface or serial interface (/C2 or /C3 option).
- If you want to use this feature via a serial interface, configure the serial interface according to Chapter 3.

Maintenance/Test Server

- You can use this feature to transmit connection information, network statistics, and other Ethernet communication information from the MV.
- You can use maintenance/test commands (see section 4.11) with this feature.

FTP Server

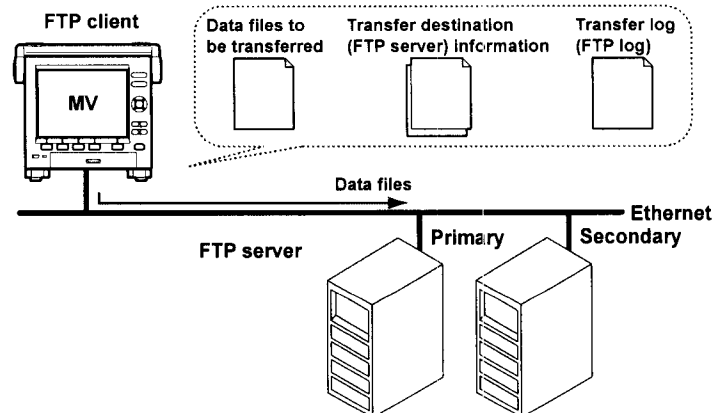
- You can access the MV from a PC via FTP. You can perform operations such as retrieving directory and file lists and transferring and deleting files from an external storage medium connected to the MV. You can also retrieve directory and file lists and transfer files from the internal memory.
- For the settings necessary to use this feature, see section 2.5.



FTP Client

Automatic File Transfer

- You can use this feature to automatically transfer display, event, report, and snapshot data files that are created in the MV internal memory to an FTP. The result of the transfer is recorded in the FTP log. You can view the FTP log on the MV (see "Log Display" described later) or transmit the log to a PC using commands.



You can specify two destination FTP servers: primary and secondary. If the primary FTP server is down, the file is transferred to the secondary FTP server.

- For the settings necessary to use this feature, see section 2.6.
- **FTP Test**
 - You can perform an FTP test by transferring a test file from the MV to an FTP server.
 - You can view the result of the FTP test on the FTP log screen.
 - For information on how to use this feature, see section 2.6.

Instrument Information Server

- You can use this feature to output the serial number, model name, and other information about an MV that is connected via an Ethernet network.
- You can use instrument information output commands (see section 4.12) with this feature.

Login

- You can use this feature when accessing the setting/measurement server, maintenance/test server, and FTP server functions via an Ethernet interface.
- For a description of the settings required to use this feature, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.
- For the procedure to log into the setting/measurement server or the maintenance/test server, see appendix 3.

User Registration

Users are registered using the MV login feature. There are two user levels: administrator and user.

- **Administrator**

An administrator has privileges to use all the features of the setting/measurement server, maintenance/test server, and FTP server.

- **User**

A user has limited privileges to use the features of the setting/measurement server, maintenance/test server, and FTP server. For command limitations, see section 4.2.

- Setting/measurement server feature limitations

A user cannot change settings that affect the MV operation. A user can output measured data and setting data.

- Maintenance/test server feature limitations

A user cannot disconnect a connection between another PC and the MV. A user can disconnect the connection between the user's own PC and the MV.

- FTP server feature limitations

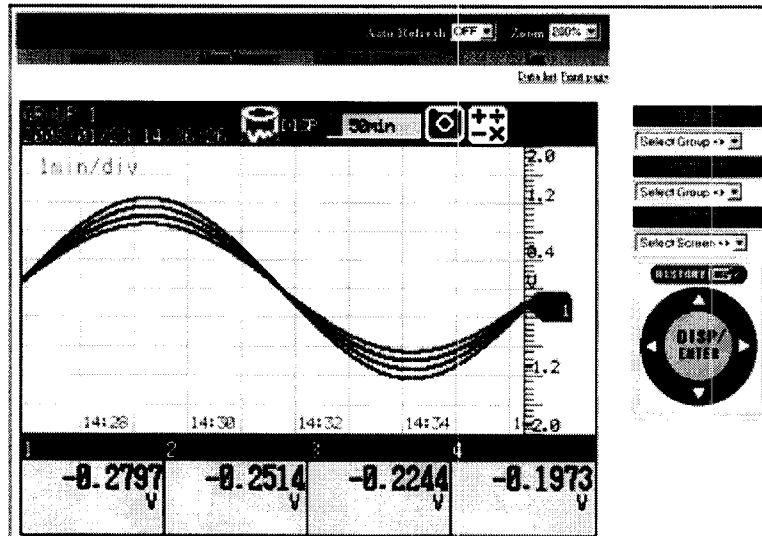
A user cannot save or delete files on an external storage medium connected to the MV. A user can only load files.

- **Application Timeout**

This feature drops the connection with the PC if there is no data transfer for a given time. It prevents a PC from being connected to the MV indefinitely which would prohibit other users from making new connections.

Web Server

- The MV screen can be displayed in Microsoft Internet Explorer.
 - The following two pages are available.
 - Monitor page: A dedicated monitoring screen.
 - Operator page: You can switch the MV display and change or write messages.
- You can set access control (user name and password specified with the login function) for each page.



- The MV screen can be refreshed at a constant interval (approximately 10 s).
- The following information can be displayed.
 - Alarm summary
 - Measured and computed values of all channels
 - Log (message log, error log, etc.)
- For Web server feature settings, see section 2.4.
- For a description of the monitor page and operator page operations, see section 2.4.

E-mail Transmission

E-mail Transmission

The available e-mail types are listed below. The MV can automatically transmit each e-mail type. You can specify two destination groups and specify one of the two destination groups for each e-mail type. You can also set a header string for each type.

- Alarm e-mail
Reports alarm information when an alarm occurs or clears.
- System e-mail
When the MV recovers from a power failure, it reports the time of the power failure and the time of recovery.
Reports the detection of a memory shortage when it is detected.
Reports the error code and message when a media error occurs (when an error occurs on an external storage medium or when data cannot be stored due to insufficient free space on an external storage medium).
Reports the error code and message when an FTP client error (when data transfer fails using the FTP client feature) occurs.
- Scheduled e-mail
Transmits a message when the specified time is reached. You can use this feature to check that the network and e-mail transmission functions are working properly. You can specify a reference time and e-mail transmission interval for each destination.
- Report e-mail (only on models with the computation function, /M1 option)
Transmits report results.

You can specify POP before SMTP if authentication is necessary before transmission.

For e-mail transmission settings, see section 2.3.

For e-mail transmission formats, see section 2.3.

For the procedure to start/stop e-mail transmission, see section 2.3.

Example of an e-mail sent at a scheduled time

From: MV1000@daqstation.com	
Date: Tue, 22 Jan 2008 08:00:45 +0900 (JST)	
Subject: Periodic_data	Subject
To: user1@daqstation.com, user2@mvadv.co.jp	
LOOP1	Header 1
TEMPERATURE	Header 2
Time	
Host name	
MV1000	
Time of transmission	
01/05 08:00:01	

E-mail Transmission Test

- You can test e-mail transmission by sending a test mail from the MV to a destination.
- You can view the test result in the e-mail log screen.
- For information on how to use this feature, see section 2.3.

SNTP Server/Client

The client feature retrieves time information from a specified SNTP server at a specified interval.

The server feature can provide time information to MVs and other devices connected to the same network.

DHCP Client

You can use this feature to automatically obtain an IP address from a DHCP server. You can manually retrieve or release network information.

Other Features

Ethernet Interface Connection Status Check

You can check the Ethernet interface connection status on the MV rear panel or the MV screen.

For a description of the connection status indicators, see section 2.2.

Keepalive (TCP extension feature)

This feature drops the connection if there is no response to a test packet that is periodically transmitted at the TCP level.

For the settings necessary to use this feature, see section 2.2.

Log Display

You can display operation logs on the MV log screen. You can also check logs using communication commands. The Web screen can also display logs (except communication and DHCP logs).

- Error log screen: A log of operation errors
- Communication log screen: A setting/measurement server communication input/output log
- FTP log screen: A log of file transfers carried out using the FTP client feature
- WEB log screen: A Web server operation log
- Mail log screen: A log of e-mail transmissions
- Login log screen: A login/logout log
- SNTP log screen: An SNTP server access log
- DHCP log screen: A DHCP server access log
- Modbus log screen: A Modbus status (master/client operating condition) log

For the procedure to show the log screen and details on the displayed contents, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

For details on the Modbus status log, see section 2.8.

For details on how to output logs using communication commands, see section 5.2. For details on how to show logs on the Web screen, see section 2.4.

1.2 Serial Interface

The MV supports serial communications via the RS-232 and RS-422/RS-485. This chapter gives an overview of the MV serial communication functions.

Modbus Communications

- The MV can connect to a Modbus device and read and write to the device's internal registers. See section 1.3 for details.

Setting/Measurement Server

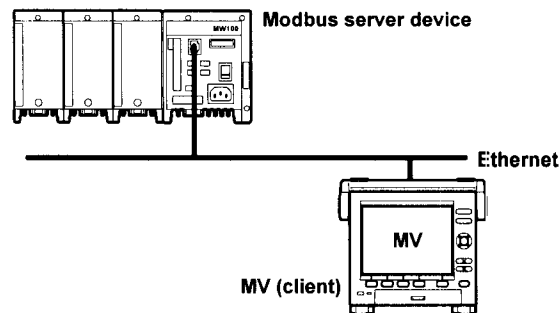
- You can use this feature to set almost all of the settings that can be configured from the MV front panel keys. See section 1.1 for details.
- For the settings necessary to use this feature, see section 3.3.

1.3 Modbus Protocol

Modbus Client/Master

- The MV can connect to a Modbus server or slave device and read and write to the device's internal registers.
The MV can handle the data that is read from the registers as communication input data on a computation channel (computation function¹). The MV can also handle the data on an external input channel.²
The MV can write measured and computed data to the registers.
 - 1 /M1 option.
 - 2 RD-MV2000 with the /MC1 option.
- For details on the Modbus function codes that the MV supports, see section 7.3.
- For the settings to use the Modbus client feature, see section 2.9. For the settings to use the Modbus master feature, see sections 3.3, 3.5, and 3.6.

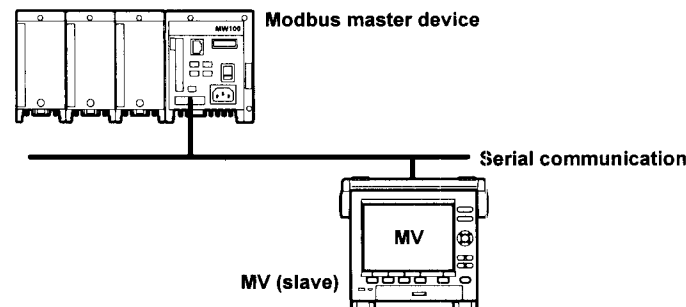
Server Device Connection Example



Modbus Server/Slave

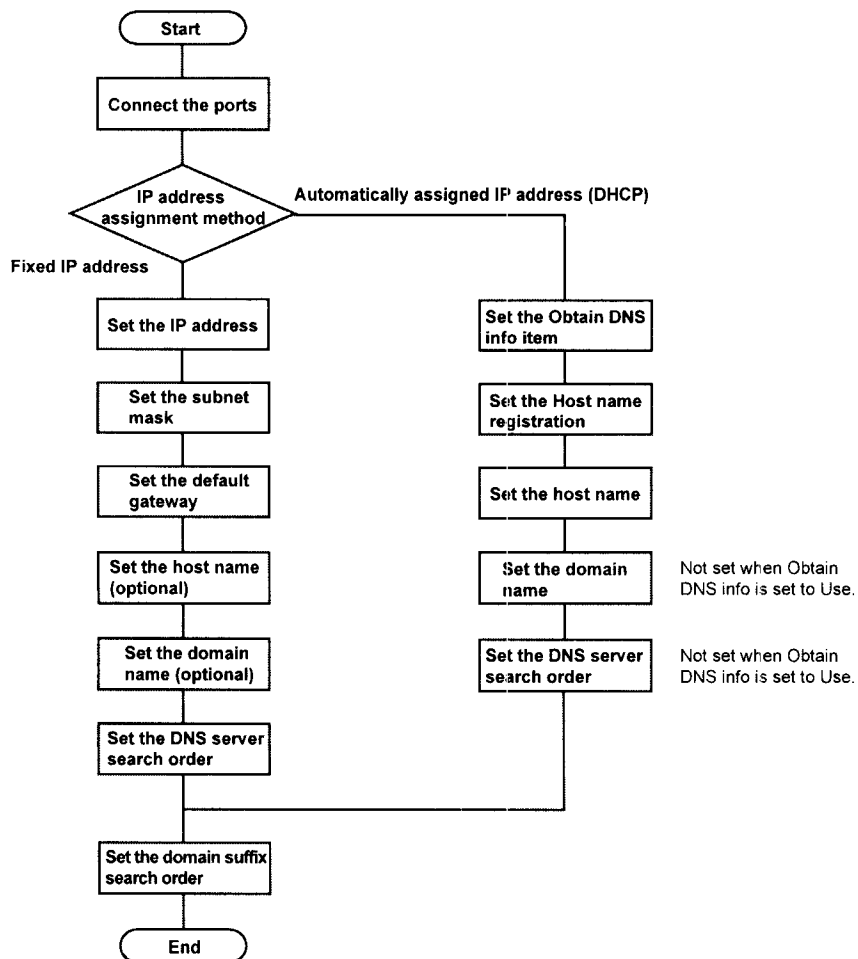
- A Modbus client (master) device can connect to an MV, a Modbus server (slave) device, to read the measured, computed,¹ or external input² data that is written in the input register or to read or write data to communication input data¹ or to an external input channel² through the MV hold register.
 - 1 /M1 option.
 - 2 RD-MV2000 with the /MC1 option.
- For details on the Modbus function codes that the MV supports, see section 7.3.
- For the settings to use the Modbus client feature, see section 2.8. For the settings to use the Modbus master feature, see sections 3.3, 3.4, and 3.6.

Example of a Connection with a Modbus Master Device



2.1 Workflow for Using the Ethernet Interface

Follow the flowchart below to configure Ethernet communication.

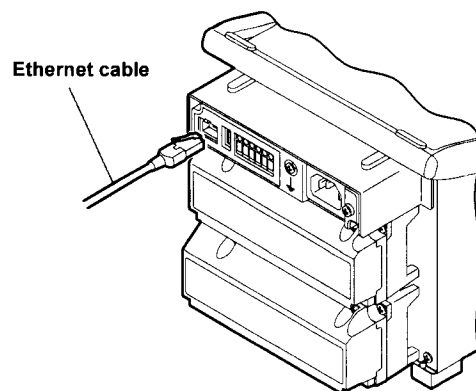


2.2 Connecting the MV

Connecting to the Port

Ethernet Port

Connect an Ethernet cable to the Ethernet port on the MV rear panel.

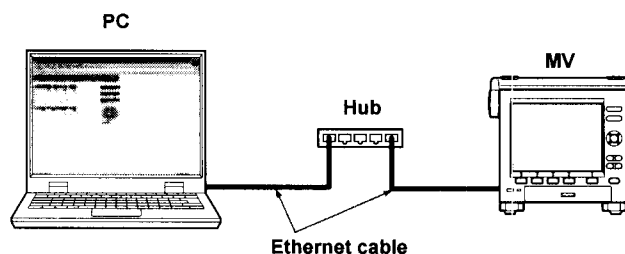


CAUTION

Be sure to connect an Ethernet cable with an FCC-compliant plug. Otherwise, the MV may malfunction.

Connecting to a PC

Connect the MV to a PC via a hub. To make a one-to-one connection, see the figure below. You can connect multiple MVs to a single PC in the same way.



Setting the IP Address, Host Information, and DNS

RD-MV1000

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > IP address**
- ◇ Press **MENU** and then select **MENU tab > Basic setting mode > Menu tab > Communication (Ethernet) > Host settings**
- ◇ Press **MENU** and then select **MENU tab > Basic setting mode > Menu tab > Communication (Ethernet) > DNS settings**

RD-MV2000

- ◇ Press **MENU** and then select **MENU tab > Basic setting mode > Menu tab > Communication (Ethernet) > IP address, Host settings**
- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > DNS settings**

IP address settings (DHCP set to Not)

Basic Setting Mode	
IP-address	
DHCP	Not
Fixed IP-address	
IP-address	192.168. 1.100
Subnet mask	255.255.255. 0
Default gateway	192.168. 1. 10
Use Not	

IP address settings (DHCP set to Use)

Basic Setting Mode	
IP-address	
DHCP	Use
DNS address	Use
Host-name register	Use
Use Not	

Host name settings

Basic Setting Mode	
Host settings	
Host name	mvadv
Domain name	daqstation.com
Input Clear Copy	

DNS settings

Basic Setting Mode	
Server search order	
Primary	192.168. 1. 20
Secondary	192.168. 1. 30
Domain suffix search order	
Primary	pri.daqstation.com
Secondary	sec.daqstation.com
Input	

Set the IP address to a fixed IP address or obtain it automatically (DHCP). Consult with your network administrator for network parameters such as the IP address, subnet mask, default gateway, and DNS.

When Using a Fixed IP Address

- **DHCP**
Set DHCP to **Not**.
- **IP address**
Set the IP address to be assigned to the MV.
- **Subnet mask**
Set the subnet mask according to the system or network that the MV belongs to.
- **Default gateway**
Set the gateway IP address.
- **Host name**
Set the MV host name using up to 64 alphanumeric characters. You do not have to set this parameter.
- **Domain name**
Set the name of the domain that the MV belongs to using up to 64 alphanumeric characters. You do not have to set this parameter.
- **Server search order**
Register up to two IP addresses for the primary and secondary DNS servers.
- **Domain suffix search order**
Set up to two domain suffixes: primary and secondary.

When Obtaining an IP Address Automatically (DHCP)

- **DHCP**
Set DHCP to **Use**.
- **Obtain DNS info**
To automatically obtain the DNS server address, select **Use**. Otherwise, select **Not**. If you select **Not**, you must set the server search order.
- **Host name registration**
To automatically register the host name to the DNS server, select **Use**.
- **Host name**
Set the MV host name using up to 64 alphanumeric characters.
- **Domain name**
Set the name of the domain that the MV belongs to using up to 64 alphanumeric characters. This parameter is valid when Obtain DNS info is set to **Not**.
- **Server search order**
Register up to two IP addresses for the primary and secondary DNS servers.
- **Domain suffix search order**
Set up to two domain suffixes: primary and secondary.

Requesting/Clearing Network Information through DHCP

You can manually request or release IP address and other network information. This operation applies when DHCP is set to Use. First switch to the network information screen and then execute the request or release (clear) operation.

Requesting Network Information

1. Switch to the network information screen.

◇ Press **FUNC > Network info**

```

NETWORK INFO
DHCP: ON / OFF: ON / OFF
IP address      : 0. 0. 0. 0
Subnet mask     : 0. 0. 0. 0
Default gateway : 0. 0. 0. 0
MAC address     : 00:00:00:00:00:0A
DNS server
Primary         : 0. 0. 0. 0
Secondary       : 0. 0. 0. 0
Host name
mvadv
Domain name
daqstation.com
  
```

2. Request network information.

◇ Press **FUNC > Network info > Request**

```

NETWORK INFO
DHCP: ON / OFF: ON / OFF
IP address      : 0. 0. 0. 0
Subnet mask     : 0. 0. 0. 0
Default gateway : 0. 0. 0. 0
MAC address     : 00:00:00:00:00:0A
DNS server
Primary         : 0. 0. 0. 0
Secondary       : 0. 0. 0. 0
Host name
mvadv
Domain name
daqstation.com
Favorite System Network
regist info info
Next 3/3
  
```



```

NETWORK INFO
DHCP: ON / OFF: ON / OFF
IP address      : 0. 0. 0. 0
Subnet mask     : 0. 0. 0. 0
Default gateway : 0. 0. 0. 0
MAC address     : 00:00:00:00:00:0A
DNS server
Primary         : 0. 0. 0. 0
Secondary       : 0. 0. 0. 0
Host name
mvadv
Domain name
daqstation.com
Request
  
```



```

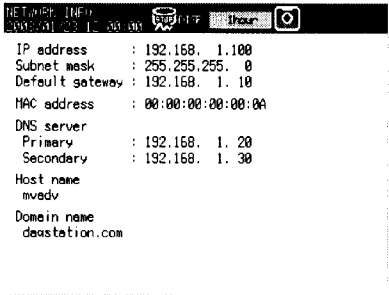
NETWORK INFO
DHCP: ON / OFF: ON / OFF
IP address      : 192.168. 1.100
Subnet mask     : 255.255.255. 0
Default gateway : 192.168. 1. 10
MAC address     : 00:00:00:00:00:0A
DNS server
Primary         : 192.168. 1. 20
Secondary       : 192.168. 1. 30
Host name
mvadv
Domain name
daqstation.com
  
```

The retrieved network information appears.

Clearing Network Information

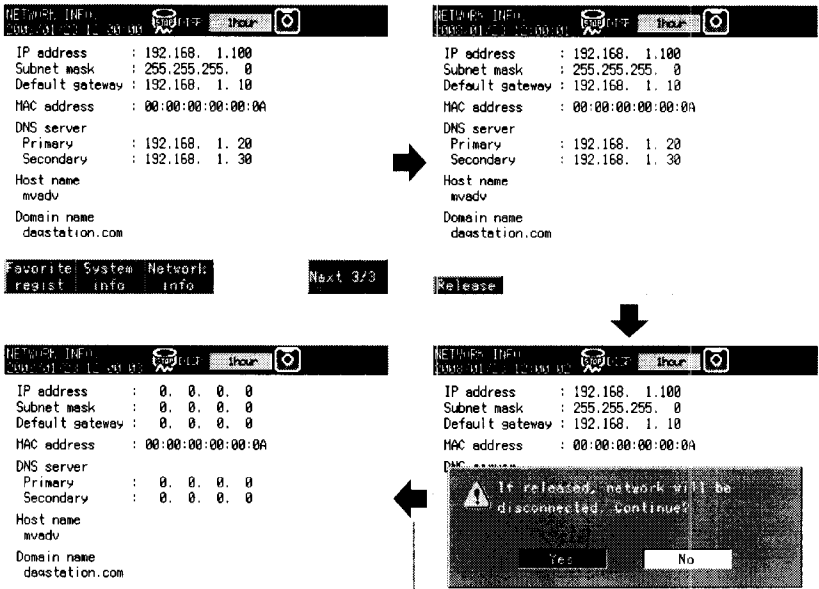
1. Switch to the network information screen.

◇ Press **FUNC** > **Network info**



2. Release (clear) the network information.

◇ Press **FUNC** > **Network info** > **Release**



The network information is released.

DISP/ENTER key

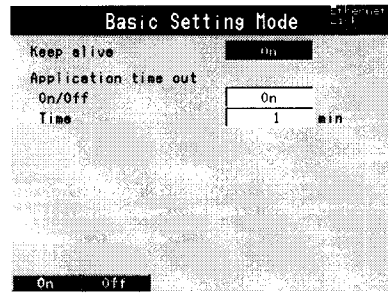
Setting the Communication Conditions

RD-MV1000

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Keep alive, Timeout**

RD-MV2000

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Keep alive, Application time out**



2

Using the Ethernet Interface

Setting the Keepalive Feature

To disconnect when there is no response to the test packets that are periodically sent, select **On**. Otherwise, select **Off**.

Setting the Application Timeout

- **Selecting On or Off**
To use the application timeout feature, select **On**. Otherwise, select **Off**. If you select **On**, the **Time** parameter appears.
- **Time**
Set the timeout value in the range of 1 to 120 (minutes).

Checking the Communication Status

You can check the Ethernet communication status with the LED lamp that is provided on the MV rear panel Ethernet connector or the Ethernet link that is shown at the upper right of the basic setting screen.

2.3 Sending E-mail Messages

Configuring E-mail Transmission

Configure the server, and set the contents of the e-mail.

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > E-Mail**

Basic settings

Basic Setting Mode	
Basic settings	
SMTP server name	smtp.daqstation.com
Port number	25
Security	Off
Input Clear Copy	

Recipients

Basic Setting Mode	
Recipients	
Recipient 1	user1@daqstation.com
Recipient 2	user2@daqstation.com
Sender	psvadv@daqstation.com
Input Clear Copy	

POP3 Settings

Basic Setting Mode	
POP3 Settings	
POP3 Server name	pop3.daqstation.com
Port number	110
Login name	
Password	*****
Input Clear Copy	

Alarm settings

Basic Setting Mode	
Alarm settings	
Recipient 1	On
Recipient 2	Off
Active Alarms	
Alarm 1	On
Alarm 2	On
Alarm 3	Off
Alarm 4	Off
Include INST	On
Include source URL	On
Subject	Alarm_summary
Header 1	
Header 2	
On Off	

Scheduled settings

Basic Setting Mode	
Scheduled settings	
Recipient 1	On
Recipient 2	Off
Interval	1h
Interval	24h
Ref.time	15:00
Ref.time	00:00
Include INST	On
Include source URL	On
Subject	Periodic_data
Header 1	
Header 2	
On Off	

System settings

Basic Setting Mode	
System settings	
Recipient 1	On
Recipient 2	Off
Include source URL	On
Subject	System_warnings
Header 1	
Header 2	
On Off	

Report settings

Basic Setting Mode	
Report settings	
Recipient 1	On
Recipient 2	Off
Include source URL	On
Subject	Report_data
Header 1	
Header 2	
On Off	

Basic Settings

Specify the SMTP server and POP before SMTP.

- **SMTP server name**
Enter the host name or IP address of the SMTP server.
- **Port number**
Unless specified otherwise, set the number to the default value. The default value is 25.
- **Security**
If you need to use POP before SMTP, set Security to **PbS**.

Recipients

Set the recipient e-mail addresses.

- **Recipient 1 and Recipient 2**
Enter e-mail addresses. You can enter multiple addresses in each recipient box. Separate each address with a space. You can enter up to 150 characters.
- **Sender**
Enter the sender e-mail address. You can enter up to 64 characters.

POP3 Settings

If you need to use POP before SMTP, specify the POP3 server.

► For the POP3 login procedure, see "Setting the POP3 Server Connection" in this section.

- **POP3 Server name**
Enter the host name or IP address of the POP3 server.
- **Port number**
Unless specified otherwise, set the number to the default value. The default value is 110.
- **Login name**
Enter the POP3 server login name.
- **Password**
Enter the POP3 server login password. You can enter up to 32 characters.

Alarm Settings

Specify the settings for sending e-mail when alarms occur or clear.

- **Recipient 1 and Recipient 2**
Specify the recipients. For **Recipient 1** and **Recipient 2**, select **On** to send e-mail or **Off** to not send e-mail.
- **Active Alarms**
Sends an e-mail when an alarm occurs or clears. For alarms 1 to 4, select **On** to send e-mail or **Off** to not send e-mail.
- **Include INST**
Select **On** to attach instantaneous value data that is acquired at the time of alarm occurrence.
- **Include source URL**
Select **On** to attach the source URL. You can attach the URL when the Web server is enabled.
- **Subject**
Enter the subject of the e-mail using up to 32 alphanumeric characters. The default subject is **Alarm_summary**.
- **Header 1 and Header 2**
Enter Header 1 and Header 2 using up to 64 characters.

Scheduled Settings

Specify the settings for sending e-mail at scheduled times.

- **Recipients**
Specify the recipients. For **Recipient 1** and **Recipient 2**, select **On** to send e-mail or **Off** to not send e-mail.
- **Interval**
For **Recipient 1** and **Recipient 2**, set the interval for sending e-mail to 1, 2, 3, 4, 6, 8, 12, or 24 hours.
- **Ref.time**
Enter the time reference for sending e-mail to **Recipient 1** and **Recipient 2** at a specified interval.
- **Include INST, Include source URL, Subject, Header**
These parameters are the same as those listed under "Alarm Settings." The default subject is **Periodic_data**.

System Settings

Specify the settings for sending e-mail when the MV recovers from a power failure, when there is a memory shortage, and when an error occurs.

- **Recipients**
Specify the recipients. For **Recipient 1** and **Recipient 2**, select **On** to send e-mail or **Off** to not send e-mail.
- **Include source URL, Subject, and Header**
These parameters are the same as those listed under "Alarm Settings." The default subject is **System_warning**.

Report Settings

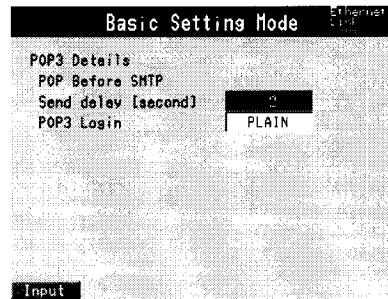
Specify the settings for sending e-mail when reports are generated.

- **Recipients**
Specify the recipients. For **Recipient 1** and **Recipient 2**, select **On** to send e-mail or **Off** to not send e-mail.
- **Include source URL, Subject, and Header**
These parameters are the same as those listed under "Alarm Settings." The default subject is **Report_data**.

Setting the POP3 Server Connection

Specify the operation for connecting to the POP server.

- ◇ Press **MENU** and then select **Menu** tab > **Basic setting mode** > **Environment** tab > **Communication** > **POP3 Details**



Send delay [second]

Enter the wait time from POP3 server authentication until transmission. Set a value in the range of 0 to 10 (seconds).

POP3 Login

To send the POP3 server login password without encryption, set **POP3 Login** to **PLAIN**.
To send the password with encryption, set **POP3 Login** to **APOP**.

E-mail Test

- ◇ Press **FUNC** and then select **E-mail test** > **Recipient1** or **Recipient2**
You can send a test e-mail to check the e-mail settings.

Enabling/Disabling the E-mail Transmission Function

Enabling the E-mail Transmission Function

- ◇ Press **FUNC** and then select **E-Mail start**
The e-mail transmission function is enabled.

Disabling the E-mail Transmission Function

- ◇ Press **FUNC** and then select **E-Mail stop**
The e-mail transmission function is disabled. Unsent e-mail messages are discarded.

E-mail Retransmission

If an e-mail transmission fails, the MV retransmits the message up to three times at 30-s, 1-minute, or 3-minute intervals. If retransmission fails, the MV discards the e-mail message.

E-mail Format

The formats of alarm, scheduled, system, report, and test e-mails are given below. For details on the displayed items that are common to all e-mails, see “Display Items Common to All Formats” in this section.

Alarm Notification E-mail Format

- **Subject**

Subject: [Alarm Summary]

- **Syntax**

```
header1CRLF
header2CRLF
CRLF
Alarm_summary.CRLF
<Host_name>CRLF
hostCRLF
CRLF
<CH>ccc...cCRLF
<Type>lqCRLF
<aaa>mo/dd_hh:mi:ssCRLF
CRLF
<Inst._value>CRLF
mo/dd_hh:mi:ssCRLF
ccc...c=ddd...dCRLF
.....
CRLF
Access_the_following_URL_in_order_to_look_at_a_screen.CRLF
http://host.domain/CRLF
CRLF
```

ccc...c	Channel number or tag name (Up to 16 characters. Channels set to Skip or Off are not transmitted. See section 4.3 for channel numbers.)
l	Alarm level (1 to 4)
q	Alarm type (H, L, h, l, R, or r) H(high limit alarm), L(low limit alarm), h(difference high limit alarm), l(difference low limit alarm), R(high limit on rate-of-change alarm), and r(low limit on rate-of-change alarm)
aaa	Alarm status (off or on)
ddd...d	Measured/computed value (up to 10 digits including the sign and decimal point) + unit (up to six characters) +OVER: Positive range-out -OVER: Negative range-out Burnout: Burnout data ****: Error data

The MV transmits the channel numbers, alarm types, and alarm statuses for up to 10 events in a single e-mail.

Scheduled E-mail Format

• **Subject**
Subject: [Periodic Data]

• **Syntax**
header1CRLF
header2CRLF
CRLF
Periodic_data.CRLF
<Host_name>CRLF
hostCRLF
CRLF
<Time>CRLF
mo/dd_hh:mi:ssCRLF
CRLF
E-mail_message(s)_did_not_reach_intended_recipient(s).CRLF
ttt...t
Count=nnCRLF
mo/dd_hh:mi:ssCRLF
.....
CRLF
<Inst._value>CRLF
mo/dd_hh:mi:ssCRLF
ccc...c=ddd...dCRLF
.....
CRLF
Access_the_following_URL_in_order_to_look_at_a_screen.CRLF
http://host.domain/CRLF
CRLF

ccc...c Channel number or tag name
 (Up to 16 characters. Channels set to Skip or Off are not transmitted.
 See section 4.3 for channel numbers.)

ttt...t Type of discarded e-mail
 Alarm_summary: Alarm e-mail
 Periodic_data: Scheduled e-mail
 System_warning: System e-mail
 Report_data: Report e-mail

nn Number of discarded e-mails

ddd...d Measured/computed value (up to 10 digits including the sign and
 decimal point) + unit (up to six characters)
 +OVER: Positive range-out
 -OVER: Negative range-out
 Burnout: Burnout data
 ****: Error data

The time that follows the type and count of discarded e-mails is the time when the last e-mail is discarded.

System E-mail (Power Failure) Format

- **Subject**

Subject: [System_warning]

- **Syntax**

header1CRLF

header2CRLF

CRLF

Power_failure.CRLF

<Host_name>CRLF

hostCRLF

CRLF

<Power_fail>mo/dd_hh:mi:ssCRLF

<Power_on>mo/dd_hh:mi:ssCRLF

CRLF

Access_the_following_URL_in_order_to_look_at_a_screen.CRLF

http://host.domain/CRLF

CRLF

System E-mail (Memory Full) Format

- **Subject**

Subject: [System_warning]

- **Syntax**

header1CRLF

header2CRLF

CRLF

Memory_full.CRLF

<Host_name>CRLF

hostCRLF

CRLF

<Memory_remain>ppp...pMbytesCRLF

<Memory_blocks>bbb/400CRLF

<Media_remain>rrr...rMbytesCRLF

CRLF

Access_the_following_URL_in_order_to_look_at_a_screen.CRLF

http://host.domain/CRLF

CRLF

ppp...p	Remaining amount of internal memory
bbb	Number of unsaved blocks (0 to 400)
rrr...r	Remaining free space on the external storage medium (when an external storage medium is connected)

System E-mail (Error) Format• **Subject**

Subject: [System_warning]

• **Syntax**

header1CRLF

header2CRLF

CRLF

Error.CRLF

<Host_name>CRLF

hostCRLF

CRLF

mo/dd_hh:mi:ssCRLF

ERROR:fffCRLF

.....

"Operation_aborted_because_an_error_was_found_in_media."CRLF

CRLF

Access_the_following_URL_in_order_to_look_at_a_screen.CRLF

http://host.domain/CRLF

CRLF

fff Error number (200, 201, 211, or 281 to 285)

The displayed error message varies depending on the error type. For details on errors, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

Report E-mail Format• **Subject**

Subject: [Report_data]

• **Syntax**

header1CRLF

header2CRLF

CRLF

ti_report.CRLF

<Host_name>CRLF

hostCRLF

CRLF

mo/dd_hh:mi:ssCRLF

<CH>ccc...cCRLF

<tp>eee...eCRLF

<tp>eee...eCRLF

<tp>eee...eCRLF

<tp>eee...eCRLF

<Unit>uuu...uCRLF

.....

CRLF

Access_the_following_URL_in_order_to_look_at_a_screen.CRLF

http://host.domain/CRLF

CRLF

ti Contents of the report e-mail (hourly, daily, weekly, or monthly report)

ccc...c Channel number or tag name
(Up to 16 characters. Channels set to Skip or Off are not transmitted.
See section 4.3 for channel numbers.)

2.3 Sending E-mail Messages

tp	Report content (average, maximum, minimum, instantaneous, and sum. Four out of the five items above are transmitted.)
eee...e	Measured/computed value (up to 10 digits including the sign and decimal point). However, sum values are transmitted as a combination of the sign, mantissa, E, sign, and exponent such as in -3.800000E+02. +OVER: Positive range-out -OVER: Negative range-out Burnout: Burnout data Empty data: Error data
uuu...u	Unit (up to six characters)

Test E-mail Format

- **Subject**

Subject: [Test]

- **Syntax**

Test_mail.CRLF

<Host_name>CRLF

hostCRLF

CRLF

<Time>CRLF

mo/dd_hh:mi:ssCRLF

CRLF

<Message>CRLF

x:msCRLF

.....

CRLF

x Message number (1 to 10)

ms Message content (only specified messages are transmitted.)

Display Items Common to All Formats

- Time information

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)

The MV transmits the month, day, hour, minute, and second in the time information in the order specified by the date format set in Basic Setting Mode.

- Host name, domain name, and header information

header1 Header 1 (displayed only when it is set)

header2 Header 2 (displayed only when it is set)

host Host name or IP address (IP address when the host name is not assigned. In the case of an IP address, the <Host> section is set to <IP address>.)

domain Domain name

_ Space

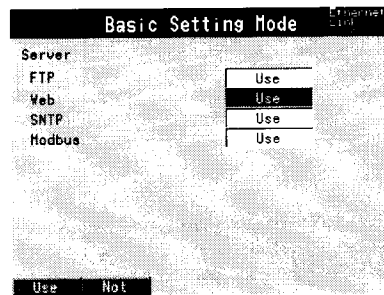
2.4 Monitoring the MV on a PC Browser

Configuring the Web Server

From the Basic Setting Mode menu, set the server function and Web page for Ethernet communication.

Setting the Web Server

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Server**



- **Web**

Set the Web parameter under Server to **Use** or **Not** (don't use). If set to Use, Web page parameters appear in the Basic Setting Mode menu.

Port Number

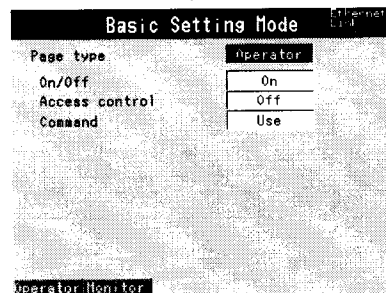
The default value is 80. To change the value:

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Communication > Service port**

For the selectable range, see section 7.1.

Setting the Web Page

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Web page**



Page Types (displayed screen types)

- **Monitor**
Configure the monitor page. The monitor page can display the following items.
 - Alarm summary
 - Measured and computed values of all channels
 - Log (message summary, error log, etc.)
 - For screen examples, see "Monitoring with a Browser" in this section.
- **Operator**
Configure the operator page. You can carry out the following operations in addition to the functions available on the monitor page.
 - Switch the MV display by specifying the display type (trend, historical trend, digital, bar graph, or overview). You can also specify the trend and historical trend groups.
 - Control the MV DISP/ENTER key, arrow keys, and HISTORY key.
 - Set and write MV messages.
 - For screen examples, see "Monitoring with a Browser" in this section.

Configuring the Monitor Page

- **Setting the page type**
To configure the monitor page, select **Monitor**.
- **Selecting On or Off**
To display the monitor page on a browser, select **On**. Otherwise, select **Off**.
- **Setting the access control**
To use access control, select **On**. You must enter a user name and password to display the monitor page. You must set the security and login in the environmental settings to use this function. For settings, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

Configuring the Operator Page

- **Setting the page type**
To configure the operator page, select **Operator**.
- **Setting the access control**
This setting is the same as that for the monitor page.
- **Selecting whether or not to use command input**
To use the set and write commands for messages, select **On**. Otherwise, select **Off**.

Monitoring the MV on a Browser

Setting the URL

Set the URL appropriately according to your network environment. You can access the MV by setting the URL as follows:

`http://host name.domain name/file name`

- **http:** The protocol used to access the server.
- **Host name.domain name:** The MV host name and domain name.
You can also use an IP address in place of the host name and domain name.
- **File name:** The file name of the MV monitor page or operator page.

File name of the monitor page: `monitor.htm`

File name of the operator page: `operator.htm`

Omitting the file name is equivalent to specifying the monitor page. However, if the monitor page is disabled, it is equivalent to specifying the operator page.

Example

To display the operator page on a PC that is in the same domain as the MV, enter the URL in the browser Address box as follows:

`http://RD-MV1000.daqstation.com/operator.htm` or

`http://192.168.1.100/operator.htm`

(In this example, we assume that the domain name is `daqstation.com`, the host name is `RD-MV1000`, and the IP address is `192.168.1.100`.)

Login

Enter the user name and login password. You do not have to enter these items if access control is set to **Off** in the Web page setting.

• Monitor Page Contents

All channel display

Displays measured values and alarm statuses of all channels in a separate window.

Display the alarm summary

Displays an alarm summary in a separate window.

Refresh the screen

Automatically refreshes the screen

Turn this ON to automatically refresh the screen.

Log display

Displays each log in a separate window.

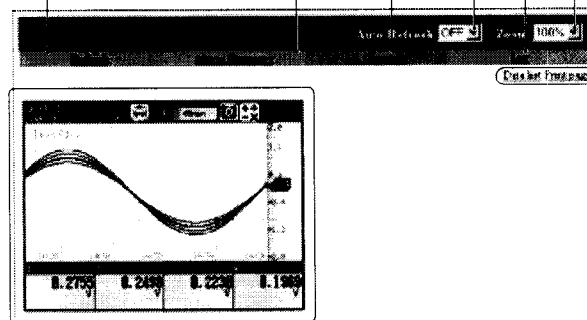
Zoom

Changes the zoom rate of the screen.

MV1000: 100% and 200%
MV2000: 50% and 100%

Data list and print page

Displays the information in a separate window.



MV screen image

The displayed information is the same as that shown on the MV.

2.4 Monitoring the MV on a PC Browser

- If the MV is in Setting Mode* or Basic Setting Mode*, the monitor page cannot be displayed. An error message will appear.
 - * For details on modes, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.
- Refreshing the monitor page

The monitor page can be refreshed automatically or manually.

 - Auto Refresh ON

The monitor page is refreshed at approximately 10-second intervals.
 - Auto Refresh OFF

The monitor page is not automatically refreshed. You can refresh the page manually. The page will not be refreshed within approximately 10 seconds for the last refreshing even if you try to refresh the page manually.
- Displaying the log

You can display the message summary, error log, FTP log, login log, Web operation log, e-mail log, SNMP log, and Modbus log in a separate window. From the **Log** list, select the log you want to display. Click **Refresh** to refresh the data. The window can display up to 100 messages and 50 added messages.

Log display (example of a message log display)

LOG				
MESSAGE				
Refresh	Close	Creation date: 2008/01/23 17:18:53		
Date	Message	Group	User	
2008/01/23 17:18:51	POWER OFF	ALL	[Key]	
2008/01/23 14:38:06	STOP	ALL	[Communication]	
2008/01/23 13:17:12	DANGER	ALL	[Key]	
2008/01/23 13:15:29	HIGH VOLTAGE	01	[Communication]	
2008/01/23 12:14:37	BATTERY	ALL	[Key]	
2008/01/23 10:13:15	POWER ON	ALL	[Communication]	

- Refreshing the alarm summary display and all channel display

Click **Refresh** to refresh the data. The alarm summary can display up to 400 alarms.

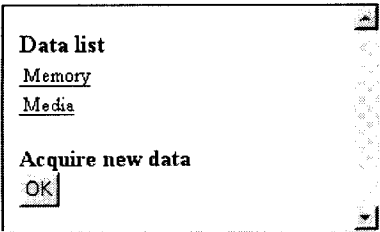
Example of an alarm summary display

Refresh	Close	Creation date: 2008/01/23 17:23:32	
Status	Channel	Type	Alarm Time
OFF	1	1H	2008/01/23 17:23:30
11		1L	2008/01/23 17:23:30
11		2L	2008/01/23 17:23:30

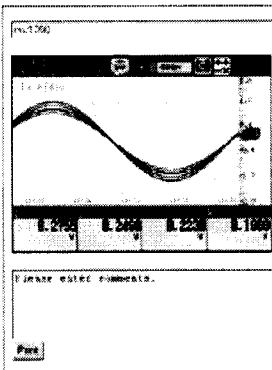
Example of an all channel display

Refresh		Close		Creation date 2008/01/23 17:25:12	
	Channel	Alarm status 1 2 3 4	Reading	Unit	
1	1	11 10	0.9131	V	
2	2	11	0.7114	V	
3	3		0.5895	V	
4	4		0.4384	V	

- **Data list**
You can easily retrieve files via FTP from the data list link without having to specify the URL. You can also save the data that is being sampled to a file and retrieve the file.
► For the procedure, see section 2.5.



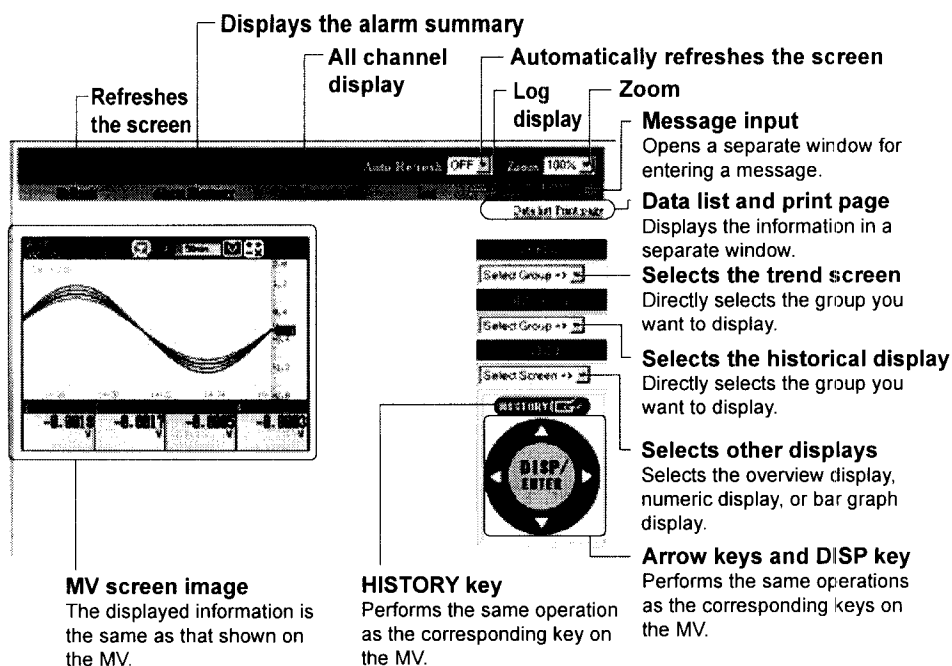
- **Print page**
You can enter a title and comments in the screen image and print the image.



Title box
By default, the title box displays the IP address or host name. You can overwrite the default title with your own.

Comment input box
Enter comments. You can enter more than five lines of comments, but only the first five lines will be printed.

• Operator Page Contents



You can carry out the following operations on the operator page in addition to the operations available on the monitor page.

- Switch between trend, historical trend, digital, bar graph, and overview displays.
For the trend and historical trend displays, you can switch the MV screen by specifying the group you want to display.
- Control the MV using the DISP/ENTER key, arrow keys, and HISTORY key on the operator page.

You can carry out the same operations as the DISP/ENTER key, arrow keys, and HISTORY key on the MV.

- Set and write messages

You can set a message string to MV messages 1 through 10 (up to 32 alphanumeric characters) and, at the same time, write it to the specified group. The existing message is overwritten. The following figure indicates an example in which the word "ALARM" is written to all groups in message number 9, and the Command Response box shows that the operation has been successfully completed.

Message entry example

The screenshot shows the 'Active Message' dialog box and the 'Command Response' box.

Active Message

- Message No: 9
- Write message to: All Groups
- Group Number: 1
- Input Characters: HIGH VOLTAGE
- Buttons: Set & Write, Cancel

Command Response

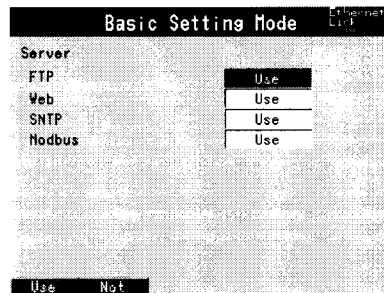
0000 OK

2.5 Accessing Measured Data Files on the MV from a PC

You can access data files stored on an external storage medium.

Configuring the FTP Server

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet)> Server**



- **FTP**
Set the FTP parameter under Server to **Use** or **Not** (don't use).

Accessing the MV from a PC

You can use the following functions when the FTP server is enabled.

Accessing a Data File from a Web Page

- If the Data File to Be Retrieved Is Already Generated
 1. Click the **Data list** link.
 2. Click **Memory** or **Media**.
 3. Select the file you want to retrieve from the file list.
 4. Drag and drop the file to the desired folder on the PC.

Note

- The Internal memory link is ftp://hostname/MEM0/DATA.
- The External media link is ftp://hostname/DRV0/.

2.5 Accessing Measured Data Files on the MV from a PC

- If the Data File to Be Retrieved Is Being Generated

1. Click the **Data list** link.
2. Click **OK** for retrieving the most recent data.
The **Confirmation** window opens.
3. Read the information, and click **OK**.
4. In the **File status** window, click **Update**.
If the file has been generated, the Final status window opens. If not, the File status window will open. Wait for a little while, and click **Update** again.
5. In the Final status window, click **Get**.
6. In the **File Download** window, click **Save**.

Note

- You can retrieve files by carrying out the steps above when the data file contains display data or event data stored in Free mode.
 - The file is generated at different times from the specified file save interval.
-

Connecting to the MV from a PC via the FTP

An example of retrieving files using a browser is described below. In the Address box, enter the following:

ftp://host name.domain name/file name

To retrieve data from the internal memory, drag the files from the /MEM0/DATA folder. To retrieve data from an external storage medium, drag the files from the /DRV0 folder. You can also use an IP address in place of the host name and domain name.

You can also retrieve files easily from the Data list link in the browser window. See section 2.4 for details.

Login

If the security feature is enabled, you will be prompted for a login name and password. Enter the login name and password to connect to the server.

Port Number

The default value is 21. To change the value:

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Communication > Service port**

For the selectable range, see section 7.1.

2.6 Transferring Data Files from the MV

The MV can automatically transfer display and event data files, report data files, and snapshot data files that are created in the MV internal memory via FTP as the files are created.

Files to Be Transferred via FTP

The MV automatically transfers display and event data files and report data files to the FTP destination at appropriate times.

File Type	Description
Display data file	Automatically transferred at the file save interval.
Event data file	Automatically transferred each time the specified length of data is recorded.
Report data file	Automatically transferred when a report file is closed (divided). For example, a data file is transferred once per month if you configure the MV to generate only daily reports.
Snapshot data file	Automatically transferred when you take a snapshot.* Snapshot data files are transferred regardless of the media storage settings. * Snapshots taken using the FUNC key, the EV2 communication command, the USER key, or the remote control function.

Configuring the FTP Client

- Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > FTP client**

FTP transfer file settings

Basic Setting Mode Ethernet Link

FTP transfer file

Disp&Event data ☒ On

Report ☒ On

Snapshot ☒ On

On Off

FTP connection settings

Basic Setting Mode Ethernet Link

FTP connection ☒ Primary

Server name ftp.daqstation.com

Port number 21

Login name mv1000

Password *****

Account

PASV mode Off

Initial path /data

Primary Second

Specifying the Files to be Transferred via FTP

- Disp&Event Data**
Select **On** to automatically transfer display and event data files.
- Report**
Select **On** to automatically transfer report data files.
- Snapshot**
Select **On** to automatically transfer snapshot data files.

Setting the FTP Connection Destination

Set the primary and secondary FTP servers, port number, login name, password, account, PASV mode, etc. Consult your network administrator for the correct values.

- **FTP connection**

You can specify two destination FTP servers: primary and secondary. If the primary FTP server is down, the file is transferred to the secondary FTP server.

- **Server name**

Enter the name of the destination FTP server using up to 64 alphanumeric characters.

- If you are using the DNS, you can set the host name for the server name. For DNS settings, see section 2.2.
- You can also set the IP address. In this case, the DNS is not required.

- **Port number**

Enter the port number of the destination FTP server in the range of 1 to 65535. The default value 21.

- **Login name**

Enter the login name for accessing the FTP server using up to 32 alphanumeric characters.

- **Password**

Enter the password for accessing the FTP server using up to 32 alphanumeric characters. The characters that you enter will be displayed as *****.

- **Account**

Enter the account ID for accessing the FTP server using up to 32 alphanumeric characters.

- **PASV mode**

Select **On** when using the MV behind a firewall that requires the passive mode. The default setting is Off.

- **Initial path**

Set the file transfer destination directory using up to 64 alphanumeric characters. The delimiter for directories varies depending on the implementation of the destination FTP server.

Example: When transferring files to the "data" directory in the "home" directory of an FTP server on a UNIX file system.

/home/data

If the file transfer to both primary and secondary destinations fails, the MV will abort the file transfer. When the connection recovers, the MV will transfer the data that could not be transferred along with the new data file. However, because the data that could not be transferred resides in the MV internal memory, the data will be lost if it is overwritten.

Testing the FTP Transfer

You can transfer a test file from the MV to an FTP server.

◇ Press **FUNC > FTP test**

Items to Check Before Executing This Test

- Connect the Ethernet cable properly. For the connection procedure, see section 2.2.
- Check that the Ethernet interface settings are correct. For the setup procedure, see section 2.2.

Viewing the FTP Test Result

- When you execute an FTP test, the MV transfers a test file named FTP_TEST.TXT to the FTP connection destination initial path directory that you specified in this section.
- You can check the FTP test result on the FTP log (displayed on the MV (see the User's Manual), displayed on the Web screen (see section 2.4), or transmitted with the FL command (see section 4.8)).

2.7 Synchronizing the Time

The MV time can be synchronized to the time on an SNTP server. You can also configure the MV to run as an SNTP server.

Configuring the SNTP Client

You can configure the SNTP client to synchronize the MV time to an SNTP server.

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > SNTP client**

SNTP client settings	
Use/Not	Use
Server name	sntp.daqstation.com
Port number	123
Access interval	8h
Access reference time	00:00
Access timeout	30s
Time adjust on Start action	Off

- **Use/Not**
To use the SNTP client function, select **Use**. Otherwise, select **Not**. If you select Use, the SNTP client parameters appear.
- **Server name**
Enter the SNTP server name using up to 64 alphanumeric characters.
 - If you are using the DNS, you can set the host name for the server name. For DNS settings, see section 2.2.
 - You can also set the IP address. In this case, the DNS is not required.
- **Port number**
Enter the SNTP server port number in the range of 1 to 65535. The default value is 123.
- **Access interval**
Set the time interval for synchronizing the time with the server to Off, 1, 8, 12, or 24h. If you select Off, you can synchronize the time using the soft keys. The time is not synchronized if the time difference between the MV and the server is greater than or equal to 10 minutes.
- **Access reference time**
Set the reference time for making queries.
- **Access timeout**
Set the time that the MV will wait for a response from the SNTP server after making a query to 10, 30, 90 s.
- **Time adjust on Start action**
Select **On** to synchronize the time with an SNTP server when memory start is executed. Otherwise, select **Off**.

Manually Synchronizing the Time

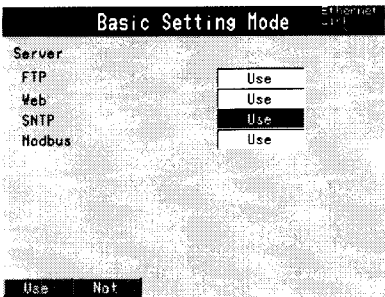
You can synchronize the time at any time using the FUNC key. The SNTP client setting must be enabled.

- ◇ Press **FUNC > SNTP**

Configuring the SNTP Server

You can configure the MV to run as an SNTP server.

- Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Server**



• **SNTP**

Set the SNTP parameter under Server to **Use** or **Not** (don't use).
When an SNTP client on the network queries the MV for the time information, the MV returns the time information.

Port Number

The default value is 123. To change the value:

- Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Communication > Service port**

For the selectable range, see section 7.1.

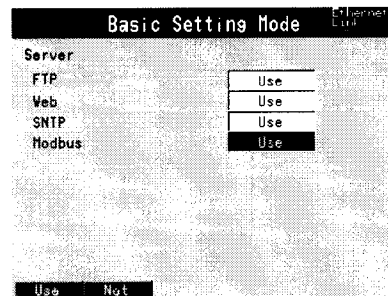
2.8 Reading/Writing the MV Data from Another Device via Modbus

The MV is a Modbus server.
For Modbus specifications, see section 7.3.

Configuring the Modbus Server

You can configure the Modbus server so that another device will be able to read or write the MV data via Modbus.

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Server**



- **Modbus**
Set the Modbus parameter under Server to **Use**. If you select **Not** (not use), you will not be able to use the Modbus server function.

Port Number

The default value is 502. To change the value:

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Communication > Service port**

For the selectable range, see section 7.1.

Reading or Writing the MV Data from Another Device

Another device (client device) sends commands to the MV to read data from the MV or write data to the MV.

For the function codes that the MV supports and the MV registers that the client device can access, see "Modbus Server Function" in section 7.3.

2.9 Reading/Writing Data on Another Device from the MV via Modbus

The MV is a Modbus client.
For Modbus specifications, see section 7.3.

Configuring the Modbus Client

You can configure the Modbus client so that the MV will be able to read or write data to another device via Modbus.

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Modbus client**

Basic settings

Basic Setting Mode Ethernet

Modbus client basic settings

Read cycle **1s**

Retry interval **10min**

125ms 250ms 500ms 1s Next 1/2

Destination server settings

Basic Setting Mode Ethernet

Server number **1-8**

	Port	Modbus server name	Unit	No.
1	502	modbus.deastation.com	Auto	
2	502	192.168.1.80	Fixed	3
3	502		Auto	
4	502		Auto	
5	502		Auto	
6	502		Auto	
7	502		Auto	
8	502		Auto	

1-8 9-16

Transmission command settings

Basic Setting Mode Ethernet

Client command number **1-8**

	First	Last	Server Regi.	Type
1 R-M	C01	C08	1	30001 INT16
2 W	01	04	1	40001 INT16
3 W-M	101	105	2	40010 INT32_B
4	Off			
5	Off			
6	Off			
7	Off			
8	Off			

1-8 9-16

Basic Settings

- **Read cycle**
Set the read cycle to 125m, 250m, 500m, 1s, 2s, 5s, or 10s.
- **Retry interval**
Set the interval for retrying the connection when the connection is interrupted for some reason. Select Off, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30 min, or 1h. If you select **Off**, the MV will not retry the connection. If communication fails, communication will stop.

Destination Server Settings

- **Server number**
Select registration numbers of the server you want to configure from 1 to 16.
- **Port**
Enter the port number for the selected server in the range of 0 to 65535. The default value is 502.
- **Modbus server name**
Set the destination Modbus server name using up to 64 alphanumeric characters.
 - If you are using the DNS, you can set the host name for the server name.
 - You can also set the IP address. In this case, the DNS is not required.
- **Unit**
If the unit number of the destination server is not necessary, select **Auto**. If a fixed unit number is necessary, select **Fixed**. If you select **Fixed**, the unit number parameter appears.
- **No.**
Enter a fixed unit number in the range of 0 to 255.

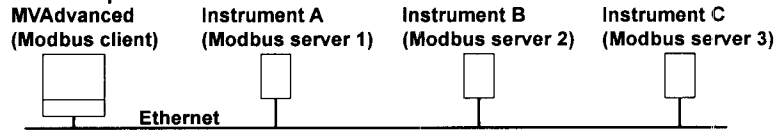
Transmission Command Settings

- **Client command number**
Select numbers of the transmission commands you want to configure from 1 to 16.
- **Command type**
Set the command type to Off, R, R-M, W, or W-M. If you select a command type other than **Off**, the client channel, server number, register, and data type parameters appear.
 - R: Read the data from the server into external input channels (16-bit signed integer)
 - R-M: Read the data from the server into communication input channels (32-bit floating point)
 - W: Write measurement channel data (16-bit signed integer) to the server
 - W-M: Write computation channel data (32-bit signed integer) to the server
 - R is selectable on the RD-MV2000 when external input channels (/MC1 option) is installed.
 - R-M and W-M are selectable when the computation function (/M1 option) is installed.
- **First/Last (MV channels)**
Enter the first and last channel numbers of input/output. The range of channels that you can enter varies depending on the command type as follows:
 - R: 201 to 440, R-M: C01 to C60, W: 1 to 48, W-M: 101 to 160
- **Server (server number)**
Select a server number from 1 to 16.
- **Regi. (server register)**
Set the server register number.
Enter an input register in the range of 30001 to 39999 and 300001 to 365536 or a hold register in the range of 40001 to 49999 and 400001 to 465536.
The register numbers that you can specify vary depending on the command type. See section 7.3 for details.
- **Type**
The data type.
Select INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L, FLOAT_B, or FLOAT_L.
The data type that you can specify vary depending on the command type. See section 7.3 for details.

Examples of Entering Commands

The following are examples of commands when the MV is operating as a Modbus client device. If the MV is operating as a Modbus master device, read the word "client" as "master" and "server" as "slave."

Connection example



Loading Data into Communication Input Channels

The MV reads the data from the server device and enters the data into communication input channels in floating point format.

• Example 1

Read a 16-bit signed integer value from instrument A's register 30001 into C01.

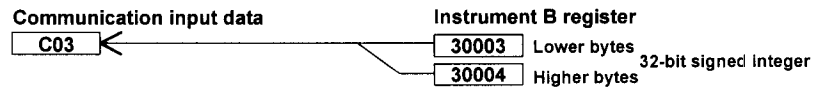


Command



• Example 2

Read a 32-bit signed integer value from instrument B's registers 30003 and 30004 (lower bytes and higher bytes) into C03. Specify the smaller register number in the command.

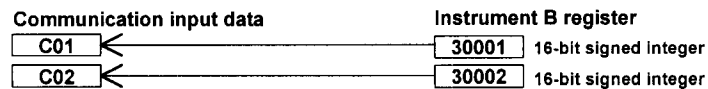


Command



• Example 3

Read a 16-bit signed integer value from instrument B's registers 30001 and 30002 into C01 and C02. Specify the smaller register number in the command.

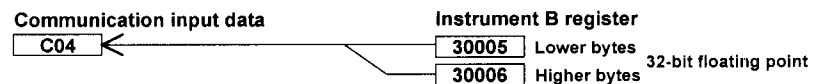


Command



• Example 4

Read a 32-bit floating point value from instrument B's registers 30005 and 30006 (lower bytes and higher bytes) into C04. Specify the smaller register number in the command.



Command



Reading Data into External Input Channels (RD-MV2000 only)

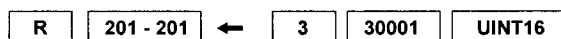
The MV reads the data from the server device and enters the data into external input channels in 16-bit signed integer format.

- Example 1**

Read a 16-bit unsigned integer value from instrument C's register 30001 into external input channel 201.

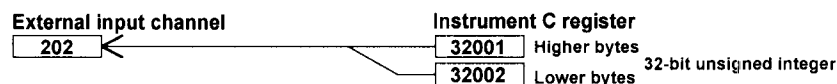


Command

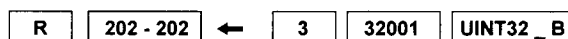


- Example 2**

Read a 32-bit unsigned integer value from instrument C's register 32001 and 32002 into external input channel 202. Specify the smaller register number in the command.



Command

**Writing Measured Values to a Server**

- Example**

Write the measured value of channel 1 (16-bit signed integer) to instrument A's register 40001.

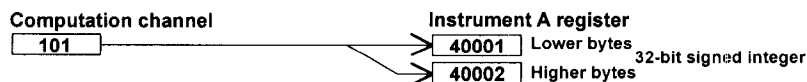


Command

**Writing Computed Values to a Server**

- Example**

Write the computed value of channel 101 (32-bit signed integer) to instrument A's 40001 and 40002 registers, lower 16 bits first and then higher 16 bits. Specify the smaller register number in the command.



Command



Checking the Modbus Operating Status

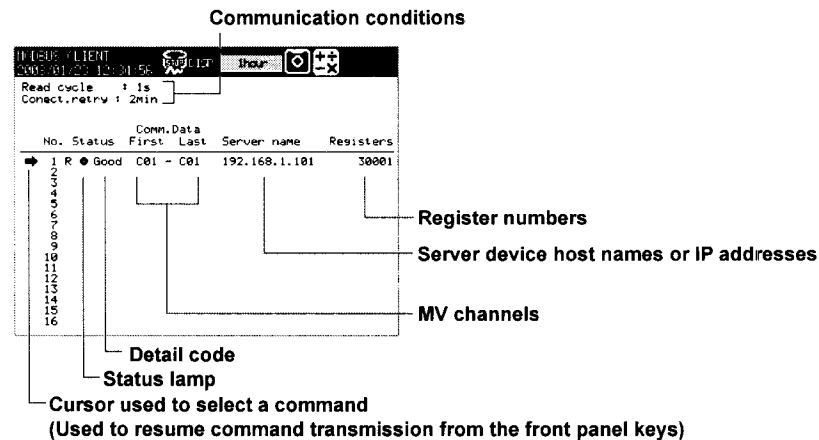
Displaying the Modbus Operating Status

- Press **DISP/ENTER** and then select **INFORMATION > MODBUS CLIENT**

Note

To show the MODBUS CLIENT on the display selection menu, you need to change the setting using the menu customize feature. Carry out the following steps.

- Press **MENU** and then select **Menu tab > Menu customize > Display menu**
 - Select **INFORMATION > MODBUS CLIENT** using the arrow keys.
 - Press the **View** soft key.



- Communication Conditions**

The Read cycle and Connect.retry settings are displayed.

- Communication Status**

The MV displays the communication status using status lamps and detail codes.

Status Lamp	Detail Code	Meaning
Green	Good	Communication is operating normally.
Yellow		Command is readying.
Orange		Trying to establish a TCP connection.
Red		Communication is stopped.
Common to yellow, orange, and red	None	No response from the server device.
	Func	The server device cannot execute the command from the MV.
	Regi	The server device does not have the specified register.
	Err	There is an error in the response data from the server device.
	Link	Ethernet cable is disconnected.
	Host	Unable to resolve the IP address from the host name.
	Cnct	Failed to connect to the server.
	Send	Failed to transmit the command.
	BRKN	Failed to receive the response data or detected a disconnection.
	(Space)	The detail code does not appear until the status is confirmed when communication is started.

Resuming Command Transmission

Using the front panel keys, you can resume command transmission to a server device whose communication is stopped (red status lamp).

1. Using the up and down arrow keys, select the command assigned to the server device that you want to resume transmission. The message "Push [right arrow] key to refresh" appears.
2. Press the right arrow key. The MV will transmit a command to the specified server.

Data When Communication Is Stopped and during Connection Retrials

If command transmission stops such as when the connection is disconnected, the status lamp will turn orange or red, and the communication input data and external input channel data will be error data. For computation channels, the MV displays "+OVER" or "-OVER" according to the settings. The MV displays "*****" for external input channels.

Data Dropout

A data dropout occurs when the commands 1 to 16 do not complete within the read cycle (see appendix 2). When a data dropout occurs, the communication input data is held at the previous value. The Modbus operating status display shows a message indicating that a data dropout occurred. If this happens, take measures such as making the read cycle longer or reducing the number of commands. Be sure to confirm that no data dropout occurs on the Modbus status log display.

Function for Automatically Assigning MW100s to the Modbus Client (RD-MV2000 only)

The following setup is carried out from the MV using Omega MW100 Data Acquisition Unit as a Modbus server.

If the RD-MV2000 is a Modbus client, MW100s—Modbus servers on the network—can be automatically assigned to the RD-MV2000. This feature is available only on MV2000s with the external input channel function (/MC1 option).

Setup Preparation

Configure the MW100s so that they are ready to make measurements (IP address, system construction, range setting, and the like of the MW100s that are going to be automatically assigned). For details, see the MW100 User's Manual.

Setup Procedure

If the MV IP address is not set, set it before carrying out the procedure below.

1. Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Modbus client > Auto setting**.
2. Carefully read the displayed precautions. Select **Yes** to execute the auto setting. Select **No** to return to the screen operation.
3. From the list of MW100s that is displayed, select the MW100s to be connected using the up and down arrow keys, and press DISP/ENTER. The selected MW100s are assigned to the external input channels of the MV.

Displays the IP address or host name.

Displays the MW100 unit number. The list displays up to 16 units in order from the smallest unit number.

Displays the status of the external input channel assignments.

No settings: The MW100 is not automatically assigned.

Not Ready: The MW100 cannot be connected.*

A value:

Displays the number of the assigned external input channel

Example: If an MW100 is assigned to external input channels 201 to 220, the status displays 201/220.

To correct the problem, see the
MV1000/MV2000 User's Manual.

[illegible]

Call

Pressing the **Call** soft key causes "--" to blink for 2 seconds on the 7-segment LED display of the selected MW100.

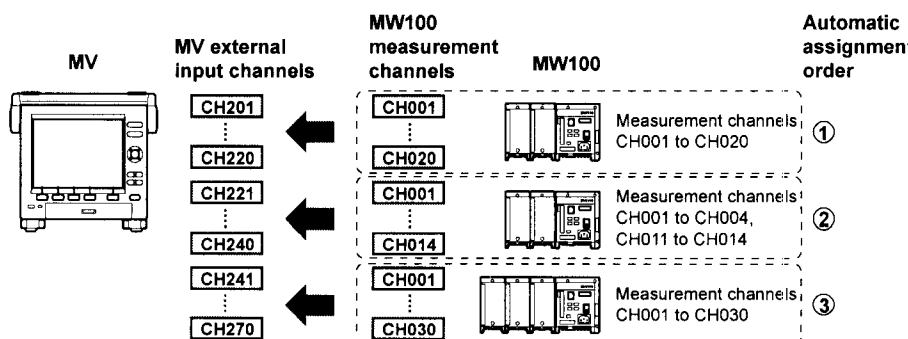
This feature allows you to check which MW100 is selected if multiple MW100s are connected.

Settings

The MW100 channels are assigned to the MV external input channels as follows:

- Channel numbers

The channels of the MW100 selected first are assigned consecutively to external input channels from 201. The channels of the MW100 selected next are assigned consecutively to the available external input channels from the smallest number. You cannot select the target external input channels.



- Range settings

The range settings of the MW100 (including the span and unit) are set automatically to the external input channels.

If the span setting of the MW100 range exceeds the span setting range of the MV external input channel (–30000 to 30000), it is set to the span upper limit (30000) or lower limit (–30000).

Specify the settings such as the alarm, the tag, and the area display of the color scale band of each channel after the auto setting is complete.

Note

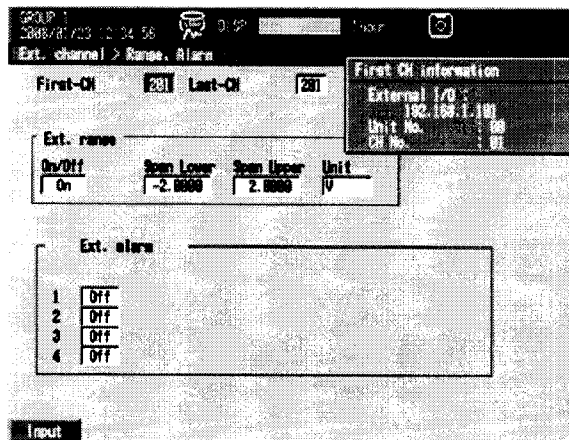
Precautions When Assigning Channels to the External Input Channels

- The MW100 channels are assigned 10 channels at a time to the external input channels. If the MW100 measurement module consists of less than 10 channels, "OFF" is assigned to the external input channels for the section without channels.
- An error occurs if the number of MW100 channels to be automatically assigned is greater than the number of available external input channels.
- If the range setting of a MW100 channel is set to "SKIP," the corresponding MV external input channel is set to "OFF."
- If a MW100 unit contains a module that cannot be assigned automatically, only the channels that can be assigned are assigned to the MV external input channels.
- If a new MW100 is added, auto setting is executed again. Because all the settings are cleared, you must execute auto setting again for all MW100s.
- If you are connecting MW100s that can be automatically assigned along with MW100s that cannot be automatically assigned or other Modbus devices, automatically assign the MW100s that can be automatically assigned first and then manually assign the remaining devices.

Note**About the MW100**

- MW100s that support auto assignment are those with firmware version R2.22 or later.
- MW100 modules that can be automatically assigned are the following input modules. The installable input modules vary depending on the MW100 firmware version.
 - 4-CH, High-Speed Universal Input Module
 - 10-CH, Medium-Speed Universal Input Module
 - 6-CH, Medium-Speed Four-Wire RTD Resistance Input Module
 - 10-CH, High-Speed Digital Input Module
 - 30-CH, Medium-Speed DCV/TC/DI Input Module
 - 10-CH, Medium-Speed Pulse Input Module
- If there are no assignable channels or the Modbus server setting is Off, auto setting fails with an error. Check the settings.
- MW100s that are connected through auto setting automatically switches to the measurement mode.
- MW100 port number 34324 is used to perform auto setting.
- For details on the MW100 settings, see the MW100 User's Manual.

The first channel information of the MW100 that is automatically assigned to an external input channel can be displayed when the cursor is on the first or last channel.



In addition, you can check the status of the connected MW100 on the Modbus status display screen.

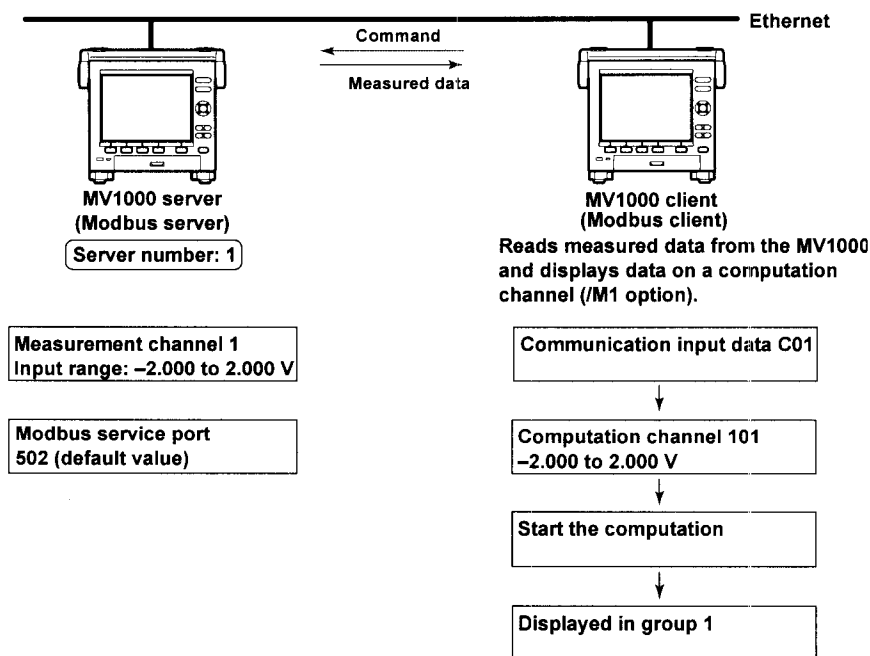


2.10 Usage Example of the Modbus Function

This section explains an example of setting two MV1000s that are connected via the Ethernet network, one configured to be a Modbus client and another configured to be a Modbus server. This section refers to the RD-MV1000 configured to be a Modbus server as the RD-MV1000 server and the RD-MV1000 configured to be a Modbus client as the RD-MV1000 client.

System Configuration and Operation

The measurement channels, computation channels, and communication input data shown below will be used. We assume that the Ethernet interface is already configured.



Operation

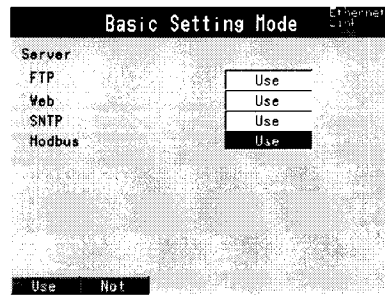
- The RD-MV1000 client reads the measured value from the RD-MV1000 server channel 1 into communication input channel C01 and displays the value on computation channel 101. The MV displays computation channel 101 in group 1.
- The measured value of RD-MV1000 server channel 1 is transferred to the RD-MV1000 client as an integer in the range of -20000 to 20000.
- The RD-MV1000 client displays values in the range of -2.0000 to 2.0000 V for values in the range of -20000 to 20000. The value is linearly scaled using the following equation.

The value on RD-MV1000 client computation channel 101 = Communication input data C01 \times 0.0001

Configuring the RD-MV1000 Server (Modbus server)

Configuring the Modbus Server Function

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) > Server**



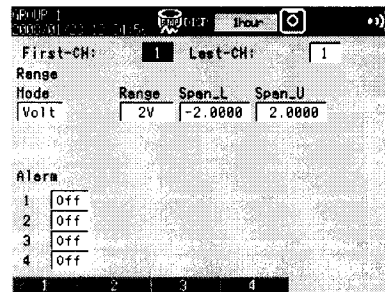
Parameter	Setting
Modbus	Use

Port Number

The default value is 502.

Configuring Measurement Channels

- ◇ Press **MENU** and then select **Menu tab > Meas channel > Range, Alarm**



Parameter	Setting
First channel and last channel	1
Mode	Volt
Range	2V
Span_L	-2.0000
Span_U	2.0000

Configuring the RD-MV1000 Client (Modbus client)

The description below assumes that settings other than destination server settings and commands are at default values.

Registering the Destination Server

The example below describes the settings used to register the RD-MV1000 server to number 1.

The RD-MV1000 server IP address is assumed to be 192.168.1.101.

◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab >**

Communication (Ethernet) > Modbus client > Modbus server settings

Server number	Port	Modbus server name	Unit
1	502	192.168.1.101	Auto
2	502		Auto
3	502		Auto
4	502		Auto
5	502		Auto
6	502		Auto
7	502		Auto
8	502		Auto

Parameter	Setting
Port	502
Modbus server name	192.168.1.101
Unit	Auto

Setting Transmission Commands

◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab >**

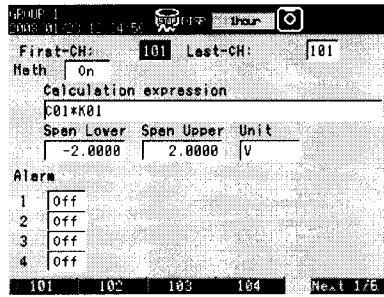
Communication (Ethernet) > Modbus client > Command settings

Client command number	First	Last	Server	Regi.	Type
1	R-M	C01	1	30001	INT16
2	Off				
3	Off				
4	Off				
5	Off				
6	Off				
7	Off				
8	Off				

Parameter	Setting
Command type	R-M
First and Last	C01
Server	1
Regi.	30001
Type	INT16

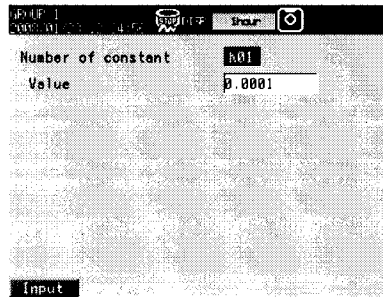
Configuring Computation Channels

- ◇ Press **MENU** and then select **Menu tab > Math channel > Expression, Alarm**



Parameter	Setting
First and Last	101
Math	On
Calculation expression	01*K01
Span Lower	-2.0000
Span Upper	2.0000
Unit	V

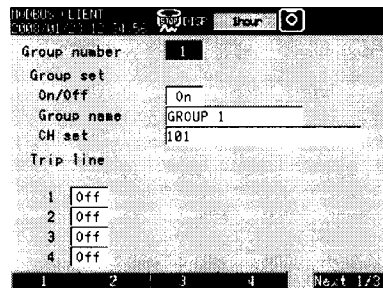
- ◇ Press **MENU** and then select **Menu tab > Math channel > Constant**



Parameter	Setting
Number of constant	K01
Value	0.0001

Assigning a Channel to a Group

- ◇ Press **MENU** and then select **Menu tab > Group set, Trip line**

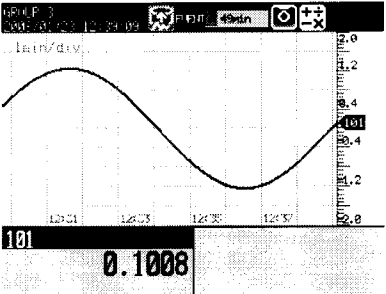


Parameter	Setting
Group number	1
On/Off	On
Group name	GROUP 1
CH set	101

Starting Computation (RD-MV1000 client)

- ◇ Press **FUNC > Math** start

Computation starts, and the status display section shows the math icon.
The value of the **RD-MV1000 client's** computation channel 101 shown in GROUP 1 varies in sync with the measured value of the **RD-MV1000 server's** measurement channel 1.



Checking the Modbus Operating Status (RD-MV1000 client)

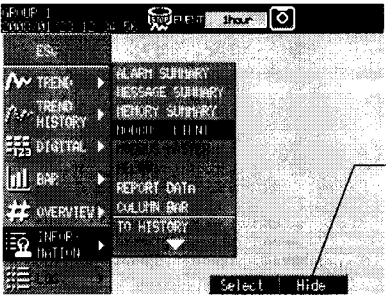
Showing the Menu Used to Switch to the Modbus Client Screen

Carry out the procedure below to show **INFORMATION > MODBUS CLIENT** in the display selection menu.

- ◇ Press **MENU** and then select **Menu tab > Menu customize > Display menu**

1. Select **INFORMATION > MODBUS CLIENT** using the arrow keys.
 - * Select **MODBUS MASTER** to use Modbus master via the serial interface.
2. Press the **View** soft key.

The menu item is enabled and is displayed in white.



View/Hide
Pressing the **View** soft key changes the soft key to **Hide**.

3. Press **ESC** several times to return to the operation screen.

Displaying the Modbus Client Screen

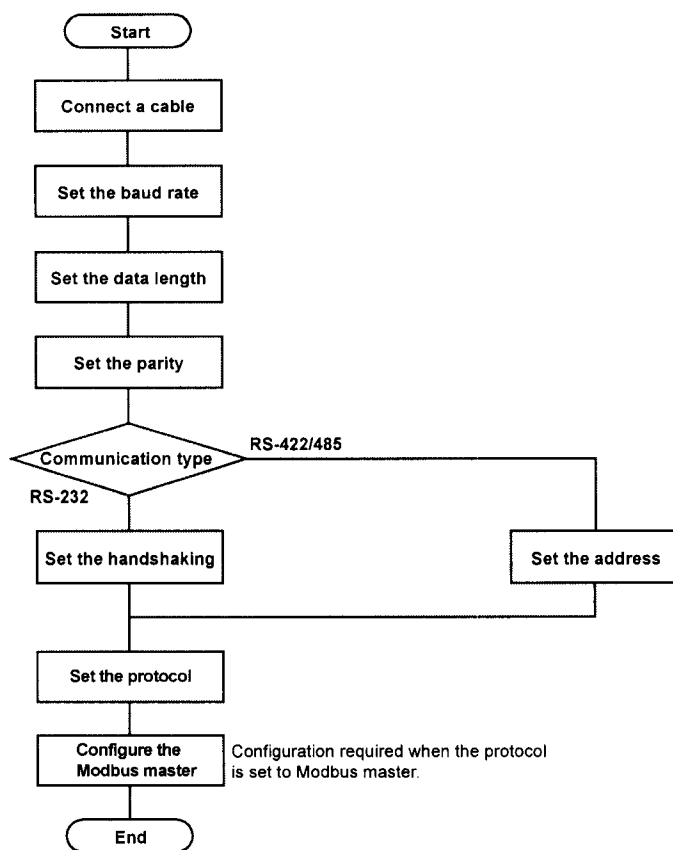
- ◇ Press **DISP/ENTER** and then select **INFORMATION > MODBUS CLIENT**
 - * Select **INFORMATION > MODBUS MASTER** to use Modbus master via the serial interface.

No.	Status	Comm. Data	First	Last	Server name	Registers
1	R	Good	C01	C01	192.168.1.101	30001
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

3.1 Workflow for Using the Serial Interface

The flow chart below shows the procedure to set RS-232 or RS-422/RS-485 communication.

The procedure differs between RS-232 and RS-422/RS-485.



3.2 Connecting the MV

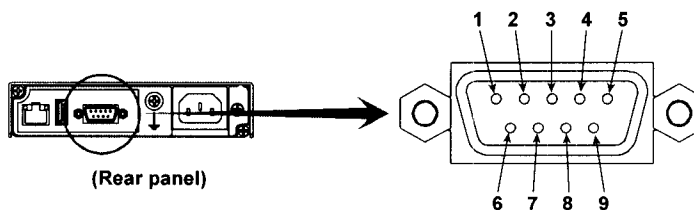
Connecting a Cable

Connect a cable to the serial port on the MV rear panel.

RS-232 Connection Procedure

Connect a cable to the 9-pin D-sub RS-232 connector.

Connector Pin Arrangement and Signal Names



Pin assignments are shown in the table below.

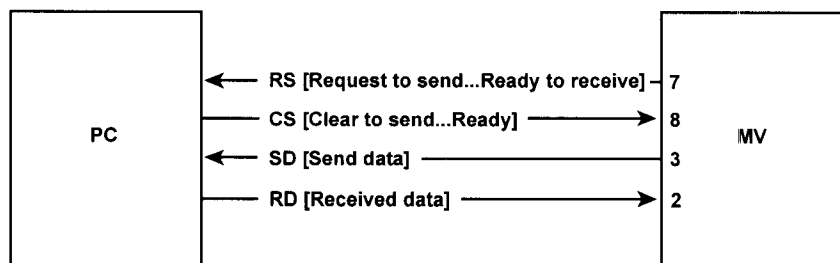
The table shows the signal names as defined by the RS-232, JIS, and ITU-T standards along with their description.

Pin	Signal Name			Name	Signal Description
	JIS	ITU-T	RS-232		
2	RD	104	BB(RXD)	Received data	Input signal to the MV.
3	SD	103	BA(TXD)	Transmitted data	Output signal from the MV.
5	SG	102	AB(GND)	Signal ground	Signal ground.
7	RS	105	CA(RTS)	Request to send	Handshaking signal transmitted from the MV used to receive data from the PC.
8	CS	106	CB(CTS)	Clear to send	Handshaking signal transmitted from the MV used to receive data from the PC.

* Pins 1, 4, 6, and 9 are not used.

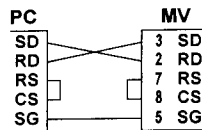
Connection

- Signal direction

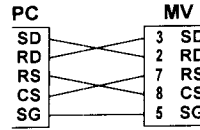


- Connection example

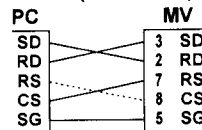
- OFF-OFF/XON-XON



- CS-RS (CTS-RTS)



- XON-RS (XON-RTS)



You do not need to wire RS on the PC to CS on the MV. However, we recommend it so that the cable can be used in either direction.

Handshaking

When using the RS-232 interface for transferring data, it is necessary for equipment on both sides to agree on a set of rules to ensure the proper transfer of data. The set of rules is called handshaking. Because there are various handshaking methods that can be used between the MV and the PC, you must make sure to choose the same method for both the MV and the PC.

You can choose any of the four methods in the table below for the MV.

Handshaking Combinations (Yes indicates that it is supported)

	Data transmission control (Control used to send data to a computer)			Data Reception Control (Control used to receive data from a computer)		
	Software handshaking	Hardware handshaking	No handshaking	Software handshaking	Hardware handshaking	No handshaking
	Stops sending when X-OFF is received. Resumes when X-ON is received.	Stops sending when CS (CTS) is false. Resumes when it is true.		Sends X-OFF when the receive data buffer is 3/4 full. Sends X-ON when the receive data buffer is 1/4 full.	Sets RS (RTS) to false when the receive data buffer is 3/4 full. Sets RS (RTS) to true when the receive data buffer is 1/4 full.	
Handshaking						
OFF-OFF			Yes			Yes
XON-XON	Yes			Yes		
XON-RS	Yes				Yes	
CS-RS		Yes			Yes	

- OFF-OFF

- Data transmission control

There is no handshaking between the MV and the PC. The MV treats the "X-OFF" and "X-ON" signals that are received from the PC as data and ignores the CS signal.

- Data reception control

There is no handshaking between the MV and the PC. When the received buffer becomes full, the MV discards all of the data that overflows.

RS = True (fixed).

- **XON-XON**

- Data transmission control

Software handshaking is performed between the MV and the PC. When an "X-OFF" code is received while sending data to the PC, the MV stops the data transmission. When the next "X-ON" code is received, the MV resumes transmission. The MV ignores the CS signal that is received from the PC.

- Data reception control

Software handshaking is performed between the MV and the PC. When the used area in the received buffer increases to 1537 bytes, the MV sends an "X-OFF" code. When the used area decreases to 511 bytes, the MV sends an "X-ON" code. RS = True (fixed).

- **XON-RS**

- Data transmission control

The operation is the same as with XON-XON.

- Data reception control

Hardware handshaking is performed between the MV and the PC. When the used area in the received buffer increases to 1537 bytes, the MV sets "RS=False." When the used area decreases to 511 bytes, the MV sets "RS=True."

- **CS-RS**

- Data transmission control

Hardware handshaking is performed between the MV and the PC. When the CS signal becomes False while sending data to the PC, the MV stops the data transmission. When the CS signal becomes True, the MV resumes the data transmission. The MV treats the "X-OFF" and "X-ON" signals that are received from the PC as data.

- Data reception control

The operation is the same as with XON-RS.

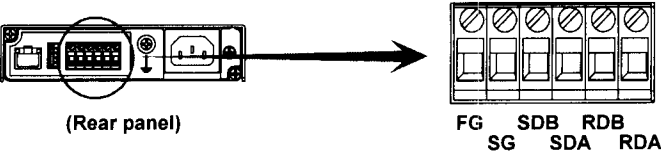
Note

- You must design the PC program so that the received buffer of neither the MV nor the PC does not become full.
 - If you select XON-XON, send the data in ASCII format.
-

RS-422/485 Connection Procedure

Terminal Arrangement and Signal Names

Connect a cable to the clamp terminal.

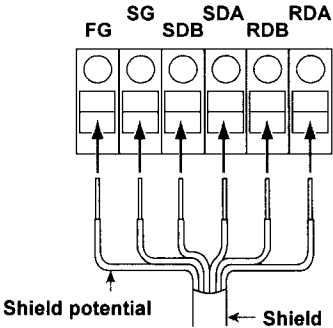


Terminal assignments are shown in the table below.

Signal Name	Signal Description
FG (Frame Ground)	The MV case ground.
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 (-).

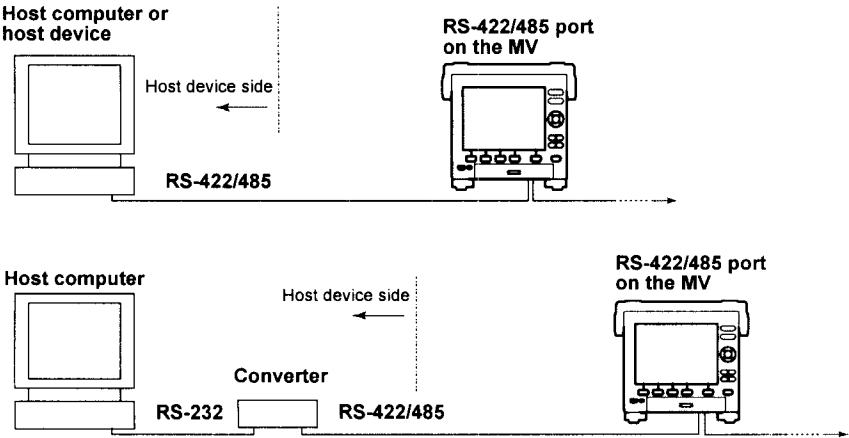
Connection

- Connecting a cable
As shown in the figure below, remove approximately 5 mm of the covering from the end of the cable to expose the conductor. Keep the exposed section from the end of the shield within 5 cm.
- Connection for a four-wire system



Connecting to a Host Device

The figure below illustrates the connection of the MV to a host device. If the port on the host device is RS-232, connect a converter.



3.2 Connecting the MV

Example of a Connection to the Host Device

The MV can connect to a host device that has an RS-232, RS422, or RS-485 port.

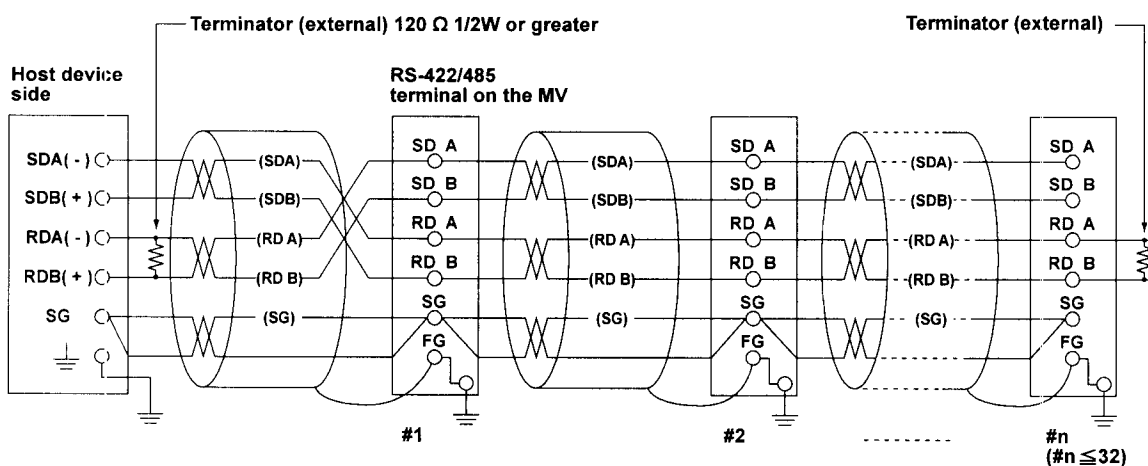
If the host device has an RS-232 port, use a converter. See the examples below for typical converter terminals. For details, see the converter manual.

RS-422/485 Port	Converter
SDA(-)	TD(-)
SDB(+)	TD(+)
RDA(-)	RD(-)
RDB(+)	RD(+)
SG	SHIELD
FG	EARTH

There is no problem with connecting a 220-Ω terminator at each end if Omega PLCs or temperature controllers are also connected in the communication line.

• Four-Wire System

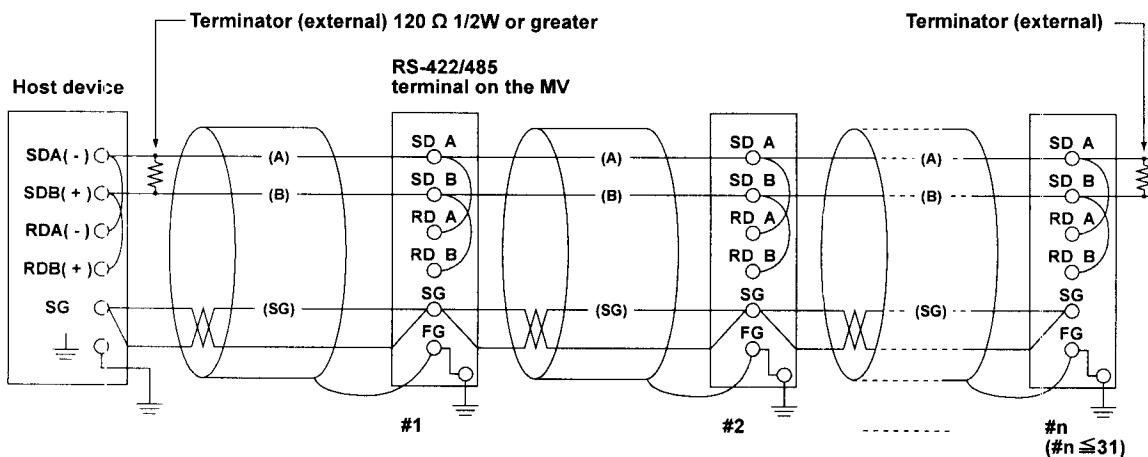
Generally, a four-wire system is used to connect the MV to a host device. In a four-wire system, the transmission and reception lines need to be crossed over.



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

• Two-Wire System

Connect the transmission signals to the reception signals with the same polarity on the RS422/485 terminal block. Only two wires are used to connect to the external device.



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

Note

- The way to eliminate noise varies depending on the situation. In the connection example, the cable shield is connected only to the MV's ground (one-sided grounding). This is effective when there is a difference in the electric potential between the PC's ground and the MV's ground, which may be the case with long distance communications. If there is no difference in the electric potential between the PC's ground and the MV's ground, connecting the cable shield to ground at both ends may be effective (two-sided grounding). In some cases, using two-sided grounding with a capacitor connected in series at one end is effective. Consider these possibilities to eliminate noise.
- When using the two-wire system (Modbus protocol), the 485 driver must be set to high impedance within 3.5 characters after the last data byte that the host PC sends.

Serial Interface Converter

We recommend the following converter.

MODEL RC-770X by SYSMEX RA CO., LTD; SI-30FA by LINE EYE; or ML2 by Omega.

**CAUTION**

In converters other than those that we recommend, the FG and SG terminals may not be isolated. In such case, do not follow the diagram on the previous page (do not connect anything to the FG and SG terminals). Especially in long distance communications, the potential difference that occurs may damage the instruments or may cause communication errors. For converters that do not have the SG terminal, they can be used without the signal ground. For details, see the converter manual.

In converters other than those that we recommend, the signal polarities may be reversed (A/B or +/- indication). In this case, reverse the connection.

In the case of a two-wire system, the host device must control the converter transmission driver to prevent collisions of transmitted and received data. If you are using one of the recommended converters, control the transmission driver using the RS (RTS) signal on the RS-232.

When the System Contains Instruments That Only Support the RS-422 Interface

In a four-wire system, up to 32 MVs can connect to a single host device. However, this may not be possible if the system contains instruments that support only the RS-422 interface.

When the System Contains Omega Recorders That Only Support the RS-422 Interface

Only up to 16 instruments can be connected. Some of the conventional Omega recorders (HR2400 and μR , for example) only support the RS-422 driver. If the system contains these recorders, only up to 16 instruments can be connected.

Note

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

Terminator

In a multidrop connection (including point-to-point connection), connect a terminator to the MV if the MV is connected to the end of the chain. Do not connect a terminator to a MV in the middle of the chain. In addition, turn the host device terminator ON (see the host device manual). If a converter is being used, turn ON its terminator. We recommend converters with a built-in terminator.

Select the appropriate terminator (120 Ω), indicated in the figure, according to the characteristic impedance of the line, the installation conditions of the instruments, and so on.

3.3 Configuring the Serial Interface

- ◊ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Serial) > Basic settings**

Basic Setting Mode

Serial

Baud rate	9600	bps
Data length	8	bit
Parity	Even	
Handshaking	Off:Off	
Address	1	
Protocol	Normal	

1200 2400 4800 9600 Next 1/2

For RS-232

- **Baud rate**
Select 0, 1200, 2400, 4800, 9600, 19200, or 38400 (bps).
- **Data length**
Select 7 or 8 (bits). To output the data in binary format, select **8**.
- **Parity**
Set the parity to Odd, Even, or None.
- **Handshaking**
Select Off:Off, XON:XON, XON:RS, or CS:RS.
- **Address**
Enter a value in the range of 1 to 99 for the Modbus protocol. For a general purpose communication protocol, do not set this value.
- **Protocol**
Select **Standard** for a general purpose communication protocol, **Modbus** for Modbus slave, and **Master-M** for Modbus master.
If you select Modbus master, you must specify Modbus master settings. See section 3.5 for details.

For RS-422/485

- **Baud rate**
Select 0, 1200, 2400, 4800, 9600, 19200, or 38400 (bps).
- **Data length**
Select 7 or 8 (bits). To output the data in binary format, select **8**.
- **Parity**
Set the parity to Odd, Even, or None.
- **Handshaking**
Do not set.
- **Address**
Select a number from 1 to 99.
- **Protocol**
This is the same as with the RS-232.

3.4 Reading/Writing the MV Data from Another Device via Modbus

The MV is a Modbus slave.
For Modbus specifications, see section 7.3.

Configuring the Serial Interface

Set **Protocol** to **Modbus** under **Serial basic settings**. See section 3.3 for details.

Reading or Writing the MV Data from Another Device

Another device (master device) sends commands to the MV to read data from the MV or write data to the MV.

For the function codes that the MV supports and the MV registers that the master device can access, see "Modbus Server Function" in section 7.3.

3.5 Reading/Writing Data on Another Device from the MV via Modbus

The MV is a Modbus master.

For Modbus specifications, see section 7.3.

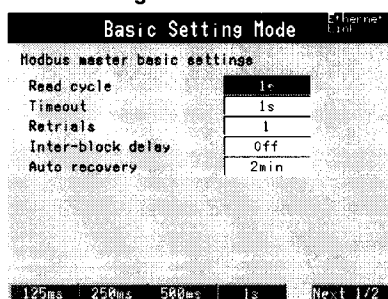
Configuring the Serial Interface

Set **Protocol** to **Master-M** under **Serial basic settings**. See section 3.3 for details.

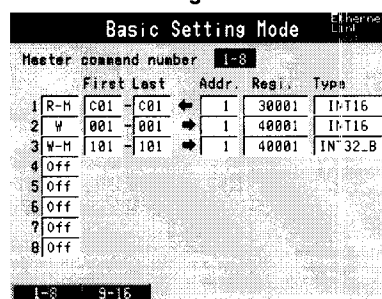
Configuring the Modbus Master

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Serial) > Modbus master > Basic settings** or **Command settings**

Basic settings



Command Settings



Basic Settings

- **Read cycle**
Set the read cycle to 125ms, 250ms, 500ms, 1s, 2s, 5s, or 10s.
- **timeout**
Set the command timeout value to 125ms, 250ms, 500ms, 1s, 2s, 5s, 10s, or 1min.
- **Retrials**
Set the number of retrials when there is no response from the slave. Select Off, 1, 2, 3, 4, 5, 10, or 20.
- **Inter-block delay**
Set the wait time between commands to Off, 5ms, 10ms, 15ms, 45ms, or 100ms.
- **Auto recovery**
Set the auto recovery time from communication halt. Select Off, 1min, 2min, 5min, 10min, 20min, 30min, or 1h.

Command Settings

- **Master command number**
Select 1-8 or 9-16 for the command numbers to be configured.
- **Command type**
Set the transmission command type to Off, R, R-M, W, or W-M.
 - R: Read the data from the slave into external input channels (16-bit signed integer)
 - R-M: Read the data from the slave into communication input channels (32-bit floating point)
 - W: Write computation channel data (16-bit signed integer) to the slave
 - W-M: Write computation channel data (32-bit signed integer) to the slave

R is selectable on the RD-MV2000 when external input channels (/MC1 option) is installed.
R-M and W-M are selectable when the computation function (/M1 or /PM1 option) is installed.

- **First/Last (MV channel numbers)**
Enter the first and last channel numbers of input/output. The range of channels that you can enter varies depending on the command type as follows:
R: 201 to 440, R-M: C01 to C60, W: 1 to 48, W-M: 101 to 160
- **Address**
Enter the slave device address in the range of 1 to 247.
- **Regi.**
Set the slave register number.
Enter an input register in the range of 30001 to 39999 and 300001 to 365536 or a hold register in the range of 40001 to 49999 and 400001 to 465536.
The register numbers that you can specify vary depending on the command type. See section 7.3 for details.
- **Type**
The data type.
Select INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L, FLOAT_B, or FLOAT_L.
The data type that you can specify vary depending on the command type. See section 7.3 for details.

Example of Entering Commands

See section 2.9.

Checking the Modbus Operating Status

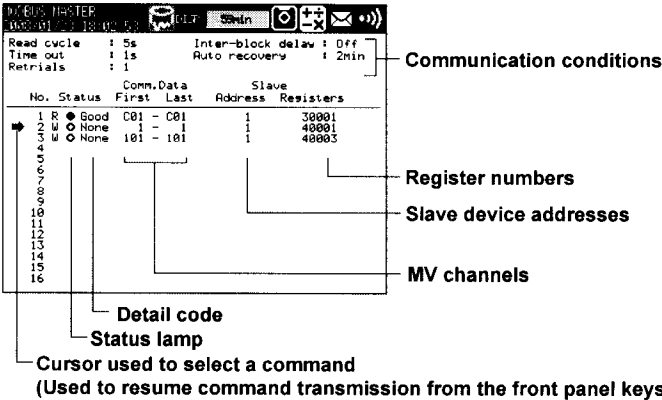
Displaying the Modbus Operating Status

◇ Press **DISP/ENTER** and then select **INFORMATION > MODBUS MASTER**.

Note

To display the MODBUS MASTER on the display selection menu, you need to change the setting using the menu customize feature. Carry out the following steps.

- ◇ Press **MENU** and then select **Menu tab > Menu customize > Display menu**
 1. Select **INFORMATION > MODBUS MASTER** using the arrow keys.
 2. Press the **View** soft key.



3.5 Reading/Writing Data on Another Device from the MV via Modbus

- **Communication Conditions**

The read cycle, Inter-block delay, Time out, Auto recovery, and Retrials settings are displayed.

- **Communication Status**

The MV displays the communication status using status lamps and detail codes.

Status Lamp	Detail Code	Meaning
Green	Good	Communication is operating normally.
Yellow		Command is readying.
Red		Communication is stopped.
Common to yellow and red	None	No response from the slave device.
	Func	The slave device cannot execute the command from the MV.
	Regi	The slave device does not have the specified register.
	Err	There is an error in the response data from the slave device (communication error).
	(Space)	The detail code does not appear until the status is confirmed when communication is started.

Resuming Command Transmission

Using the front panel keys, you can resume command transmission to a slave device whose communication is stopped (red status lamp).

1. Using the up and down arrow keys, select the command assigned to the slave device that you want to resume transmission. The message "Push [right arrow] key to refresh" appears.
2. Press the right arrow key. The MV will transmit a command to the specified slave device.

Data during Connection Retrials

On a Modbus master, the communication input data and external input channel data are held at the previous values while the command is being retried. If the command transmission stops, the status lamp will turn red, and the communication input data and external input channel data will be error data. For computation channels, the MV displays "+OVER" or "-OVER" according to the settings. The MV displays "*****" for external input channels.

Data Dropout

A data dropout occurs when the commands 1 to 16 do not complete within the read cycle (see appendix 2). When a data dropout occurs, the communication input data is held at the previous value. The Modbus status display shows a message indicating that a data dropout occurred. If this happens, take measures such as making the read cycle longer or reducing the number of commands. Be sure to confirm that no data dropout occurs on the Modbus status log display.

3.6 Usage Example of the Modbus Function

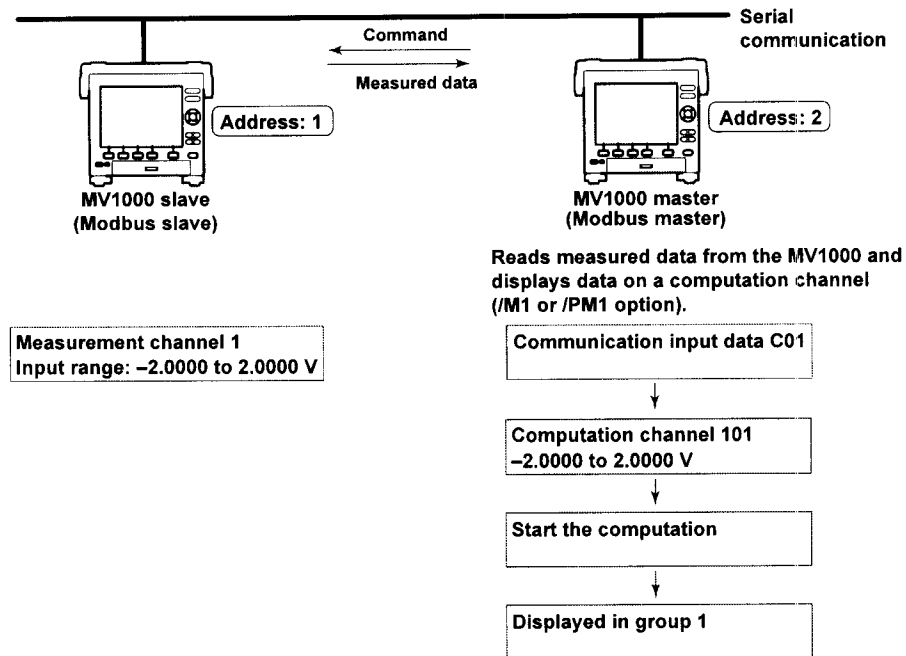
This section explains an example of setting two MV1000s that are connected via the serial interface, one configured to be a Modbus master and another configured to be a Modbus slave. This section refers to the RD-MV1000 configured to be a Modbus master as the RD-MV1000 master and the RD-MV1000 configured to be a Modbus slave as the RD-MV1000 slave.

3

Using the Serial Interface

System Configuration and Operation

The measurement channels, computation channels, and communication input data shown below will be used. We assume that the serial interface is already configured.



Operation

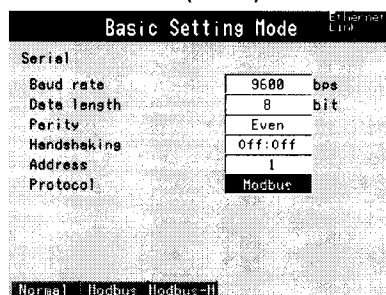
- The RD-MV1000 master reads the measured value from the RD-MV1000 slave channel 1 into communication input channel C01 and displays the value on computation channel 101. The MV displays computation channel 101 in group 1.
- The measured value of RD-MV1000 slave channel 1 is transferred to the RD-MV1000 master as an integer in the range of -20000 to 20000.
- The RD-MV1000 master displays values in the range of -2.0000 to 2.0000 V for values in the range of -20000 to 20000. The value is linearly scaled using the following equation.

The value on RD-MV1000 master computation channel 101 = Communication input data C01 × 0.0001

Configuring the RD-MV1000 Slave (Modbus Slave)

Configuring the Modbus Slave

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Serial) > Basic settings**

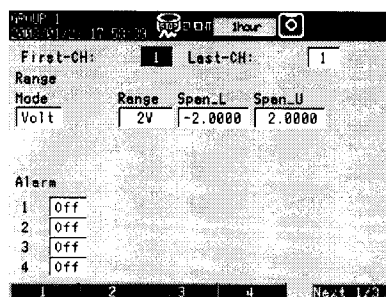


Parameter	Setting
Address	1
Protocol	Modbus

* Set the communication parameters the same as those of the master device.

Configuring Measurement Channels

- ◇ Press **MENU** and then select **Menu tab > Meas channel > Range, Alarm**



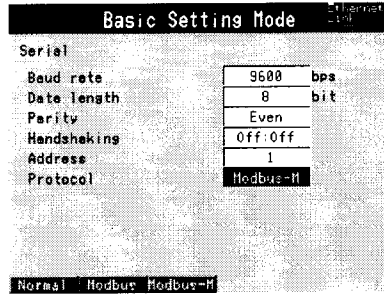
Parameter	Setting
First channel and last channel	1
Mode	Volt
Range	2V
Span_L	-2.0000
Span_U	2.0000

Configuring the RD-MV1000 Master (Modbus Master)

Set default values for parameters other than those listed below.

Configuring the Modbus Master

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Serial) > Basic settings**

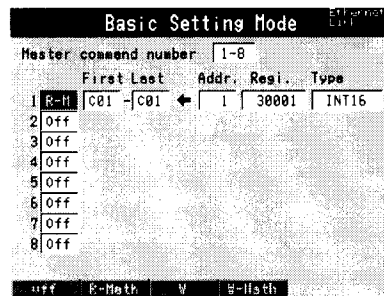


Parameter	Setting
Address	2
Protocol	Modbus-M

* Set the communication parameters the same as those of the slave device.

Setting Transmission Commands

- ◇ Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Serial) > Modbus master > Command settings**



Parameter	Setting
Command type	R-M
First and Last	C01
Address	1
Regi.	30001
Type	INT16

Configuring Computation Channels

See section 2.10, "Usage Example of the Modbus Function."

Assigning a Channel to a Group

See section 2.10, "Usage Example of the Modbus Function."

Starting Computation

See section 2.10, "Usage Example of the Modbus Function."

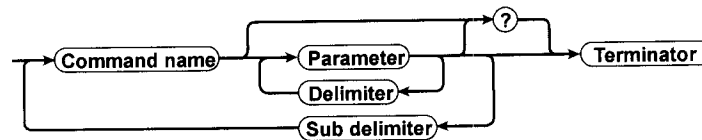
Checking the Modbus Operating Status

See section 2.10, "Usage Example of the Modbus Function."

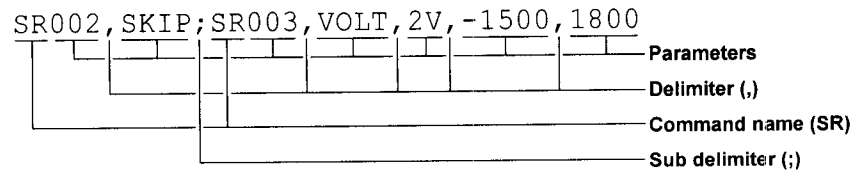
4.1 Command Syntax

Command Syntax

This section describes the MV setting, basic setting, and output command syntax (see sections 4.4 to 4.10). ASCII codes (see appendix 1) are used for the character codes. For the maintenance/test command syntax (see section 4.11) and instrument information output command syntax (see section 4.12), see the corresponding sections or the examples for each command.



Command example



Command Name

A command name is defined using two alphabet characters.

Parameters

- Command parameters.
- Parameters are specified using alphabet characters or numeric values.
- Each parameter is separated by a delimiter (comma).
- A numeric value is specified using an integer.
- If the parameter is a numeric value, the valid range of the value varies depending on the command.
- Spaces before and after a parameter are discarded. (However, spaces are significant in a parameter (unit) specified using an ASCII character string.) In the examples given in this manual, spaces are not used.
- You can omit parameters that do not need to be changed from their current settings. However, delimiters cannot be omitted.

Example SR001, , 2V<terminator>

- If multiple parameters are omitted and delimiters occur at the end of the command, those delimiters can be omitted.

Example SR001, VOLT, , , <terminator> □ SR001, VOLT<terminator>

- The number of digits is fixed for the parameters listed below. If you enter the wrong number of digits, a syntax error will occur.
 - Date YY/MM/DD (eight characters)
 - YY: Enter the lower two digits of the year.
 - MM: Month
 - DD: Day
 - Time HH:MM:SS (eight characters)
 - HH: Hour
 - MM: Minute
 - SS: Second
 - Channel number: Three characters
 - Relay number: Three characters

Query

- A question mark is used to specify a query.
- You can insert a question mark after a command or parameter to query the corresponding command setting. Queries are not allowed on some commands. For the query syntax of each command, see sections 4.4 to 4.7.

Example 1 SR[p1]? You can execute SR? or SRp1?.

Example 2 SA[p1[,p2]]? You can execute SA?, SAp1?, and SAp1,p2?.

Delimiter

- A comma is used as a delimiter.
- Separate each parameter with a delimiter.

Sub Delimiter

- A semicolon is used as a sub delimiter.
- You can specify up to 10 commands consecutively by separating each command with a sub delimiter. However, you cannot do this with the commands listed below and all queries. Specify them independently.
 - Output commands other than BO, CS, and IF
 - Queries
 - * If there are consecutive sub delimiters, they are considered to be one. Sub delimiters at the front and at the end of a command sequence are ignored.

Example ;SR001,VOLT;;SR002,VOLT;<terminator> is interpreted as SRC01,VOLT;SR002,VOLT<terminator>.

Terminator

Use either of the following for the terminator.

- CR+ LF (0DH 0AH in ASCII code)
- LF (0AH in ASCII code)

Note

- Do not specify a channel or relay number that is not available on the MV. If you do, an error will occur.
 - The total data length from the first character to the terminator must be less than 2048 bytes.
 - Commands are not case-sensitive except for user-specified character strings.
 - All commands that are listed with sub delimiters are executed even if any of the commands is in error.
 - 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 will occur.
-

Response

The MV returns a response (affirmative/negative response) to a command that is delimited by a terminator.* The controller should follow the one command to one response format. If the command-response rule is not observed, the operation is not guaranteed. For the response syntax, see section 5.1.

- RS-422/485 commands (see section 4.9) and instrument information output commands (section 4.12) are exceptions.

4.2 A List of Commands

Setting Commands

Group/ Command Name	Function	Execution Mode	Administrator	User	See Page
Setting					
SR	Sets an input range	Operation Mode	Yes	No	4-10
SO	Sets a calculation expression	Operation Mode	Yes	No	4-11
ER	Sets the range of an external input channel	Operation Mode	Yes	No	4-11
TJ	Sets memory sampling	Operation Mode	Yes	No	4-11
SA	Sets an alarm	Operation Mode	Yes	No	4-12
SW	Sets the display update rate and auto-save interval	Operation Mode	Yes	No	4-13
TW	Sets the secondary trend update rate	Operation Mode	Yes	No	4-13
TM	Sets manual sampling.	Operation Mode	Yes	No	4-13
TE	Sets sampling conditions of the event data	Operation Mode	Yes	No	4-13
SZ	Sets a zone	Operation Mode	Yes	No	4-14
SP	Sets the partial expanded display	Operation Mode	Yes	No	4-14
ST	Sets a tag	Operation Mode	Yes	No	4-14
SX	Sets a group	Operation Mode	Yes	No	4-14
SL	Sets a trip line	Operation Mode	Yes	No	4-14
SG	Sets a message	Operation Mode	Yes	No	4-15
TH	Sets the data storage directory on an external storage medium	Operation Mode	Yes	No	4-15
TZ	Sets the file header	Operation Mode	Yes	No	4-15
TF	Sets the data file name	Operation Mode	Yes	No	4-15
SD	Sets the date and time	Operation Mode	Yes	No	4-15
TT	Sets the trend display	Operation Mode	Yes	No	4-15
SE	Sets the trend graph line width and the number of grids	Operation Mode	Yes	No	4-16
TB	Sets the bar graph display	Operation Mode	Yes	No	4-16
SB	Sets the bar graph of a channel	Operation Mode	Yes	No	4-16
TN	Sets the scale	Operation Mode	Yes	No	4-16
SV	Sets the moving average of a measurement channel	Operation Mode	Yes	No	4-16
SC	Sets a channel display color	Operation Mode	Yes	No	4-16
TA	Sets an alarm point mark	Operation Mode	Yes	No	4-16
TG	Sets a color scale band	Operation Mode	Yes	No	4-16
SQ	Sets the LCD brightness and screen backlight saver	Operation Mode	Yes	No	4-17
TC	Sets the background color	Operation Mode	Yes	No	4-17
TP	Sets auto group switching	Operation Mode	Yes	No	4-17
TR	Sets auto monitor recovery	Operation Mode	Yes	No	4-17
TQ	Sets a timer	Operation Mode	Yes	No	4-17
TK	Sets a match timer	Operation Mode	Yes	No	4-17
TU	Sets an event action	Operation Mode	Yes	No	4-18
SK	Sets a computation constant	Operation Mode	Yes	No	4-18
SI	Sets rolling average on a computation channel	Operation Mode	Yes	No	4-19
SJ	Sets a TLOG timer	Operation Mode	Yes	No	4-19
TX	Sets the ancillary operation of the start key	Operation Mode	Yes	No	4-19
FR	Sets the FIFO buffer acquisition interval	Operation Mode	Yes	No	4-19
BH	Sets a batch text field	Operation Mode	Yes	No	4-20
EH	Sets a calibration correction	Operation Mode	Yes	No	4-20
BD	Sets an alarm delay	Operation Mode	Yes	No	4-20
SM	Sets the custom menu	Operation Mode	Yes	No	4-20
SY	Sets the 4 panel display	Operation Mode	Yes	No	4-22
TY	Sets the file format	Operation Mode	Yes	No	4-23
NF	Sets the HISTORY key function	Operation Mode	Yes	No	4-23

Yes: Command usable

No: Command not usable

4.2 A List of Commands

Note

- There are two execution modes on the MV. If you attempt to execute a command in the wrong mode, a syntax error will occur. Use the DS command to switch to the appropriate execution mode, and then execute the command. Query commands can be executed in either mode.

Basic Setting Mode

A mode in which settings are changed after stopping measurements and computations.

Operation Mode

A mode in which commands other than those in Basic Setting Mode are used.

- The administrator and user indications in the table are the user levels that are specified through the Ethernet communication login function. See section 2.1 for details.

Group/ Command Name	Function	Execution Mode	Administrator	User	See Page
Control					
BT	Sets a batch name	Operation Mode	Yes	No	4-24
BU	Sets a batch comment	Operation Mode	Yes	No	4-24
UD	Switches the display	Operation Mode	Yes	No	4-24
PS	Starts/stops measurements	Operation Mode	Yes	No	4-25
AK	Releases the alarm output (alarm acknowledge)	Operation Mode	Yes	No	4-25
EV	Executes manual sample, manual trigger, snapshot, or forced timeout	Operation Mode	Yes	No	4-25
CL	Executes manual SNTP	Operation Mode	Yes	No	4-25
CV	Switches the trend update rate	Operation Mode	Yes	No	4-25
MS	Writes a message (displays and writes)	Operation Mode	Yes	No	4-25
BJ	Writes a free message	Operation Mode	Yes	No	4-25
EJ	Changes the login password	Operation Mode	Yes	Yes	4-25
TL	Starts, stops, resets computation (MATH) or clears the computation dropout status display	Operation Mode	Yes	No	4-26
DS	Switches the execution mode between operation and basic setting	All modes	Yes	No	4-26
LO	Loads setup data	Operation Mode	Yes	No	4-26
LI	Saves setup data	Operation Mode	Yes	No	4-26
CM	Sets communication input data	Operation Mode	Yes	No	4-26
CE	Enters data in an external input channel	Operation Mode	Yes	No	4-26
EM	Starts/stops the e-mail transmission function	Operation Mode	Yes	No	4-27
CU	Manually recovers Modbus	Operation Mode	Yes	No	4-27
BV	Enters characters*	All modes	Yes	No	4-27
KE	Key operation command	Operation Mode	Yes	No	4-27
YC	Clears measured/computed data and initializes setup data	Operation Mode	Yes	No	4-27
IR	Resets a relative timer	Operation Mode	Yes	No	4-27
MA	Resets a match timer	Operation Mode	Yes	No	4-27
NR	Sets the trend update rate	Operation Mode	Yes	No	4-27

Yes: Command usable

No: Command not usable

* Can only be used in serial communications.

Basic Setting Commands

- To activate the settings that are changed with the basic setting commands, you must save the settings with the YE or XE command. Make sure to save the settings before changing from Basic Setting Mode to Operation Mode. Otherwise, new settings will not take effect.
- The settings that are returned in response to a query in Basic Setting Mode will contain the new settings even if they are not saved. However, the new settings will not take effect until they are saved. To activate the new settings, you must save the settings with the YE or XE command as described earlier. If you clear the settings or change the execution mode from Basic Setting Mode to Operation Mode without saving the settings, the MV will return the original settings in response to a query.

Note

- The settings that are changed with the YA, YK, RU, YQ, YS, YB, YD, WS, and WW commands are activated after saving the new settings with the XE command and then power-cycling the MV.
- Executing the YE or LO command will disconnect communications.

Group/Command Name	Function	Execution Mode	Administrator	User	See Page
Setting					
WO	Sets alarm and DO settings	Basic Setting Mode	Yes	No	4-28
WH	Sets an alarm hysteresis	Basic Setting Mode	Yes	No	4-28
XV	Sets the scan interval	Basic Setting Mode	Yes	No	4-28
XB	Sets the burnout detection	Basic Setting Mode	Yes	No	4-28
XJ	Sets an RJC	Basic Setting Mode	Yes	No	4-29
WU	Sets environment settings	Basic Setting Mode	Yes	No	4-29
XM	Sets the memory sample condition	Basic Setting Mode	Yes	No	4-31
RF	Sets the key lock function	Basic Setting Mode	Yes	No	4-31
RN	Sets basic login settings	Basic Setting Mode	Yes	No	4-31
RP	Sets login and user limitations	Basic Setting Mode	Yes	No	4-31
RO	Sets report types and generation times	Basic Setting Mode	Yes	No	4-32
RM	Sets a report channel	Basic Setting Mode	Yes	No	4-32
XG	Sets the time zone	Basic Setting Mode	Yes	No	4-32
XN	Sets the date format	Basic Setting Mode	Yes	No	4-33
YB	Sets host information	Basic Setting Mode	Yes	No	4-33
YD	Sets network settings	Basic Setting Mode	Yes	No	4-33
YA	Sets the IP address, subnet mask, and default gateway	Basic Setting Mode	Yes	No	4-33
YK	Sets the keepalive feature	Basic Setting Mode	Yes	No	4-33
RU	Sets DNS parameters	Basic Setting Mode	Yes	No	4-33
WS	Sets a server	Basic Setting Mode	Yes	No	4-33
WW	Sets the Web homepage	Basic Setting Mode	Yes	No	4-34
YQ	Sets the application timeout	Basic Setting Mode	Yes	No	4-34
YT	Sets the FTP transfer timing	Basic Setting Mode	Yes	No	4-34
YU	Sets the contents to be sent via e-mail	Basic Setting Mode	Yes	No	4-34
YV	Sets e-mail recipient addresses	Basic Setting Mode	Yes	No	4-35
YW	Sets the e-mail sender address	Basic Setting Mode	Yes	No	4-35
YX	Sets the e-mail SMTP server name	Basic Setting Mode	Yes	No	4-35
YJ	Sets a Modbus client destination server	Basic Setting Mode	Yes	No	4-35
YP	Sets basic Modbus client settings	Basic Setting Mode	Yes	No	4-36
YR	Sets a Modbus client transmission command	Basic Setting Mode	Yes	No	4-36
WB	Sets SMTP client settings	Basic Setting Mode	Yes	No	4-36
WC	Sets the SMTP operation when memory start is executed	Basic Setting Mode	Yes	No	4-36
YS	Sets serial interface parameters	Basic Setting Mode	Yes	No	4-37

4.2 A List of Commands

Group/Command Name	Function	Execution Mode	Administrator	User	See Page
Setting (continued)					
YL	Sets Modbus master function settings	Basic Setting Mode	Yes	No	4-37
YM	Sets a Modbus master transmission command	Basic Setting Mode	Yes	No	4-37
WR	Sets the instrument information output	Basic Setting Mode	Yes	No	4-38
XE	Activates Basic Setting Mode	Basic Setting Mode	Yes	No	4-38
YE	Activates Basic Setting Mode (cold reset)	Basic Setting Mode	Yes	No	4-39
			Yes: Command usable		
			No: Command not usable		

Output Commands

Group/Command Name	Function	Execution Mode	Administrator	User	See Page
Control					
BO	Sets the byte output order	All modes	Yes	Yes	4-39
CS	Sets the checksum (can be used only during serial communications)	All modes	Yes	Yes	4-39
IF	Sets the status filter	All modes	Yes	Yes	4-39
CC	Disconnects the Ethernet connection (can be used only during Ethernet communications)	All modes	Yes	Yes	4-39
CB	Sets the data output format	All modes	Yes	Yes	4-40
Setup, measurement, and computed data output					
FC	Transmits screen image data	All modes	Yes	Yes	4-40
FE	Transmits setup data	All modes	Yes	Yes	4-40
FD	Transmits most recent measured/computed data	Operation Mode	Yes	Yes	4-40
FF	Transmits FIFO data	Operation Mode	Yes	Yes	4-41
FL	Transmits a log, alarm summary, or message summary	All modes	Yes	Yes	4-41
IS	Transmits status information	All modes	Yes	Yes	4-41
FU	Transmits the user level	All modes	Yes	Yes	4-41
FA	Transmits instrument information	All modes	Yes	Yes	4-42
ME	Transmits data stored on an external storage medium or the internal memory (can be used through either Ethernet or serial communications)	Operation Mode	Yes	No	4-42
MO	Manipulates or transmits data stored in the internal memory	Operation Mode	Yes	No	4-42
RS-422/485 commands					
Esc O	Opens a instrument	All modes	Yes	Yes	4-43
Esc C	Closes a instrument	All modes	Yes	Yes	4-43
Common command					
*I	Transmits instrument information	All modes	Yes	Yes	4-43
			Yes: Command usable		
			No: Command not usable		

Maintenance/Test Commands (available when using the maintenance/test server function via the Ethernet interface)

Command Name	Function	Administrator	User	See Page
close	Disconnects the connection between other instruments	Yes	No	4-44
con	Transmits connection information	Yes	Yes	4-44
eth	Transmits Ethernet statistics	Yes	Yes	4-44
help	Displays help	Yes	Yes	4-44
net	Transmits network statistics	Yes	Yes	4-44
quit	Disconnects the connection to the instrument that is being controlled	Yes	Yes	4-45

Yes: Command usable

No: Command not usable

Instrument Information Output Commands (available when using the instrument information server function via the Ethernet interface)

Parameter Name	Function	See Page
serial	Transmits the serial number	4-45
host	Transmits the host name	4-45
ip	Transmits the IP address	4-45

4.3 Setup Parameters

The measurement range and setup range of parameters used in a command vary depending on the combination of the command, range, and options.

Examples of Entering Measurement Range Parameters

The span upper and lower limit parameters of the SR command (input range setting command) requires all digits including fractional digits to be set. For example, if you want to set the upper limit to 1.0000 V when the measurement range is -2.0000 V to 2.0000 V, specify 10000. If you want to set the limit to 0.5000 V, specify 5000.

The table below gives examples.

Measurement Range	Input Type Parameter	Selectable Range of Measurement Range	The Range You Want to Set	Parameter
VOLT	20mV	-20.000mV to 20.000mV	-10.000mV to 20.000mV	-10000 to 20000
/SQRT	2V	-2.0000V to 2.0000V	-2.0000V to 0.5000V	-20000 to 5000
TC	R	0.0 to 1760.0	0.0 to 400.0	0 to 4000
	K	-200.0 to 1370.0	-200.0 to 1370.0	-2000 to 13700
RTD	Pt100	-200.0 to 600.0	-10.0 to 500.0	-100 to 5000
DI	LEVEL	0 to 1	0 to 1	0 to 1

Measurement Range Parameters

The table below shows the relationship between the input types and range parameters. For the selectable range, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

Input Type	Input Type Parameter	Range	Range Parameter	Required Option
DC voltage	VOLT	20mV	20MV	
		60mV	60MV	
		200mV	200MV	
		2V	2V	
		6V	6V	
		20V	20V	
		50V	50V	
Thermocouple	TC	R	R	
		S	S	
		B	B	
		K	K	
		E	E	
		J	J	
		T	T	
		N	N	
		W	W	
		L	L	
		U	U	
		Kp vs Au7Fe	KP	/N3
		PLATINEL	PLATI	/N3
		PR40-20	PR	/N3
RTD	RTD	NiNiMo	NIMO	/N3
		WRe	WRE	
		W/WRe26	W/WRE	/N3
		TypeN(AWG14)	N2	/N3
		Pt	PT	
		JPt	JPT	
		Pt50	PT50	/N3
		Ni100(SAMA)	NI1	/N3
		Ni100(DIN)	NI2	/N3
		Ni120	NI3	/N3
		J263*B	J263	/N3

Input Type	Input Type Parameter	Range	Range Parameter	Required Option
RTD	RTD	Cu53	CU53	/N3
		Cu100		/N3
		Cu10:GE		/N1
		Cu10:L&N		/N1
		Cu10:WEED		/N1
		Cu10:BAILEY		/N1
		Cu10:0.000392at20		/N1
		Cu10:0.000393at20		/N1
		Cu25:0.00425at0		/N1
		Pt25		/N3
Contact input	DI	Level	LEVEL	
		Cont	CONT	
1-5V voltage	1-5V	1-5V	1-5V	

Channel Number Notations

The table below lists the channel notations that are used.

Channel Type	Model	Channel Notation	Notes
Measurement channel	RD-MV1000	001 to 024	Varies depending on the number of inputs
	RD-MV2000	001 to 048	Varies depending on the number of inputs
Computation channel	RD-MV1000	101 to 112	High-speed input model
		101 to 124	Medium-speed input model
	RD-MV2000	101 to 112	High-speed input model
		101 to 160	Medium-speed input model
External input channel	RD-MV1000	---	Not available
	RD-MV2000	201 to 440	with the /MC1 option
Manual sample	RD-MV1000	---	Not available
	RD-MV2000	001 to 120	with the /MC1 option
Report channel	RD-MV1000	R01 to R12	High-speed input model
		R01 to R24	Medium-speed input model
	RD-MV2000	R01 to R12	High-speed input model
		R01 to R60	Medium-speed input model
Internal switch	RD-MV1000	S01 to S30	
	RD-MV2000		
Output relay	RD-MV1000	I01 to I06	
	RD-MV2000	I01 to I06, I11 to I16, I21 to I26, I31 to I36	Varies depending on the options
Constant	RD-MV1000	K01 to K60	
	RD-MV2000		
Communication input channel	RD-MV1000	C01 to C24	
	RD-MV2000	C01 to C60	
Display group	RD-MV1000	1 to 10	
	RD-MV2000	1 to 36	
Remote control terminal	RD-MV1000	D01 to D08	
	RD-MV2000		
Pulse input	RD-MV1000	P01 to P08,	
	RD-MV2000	Q01 to Q08	
Flag	RD-MV1000	F01 to F08	
	RD-MV2000		
High-speed input model		RD-MV1004, RD-MV1008, RD-MV2008	
Medium-speed input model		RD-MV1006, RD-MV1012, RD-MV1024 RD-MV2010, RD-MV2020, RD-MV2030, RD-MV2040, RD-MV2048	

4.4 Setting Commands (Setting)

SR Sets an input range

To set a channel to skip

Syntax SR p1,p2<terminator>

p1 Measurement channel number

p2 Setting type (SKIP)

Query SR[p1]?

Example Skip channel 001.

SR001,SKIP

- Description**
- You cannot execute this command while the MV is measuring or computing.
 - A channel set to SKIP is not measured.
 - Set parameter p1 according to the table in section 4.3.

To set a channel to voltage, TC, RTD, or ON/OFF input

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

p1 Measurement channel number

p2 Input type

VOLT DC voltage

TC Thermocouple

RTD RTD

DI ON/OFF input

p3 Measurement range

p4 Span lower limit

p5 Span upper limit

Query SR[p1]?

Example Set the channel 001 input type to TC type R, the span lower limit to 0°C, and the span upper limit to 1760.0°C.

SR001,TC,R,0,17600

- Description**
- You cannot execute this command while the MV is measuring, computing, or generating a report.
 - Set parameters p1 and p3 according to the table in section 4.3.
 - For parameters p4 and p5, enter a value using 5 digits or less excluding the decimal point.

To set a channel to difference computation

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

p1 Measurement channel number

p2 Setting type (DELTA)

p3 Input type

VOLT DC voltage

TC Thermocouple

RTD RTD

DI ON/OFF input

p4 Measurement range

p5 Span lower limit

p6 Span upper limit

p7 Reference channel number (measurement channel number)

Query SR[p1]?

Example Set the channel 010 setting type to differential computation between channels with the reference channel set to 001, and set the input type to TC. Set the measurement range to R. Set the span lower limit to 10.0°C and span upper limit to 100.0°C.
SR010,DELTA,TC,R,100,1000,001

- Description**
- You cannot execute this command while the MV is measuring, computing, or generating a report.
 - Set parameters p1 and p4 according to the table in section 4.3.
 - For parameters p5 and p6, enter a value using 5 digits or less excluding the decimal point.

To set a channel to scaling

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

p1 Measurement channel number

p2 Setting type (SCALE)

p3 Input type

VOLT DC voltage

TC Thermocouple

RTD RTD

DI ON/OFF input

p4 Measurement range

p5 Span lower limit

p6 Span upper limit

p7 Scaling lower limit (–30000 to 30000)

p8 Scaling upper limit (–30000 to 30000)

p9 Scaling decimal place (0 to 4)

p10 Unit (up to six alphanumeric characters)

Query SR[p1]?

Example Convert the DC voltage measured on channel 002 to DC current. Set the input range to 6 V, the span lower limit to 1 V, the span upper limit to 5 V, the scaling lower limit to 1.00 A, and the scaling upper limit to 5.00 A.
SR002,SCALE,VOLT,6V,1000,5000,100,500,2,A

- Description**
- You cannot execute this command while the MV is measuring, computing, or generating a report.
 - Set parameters p1 and p4 according to the table in section 4.3.
 - For parameters p5 and p6, enter a value using 5 digits or less excluding the decimal point.
 - Set all parameters p7, p8, and p9 or omit all three parameters.

To set a channel to square root computation

Syntax SR p1,p2,p3,p4,p5,p6,p7,p8,p9,p10,p11<terminator>

p1 Measurement channel number

p2 Setting type (SQRT)

p3 Measurement range

p4 Span lower limit

p5 Span upper limit

p6 Scaling lower limit (–30000 to 30000)

p7 Scaling upper limit (–30000 to 30000)

p8 Scaling decimal place (0 to 4)
 p9 Unit (up to six alphanumeric characters)
 p10 Low-cut function ON/OFF
 p11 Low-cut point (0 to 50)

Query SR[p1]?

Example Convert the DC voltage measured on channel 001 to a flow rate using the square root computation. Set the input range to 6 V, the span lower limit to 1 V, the span upper limit to 5 V, the scaling lower limit to 10.0 m³/s, and the scaling upper limit to 100.0 m³/s.
 SR001,SQRT,6V,1000,5000,100,1000,1,m3/s

Description

- You cannot execute this command while the MV is measuring, computing, or generating a report.
- Set parameters p1 and p3 according to the table in section 4.3.
- For parameters p4 and p5, enter a value using 5 digits or less excluding the decimal point.
- Set all parameters p6, p7, and p8 or omit all three parameters.

To set a channel to 1-5V DC input

Syntax SR p1,p2,p3,p4,p5,p6,p7,p8,p9,p10 <terminator>
 p1 Measurement channel number
 p2 Input type(1-5V)
 p3 Measurement range (1-5V)
 p4 Span lower limit (800 to 5200)
 p5 Span upper limit (800 to 5200)
 p6 Scaling lower limit (-30000 to 30000)
 p7 Scaling upper limit (-30000 to 30000)
 p8 Scaling decimal place (0 to 4)
 p9 Unit (up to six alphanumeric characters)
 p10 Low-cut function ON/OFF

Query SR[p1]?

Example Set the channel 005 input type to 1-5V, the span lower limit to 1 V, the span upper limit to 5 V, and turn the 1-5V low-cut function ON.
 SR005,1-5V,1-5V,1000,5000,,,,,ON

Description

- You cannot execute this command while the MV is measuring or computing.
- Set parameter p1 according to the table in section 4.3.
- For parameters p4 and p5, enter a value using 4 digits or less excluding the decimal point.
- Set all parameters p6, p7, and p8 or omit all three parameters.

SO Sets a calculation expression

Syntax SO p1,p2,p3,p4,p5,p6,p7<terminator>
 p1 Computation channel number
 p2 Computation ON/OFF
 p3 Calculation expression (up to 120 characters)
 p4 Span lower limit (-99999999 to 99999999)

p5 Span upper limit (-99999999 to 99999999)
 p6 Span decimal place (0 to 4)
 p7 Unit (up to six alphanumeric characters)

Query SO[p1]?

Example Compute the sum of channels 001 and 002 on channel 106. Set the span lower limit to -10.0000, the span upper limit to 15.0000, and the unit to V.
 SO106,ON,001+002,-100000,150000,4,V

Description

- You can execute this command on models with the /M1 math option.
- You cannot execute this command while the MV is measuring or computing.
- For details on calculation expressions, see section 2.2.
- Set parameter p1 according to the table in section 4.3.
- For parameters p4 and p5, enter a value using 7 digits or less excluding the decimal for negative numbers and 8 digits or less for positive numbers.
- Set all parameters p4, p5, and p6 or omit all three parameters.

ER Sets the range of an external input channel

Syntax ER p1,p2,p3,p4,p5,p6<terminator>
 p1 External input channel number
 p2 External input channel ON/OFF
 p3 Span lower limit (-30000 to 30000)
 p4 Span upper limit (-30000 to 30000)
 p5 Decimal place (0 to 4)
 p6 Unit (up to six alphanumeric characters)

Query ER[p1]?

Example Set the span of external input channel 201 to -150.00 to 150.00.
 201,ON,-15000,15000,2

Description You can execute this command on models with the /MC1 external input channel option.

TJ Sets memory sampling

Syntax TJ p1,p2<terminator>
 p1 Measurement, computation, or external input channel number
 p2 Memory sampling ON/OFF

Query TJ[p1]?

Example Save channel 002 to memory.
 TJ002,ON

Description You can execute a computation channel (or make a query) on models with the /M1 math option. You can specify an external input channel (or make a query) on models with the /MC1 external input channel option.

4.4 Setting Commands (Setting)

SA Sets an alarm

To turn an alarm off

Syntax SA p1,p2,p3<terminator>

p1 Measurement, computation, or external input channel number

p2 Alarm number (1 to 4)

p3 Alarm ON/OFF state (OFF)

Query SA[p1[,p2]]?

Example Turn off alarm number 1 on channel 010.
SA010,1,OFF

Description You can specify a computation channel (or make a query) on models with the /M1 math option. You can specify an external input channel (or make a query) on models with the /MC1 external input channel option.

To turn an alarm on

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

p1 Measurement, computation, or external input 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

R High limit on rate-of-change alarm

r Low limit on rate-of-change alarm

T Delay high limit alarm

t Delay low limit alarm

(The character is case-sensitive.)

p5 Alarm value

p6 Relay setting

ON Relay ON

OFF Relay OFF

p7 Relay number when p6 is ON

Empty when p6 is OFF

p8 Alarm detection ON/OFF

Query SA{ p1[,p2]]?

Example Set alarm number 1 on channel 002 to high limit alarm (alarm value = 1000), and activate relay I01 when an alarm occurs.

SA002,1,ON,H,1000,ON,I01

Description

- Parameter p3 cannot be set to ON if the input range (SR command) is set to SKIP.
- Parameter p3 cannot be set to ON for a computation channel if computation is OFF (SO command).
- Parameter p3 cannot be set to ON for an external input channel if the channel is OFF (ER command).
- All alarm settings of a channel are turned OFF if
 - The input type is changed (VOLT, TC, etc).
 - The input range is changed.
 - The span and scaling values are changed during scaling display (includes changing the decimal place.)

- The computation channel is turned ON/OFF or the calculation expression or the span value is changed on a computation channel.
- If you set p4 to h or l, they are valid only when the measurement range is set to differential computation between channels.
- If you set p4 to R or r, set the interval for the high/low limit on the rate-of-change with the XA command.
- If you set p4 to T or t, set the alarm delay with the BD command.
- Set the p5 alarm value in the following range according to the p4 alarm type or the target channel.
 - High limit, low limit, delay high limit, or delay low limit alarm
 - DC voltage, thermocouple, or RTD input
 - A value in the measurable range
 - Contact input
 - 0 or 1
 - Scaling (1-5V, scaling, or square root)
 - 5 to 105% of span (but, in the range of -30000 to 30000)
- Difference high limit or difference low limit alarm
 - A value in the measurable range
- High limit on rate-of-change or low limit on rate-of-change alarm
 - A value greater than equal to the value with the least significant digit set to 1. For example, the alarm value is 0.0001 for the 2V range.
 - The maximum alarm value that you can specify is the maximum value in the measurable range (but, in the range of -30000 to 30000). For example, the it is 3.0000 for the 2V range. You can only set the alarm value to 1 for a contact input.
- Computation channel
 - 9999999 to 9999999 (excluding the decimal point. Set using an integer.)
- External input channel
 - 30000 to 30000
- An error will occur if p7 is set to a number of a relay that is not installed.
- You can specify a computation channel (or make a query) on models with the /M1 math option.
- For computation channels and external input channels, you can specify only the following alarm types: H (high limit alarm), L (low limit alarm), T (delay high limit alarm), and t (delay low limit alarm).
- For computation channels, the alarm hysteresis is fixed to zero. Use the XA command to set the alarm hysteresis.

SW Sets the display update interval and auto-save interval

Syntax SW p1,p2,p3,p4<terminator>
 p1 1
 p2 Waveform type (T-Y)
 p3 Display update interval (5S, 10S, 15S, 30S, 1MIN, 2MIN, 5MIN, 10MIN, 15MIN, 20MIN, 30MIN, 1H, 2H, 4H, 10H)
 p4 Auto-save interval (10MIN, 20MIN, 30MIN, 1H, 2H, 3H, 4H, 6H, 8H, 12H, 1DAY, 2DAY, 3DAY, 5DAY, 7DAY, 10DAY, 14DAY, 31DAY)

Query SW?

Description

- You cannot execute this command while the MV is measuring.
- The selectable auto-save interval (p4) varies depending on the display update interval (p3) setting. For details, see the *RD-MV1000/RD-MV2000 User's Manual*.
- You can specify the data update intervals (p3) 5S and 10S only on high-speed input models (RD-MV1004, RD-MV1008, and RD-MV2008). You can specify 15S on medium-speed input models set to fast sampling mode and high-speed input models.
- Set the data update interval (p3) to an interval slower than the scan interval.
- The p4 setting is valid when the saving method to the external storage medium is set to auto with the XM command (p1 in the XM command set to AUTO).
- Set the trend update interval with the NR command after setting the data update interval and auto save interval with the SW command.
- The data update interval (p3) can only be set to an interval slower than the scan interval. (The scan interval is set using p3 in the XV command.)
- The selectable range of auto save interval (p4) varies depending on the data update interval (p3) setting and the number of channels that is set with the TJ command.

TW Sets the secondary trend update rate

Syntax TW p1<terminator>
 p1 Data update rate (5S, 10S, 15S, 30S, 1MIN, 2MIN, 5MIN, 10MIN, 15MIN, 20MIN, 30MIN, 1H, 2H, 4H, 10H)

Query TW?

Example Set the update rate to 2 minutes.

TW2MIN

Description

- Set the data update interval (p1) to an interval slower than the scan interval.
- You can specify the data update intervals (p1) 5S and 10S only on high-speed input models (RD-MV1004, RD-MV1008, and RD-MV2008). You can specify 15S on medium-speed input models set to fast sampling mode and high-speed input models.

TM Sets manual sampling.

Syntax TM p1,p2,p3<terminator>
 p1 Manual sampling channel number
 p2 Enable/Disable (ON, OFF)
 p3 Measurement, computation, or external input channel number

Query TM[p1]?

Example Assign measurement channel 002 to manual sampling number 001.

TM001,ON,002

Description

- You can execute this command on models with the /MC1 external input channel option.
- You can assign a computation channel on models with the /M1 math option.

TE Sets sampling conditions of the event data

Syntax TE p1,p2,p3,p4,p5,p6<terminator>
 p1 1
 p2 Sample rate (25MS, 125MS, 250MS, 500MS, 1S, 2S, 5S, 10S, 30S, 1MIN, 2MIN, 5MIN, 10MIN)
 p3 Sample mode
 FREE Starts data acquisition at memory start and stops data acquisition at memory stop.
 SINGLETRIGGER Acquires data for a specified time once after a trigger occurs and stops.
 REPEATTRIGGER Acquires data for a specified time after a trigger occurs and waits for the next trigger.
 p4 Sample time (10MIN, 20MIN, 30MIN, 1H, 2H, 3H, 4H, 6H, 8H, 12H, 1DAY, 2DAY, 3DAY, 5DAY, 7DAY, 10DAY, 14DAY, 31DAY)
 p5 Pre-trigger length (0, 5, 25, 50, 75, 95, 100) percent
 p6 Key trigger source ON/OFF

Parameters p5 to p6 are valid when p3 is set to SINGLETRIGGER or REPEATTRIGGER.

Query TE[p1]?

Example Acquire data at a sampling rate of 125-ms over 10 minutes using a single trigger.

TE1,125MS,SINGLETRIGGER,10MIN

Description You cannot specify a sampling rate that is faster than the scan interval.

4.4 Setting Commands (Setting)

SZ Sets a zone

- Syntax** SZ p1,p2,p3<terminator>
- p1 Measurement, computation, or external input channel number
- p2 Bottom edge of zone (0 to 95) [%]
- p3 Top edge of zone (5 to 100) [%]
- Query** SZ[p1]?
- Example** Display channel 002 in a 30%-to-50% zone.
SZ002,30,50
- Description**
- You can specify a computation channel (or make a query) on models with the /M1 math option. You can specify an external input channel (or make a query) on models with the /MC1 external input channel option.
 - The width of the waveform display area along the amplitude axis is assumed be 100%.
 - The zone width must be at least 5%.
 - Set the top edge of the zone to a value greater than the bottom edge of the zone.

SP Sets the partial expanded display

- Syntax** SP p1,p2,p3,p4<terminator>
- p1 Measurement, computation, or external input channel number
- p2 Partial expanded setting ON/OFF
- p3 Boundary position (1 to 99) [%]
- p4 Boundary value
- Query** SP[p1]?
- Example** Partially expand the display of channel 001. Set the boundary position to 25% and the boundary value to 1.00 V.
SP001,ON,25,100
- Description**
- You can specify a computation channel (or make a query) on models with the /M1 math option. You can specify an external input channel (or make a query) on models with the /MC1 external input channel option.
 - Parameter p2 cannot be set to ON if the input range (SR command) is set to SKIP.
 - Parameter p2 cannot be set to ON for a computation channel if computation is OFF (SO command).
 - Parameter p2 cannot be set to ON for an external input channel if the channel is OFF (ER command).
 - The range between the span upper and lower limits (scale upper and low limits when scaling is enabled) is assumed to be 100% for parameter p3.
 - You can set p4 in the range of (span upper limit – 1) to (span lower limit + 1). If scaling is enabled, you can set p4 in the range of (scaling upper limit – 1) to (scaling lower limit + 1).
 - The decimal place and the number of digits are set to the same values as the span and scaling settings (see the SR command).

- You can execute this command (or make a query) when the partial expanded display function is set to USE (XU command).
- You cannot execute this command if the partial expanded display range is not available (such as when the span width is set to 1).

ST Sets a tag

- Syntax** ST p1,p2<terminator>
- p1 Measurement, computation, or external input channel number
- p2 Tag (up to 16 characters)
- Query** ST[p1]?
- Example** Set the channel 002 tag to TAG2.
ST002,TAG2
- Description**
- For the characters that can be used in a tag, see appendix 1, "ASCII Character Codes." However, you cannot use a semicolon or comma in a tag.
 - You can specify a computation channel (or make a query) on models with the /M1 math option. You can specify an external input channel (or make a query) on models with the /MC1 external input channel option.

SX Sets a group

- Syntax** SX p1,p2,p3<terminator>
- p1 Group number
- p2 Group name (up to 16 characters)
- p3 Channel configuration
- Query** SX[p1]?
- Example** Assign channels 001, 003, 004 to 006 to group number 1 and assign GROUP2 for the group name.
SX1,GROUP2,001.003.004-006
- Assign channels by using a period to separate each channel or a hyphen to specify a range of channels.
- Description** For the characters that can be used in a group name, see appendix 1, "ASCII Character Codes." However, you cannot use a semicolon or comma in a group name.

SL Sets a trip line

- Syntax** SL p1,p2,p3,p4,p5,p6<terminator>
- p1 Group number
- p2 Trip line number (1 to 4)
- p3 Trip line display ON/OFF
- p4 Display position (0 to 100)
- p5 Display color (RED, GREEN, BLUE, B.VIOLET, BROWN, ORANGE, Y.GREEN, LIGHTBLUE, VIOLET, GRAY, LIME, CYAN, DARKBLUE, YELLOW, LIGHTGRAY, PURPLE, BLACK, PINK, L.BROWN, L.GREEN, DARKGRAY, OLIVE, DARKCYAN, S.GREEN)
- p6 Line width (1, 2, 3)
- Query** SL[p1[,p2]]?

Example Display trip line 1 in red at the 10% position of group 1. Set the line width to 1.
SL1,1,ON,10,RED,1

Description The width of the waveform display area along the amplitude axis is assumed be 100%.

SG Sets a message

Syntax SG p1,p2<terminator>
p1 Message number (1 to 100)
p2 Message (up to 32 characters)

Query SG[p1]?

Example Set character string "MESSAGE1" in message number 2.
SG2,MESSAGE1

Description For the characters that can be used in a message, see appendix 1, "ASCII Character Codes." However, you cannot use a semicolon or comma in a message.

TH Sets the data storage directory on an external storage medium

Syntax TH p1<terminator>
p1 Directory name (up to 20 characters)

Query TH ?

Example Save data to the DATA1 folder on the external storage medium.
THDATA1

TZ Sets the file header

Syntax TZ p1,p2<terminator>
p1 1
p2 File header (up to 50 characters)

Query TZ[p1]?

Example Set the header to MV1000DATA.
TZ1,MV1000DATA

TF Sets the data file name

Syntax TF p1,p2,p3<terminator>
p1 1
p2 Configuration
 BATCH File name specified by the batch function
 DATE User-assigned character string + the date
 SERIAL User-assigned character string + a serial number
p3 User-assigned name (up to 16 characters) (valid when p2 is DATE or SERIAL)

Query TF[p1]?

Example Set the file name to the user-assigned string MV1DATA followed by a serial number.
TF1,SERIAL,MV1DATA

SD Sets the date and time

Syntax SD p1,p2<terminator>
p1 Date (YY/MM/DD)
 YY Year (00 to 79)
 MM Month (01 to 12)
 DD Day (01 to 31)
p2 Time (HH/MM/SS)
 HH Hour (00 to 23)
 MM Minute (00 to 59)
 SS Second (00 to 59)

Query SD?

Example Set the internal clock to 13:00:00, October 1, 2005.
SD05/10/01,13:00:00

Description The syntax for p1 and p2 is fixed to eight characters. Use the syntax below. Do not insert spaces; otherwise an error will occur.
p1 = YY/MM/DD (Lower two digits of the year/month/day)
p2 = HH:MM:SS (Hour:minute:second)

TT Sets the trend display

Syntax TT p1,p2,p3,p4,p5<terminator>
p1 Graph display direction
 HORIZONTAL Horizontal display
 VERTICAL Vertical display
 WIDE Horizontal wide display
 SPLIT Horizontal split display
p2 Clear waveform at start ON/OFF
p3 Message display direction
 HORIZONTAL
 VERTICAL
p4 Scale display digits
 NORMAL 3-digit display
 FINE 4-digit display
p5 Current value display
 MARK Display using a mark
 BARGRAPH Display using a bar graph

Query TT?

Example Set the waveform to horizontal display and the message direction to vertical, and display the waveform by clearing the existing waveform at memory start.
TTHORIZONTAL,ON,VERTICAL

4.4 Setting Commands (Setting)

SE Sets the trend graph line width and the number of grids

Syntax SE p1,p2<terminator>
p1 Trend line width (1 to 3) [dot]
p2 Number of grids (4 to 12, AUTO)
Query SE?
Example Set the trend waveform line width to 1 dot and the number of grids to 10.
SE1,10

TB Sets the bar graph display

Syntax TB p1<terminator>
p1 Bar graph display direction
HORIZONTAL
VERTICAL
Query TB?
Example Display the bar graph horizontally.
TBHORIZONTAL

SB Sets the bar graph of a channel

Syntax SB p1,p2,p3<terminator>
p1 Measurement, computation, or external input channel number
p2 Base position of the bar graph display
NORMAL Normal (lower limit)
CENTER
LOWER Lower limit
UPPER Upper limit
p3 Number of scale divisions (4 to 12)
Query SB[p1]?
Example Set the number of scale divisions of the channel 002 bar graph to 5, and display the bar graph from the span lower limit (scale lower limit if scaling is enabled).
SB002,NORMAL,5
Description You can specify a computation channel (or make a query) on models with the /M1 math option. You can specify an external input channel (or make a query) on models with the /MC1 external input channel option.

TN Sets the scale

Syntax TN p1,p2,p3<terminator>
p1 Measurement, computation, or external input channel number
p2 Display position (OFF, 1 to 10)
p3 Number of divisions (4 to 12, C10)
Query TN[p1]?
Example Set the channel 003 scale position to 2 and the number of divisions to 10.
TN003,2,10

SV Sets the moving average of a measurement channel

Syntax SV p1,p2,p3<terminator>
p1 Measurement channel number

p2 Moving average ON/OFF
p3 Number of samples for computing the moving average (2 to 400) [times]

Query SV[p1]?

Example Set the number of samples for computing the moving average on channel 002 to 12.
SV002,12

SC Sets a channel display color

Syntax SC p1,p2<terminator>
p1 Measurement, computation, or external input channel number
p2 Display color (see SL (sets a trip line))
Query SC[p1]?
Example Set the channel 002 display color to blue.
SC002,BLUE
Description You can specify a computation channel (or make a query) on models with the /M1 math option. You can specify an external input channel (or make a query) on models with the /MC1 external input channel option.

TA Sets an alarm point mark

Syntax TA p1,p2,p3,p4,p5,p6,p7<terminator>
p1 Measurement, computation, or external input channel number
p2 Mark type
ALARM Alarm mark
FIXED Fixed mark
p3 Scale board display ON/OFF
p4 Alarm level 1 color (see SL (sets a trip line))
p5 Alarm level 2 color (see SL (sets a trip line))
p6 Alarm level 3 color (see SL (sets a trip line))
p7 Alarm level 4 color (see SL (sets a trip line))
Query TA[p1]?
Example Display alarm marks on the channel 004 scale.
TA004,ALARM,ON

TG Sets a color scale band

Syntax TG p1,p2,p3,p4,p5<terminator>
p1 Measurement, computation, or external input channel number
p2 Area (OFF, IN, OUT)
p3 Display color (see SL (sets a trip line))
p4 Display position lower limit
p5 Display position upper limit
Query TG[p1]?
Example Set the color scale band range to -1.0000 to 0.5000 V (2 V range) on channel 005, and set the display color to green.
TG005,IN,GREEN,-10000,5000

SQ	Sets the LCD brightness and screen backlight saver
Syntax	SQ p1,p2,p3,p4<terminator>
p1	LCD brightness
1-8	RD-MV1000
1-6	RD-MV2000
p2	Type of display backlight saver function
OFF	Disable the saver function
DIMMER	Dim
TIMEOFF	Turn OFF
p3	Time to switch to saver mode
1MIN, 2MIN, 5MIN, 10MIN, 30MIN, 1H	
p4	Event that causes the MV to return from saver mode
KEY	Pressing of a key
KEY+ALARM	Pressing of a key or an alarm occurrence
Query	SQ?
Example	Set the LCD brightness to 2 and the screen backlight saver function to dim. Set the time to switch to saver mode to 5 minutes and the event that causes the MV to return from saver mode to pressing of a key. SQ2, DIMMER, 5MIN, KEY
Description	If p2 is set to OFF, do not specify p3 or p4.

TC	Sets the background color
Syntax	TC p1,p2<terminator>
p1	Display screen (WHITE, BLACK)
p2	Historical trend display (WHITE, CREAM, LIGHTGRAY, BLACK)
Query	TC?
Example	Set the display background to black and the historical display background to cream. TCBLACK, CREAM

TP	Sets auto group switching
Syntax	TP p1<terminator>
p1	Auto scroll time (5S, 10S, 20S, 30S, 1MIN)
Query	TP?
Example	Switch the group at 5-s intervals. TP5S

TR	Sets auto monitor recovery
Syntax	TR p1<terminator>
p1	Auto recovery time (OFF, 1MIN, 2MIN, 5MIN, 10MIN, 20MIN, 30MIN, 1H)
Query	TR?
Example	Set the auto recovery time to 5 minutes. TR5MIN

TQ	Sets a timer
If p2 is set to OFF (no timer)	
Syntax	TQ p1,p2<terminator>
p1	Timer number (1 to 4)
p2	Timer type (OFF)
If p2 is set to ABSOLUTE (absolute time)	
Syntax	TQ p1,p2,p3,p4<terminator>
p1	Timer number (1 to 4)
p2	Timer type (ABSOLUTE)
p3	Time interval (1MIN to 6MIN, 10MIN, 12MIN, 15MIN, 20MIN, 30MIN, 1H to 4H, 6H, 8H, 12H, 24H)
p4	Reference time (hh)
hh	Hour (00 to 23)
If p2 is set to RELATIVE (relative time)	
Syntax	TQ p1,p2,p3,p4<terminator>
p1	Timer number (1 to 4)
p2	Timer type (RELATIVE)
p3	Time (hh:mm)
hh	Hour (00 to 24)
mm	Minute (00 to 59)
p4	Reset at computation start (ON/OFF)
Query	TQ[p1]?
Example	Set the timer number 1 timeout value to 10 hours 30 minutes. Do not reset at start. TQ1, 1, RELATIVE, 10:30, OFF

TK	Sets a match timer
If p2 is set to OFF (not use a match timer)	
Syntax	TK p1,p2<terminator>
p1	Timer number (1 to 4)
p2	Timer designation (OFF)
If p2 is set to DAY (time designation)	
Syntax	TK p1,p2,p3,p4,p5<terminator>
p1	Timer number (1 to 4)
p2	Timer designation (DAY)
p3	Day (1 to 28)
p4	Time (hh:mm) (00:00 to 23:59)
p5	Timer operation (SINGLE, REPEAT)
SINGLE	Single operation
REPEAT	Repetitive operation
If p2 is set to WEEK (day of week/time designation)	
Syntax	TK p1,p2,p3,p4,p5<terminator>
p1	Timer number (1 to 4)
p2	Timer designation (WEEK)
p3	Designation of the day of the week (SUN, MON, TUE, WED, THU, FRI, SAT)
p4	Time (hh:mm) (00:00 to 23:59)
p5	Timer operation (SINGLE, REPEAT)

4.4 Setting Commands (Setting)

If p2 is set to MONTH (day/time designation)

Syntax TK p1,p2,p3,p4,p5<terminator>
p1 Timer number (1 to 4)
p2 Timer designation (MONTH)
p3 Day (1 to 28)
p4 Time (hh:mm) (00:00 to 23:59)
p5 Timer operation (SINGLE, REPEAT)

If p2 is set to YEAR (month/day/time designation)

Syntax TK p1,p2,p3,p4,p5,p6<terminator>
p1 Timer number (1 to 4)
p2 Timer designation (YEAR)
p3 Month designation (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC)
p4 Day designation (1 to 31) The selectable range varies on the specified month.
p5 Time (hh:mm) (00:00 to 23:59)
p6 Timer operation (SINGLE, REPEAT)

Example Specify 8:30 on April 28 every year for timer number 3.

TK3, APR, 28, 08:30, REPEAT

Query TK[p1]?

Example Specify hour 21 every Thursday for timer number 2.

TK2, WEEK, THU, 21:00, REPEAT

TU

Sets an event action

Syntax TU p1,p2,p3,p4,p5,p6,p7<terminator>
p1 Logic number (1 to 40)
p2 Event type
NONE
REMOTE
RELAY Alarm output relay
SWITCH Internal switch
ALARM Alarm occurrence
TIMER Timer expiry
MATCHTIMETIMER Match time expiry
USERKEY USER key
p3 Event detail
p2=REMOTE Remote number (1 to 8)
p2=RELAY Relay number
p2=SWITCH Internal switch number
p2=TIMER Timer number (1 to 4)
p2=MATCHTIMETIMER Match timer number (1 to 4)
p2=Other Space
p4 Action type
MEMORYSTART/STOP
MEMORYSTART
MEMORYSTOP
TRIGGER Event trigger
ALARMACK Alarm acknowledge
MATHSTART/STOP
MATHSTART
MATHSTOP
MATHRESET

SAVEDISPLAY Save display data to an external storage medium
SAVEEVENT Save event data to an external storage medium
MESSAGE Write a message
SNAPSHOT
MANUALSAMPLE
TIMERRESET Reset the relative timer
DISPLAYRATE1/2 Switch the trend update rate
DISPLAYGROUPCHANGE Switch the display group
FLAG Raise a flag
TIMEADJUST Synchronize the clock
PANELLOAD Load settings
p5 Event detail 2
p4=TIMERRESET Timer number (1 to 4)
p4=DISPLAYGROUPCHANGE Group number
p4=FLAG Flag number (1 to 8)
p4=MESSAGE Message number (1 to 100)
p4=PANELLOAD Setup file number (1 to 3)
p6 Event detail 3
p4=MESSAGE Method of specifying the destination where messages are written
ALL All display groups
SELECT A specified display group

p7 Event detail 4
If p6 is set to SELECT Group number
Some p4 parameters (action type) are not selectable depending on p2 (event type).
Some p4 parameters (action type) are not selectable depending on the settings or on the installation of options.

Query TU[p1]?

Example Execute memory start with the remote control input (terminal 1).

TUREMOTE, 1, MEMORYSTART

Description Set parameter p3 (relay number, internal switch) according to the table in section 4.3.

SK

Sets a computation constant

Syntax SK p1,p2<terminator>
p1 Constants number
p2 Constant (−9.9999E+29 to −1.0000E−30, 0, 1.0000E−30 to 9.9999E+29, 5 significant digits)
Query SK[p1]?
Example Set constants number K01 to 1.0000E−10.
SKK01, 1.0000E−10
Description • You can execute this command on models with the /M1 math option.
• You cannot execute this command while the MV is measuring or computing.
• Set parameter p1 according to the table in section 4.3.

SI Sets rolling average on a computation channel

- Syntax** SI p1,p2,p3,p4<terminator>
 p1 Computation channel number
 p2 Moving average ON/OFF
 p3 Sampling interval (1S, 2S, 3S, 4S, 5S, 6S, 10S, 12S, 15S, 20S, 30S, 1MIN, 2MIN, 3MIN, 4MIN, 5MIN, 6MIN, 10MIN, 12MIN, 15MIN, 20MIN, 30MIN, 1H)
 p4 Number of samples (1 to 1500)
- Query** SI[p1]?
- Example** Set the computation channel 107 rolling average to ON, the sampling interval to 1 minute, and the number of samples to 20.
 SI107,ON,1MIN,20
- Description** • You can execute this command on models with the /M1 math option.
- If p2 is set to OFF, do not specify p3 or p4.
 - Set the sampling interval greater than or equal to the scan interval.

SJ Sets a TLOG timer

- Syntax** SJ p1,p2,p3,p4,p5<terminator>
 p1 Computation channel number
 p2 Timer (1 to 4)
 p3 Conversion of the time unit for TLOG.SUM computation
 OFF No conversion.
 /S Convert as though the physical values are integrated in units of seconds.
 /MIN Convert as though the physical values are integrated in units of minutes.
 /H Convert as though the physical values are integrated in units of hours.
 p4 Reset ON/OFF
 p5 Timer type
 TIMER
 MATCHTIMETIMER
- Query** SJ[p1]?
- Example** Set timer 1 to computation channel 110. Do not convert the unit time and enable the reset function.
 SJ110,1,OFF,ON
- Description** • You can execute this command on models with the /M1 math option.
- Set parameter p1 according to the table in section 4.3.
 - You cannot execute this command while the MV is computing.
 - About p3
 Because the sampled data is integrated over each scan interval, the physical value integrated over a given period may be different from the actual integrated value. This occurs if the given period is not equal to the scan interval. In such case, set p3 to the same unit

as that of the physical value being measured. The integrated value is found according to the following converting equations that depend on the parameter.

- OFF \square (measured value)
 /S \square (measured value) \times scan interval
 /MIN \square (measured value) \times scan interval/60
 /HOUR \square (measured value) \times scan interval/3600

The scan interval unit is seconds.

TX Sets the ancillary operation of the start key

- Syntax** TX p1<terminator>
 p1 Computation operation (OFF, START, RESET+START)
- Query** TX?
- Example** Configure the MV so that the start key also starts computation.
 TXSTART

FR Sets the FIFO buffer acquisition interval

- Syntax** FR p1<terminator>
 p1 1 (fixed)
 p1 FIFO acquisition interval (25MS, 125MS, 250MS, 500MS, 1S, 2S, 5S)
- Query** FR?
- Example** Set the FIFO acquisition interval to 1 s.
 FR1,1S
- Description** • Set the acquisition interval to a value greater than the scan interval.
- If you set the scan interval to a value greater than the acquisition interval with the XV command or from the screen, the acquisition interval is automatically set equal to the scan interval.
 - The MV has a circular FIFO (First In First Out) buffer. The MV acquires measured/computed values to the internal memory at given time intervals after the power is turned ON and transmits the data when a FF command is received. The previous output position is held for each connection. Upon receiving an FF command, the MV transmits the next data and updates the output position. This scheme compensates for the differences in the processing power of the measurement PC and the communication delay. This enables data to be retrieved without dropouts if the measurement PC reads the data before the ring buffer is overwritten. For the output flow diagram of FIFO data, see appendix 5.

4.4 Setting Commands (Setting)

BH Sets a batch text field

Syntax BH p1,p2,p3,p4<terminator>
p1 1
p2 Field number (1 to 8)
p3 Field title (up to 20 characters)
p4 Field characters (up to 30 characters)Field title (up to 30 characters)

Query BH[p1,[p2]]?

Example Set the title to "OPERATOR" and the text to "DAQSTATION" for field number 2.
BH1,2,OPERATOR,DAQSTATION

Description For the characters that can be used, see appendix 1.

EH Sets a calibration correction

If p2 is set to BEGIN

Syntax EH p1,p2,p3<terminator>
p1 Measurement channel number
p2 Type of operation (BEGIN)
p3 Number of break points in the calibration segment (OFF, 2 to 16)
OFF Calibration OFF
2 to 16 Number of break points

If p2 is set to SET

Syntax EH p1,p2,p3,p4,p5<terminator>
p1 Measurement channel number
p2 Type of operation (SET)
p3 Break point designation (1 to 16)
p4 True value of the specified break point
p5 Measured value of the specified break point

Description

- Set parameter p1 according to the table in section 4.3.
- The selectable range of p4 and p5 varies depending on the current set range.
- If set to scale range, the selectable range of p4 and p5 is -30000 to 30000.
- Set true value p4 so that the value increases as break point p3 increases.

If p2 is set to END

Syntax EH p1,p2<terminator>
p1 Measurement channel number
p2 Type of operation (END)

Example Example in which three break points are specified on CH2

```
EH002,BEGIN,3
EH002,SET,1,0,1
EH002,SET,2,50,49
EH002,SET,3,100,101
EH002,END
```

Description

- First, execute this command with the type of operation set to BEGIN to specify the number of break points.

- Set the values for the specified number of the break points using the SET operation.
- Execute this command with the type of operation set to END to finalize the settings.
- The EH2? command transmits the CH2 settings.
- The output example is as shown in the example above.
- You cannot execute this command while the MV is computing.

BD Sets an alarm delay

Syntax BD p1,p2<terminator>
p1 Measurement, computation, or external input channel number
p2 Alarm delay (1 to 3600) [s]

Query BD[p1]?

Example Set the channel 001 alarm delay to 120 s.
BD001,120

Description Set parameter p1 according to the table in section 4.3.

SM Sets the custom menu

To set the main menu

Syntax SM p1,p2,p3,p4,p5,p6,p7,p8,p9<terminator>
p1 Type (DISP_MAIN)
p2 to p9 Menu items to be displayed
The menu items are displayed in the specified order.
Only the specified menu items are displayed.
TREND
DIGITAL
BAR
OVERVIEW
INFORMATION
TRENDHISTORY
LOG
4PANEL
ESC
EXPAND
SEPARATOR

Example Set the first menu item to TREND and the second menu item to TRENDHISTORY.
SMDISP_MAIN,TREND,TRENDHISTORY,

Description

- If you omit parameters p2 and subsequent parameters, all menu items will be hidden.
- A command error will occur if you specify the same menu item multiple times.
- You can specify up to three separators. If you specify more than three, an error will occur.
- You cannot omit parameters by using delimiters (, ,).
- 4PANEL is available only on the RD-MV2000.
- If you set the first menu item to SEPARATOR, it will be ignored.

To set a submenu

Syntax SM p1,p2,p3,...<terminator>

p1 Type (DISP_SUB)

p2 Menu type (TREND, DIGITAL, BAR, TRENDHISTORY, OVERVIEW, INFORMATION, LOG, 4PANEL)

p3 and up

Menu items to be displayed in the submenu

The items are displayed in the specified order.

Only the specified menu items are displayed.

If p2 is TREND [select from the items below]

GROUP1-GROUP36	Group designation
ALL_CHANNEL	All channel display
SCALE	Scale display
DIGITAL	Digital display
MESSAGE_DISP	Message display
TREND_SPACE	Trend space
AUTO	Auto switching
EXPAND	
SEPARATOR	
FINE_GRID	Fine grid ON/OFF
AUTO_ZONE	Auto zone display/ normal display

If p2 is DIGITAL [select from the items below]

GROUP1-GROUP36	Group designation
AUTO	Auto switching
EXPAND	
SEPARATOR	

If p2 is BAR [select from the items below]

GROUP1-GROUP36	Group designation
AUTO	Auto switching
EXPAND	
SEPARATOR	

If p2 is TRENDHISTORY [select from the items below]

GROUP1-GROUP36	Group designation
SEPARATOR	

If p2 is OVERVIEW [select from the items below]

CURSOR	Cursor display
TO_ALARM	To alarm summary
TO_TREND	To trend display
TO_DIGITAL	To digital display
TO_BAR	To bar graph display
EXPAND	
SEPARATOR	

If p2 is INFORMATION [select from the items below]

ALARM	Alarm summary
MESSAGE	Message summary
MEMORY	Memory summary
MODBUS_CLIENT	ModbusTCP status display

MODBUS_MASTER	ModbusRTU status display
RELAY	Relay status display
REPORT	Report display
TO_HISTORY	To historical display
TO_HISTORY_D	To historical (display)
TO_HISTORY_E	To historical (event)
TO_OVERVIEW	To overview display
SORT_KEY	Switch the sort key
SORT_ORDER	Switch the sort order
DISP_ITEM	Switch Date/ Username
DATA_KIND	Switch the data type
DATE/FILE	Switch Date/ Filename
SELECT_SAVE	Select save
REPORT_CHANNEL	Switch the report channel display
ALL_SAVE	
MANUAL_SAVE	Save manual sample
REPORT_SAVE	Save report
EXPAND	
SEPARATOR	
DATA_SAVE_MODE	Data save mode
COLUMN_BAR	Stacked bar graph
COLUMN_BAR_DISP	1-column display/2- column display
COLUMN_BAR_SELECT	Select a bar graph/ select a group
REPORT_GROUP1-GROUP6	Select a report group on the RD-MV2000
REPORT_GROUP1-GROUP4	Select a report group on the RD-MV1000
If p2 is LOG [select from the items below]	
LOGIN_LOG	Login log
ERROR_LOG	Error log
COMMU_LOG	Communication log
FTP_LOG	FTP log
WEB_LOG	Web log
MAIL_LOG	E-mail log
SNTP_LOG	SNTP log
DHCP_LOG	DHCP log
MODBUS_LOG	Modbus log
SEPARATOR	
If p2 is 4PANEL [select from the 5 items below]	
4PANEL1-4PANEL4	4 panel designation
SEPARATOR	

Example Display SCALE and DIGITAL for the first and second submenu items under the TREND main menu item.

SM DISP_SUB,TREND,SCALE,DIGITAL

4.4 Setting Commands (Setting)

- Description • Selectable items for p3 and subsequent parameters vary depend on the p2 setting.
- If you omit parameters p3 and subsequent parameters, all menus items will be hidden.
 - A command error will occur if you specify the same menu item multiple times.
 - You can specify up to three separators. If you specify more than three, an error will occur.
 - You cannot specify EXPAND for LOG and 4PANEL.
 - You cannot omit parameters by using delimiters (, .).
 - If you execute SM DISP_SUB?, the MV also transmits submenus of main menu items that are turned Off.
 - If you set the first menu item to SEPARATOR, it will be ignored.
 - The Show/Hide setting for the group designation parameters, GROUP1 to GROUP36, and the auto switching parameter, AUTO, are applied universally to Trend, Digital, Bar Graph, and Historical Trend. (For example, if you set AUTO to Hide for Trend and then set AUTO to Show for Digital, AUTO will be set to Show for Trend, Digital, Bar Graph, and Historical Trend.)

To set the function menu

p1	Type (FUNC)
p2-p28	Menu items to be displayed
The menu items for the functions you select from below are displayed in the specified order.	
Only the specified menu items are displayed.	
ALARMACK	Alarm acknowledge
MESSAGE	
FREE_MESSAGE	
TRIGGER	Event trigger
SAVE_DISPLAY	Save the display data
SAVE_EVENT	Save the event data
MANUAL_SAMPLE	
SNAPSHOT	
BATCH	
MATH_START/STOP	
MATH_RESET	
MATH_ACK	Math data dropout acknowledge
KEYLOCK	Enable/disable key lock
LOGOUT	
PASSWORD_CHANGE	
EMAIL_START/STOP	
EMAIL_TEST	
FTP_TEST	

SNTF	
MEDIA_EJECT	Eject the storage medium
SYSTEM_INFO	System information
NETWORK_INFO	Network information
TEXT_FIELD	Text field display
4PANEL	
JUMP_DISPLAY	Register the home display
RATE_CHANGE	Display rate 1/display rate 2
FAVORITE_REGIST	Register as favorite
SAVE_STOP	Stop the save operation
TIMER_RESET	
PAUSE_DISPLAY	Stop the monitor
LCD_SAVER	Backlight saver
MATCH_T_RESET	Reset the single match timer

Example Display FREE MESSAGE and SNAPSHOT for the first and second function menu items.

SMFUNC, FREE_MESSAGE, SNAPSHOT

- Description • A command error will occur if you specify the same menu item multiple times.
- You cannot specify SEPARATOR.
 - You cannot omit parameters by using delimiters (, .).
 - You cannot hide LOGOUT. If it is not included in the parameters, it is displayed as the last menu item.

Query	SM ?	To query all menu items
	SM DISP_MAIN?	To query all main menu items
	SM DISP_SUB?	To query all submenu items
	SM DISP_SUB, TREND?	To query the Trend submenu items
	SM FUNC?	To query all function menu items

SY Sets the 4 panel display

Syntax	SY p1, p2, p3, p4, p5, p6, p7, p8, p9, p10, p11<terminator>
p1	1
p2	Screen number (1 to 4)
p3	Screen group name (up to 16 characters)
p4	Screen 1 type
	TREND Trend display
	DIGITAL Digital display
	BAR Bar graph display
	OVERVIEW

4.4 Setting Commands (Setting)

	ALARM	Alarm summary
	MESSAGE	Message summary
	MEMORY	Memory summary
	MODBUS-M	Modbus master status display
	MODBUS-C	Modbus client status display
	RELAY	Relay status display
	REPORT	Report display
	COLUMN_BAR	Stacked bar graph
p5	Group number to be displayed on screen 1	
p6	Screen 2 type (see p4)	
p7	Group number to be displayed on screen 2	
p8	Screen 3 type (see p4)	
p9	Group number to be displayed on screen 3	
p10	Screen 4 type (see p4)	
p11	Group number to be displayed on screen 4	
Query	SY[p1, [p2]]?	
Example	Set screen number 1 as follows: 4 panel name: TEMP Screen 1: Trend display, group 1 Screen 2: Digital display, group 3 Screen 3: Alarm summary Screen 4: Overview SY1,1,TEMP,TREND,1,DIGITAL,3,ALARM,1,OVERVIEW	
Description	<ul style="list-style-type: none"> The group designations (p5, p7, p9, and p11) are valid only if the corresponding display types (p4, p6, p8, and p10) are {TREND, DIGITAL, BAR}. The setting p4=MODBUS-M is valid only if the serial interface protocol is set to MODBUS-M. The setting p4=REPORT or COLUMN_BAR is valid only on models with the /M1 MATH option. 	

TY Sets the file format

Syntax	TY p1,p2
	p1 1
	p2 File format
	TEXT Saves files in text format
	BINARY Saves files in binary format
Query	TY?
Example	Save files in text format. TY TEXT
Description	<ul style="list-style-type: none"> You can specify the file format for display data and event data files. The ways you can save files whose file format can be specified are auto save, save unsaved data, manual save, and FTP data transfer. If you are using a communication command to transmit a data file in the internal memory, it is transmitted in binary format regardless of the file format setting.

- If you are using a communication command to transmit a data file on an external storage medium, it is transmitted in the format that the file is stored on the external storage medium.
- If the MV is operating as an FTP server and you retrieve a data file in the internal memory via FTP, the data will be in binary format regardless of the file format setting. If you are retrieving a data file on an external storage medium, the file will be in the format that the file is stored in the external storage medium.
- If the MV is operating as an FTP client and you retrieve a data file in the internal memory or a data file on an external storage medium via FTP, the MV transmits the file in the specified format.

NF

Sets the HISTORY key function

Syntax	NF p1,p2,p3<terminator>
	p1 Key function
	HISTORY Use as a key to move the historical trend display
	FAVORITE Use as a favorite key
	p2 Display group number registered in the favorite function
	Valid when p1 is set to FAVORITE
	SAVED Displays the screen in the registered group
	CURRENT Displays the screen in the current displayed group
	p3 Time axis zoom registered in the favorite function
	Valid when p1 is set to FAVORITE
	SAVED Displays the screen using the registered time axis zoom
	CURRENT Displays the screen using the current time axis zoom

Query	NF?
Example	Use the HISTORY key as a favorite key and display the screen in the current displayed group using the current time axis zoom. NFAVORITE,CURRENT,CURRENT
Description	Parameter p2 and p3 settings are valid only when the key function (p1) is set to FAVORITE.

4.5 Setting Commands (Control)

BT Sets a batch name

Syntax BT p1,p2,p3<terminator>
 p1 1
 p2 Batch number (up to 32 alphanumeric characters)
 p3 Lot number (up to 8 digits)

Query BT[p1]?

Example Set the batch name configuration to batch number PRESS5LINE and lot number 007.
 BT1,PRESS5LINE,007

BU Sets a batch comment

Syntax BU p1,p2,p3<terminator>
 p1 1
 p2 Comment number (1 to 3)
 p3 Comment character string (up to 50 characters)

Query BU[p1,[p2]]?

Example Set comment number 2 to "THIS_PRODUCT_IS_COMPLETED."
 BU1,2,THIS_PRODUCT_IS_COMPLETED

UD Switches the display

To switch back to the display that was shown before you started to change the settings with communication commands

Syntax UD p1<terminator>
 p1 Screen switch (0)

Example Switch back to the display that was shown before you started to change the settings with communication commands.
 UD0

To change to one screen display

Syntax UD p1,p2,p3<terminator>
 p1 Screen switch (1)
 p2 Display item

TREND	Trend display
DIGITAL	Digital display
BAR	Bar graph display
OVERVIEW	Overview display (alarm indicator)
ALARM	Alarm summary display
MESSAGE	Message summary display
MEMORY	Memory summary display
MODBUS-M	Modbus master status display
MODBUS-C	Modbus client status display
RELAY	Relay status display
REPORT	Report display
HISTORICAL	Historical display
COLUMN_BAR	Stacked bar graph

p3 Group number

Example Set the display to one screen trend display and set the group number to 4.
 UD1,TREND,4

Description

- The setting p2=MODBUS-M is valid only if the serial interface protocol is set to MODBUS-M.
- The setting p2=REPORT or COLUMN_BAR is valid only on models with the /M1 MATH option.

To change to 4 panel display

Syntax UD p1,p2,p3,p4,p5,p6,p7,p8,p9<terminator>
 p1 Screen switch (2)
 p2 Screen 1 type (see SY (Sets the four panel display))
 p3 Group number to be displayed on screen 1
 p4 Screen 2 type (see SY (Sets the four panel display))
 p5 Group number to be displayed on screen 2
 p6 Screen 3 type (see SY (Sets the four panel display))
 p7 Group number to be displayed on screen 3
 p8 Screen 4 type (see SY (Sets the four panel display))
 p9 Group number to be displayed on screen 4

Example Assign group 1 to screen 1, group 2 to screen 2, group 3 to screen 3, group 4 to screen 4, and set all screen types to trend display.
 UD2,TREND,1,TREND,2,TREND,3,TREND,4

Description This setting is valid on the RD-MV2000.

To display the specified 4 panel number

Syntax UD p1,p2<terminator>
 p1 Display type (3)
 p2 4 panel configuration number

0	Display the specified 4 panel configuration screen.
1-4	Display the 4 panel configuration specified by SY (sets the four panel display).

To set the operation screen switching

Syntax UD p1,p2,p3,p4,p5,p6,p7<terminator>
 p1 Screen switch (4)
 p2 Automatic display switching ON/OFF
 p3 Switch between all channel display and group display (ALL, GROUP)
 p4 Scale display ON/OFF
 p5 Digital display ON/OFF
 p6 Message display method

1	Normal display
2	List display

p7 Trend space ON/OFF
 p8 Auto zone ON/OFF
 p9 Fine grid ON/OFF

Example Enable the automatic display switching, switch to the group display, set the scale display to ON, and set the digital display to OFF.
 UD4,ON,GROUP,ON,OFF

- Description • Parameter p2 is valid for the trend, digital, or bar graph displays. Use the TP command to set the scroll interval.
- Parameters p3 to p7 are valid for the trend display.

PS Starts/stops measurements

Syntax PS p1<terminator>
 p1 Measurement start/stop
 0 Start
 1 Stop

Example Start measurement.
 PS0

Description When the MV starts measuring, it records the display, event, and report data to the internal memory.

AK Releases the alarm output (alarm acknowledge)

Syntax AK p1<terminator>
 p1 Alarm acknowledge execution (0)

Example Release the alarm output (execute alarm acknowledge).
 AK0

EV Executes manual sample, manual trigger, snapshot, or forced timeout

Syntax EV p1<terminator>
 p1 Operation type
 0 Execute manual sampling.
 1 Activate a manual trigger.
 2 Take a snapshot.
 3 Expire the display data timer.
 4 Expire the even data timer.

Example Execute manual sampling.
 EV1

Description EV1 is valid only when the key trigger is set to ON with the TE command (sets sampling conditions of the event data). It functions the same as the key trigger.

CL Executes manual SNTP

Syntax CL p1<terminator>
 p1 Manual SNTP execution (0)

Example Synchronize the clock manually.
 CL0

CV Switches the trend update rate

Syntax CV p1<terminator>
 p1 Display rate (0, 1)
 0 Switch to the primary trend update rate (standard rate)
 1 Switch to the secondary trend update rate

Example Change the trend update rate to the secondary trend update rate.
 CV1

MS Writes a message (displays and writes)

Syntax MS p1,p2,p3<terminator>
 p1 Message number (1 to 100)
 p2 Destination where messages will be written
 GROUP Specify a single group
 ALL All groups
 p3 Group number

Example Write the message number 8 message to group 1.
 MS8, GROUP, 1

Description • This command displays the message to the screen and writes the message in the display data and event data.

- If you omit p2, the message is written to all groups.

BJ Writes a free message

Syntax BJ p1,p2,p3,p4<terminator>
 p1 Message number (1 to 10)
 p2 Message (up to 32 characters)
 p3 Destination type where messages will be written
 GROUP Specify a single group
 ALL All groups
 p4 Destination where messages will be written
 If p3 is set to GROUP Group number

Example Use message number 3 and write the word "ALARM" to all groups. BJ3,ALARM,ALL

Description If you omit p3, the message is written to all groups.

EJ Changes the login password

Syntax EJ p1,p2,p3<terminator>
 p1 Old password (up to eight alphanumeric characters)
 p2 New password (up to eight alphanumeric characters)
 p3 New password (up to eight alphanumeric characters)

Example Change the old password "PASS001" to the new password "WORD005."
 EJPASS001,WORD005,WORD005

4.5 Setting Commands (Control)

TL Starts, stops, resets computation (MATH) or clears the computation dropout status display

Syntax TL p1<terminator>

p1 Operation type

- 0 Computation start
- 1 Computation stop
- 2 Computation reset
- 3 Clear the computation dropout status display

Example Start computation.

TLC

Description • You cannot execute this command while setup data is being saved or loaded.
• You can execute this command on models with the /M1 math option.

DS Switches the execution mode between operation and basic setting

Syntax DS p1<terminator>

p1 Event type

- 0 Operation Mode
- 1 Basic Setting Mode

Example Set the mode to Basic Setting Mode.

DS1

Description • You cannot set p1 to 1 while the MV is measuring or computing, while the MV is formatting an external storage medium, or while the MV is saving data to an external storage medium.
• You cannot set p1 to 0 while the MV is formatting an external storage medium or while the MV is saving data to an external storage medium.
• To activate the settings that are changed with the basic setting commands, you must save the settings with the XE command. Make sure to save the settings with the XE command before changing from Basic Setting Mode to Operation Mode. Otherwise, new settings will not take effect.
• If you execute the DS command while the screen display is stopped, the monitor will resume.

LO Loads setup data

Syntax LO p1,p2<terminator>

p1 File name (up to 32 characters)

p2 Media designation

- 0 CF slot
- 1 USB

Example Load setup data from the setup file SETFILE1 (.pdl extension).

LOSETFILE1

Description • Do not specify the file name extension.
• If you omit p2, the media designation is set to the CF slot.
• This command loads the setup data of both Setting Mode and Basic Setting Mode.
• This command loads the setup data in the root directory of the specified storage medium.
• You cannot execute this command only if an external storage medium is inserted in the drive.
• You cannot execute this command while the MV is memory sampling.
• Because the MV restarts after executing this command, communications will be dropped.

LI Saves setup data

Syntax LI p1<terminator>

p1 File name (up to 32 characters)

p2 Media designation

- 0 CF slot
- 1 USB

Example Save the setup data of both the setting and basic setting commands to the file SETFILE2 on a CF card.

LISSETFILE2

Description • Do not specify the file name extension.
• If you omit p2, the media designation is set to the CF slot.
• The .pdl extension is added to the saved file.
• You cannot execute this command only if an external storage medium is inserted in the drive.

CM Sets communication input data

Syntax CM p1,p2<terminator>

p1 Communication input channel number

p2 Communication input data

The selectable range is $-9.9999\text{E}+29$ to $-1.0000\text{E}-30$, 0, and $1.0000\text{E}-30$ to $9.9999\text{E}+29$.
Five significant digits.

Query CM?

Example Set communication input channel C01 to communication input data $1.0000\text{E}-10$.

CMC01,1.0000E-10

Description You can execute this command on models with the /M1 math option.

CE Enters data in an external input channel

Syntax CE p1,p2<terminator>

p1 External input channel number

p2 Data value (-30000 to 30000)

Query CE [p1]?

Example Set external input channel number 440 to 12345.

CE440,12345

Description You can execute this command on models with the /MC1 external input channel option.

EM Starts/stops the e-mail transmission function

Syntax EM p1<terminator>

p1 Operation type

0 Start

1 Stop

Example Start the e-mail transmission function.

EM0

Description To use the e-mail transmission function, you must set the Ethernet interface, e-mail addresses, and contents to be transmitted.

CU Manually recovers Modbus

Syntax CU p1<terminator>

p1 Communication type

0 Modbus client (Ethernet)

1 Modbus master (serial)

BV Enters characters

Syntax BV p1,p2<terminator>

p1 0

p2 Character string (up to 100 characters)

Example Enter user123.

BV0,user123

KE Key operation command

Syntax KE p1<terminator>

p1 Key type

F1-F7 Soft keys 1 to 7

ESC ESC key

MENU MENU key

FUNC FUNC key

START START/STOP key

HISTORY HISTORY key

USER USER key

T/DIV T/DIV key

0-9 Number 0 to 9 keys

MINUS Number minus key

DOT Number decimal key

DISP DISP/ENTER key

UP Up arrow key

DOWN Down arrow key

RIGHT Right arrow key

LEFT Left arrow key

Example Press the DISP/ENTER key.

KEDISP

Description Operates in the same way as the keys on the MV. For a key sequence, transmit the commands in the same order that you would press the keys on the MV.

YC Clears measured/computed data and initializes setup data

Syntax YC p1<terminator>

p1 Type of data to be cleared

0 Clear measured/computed data and initialize setup data

2 Clear measured/computed data

IR Resets the relative timer

Syntax IR p1<terminator>

p1 Timer number to be reset

0 All timers

1-4 Timer number 1 to 4

MA Resets a match timer

Syntax MA p1

p1 Match timer number to be reset (1 to 4)

Example Reset match timer number 3.

MA3

Description • An error will occur if the timer operation of the match timer is set to repeat.
• Nothing will occur if the single match timer has not expired.

NR Sets the trend update rate

Syntax NR p1,p2<terminator>

p1 1

p2 Trend update rate [div] (15S, 30S, 1MIN, 2MIN, 5MIN, 10MIN, 15MIN, 20MIN, 30MIN, 1H, 2H, 4H, 10H)

Query NR[p1[,p2]]?

Example Set the trend update rate to 5 min/division.

NR1, 5MIN

Description • You cannot set the trend update rate if the memory data type is event + display.
• The logging number is fixed to 1.
• Set the data update rate and auto save rate first with the SW command and then set the trend update rate with the NR command.

4.6 Basic Setting Commands

WO Sets alarm and DO settings

To set alarm and DO settings

Syntax WO p1,p2,p3,p4,p5<terminator>
 p1 Alarm setting
 p2 Reflash operation ON/OFF
 p3 Interval for the low limit on the rate-of-change (1 to 32)
 p4 Interval for the high limit on the rate-of-change (1 to 32)
 p5 Alarm status indicator hold/nonhold
 HOLD
 NONHOLD

To set the internal switch

Syntax WO p1,p2<terminator>
 p1 DO type (SWITCH)
 p2 AND switch number
 NONE No AND setting
 S01 Specify only S01
 S01-Sxx Specify S01 to Sxx
 xx = {02 to 30}

To set the output relay

Syntax WO p1,p2,p3,p4,p5<terminator>
 p1 DO type (RLY)
 p2 Relay number
 NONE No AND setting
 I01 Specify only I01
 I01-Ixx Specify I01 to Ixx
 xx = {02 to 36}
 p3 Energize/De-energize the relay
 DE_ENERGIZE
 ENERGIZE
 p4 Relay hold/nonhold
 NONHOLD
 HOLD
 p5 Relay action on ACK
 NORMAL
 RESET

Description Set parameter p2 according to the table in section 4.3.

Query WO[p1]?

Example Set the output relay to no AND operation and the relay action to energize and release the relay output when an alarm acknowledge is received regardless of the alarm status.
 WOPLY, NONE, ENERGIZE, HOLD, RESET

WH Sets an alarm hysteresis

For measurement channels

Syntax WH p1,p2,p3<terminator>
 p1 Channel type (MEASURE)
 p2 High and low limit alarm hysteresis (0 to 50)
 p3 Difference high and low limit alarm hysteresis (0 to 50)

For computation channels

Syntax WH p1,p2<terminator>
 p1 Channel type (MATH)
 p2 High and low limit alarm hysteresis (0 to 50)

For external input channels

Syntax WH p1,p2<terminator>
 p1 Channel type (EXTERNAL)
 p2 High and low limit alarm hysteresis (0 to 50)

Query WH[p1]?

Example For measurement channels, set the high and low limit alarm hysteresis to 4.0% and the difference high and low limit alarm hysteresis to 0.0%.
 WHMEASURE, 40, 0

Description You can set alarm settings on computation channels on models with the /M1 math option.
 You can set alarm settings on external input channels on models with the /MC1 external input channel option.

XV Sets the scan interval

Syntax XV p1,p2,p3,p4<terminator>
 p1 1 (fixed)
 p2 Scan interval mode
 NORMAL Normal mode
 FAST Fast sampling mode
 p3 Scan interval (25MS, 125MS, 250MS, 1S, 2S, 5S)
 p4 A/D integration time (AUTO, 600Hz, 50Hz, 60Hz, 100ms)

Query XV?

Example Set the scan interval to 1 second in normal mode.
 XVNORMAL, 1

Description The combinations of scan interval modes and scan intervals vary depending on the model. See the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)* for details.
 You can set p4 to 600Hz when the scan interval is set to fast sampling mode. You can set p4 to 100ms when the scan interval is set to 2s or 5s.

XB Sets the burnout detection

Syntax XB p1,p2<terminator>
 p1 Measurement channel number
 p2 Burnout procedure
 OFF Not processed
 UP Set the measured result to +over
 DOWN Set the measured result to -over

Query XB[p1]?

Example Set the measured result to UP (+over) if a burnout is detected on channel 001.
 XB001, UP

Description Set parameter p1 according to the table in section 4.3.

XJ Sets an RJC**To use the internal compensation circuit**

Syntax XJ p1,p2<terminator>
 p1 Measurement channel number
 p2 Reference junction compensation designation (INTERNAL)

Query XJ[p1]?

Example Set the channel 001 RJC to the internal compensation circuit.
 XJ001, INTERNAL

To use an external RJC

Syntax XJ p1,p2,p3<terminator>
 p1 Measurement channel number
 p2 Reference junction compensation designation (EXTERNAL)
 p3 External RJC value (-20000 to 20000)

Query XJ[p1]?

Example Set the channel 002 RJC to external and set the compensation value to 0 μ V.
 XJ002, EXTERNAL, 0

Description • Set parameter p1 according to the table in section 4.3.
 • The unit of parameter p3 is μ V.

WU Sets environment settings

Setup items GENERAL, BATCH, DISPLAY, MESSAGE, INPUT, ALARM, SECURITY, MEDIA, MATH, REPORT, SERVICEPORT, DECIMALPOINT, POP3

General environment settings

Syntax WU p1,p2,p3<terminator>
 p1 Setting type (GENERAL)
 p2 Tag/channel number selection
 TAG
 CHANNEL Channel number
 p3 Language
 ENGLISH
 JAPANESE
 CHINESE
 GERMAN
 FRENCH
 KOREAN

Example Select tag display and set the language to English.
 WUGENERAL, TAG, ENGLISH

To set the batch function

Syntax WU p1,p2,p3,p4<terminator>
 p1 Setting type (BATCH)
 p2 Batch function ON/OFF
 p3 Number of lot number digits (OFF, 4, 6, 8)
 p4 Auto increment ON/OFF

Description Parameters p3 and p4 are valid only when p2 is ON.

To set the display

Syntax WU p1,p2<terminator>
 p1 Setting type (DISPLAY)
 p2 Trend type (T-Y)
 p3 Partial expansion ON/OFF
 p4 Trend update rate switching ON/OFF

To set message settings

Syntax WU p1,p2,p3,p4<terminator>
 p1 Setting type (MESSAGE)
 p2 Method of writing messages from keys
 COMMON Applied to all display groups
 SEPARATE Applied to a specified display group
 p3 Power failure message ON/OFF
 p4 Change message ON/OFF

To set the input

Syntax WU p1,p2<terminator>
 p1 Setting type (INPUT)
 p2 Detection of values exceeding the scale
 FREE When the measurement range is exceeded
 OVER When $\pm 105\%$ of the scale is exceeded

To set alarm settings

Syntax WU p1,p2<terminator>
 p1 Setting type (ALARM)
 p2 Alarm suppression function ON/OFF

To set security settings

Syntax WU p1,p2,p3<terminator>
 p1 Setting type (SECURITY)
 p2 Keys
 OFF Disable security
 KEYLOCK Lock the keys
 LOGIN Enable the login function
 p3 Communication
 OFF Disable security
 LOGIN Enable the login function

Set media settings

Syntax WU p1,p2,p3<terminator>
 p1 Setting type (MEDIA)
 p2 Auto save function ON/OFF
 p3 Media FIFO ON/OFF

Example Use media FIFO.
 WUMEDIA, ON, ON

Description Parameter p3 is valid only when p2 is ON.

4.6 Basic Setting Commands

To set computation settings

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

p1 Setting type (MATH)

p2 Display on error

+OVER

-OVER

p3 Data when the SUM or AVE value overflows

ERROR Set the computed result to computation error

SKIP Discard the data that overflowed and continue the computation

LIMIT Process the data as follows:

- High or low limit value in the measurement range for measurement channels that do not use linear scaling
- High or low limit value in the scaled range for measurement channels that use linear scaling
- High or low limit value in the specified span for measurement channels

p4 Data when the MAX, MIN, or P-P value overflows

OVER Compute using the overflow data

SKIP Discard the data that overflowed and continue the computation

To set report settings

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

p1 Setting type (REPORT)

p2 Report computation type 1

MAX Maximum value

MIN Minimum value

AVE Average value

SUM Sum value

INST Instantaneous value

p3 Report computation type 2

OFF Disable report computation

MAX Maximum value

MIN Minimum value

AVE Average value

SUM Sum value

INST Instantaneous value

p4 Report computation type 3

Same as p3.

p5 Report computation type 4

Same as p3.

p6 Generation of "hourly+daily," "daily+weekly," and "daily+monthly" files

COMBINE Output to a single file.

SEPARATE Output to separate files.

For parameters p2 to p5, the same computation type cannot be specified except for OFF.

Auto service port

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

p1 Setting type (SERVICEPORT)

p2 FTP service port (1 to 65535)

p3 Web service port (1 to 65535)

p4 SNTP service port (1 to 65535)

p5 Modbus service port (1 to 65535)

Query WU[p1]?

To set the decimal type

Syntax WU p1,p2

p1 Setting type (DECIMALPOINT)

p2 Decimal type

POINT Set the decimal to a period

COMMA Set the decimal to a comma

Query WU[p1]?

Example Set the decimal to a comma.

WU DECIMALPOINT, COMMA

Description • The specified decimal type is applied to the following items.

Items That the Decimal Type Setting Applies To	
Item	Detailed Items
File output	Display data file
	Event data file
	Manual sample file
	Report data file
Display	Trend display (digital display, scale display)
	Digital display
	Bar graph display
	Overview
	Historical display (digital display, scale display)
	4 panel display
	Report display
Web screen	All channel information display
E-mail	Instantaneous data
	Report data

- The specified decimal type is not applied to the following items.

Items That the Decimal Type Setting Does Not Apply To	
Item	Detailed Items
File output	Setup file
Setup display	Span, scale, and alarm settings for measured, computed, and external input channels
	Computation constant
	Hysteresis value (fixed decimal place)
Communication (setup/output)	Command and response syntax for communication commands

- The decimal for items that the decimal type setting does not apply to is displayed with a period.

To set POP3 parameters

Syntax WU p1,p2,p3

p1 Setting type (POP3)

p2 Number of seconds until sending e-mail to the SMTP server (0 to 10)

p3 POP3 login method

PLAIN Plain password

APOP APOP password

XM **Sets the memory sample condition**

Syntax XM p1<terminator>

p1 Data type

 DISPLAY Display data

 EVENT Event data

 E+D Display data and event data

Query XM?

Example Set the memory sampling condition to display data.

 XMDISPLAY

RF **Sets the key lock function**

p1=KEY

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

p1 Type (KEY)

p2 START/STOP key (FREE, LOCK)

p3 HISTORY key (FREE, LOCK)

p4 MENU key (FREE, LOCK)

p5 USER key (FREE, LOCK)

p6 DISP/ENTER key (FREE, LOCK)

p7 T/DIV key (FREE, LOCK)

p1=FUNC (function keys)

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

p1 Type (FUNC)

p2 Alarm acknowledge (FREE, LOCK)

p3 Message/batch (FREE, LOCK)

p4 Math (FREE, LOCK)

p5 Data save (FREE, LOCK)

p6 E-mail/FTP (FREE, LOCK)

p7 Time set (FREE, LOCK)

p8 Display function (FREE, LOCK)

p1=MEDIA (external storage media)

Syntax RF p1,p2,p3<terminator>

p1 Type (MEDIA)

p2 External storage media operation (FREE, LOCK)

p3 Load setup (FREE, LOCK)

Query RF[p1]?

Example Lock the MENU key (leave other keys unlocked).

 RFKEY, FREE, FREE, LOCK, FREE, FREE, FREE

RN **Sets basic login settings**

Syntax RN p1,p2<terminator>

p1 Auto logout (OFF, 1MIN, 2MIN, 5MIN, 10MIN)

p2 Operation when logged out

 OFF Disable the MV operation

 DISPLAY Allow only display-related operations

Query RN?

Example Set the auto logout time to 1 minute, and disable the MV operation when logged out.

 RN1MIN, OFF

RP **Sets login and user limitations**

Syntax RP p1,p2,...<terminator>

p1 User limit number (1 to 10)

p2 User limit item (KEY, FUNC, MEDIA)

Description Parameters p3 and subsequent parameters vary depending on the p2 setting as follows:

p2=KEY

p3 START/STOP key (FREE, LOCK)

p4 HISTORY key (FREE, LOCK)

p5 MENU key (FREE, LOCK)

p6 USER key (FREE, LOCK)

p7 DISP/ENTER key (FREE, LOCK)

p8 T/DIV key (FREE, LOCK)

p2=FUNC (function keys)

p3 Alarm acknowledge (FREE, LOCK)

p4 Message/batch (FREE, LOCK)

p5 Math (FREE, LOCK)

p6 Data save (FREE, LOCK)

p7 E-mail/FTP (FREE, LOCK)

p8 Time set (FREE, LOCK)

p9 Display function (FREE, LOCK)

Query RP[p1,[p2]]?

Example Lock the START, HISTORY, and DISP/ENTER keys.

 RP1, KEY, LOCK, LOCK, , , LOCK

p2=MEDIA (external storage media)

Syntax RP p1,p2,p3<terminator>

p2 User limit item (MEDIA)

p3 External storage media operation (FREE, LOCK)

p4 Load setup (FREE, LOCK)

Query RP[p1]?

Example Limit access to the external storage medium and the loading of setup data.

 RPMEDIA, LOCK, LOCK

Description If key lock is enabled, setup data cannot be loaded. You can place limitations on the loading of setup data for users that are logged in.

4.6 Basic Setting Commands

RO Sets report types and generation times

To specify no report types

Syntax RO p1<terminator>

p1 Report type (OFF)

Query RO?

Example Set the report to none.

ROOFF

Description You can execute this command on models with the /M1 math option.

To specify hourly, daily, hourly+daily, or daily+monthly reports

Syntax RO p1,p2,p3<terminator>

p1 Report type

HOURLY Hourly report

DAY Daily report

HOURLY+DAY Hourly and daily reports

DAY+MONTH Daily and monthly reports

p2 Date of generation (dd)

dd Day (01 to 28)

p3 Time of generation (hh)

hh Hour (00 to 23)

Query RO?

Example Generate a daily report at hour 9 everyday (parameter p2 ("05" in this example) is invalid in this case).

RODAY, 05, 09

Description • You can execute this command on models with the /M1 math option.
• Parameter p2 is discarded if it is specified for reports other than monthly and daily reports.

To specify daily+weekly reports

Syntax RO p1,p2,p3<terminator>

p1 Report type (DAY+WEEK)

p2 Day of generation (SUN, MON, TUE, WED, THU, FRI, SAT)

p3 Time of generation (hh)

hh Hour (00 to 23)

Query RO?

Example Generate a daily report at hour 9 every day and a weekly report at hour 9 every Tuesday.

RODAY+WEEK, TUE, 09

Description You can execute this command on models with the /M1 math option.

RM Sets a report channel

To not use a report channel

Syntax RM p1,p2<terminator>

p1 Report channel number

p2 Report channel ON/OFF (OFF)

Query RM[p1]?

Example Disable the channel 001 report channel.

RM001, OFF

Description • You can execute this command on models with the /M1 math option.
• Set parameter p1 according to the table in section 4.3.

To use a report channel

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

p1 Report channel number

p2 Report channel ON/OFF (ON)

p3 Measurement, computation, or external input channel number to be reported

p4 Conversion of the time unit for TLOG.SUM computation

OFF No conversion.

/S Convert as though the physical values are integrated in units of seconds.

/MIN Convert as though the physical values are integrated in units of minutes.

/H Convert as though the physical values are integrated in units of hours.

/DAY Convert as though the physical values are integrated in units of days.

Query RM[p1]?

Example Use report channel number R01. Set the channel number for generating reports to 001 and convert the units of the summed value to seconds.

RMR01, ON, 001, /S

Description • You can execute this command on models with the /M1 math option.
• Set parameters p1 and p3 according to the table in section 4.3.
• About p4
Because the sampled data is integrated over each scan interval, the physical value integrated over a given period may be different from the actual integrated value. This occurs if the given period is not equal to the scan interval. In such case, set p4 to the same unit as that of the physical value being measured. The integrated value is found according to the following converting equations that depend on the parameter.
OFF □ (measured value)
/S □ (measured value) × scan interval
/MIN □ (measured value) × scan interval/60
/HOUR □ (measured value) × scan interval/3600
/DAY □ (measured value) × scan interval/86400
The scan interval unit is seconds.

XG Sets the time zone

Syntax XG p1,p2<terminator>

p1 Offset time from GMT (–1300 to 1300)

Upper 2 digits: Hour (00 to 13)

Lower 2 digits: Minute (00 to 59)

p2 Time deviation limit (OFF, 10S, 20S, 30S, 1MIN, 2MIN, 3MIN, 4MIN, 5MIN)

Example Set the offset time from the GMT to 9 hours ahead and the deviation limit to 30 s.
XG0900,30S

XN Sets the date format

Syntax XN p1<terminator>
p1 Date format (Y/M/D, M/D/Y, D/M/Y, D.M.Y)
Query XN?
Example Set the date format to Y/M/D.
XNY/M/D

YB Sets host information

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 RD-MV1000 and the domain name to mvadv.daqstation.com.
YBmv1000,mvadv.daqstation.com

YD Sets network settings

To not automatically obtain network parameters

Syntax YD p1,p2,p3<terminator>
p1 Automatic allocation (NOT)

To automatically obtain network parameters

Syntax YD p1,p2,p3<terminator>
p1 Automatic allocation (USE)
p2 Obtain DNS info (USE, NOT)
p3 Automatic host name registration (USE, NOT)
Query YD?
Example Set the IP address to auto allocation, get DNS information, and automatically register the host name.
YDUSE,USE,USE

YA Sets the IP address, subnet mask, and default gateway

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.
YA192.168.111.24,255.255.255.0,0.0.0.0
Description The settings specified with this command take effect when you save the settings with the XE command and power-cycle the MV.

YK Sets the keepalive feature

Syntax YK p1<terminator>
p1 Keepalive ON/OFF
Query YK?
Example Disable keepalive.
YKOFF
Description The settings specified with this command take effect when you save the settings with the XE command and power-cycle the MV.

RU Sets DNS parameters

To set server parameters

Syntax RU p1,p2,p3<terminator>
p1 Setting type (SERVER)
p2 Primary DNS server address
(0.0.0.0 to 255.255.255.255)
p3 Secondary DNS server address
(0.0.0.0 to 255.255.255.255)

To set suffix parameters

Syntax RU p1,p2,p3<terminator>
p1 Setting type (SUFFIX)
p2 Domain suffix 1 (up to 64 characters)
p3 Domain suffix 2 (up to 64 characters)
Query RU[p1]?
Example Set domain suffix 1 to rec1.daqstation.com and domain suffix 2 to rec2.daqstation.com.
RUSUFFIX,rec1.daqstation.com,rec2.daqstation.com

WS Sets a server

Syntax WS p1,p2<terminator>
p1 Server type (FTP, WEB, MODBUS, SNTP)
p2 Server usage (USE, NOT)
Query WS[p1]?
Example Enable the Web server.
WSWEB,USE

4.6 Basic Setting Commands

WW Sets the Web homepage

Syntax WW p1,p2,p3,p4<terminator>
p1 Homepage type
 OPERATOR Operator page
 MONITOR Monitor page
p2 Homepage ON/OFF
p3 Authentication
 OFF No authentication
 ADMIN Administrator privileges
 USER User privileges
p4 Command input (USE, NOT)
Query WW[p1]?
Example Enable the operator page, disable the authentication, and enable command input.
WWOPERATOR,ON,OFF,USE
Description • Parameter p3 and p4 are valid when p2 is ON.
• Parameter p4 is valid when p1 is set to OPERATOR.

YQ Sets the application timeout

To not use the timeout feature

Syntax YQ p1<terminator>
p1 Application timeout (OFF)
Query YQ?
Example Disable timeout.
YQOFF
Description The settings specified with this command take effect when you save the settings with the XE command and power-cycle the MV.

To use the timeout feature

Syntax YQ p1,p2<terminator>
p1 Application timeout (ON)
p2 Timeout value [minutes] (1 to 120)
Query YQ?
Example Enable the application timeout and set the timeout value to 3 min.
YQON,3
Description The settings specified with this command take effect when you save the settings with the XE command and power-cycle the MV.

YT Sets the FTP transfer timing

Syntax YT p1,p2,p3<terminator>
p1 Auto transfer when display and event data files are generated (ON/OFF)
p2 Auto transfer when report data files are generated (ON/OFF)
p3 Auto transfer when snapshot data files are generated (when snapshot is executed) (ON/OFF)
Query YT?
Example Auto transfer display and event data files. Do not transfer report data files. Do not transfer image data files.
YTON,OFF,OFF

Description If the method to save data to an external storage medium is set to Auto, the MV automatically transfers data files as they are generated. For media storage settings, see the *RD-MV1000/RD-MV2000 User's Manual*.

YU Sets the contents to be sent via e-mail

To send changes in the alarm status

Syntax YU p1,p2,p3,p4,p5,p6,p7,p8,p9,p10,p11,p12<terminator>
p1 Transmitted content (ALARM)
p2 Recipient 1 ON/OFF
p3 Recipient 2 ON/OFF
p4 Alarm transmission of alarm number 1 ON/OFF
p5 Alarm transmission of alarm number 2 ON/OFF
p6 Alarm transmission of alarm number 3 ON/OFF
p7 Alarm transmission of alarm number 4 ON/OFF
p8 Include instantaneous data ON/OFF
p9 Include source URL ON/OFF
p10 Subject (up to 32 alphanumeric characters)
p11 Header 1 (up to 64 characters)
p12 Header 2 (up to 64 characters)
Query YU[p1]?
Example Transmit alarms of alarm numbers 1 to 4 including instantaneous data but not including the source URL to recipient 1. Set the subject to "ALM" and header 1 to "LP2."
YUALARM,ON,OFF,ON,ON,ON,ON,ON,OFF,ALM,LP2

To send e-mail at scheduled times

Syntax YU p1,p2,p3,p4,p5,p6,p7,p8,p9,p10,p11,p12<terminator>
p1 Transmitted content (TIME)
p2 Recipient 1 ON/OFF
p3 Interval for sending e-mail to recipient 1 (1H, 2H, 3H, 4H, 6H, 8H, 12H, 24H)
p4 Time when e-mail is sent to recipient 1 (00:00 to 23:59)
p5 Recipient 2 ON/OFF
p6 Interval for sending e-mail to recipient 2 (1H, 2H, 3H, 4H, 6H, 8H, 12H, 24H)
p7 Time when e-mail is sent to recipient 2 (00:00 to 23:59)
p8 Include instantaneous data ON/OFF
p9 Include source URL ON/OFF
p10 Subject (up to 32 alphanumeric characters)
p11 Header 1 (up to 64 characters)
p12 Header 2 (up to 64 characters)
Query YU[p1]?
Example Send e-mail at 17 hours 15 minutes every day to recipient 1. Do not include instantaneous data but include the source URL. Set the subject to "GOOD" and header 1 to "LP2."
YUTIME,ON,24H,17:15,OFF,,OFF,ON,GOOD,LP2

To send system notifications

Syntax YU p1,p2,p3,p4,p5,p6,p7<terminator>
 p1 Transmitted content (SYSTEM)
 p2 Recipient 1 ON/OFF
 p3 Recipient 2 ON/OFF
 p4 Include source URL ON/OFF
 p5 Subject (up to 32 alphanumeric characters)
 p6 Header 1 (up to 64 characters)
 p7 Header 2 (up to 64 characters)

Query YU[p1]?

Example Send system notification e-mail messages including the source URL to recipient 1. Set the subject to "SystemAlert" and header 1 to "LP2."
 YUSYSTEM,ON,OFF,ON,SystemAlert,LP2

To send report generation notifications

Syntax YU p1,p2,p3,p4,p5,p6,p7<terminator>
 p1 Transmitted content (REPORT)
 p2 Recipient 1 ON/OFF
 p3 Recipient 2 ON/OFF
 p4 Include source URL ON/OFF
 p5 Subject (up to 32 alphanumeric characters)
 p6 Header 1 (up to 64 characters)
 p7 Header 2 (up to 64 characters)

Query YU[p1]?

Example Send report generation notification e-mail messages including the source URL to recipient 1. Set the subject to "Report" and header 1 to "LP2."

YUREPORT,ON,OFF,ON,Report,LP2

Description • For the contents of system notifications, see section 2.3.
 • Report generation notification can be used on models with the /M1 math option.
 • For e-mail settings, see section 2.3.

YV Sets e-mail recipient addresses

Syntax YV p1,p2<terminator>
 p1 Recipient selection
 1 Recipient 1
 2 Recipient 2
 p2 Recipient address (up to 150 alphanumeric characters)

Query YV[p1]?

Example Set recipient 1 to "mvuser1@daqstation.com" and "mvuser2@daqstation.com."
 YV1,mvuser1@daqstation.com mvuser2@daqstation.com

Description • To set multiple recipients, separate each recipient with a space.
 • For e-mail settings, see section 2.3.

YW Sets the e-mail sender address

Syntax YW p1<terminator>
 p1 Sender address (up to 64 alphanumeric characters)

Query YW?

Example Set the sender address to "mvadv."
 YWmvadv

Description For e-mail settings, see section 2.3.

YX Sets the e-mail SMTP server name

Syntax YX p1,p2,p3<terminator>
 p1 SMTP server name (up to 64 characters)
 p2 Port number (0 to 65535)
 p3 Authentication
 OFF No authentication
 POPBEFORESMTP Execute POP Before SMTP

Query YX?

Example Set the SMTP server to "smtp.daqstation.com," the port number to "25," and execute POP Before SMTP.

YX smtp.daqstation.com,25,POPBEFORESMTP

Description For e-mail settings, see section 2.4.

YJ Sets a Modbus client destination server

Syntax YJ p1,p2,p3,p4,p5<terminator>
 p1 Server number (1 to 16)
 p2 Port number (0 to 65535)
 p3 Host name (up to 64 characters)
 p4 Unit number registration
 AUTO Not use the unit number
 FIXED Use a fixed unit number
 p5 Unit number (0 to 255)

Query YJ[p1]?

Example Set the port number of server number 3 to 502, the host name to RD-MV2000, the unit number registration to FIXED, and the unit number to 127.

YJ3,502,RD-MV2000,FIXED,127

4.6 Basic Setting Commands

YP Sets basic Modbus client settings

Syntax YP p1,p2<terminator>

p1 Read cycle (125MS, 250MS, 500MS, 1S, 2S, 5S, 10S)

p2 Retry interval (OFF, 10S, 20S, 30S, 1MIN, 2MIN, 5MIN, 10MIN, 20MIN, 30MIN, 1H)

Query YP?

Example Set the read cycle to 500 ms and the retry (reconnection) interval to 10 minutes.
YP500MS,10MIN

YR Sets a Modbus client transmission command

Syntax YR p1,p2,p3...<terminator>

p1 Command number (1 to 16)

p2 Command type (OFF, R, R-M, W, W-M)

Description Parameters p3 and subsequent parameters vary depending on the p2 setting as follows:

If p2 is OFF

There are no parameters after p2.

If p2 is R [read into external input channels]

p3 First channel (external input channel number)

p4 Last channel (external input channel number)

p5 Server number (1 to 16)

p6 First register number (30001 to 39999, 40001 to 49999, 300001 to 365536, 400001 to 465536)

p7 Register data type (INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L)

If p2 is R-M [read into communication input channels]

p3 First channel (communication input channel number)

p4 Last channel (communication input channel number)

p5 Server number (1 to 16)

p6 First register number (30001 to 39999, 40001 to 49999, 300001 to 365536, 400001 to 465536)

p7 Register data type (INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L, FLOAT_B, FLOAT_L)

If p2 is W [write measurement channels]

p3 First channel (Measurement channel number)

p4 Last channel (Measurement channel number)

p5 Server number (1 to 16)

p6 First register number (40001 to 49999, 400001 to 465536)

p7 Register data type (INT16, FLOAT_B, FLOAT_L)

If p2 is W-M [write computation channels]

p3 First channel (computation channel number)

p4 Last channel (computation channel number)

p5 Server number (1 to 16)

p6 First register number (40001 to 49999, 400001 to 465536)

p7 Register data type (INT16, UINT16, INT32_B, INT32_L, FLOAT_B, FLOAT_L)

Query YR[p1]?

Example Set the command type of command number 5 to W, the first channel to 01, the last channel to 04, the server number to 1, the first register number to 40001, and the register data type to INT16.
YR5,W,01,04,1,40001,INT16

Note

Parameter p3 must be less than or equal to p4.
Parameters p3, p4, and p7 determine the number of registers to be read or written. An error will occur if the valid range of registers indicated in p6 is exceeded.

WB Sets SNTP client settings

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

p1 SNTP client function usage (USE, NOT)

p2 SNTP server name (up to 64 alphanumeric characters)

p3 SNTP port number (0 to 65535)

p4 Access interval (OFF, 1H, 8H, 12H, 24H)

p5 Reference time for the access interval (00:00 to 23:59)

p6 Timeout value (10S, 30S, 90S)

If you set p1 to NOT, p2 to p6 are invalid.

Query WB?

Example Enable the SNTP client function, set the server name to sntp.daqstation.com, the port number to 123, the access interval to 24 hours, the reference time to 12:00, and the timeout value to 30 seconds.
WBUSE,sntp.daqstation.com,123,24H,12:00,30S

WC Sets the SNTP operation when memory start is executed

Syntax WC p1<terminator>

p1 Time adjustment by SNTP at memory start (ON/OFF)

Query WC?

Example Enable the time adjustment by SNTP at memory start.
WCON

YS Sets serial interface parameters

Syntax	YS p1,p2,p3,p4,p5,p6<terminator>
p1	Baud rate (1200, 2400, 4800, 9600, 19200, 38400)
p2	Data length (7, 8)
p3	Parity check (ODD, EVEN, NONE)
p4	Handshaking (OFF:OFF, XON:XON, XON:RS, CS:RS)
p5	RS-422/485 address (01 to 99)
p6	Protocol (NORMAL, MODBUS, MODBUS-M)
Query	YS?
Example	Set the baud rate to 9600, the data length to 8, the parity check to ODD, handshaking to OFF:OFF, the RS-422/485 address to 02, and the protocol to NORMAL. YS9600,8,ODD,OFF:OFF,02,NORMAL
Description	<ul style="list-style-type: none"> The settings specified with this command take effect when you save the settings with the XE command and power-cycle the MV. You can execute this command on models with the /C2 or /C3 serial interface option.

YL Sets Modbus master function settings

Syntax	YL p1,p2,p3,p4,p5<terminator>
p1	Read cycle (125MS, 250MS, 500MS, 1S, 2S, 5S, 10S)
p2	Timeout (125MS, 250MS, 500MS, 1S, 2S, 5S, 10S, 1MIN)
p3	Retrials (OFF, 1 to 5, 10, 20)
p4	Command wait time (OFF, 5MS, 10MS, 15MS, 45MS, 100MS)
p5	Auto recovery (OFF, 1MIN, 2MIN, 5MIN, 10MIN, 20MIN, 30MIN, 1H)
Query	YL?
Example	Set the read cycle to 500 ms, the timeout to 250 ms, the retries to 2, the command wait time to 10 ms, and the auto recovery to 5 min. YL500MS,250MS,2,10MS,5MIN
Description	<ul style="list-style-type: none"> You can execute this command on models with the /C2 or /C3 serial interface option. You can use this command when the serial interface protocol is set to Master. For serial interface settings, see section 3.3. The settings specified with this command take effect when you save the settings with the XE command and power-cycle the MV.

YM Sets a Modbus master transmission command**To not assign a command**

Syntax	YM p1,p2<terminator>
p1	Registration number (1 to 16)
p2	Command ON/OFF (OFF)
Query	YM[p1]?
Example	Do not assign a command to command registration number 1. YM1,OFF

To set a command for reading data into external input channels

Syntax	YM p1,p2,p3,p4,p5,p6,p7<terminator>
p1	Registration number (1 to 16)
p2	Command type (R)
p3	First channel number (external input channel number)
p4	Last channel number (external input channel number)
p5	Slave device address (1 to 247)
p6	First register number (30001 to 39999, 40001 to 49999, 300001 to 365535, 400001 to 465535)
p7	Type of data assigned to the register (INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L)
Query	YM[p1]?
Example	Register the following command in command registration number 2: Read the 32-bit signed integer data that is assigned to registers 30002 (upper 16 bits) and 30004 (lower 16 bits) on the slave device at address 5 into MV external input channels 201 to 203. YM2,R,201,203,5,30002,INT32_B

To set a command for reading data into communication input channels

Syntax	YM p1,p2,p3,p4,p5,p6,p7<terminator>
p1	Registration number (1 to 16)
p2	Command type (R-M)
p3	First channel number (communication input channel number)
p4	Last channel number (communication input channel number)
p5	Slave device address (1 to 247)
p6	First register number (30001 to 39999, 40001 to 49999, 300001 to 365535, 400001 to 465535)
p7	Type of data assigned to the register (INT16, UINT16, INT32_B, INT32_L, UINT32_B, UINT32_L, FLOAT_B, FLOAT_L)
Query	YM[p1]?
Example	Register the following command in command registration number 2: Read the 32-bit signed integer data that is assigned to registers 30002 (upper 16 bits) and 30004 (lower 16 bits) on the slave device at address 5 into MV communication input channels C02 to C05. YM2,R-M,C02,C05,5,30003,INT32_B

4.6 Basic Setting Commands

To set a command for writing measurement channels

Syntax YM p1,p2,p3,p4,p5,p6,p7<terminator>
p1 Registration number (1 to 16)
p2 Command type (W)
p3 First channel number (measurement channel number)
p4 Last channel number (measurement channel number)
p5 Slave device address (1 to 247)
p6 First register number (40001 to 49999, 400001 to 465535)
p7 Type of data assigned to the register (INT16, FLOAT_B, FLOAT_L)

Query YM[p1]?

Example Register the following command in command registration number 3: Write the measured data of channels 003 to 006 to registers 40003 to 40006 on the slave device at address 7.
YM3,W,003,006,7,40003,INT16

To set a command for writing computation channels

Syntax YM p1,p2,p3,p4,p5,p6,p7<terminator>
p1 Registration number (1 to 16)
p2 Command type (W-M)
p3 First channel number (computation channel number)
p4 Last channel number (computation channel number)
p5 Slave device address (1 to 247)
p6 First register number (40001 to 49999, 400001 to 465535)
p7 Type of data assigned to the register (INT16, UINT16, INT32_B, INT32_L, FLOAT_B, FLOAT_L)

Query YM[p1]?

Example Register the following command in command registration number 2: Write the 16-bit signed integer computed data of channels 101 to 105 to the first register 40003 on the slave device at address 5.
YM2,W-M,101,105,5,40003,INT16

Description

- You can execute this command on models with the /C2 or /C3 serial interface option.
- You can use this command when the serial interface protocol is set to Master. For serial interface settings, see section 2.3.
- The settings specified with this command take effect when you save the settings with the XE command and power-cycle the MV.

To set a command for writing floating type data into Modbus registers

Syntax YM p1,p2,p3,p4,p5,p6,p7<terminator>
p1 Command number (1 to 16)
p2 Command type
W Write data from measurement channels
W-M Write data from computation channels

p3 First channel number
Measurement channel number (1 to 48) if p2 is set to W
Computation channel number (101 to 124) if p2 is set to W-M
p4 Last channel number (1 to 48)
Measurement channel number (1 to 48) if p2 is set to W
Computation channel number (101 to 124) if p2 is set to W-M
p5 Server number (1 to 16)
p6 First register number (40001 to 49999, 400001 to 465535)
p7 Register data type
INT16 16-bit signed integer
UNIT16 16-bit unsigned integer
INT32_B 32-bit signed integer (Big Endian)
INT32_L 32-bit signed integer (Little Endian)
FLOAT_B 32-bit floating point (Big Endian)
FLOAT_L 32-bit floating point (Little Endian)

Example Using command number 1, write the data from measurement channels 1 to 16 to the registers at server number 3 starting from register number 40001 in 32-bit floating point format (Big Endian).
YM1,W,1,16,3,40001,FLOAT_B

Query YM?

Description The selectable range of the first channel number (p3) and last channel number (p4) varies depending on the model.

WR Sets the instrument information output

Syntax WR p1,p2,p3,p4<terminator>
p1 Memory/Media state ON/OFF
p2 Self diagnosis ON/OFF
p3 Communication error ON/OFF
p4 Memory stop ON/OFF

Query WR?

Example Output various information.
WRON,ON,ON,ON

XE Activates Basic Setting Mode

Syntax XE p1<terminator>
p1 Store or discard the settings (STORE, ABORT)

Example Save the setup data of the basic setting commands.
XESTORE

Description To activate the settings that are changed with the basic setting commands, you must save the settings with the XE command. Make sure to save the settings with the XE command before changing from Basic Setting Mode to Operation Mode. Otherwise, new settings will not take effect.

<u>YE</u>	Activates Basic Setting Mode (cold reset)
Syntax	YE p1<terminator>
	p1 Setting activation
	STORE Start by saving the basic settings
	ABORT Start without saving basic settings
Example	Start by saving the basic settings.
	YESTORE

4.7 Output Commands (Control)

BO Sets the byte output order

Syntax	BO p1<terminator>
	p1 Byte order
	0 Transmits the data MSB first.
	1 Transmits the data LSB first.

Query BO?

Example Output the data MSB first.

BO0

Description This command applies to the byte order of numeric data for BINARY output.

CS Sets the checksum

Syntax	CS p1<terminator>
	p1 Checksum usage
	0 Not calculate (value fixed to zero)
	1 Calculate

Query CS?

Example Enable (calculate) the checksum.

CS1

Description You can only use this command for serial communications.

IF Sets the status filter

Syntax	IF p1,P2<terminator>
	p1 Filter value of status information 1 to 4 (0.0.0.0 to 255.255.255.255)
	p2 Filter value of status information 5 to 8 (0.0.0.0 to 255.255.255.255)

Query IF?

Example Set the status filter value to 1.0.4.0 and 255.127.63.31.

IF 1.0.4.0,255.127.63.31

Description See chapter 6 for details.

CC Disconnects the Ethernet connection

Syntax	CC p1<terminator>
	p1 Disconnection (0)
Example	Disconnect the connection.
	CC0

CB Sets the data output format

Syntax CB p1<terminator>

- p1 Output format
- 0 Standard output (including the data of SKIP and OFF channels)
 - 1 Do not output the data of SKIP and OFF channels

- Description
- This setting is independent for each connection.
 - This command only affects the communication section and has no effect on the front panel settings.
 - Valid range of commands

Output data	Corresponding command
Instantaneous data (binary)	FD1, FF
Instantaneous data (ASCII)	FD0
Decimal place and unit information (ASCII)	FE1
Setup channel information (binary)	FE5
Configured alarm output (binary)	FE6

Note**Initialization of BO/CS/IF/CB command settings**• **For serial communications**

Settings entered using the BO/CS/IF/CB commands revert to their default values when the MV is reset (when the MV is power cycled or the user exits from Basic Setting Mode).

- Byte output order, checksum, data output format: 0

- Status filter: 255.255.255.255

If you reset the MV, specify these settings again.

• **For Ethernet communications**

Settings entered using the BO/IF/CB commands revert to their default values when the connection to the MV is dropped. After reconnecting the MV, specify the settings again.

4.8 Output Commands (Setting/Measured/Computed Data Output)

FC Transmits screen image data

Syntax FC p1<terminator>

p1 GET (Output the screen image data)

Example Output screen image data from the MV.

FCGET

Description Captures the current MV screen and transmits the data in PNG format.

FE Transmits setup data

Syntax FE p1,p2,p3<terminator>

p1 Output data type

- 0 Setting commands setup data
- 1 Decimal place and unit information
- 2 Basic setting commands setup data
- 4 Setup data file
- 5 Setup channel information output
- 6 Alarm information output

p2 First channel number (measurement/computation/external input channel)

p3 Last channel number (measurement/computation/external input channel)

Example Output the setting commands setup data of channels 001 to 005 from the MV.

FE0,001,005

- Description
- Set the first channel number and last channel number parameters so that the last channel number is greater than or equal to the first channel number.
 - Parameters p2 and p3 are valid when p1 is set to 0, 1, 2, 5, or 6. All channels are specified if parameters p2 and p3 are omitted.
 - Set parameters p2 and p3 according to the table in section 4.3.

FD Transmits most recent measured/computed data

Syntax FD p1,p2,p3<terminator>

p1 Output data type

- 0 Output the most recent measured/computed/external input data in ASCII format
- 1 Output the most recent measured/computed/external input data in binary format
- 6 Output relay status and internal switch status

p2 First channel number (measurement/computation/external input channel)

p3 Last channel number (measurement/computation/external input channel)

Example Output from the MV the most recent measured/computed data of channels 001 to 005 in ASCII format.

FD0,001,005

- Description • The most recent measured/computed data corresponds to the most recent measured/computed data in the internal memory when the MV receives the FD command.
- Set the first channel number and last channel number parameters so that the last channel number is greater than or equal to the first channel number.
 - Parameters p2 and p3 are valid when p1 is set to 0 or 1. All channels are specified if parameters p2 and p3 are omitted.
 - Set parameters p2 and p3 according to the table in section 4.3.

FF Transmits FIFO data

- Syntax `FF p1,p2,p3,p4<terminator>`
- p1 Operation type
- | | |
|--------|---|
| GET | Transmit the next block |
| RESEND | Retransmit the previous output |
| RESET | Set the most recent data position (block) to the read position of the FIFO buffer (block) |
- p2 First channel number (measurement/computation/external input channel)
- p3 Last channel number (measurement/computation/external input channel)
- p4 Maximum number of blocks that are to be loaded
- | | |
|------|---|
| 1200 | RD-MV1004/RD-MV2008/RD-MV1008 |
| 240 | RD-MV1006/RD-MV1012/RD-MV1024/RD-MV2010/RD-MV2020/RD-MV2030/RD-MV2040/RD-MV2048 |
| 60 | Models with the /MC1 external input channel option |
- If the measured/computed/external input data is less than the specified number of blocks, the MV transmits the available data.
- Example Transmit two blocks of FIFO data from channels 1 to 10.
`FFGET,001,010,2`
- Description • The FIFO buffer is a cyclic buffer, which overwrites the oldest data. Use the FR command to set the acquisition period.
- The MV transmits the specified number of blocks (p4), starting with the block after the previously read block.
- Make sure to read the data within the following buffer period to prevent data dropouts.
- RD-MV1004
FIFO buffer size: 240 cycles (scan interval)
Maximum buffer period: $240 \times$ (acquisition interval). Resending is not possible after the buffer period elapses.
 - Parameters p2 and p4 are valid when p1 is set to GET.
 - If p4 is omitted, the MV transmits all blocks.
 - Set the first channel number and last channel number parameters so that the last channel

- number is greater than or equal to the first channel number.
- For the output flow diagram of FIFO data, see appendix 5.
 - Set parameters p2 and p3 according to the table in section 4.3.

FL Transmits a log, alarm summary, or message summary

- Syntax `FL p1,p2<terminator>`
- p1 Log type
- | | |
|--------|--------------------------|
| COM | Communication |
| FTPC | FTP client |
| ERR | Operation error |
| LOGIN | Login log |
| WEB | Web operation |
| EMAIL | E-mail |
| SNTP | SNTP access log |
| DHCP | DHCP access log |
| ALARM | Alarm summary |
| MSG | Message summary |
| MODBUS | Modbus communication log |
- p2 Maximum read length of the log
- | | |
|--------|--|
| 1-200 | Parameter p1 is COM or MODBUS |
| 1-1000 | Parameter p1 is ALARM |
| 1-450 | Parameter p1 is MSG |
| 1-50 | Parameter p1 is some type other than those above |

Example Transmit the 10 most recent operation error logs.
`FLERR,10`

- Description • Transmits the log that is stored in the MV.
- If p2 is omitted, the MV transmits all written logs.

IS Transmits status information

- Syntax `IS p1<terminator>`
- p1 Status information output
- | | |
|---|---------------------------|
| 0 | Status information 1 to 4 |
| 1 | Status information 1 to 8 |

Example Transmit status information 1 to 4.
`IS0`

Description The output status can be masked using the status filter (IF command). For details on the status information, see chapter 6.

FU Transmits the user level

- Syntax `FU p1<terminator>`
- p1 User information output
- | | |
|---|--|
| 0 | Information about the user currently logged in |
| 1 | Information about the user logged into a general-purpose service |
- Example Transmit information about the user logged into a general-purpose service.
`FU1`

4.8 Output Commands (Setting/Measured/Computed Data Output)

Description: Transmits information about the user that is connected to the MV.

FA Transmits instrument information

Syntax FA p1<terminator>
p1 Information type
IP Address information including the IP address, subnet mask, default gateway, and DNS server address as well as the host name and domain name

ME Transmits data stored on an external storage medium or internal memory

Syntax ME p1,p2,p3<terminator>
p1 Operation type
DIR Transmit the file list
GET Output (first time)
NEXT Output (subsequent times). This parameter is used to output the remaining data when the first output operation is not enough to output all of the data.
RESEND Retransmit the previous output
DEL Delete
DIRNEXT Transmits the subsequent file list after the file list is transmitted by using the DIR command. The number of transmitted lists is the p3 value specified with the DIR command. If you execute this command after all lists have been output, the MV transmits the following data.
EACRLF
ENCRLF
CHKDSK Checks the disk. Transmits the free space on the external storage medium.
p2 Path name (up to 100 characters)
Specify a full path.
p3 Maximum number of files from the list to be transmitted (1 to 1000)
If omitted, the MV transmits the entire file list in the specified directory.
Example

- Transmit the list of all files in the DRV0 directory.
MEDIR, /DRV0/
- Transmit a list of 10 files in the DRV0 directory.
MEDIR, /DRV0/, 10
- Transmit the data in the file 72615100.DAD in the DRV0/DATA0 directory.
MEGET, /DRV0/DATA0/72615100.DAD

Description

- Parameter p2 is valid when p1 is set to DIR, GET, DEL, or CHKDSK.
- Parameter p3 is valid when p1 is set to DIR.
- If an error occurs during data transmission,

you can retransmit the data by setting p1 to RESEND.

Path Name Specifications

- The first level directories are as follows:
Path that starts with /MEM0/DATA/ Internal memory
Path that starts with /DRV0/ External storage medium
- Path names are case-sensitive.
- You can access files whose name is less than or equal to 48 characters in up to three directory levels.
- Wild cards have the following limitations.
 - When parameter p1 is DIR, * can be specified for parameter p2.
 - If the path ends with a slash, it is equivalent to specifying * for the path.
Example: /DRV0/DATA0/ and /DRV0/DATA0/ are equivalent.
 - For the file name and extension, characters starting with * are considered to be arbitrary.
Example: Let us assume that there are five files: ab001.ef1, ab002.ef1, ab001.ef2, ab002.ef2, and ab001.yyy.
If you specify ab*01.ef1, ab001.ef1 and ab002.ef1 are selected.
If you specify ab001.e*1, ab001.ef1 and ab001.ef2 are selected.

MO Manipulates or transmits data stored in the internal memory

Syntax MO p1,p2,p3<terminator>
p1 Operation type
DIR Data list output
GET Data output
SIZE Data size output
p2 Output data type
MANUAL Manually sampled data
REPORT
p3 Specified file name

Example Transmit report data from the MV.

MOGET, REPORT

Description Parameter p3 is valid when p1 is set to GET or SIZE.

4.9 Output Commands (RS-422/485 Commands)

ESC O Opens an instrument

The ASCII code for **ESC** is 1BH. See appendix 3 for details.

Syntax **ESC** O pl<terminator>

pl Instrument address (01 to 99)

Example Open the instrument at address 99, and enable all commands.

ESC O99

- Description**
- Specifies the address of the instrument to communicate with.
 - You can only open one instrument.
 - When you open an instrument with the **ESC O** command, another instrument that is currently open is automatically closed.
 - When the MV receives this command normally, the MV transmits the data "**ESC O** ■ ■."
 - Normally, either CR+LF or LF can be used for the terminator in communication commands. However, the terminator for this command must be set to CR+LF.

ESC C Closes an instrument

The ASCII code for **ESC** is 1BH. See appendix 3 for details.

Syntax **ESC** C pl<terminator>

pl Instrument address (01 to 99)

Example Close the instrument with the address 77.

ESC C77

- Description**
- Releases the connection with the instrument.
 - When the MV receives this command normally, the MV transmits the data "**ESC C** ■ ■."
 - Normally, either CR+LF or LF can be used for the terminator in communication commands. However, the terminator for this command must be set to CR+LF.

4.10 Output Commands (Special Response Commands)

***I** Transmits instrument information

Syntax *I<terminator>

Description Transmits the maker, model, serial number, and firmware version in a comma-separated ASCII text with a terminator at the end.

Example Omega, RD-MV1000, 99AA0123, F1.01

4.11 Maintenance/Test Commands (available when using the maintenance/test server function via the Ethernet interface)

close Disconnects the connection between other instruments

Syntax close,p1,p2:p3<terminator>

p1 MV port (1 to 65535)

p2 PC IP address
(0.0.0.0 to 255.255.255.255)

p3 PC port (0 to 65535)

Example close,34159,192.168.111.24:1054
E0

Description You cannot use this command to disconnect a server port. You cannot use this command to disconnect a port of an instrument that is being controlled. Use the quit command for this purpose.

con Transmits connection information

Syntax con<terminator>

Example

```
con
EA
00/00/00 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

The protocol used.

Local Address

The MV socket address.

Displays "IP address:port number."

Foreign Address

The destination socket address.

Displays "IP address:port number."

State

Connection state.

ESTABLISHED

Connection established.

eth Transmits Ethernet statistics

Syntax eth<terminator>

Example

```
eth
EA
00/00/00 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 Displays 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 Transmits network statistics

Syntax net<terminator>

Example

```
net
EA
00/00/00 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: sndrexitpack    = 0
TCP: sndrexitbyte    = 1
TCP: rcvttotal      = 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 closed connections.

TCP: timeoutdrop

Total number of dropped connections due

to TCP retransmission timeout. When the

transmitted packet is not received, the

MV retransmits the packet at given time

intervals. If the packet is not received after 14

retransmissions, a timeout occurs, and the MV

drops the connection.

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

TCP: sndtotal
Total number of sent packets.

TCP: sndbyte
Total number of sent bytes.

TCP: sndrexitpack
Total number of retransmitted packets.

TCP: sndrexitbyte
Total number of retransmitted bytes.

TCP: rcvttotal
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 a packet simultaneously. The tendency for collisions to occur increases when the network is congested. "16 collisions" refer to 16 consecutive collision incidents.

quit Disconnects the connection to the instrument that is being controlled

Syntax quit<terminator>

4.12 Instrument Information Output Commands (available when using the instrument information server function via the Ethernet interface)

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

Port number	34264/udp
Data format	ASCII
Receive buffer size	128
Send buffer size	512
Maximum number of parameters	32

In the command packet, list the parameters for the information you want to query.

Parameter	Description
serial	Queries the serial number.
host	Queries the host name. (The host name specified in section 3.2.)
ip	Queries the IP address. (The IP address specified in section 3.2.)

Example Query the IP address and host name. (The first box below shows the command packet. The second box shows the response packet.)

```
ip host
```

```
EA
ip = 192.168.111.24
host = MV1000-1
EN
```

- Description
- Separate each parameter with one or more spaces (space, tab, carriage return, line feed).
 - Parameters are not case-sensitive.
 - Undefined parameters are ignored.
 - Parameters exceeding the number of maximum parameters (32) are ignored.

5.1 Response Syntax

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

The MV returns a response (affirmative/negative response) to a command that is delimited by a terminator. The controller should follow the one command to one response format. If the command-response rule is not observed, the operation is not guaranteed.

Commands	Response		
	Group	Affirmation	Negation
Setting commands	Setting	Affirmative response	Single negative response or multiple negative responses
	Control		
Basic Setting commands			
Output commands	Control		
	Setup, measured, and computed data output	Text output	
		Binary output	
	RS-422/485	Dedicated response	No response
	Special response commands	Dedicated response	

* For details on the responses of the instrument information server function, see section 5.4.
For details on responses to special commands, see section 4.10.

Note

"CRLF" used in this section denotes carriage return line feed.

Affirmative Response

If a command is processed normally, the MV returns an affirmative response.

- **Syntax**

`E0CRLF`

- **Example**

`E0`

Single Negative Response

If a command fails to be processed normally, the MV returns a single negative response.

- **Syntax**

`E1_nnn_mmm...mCRLF`

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 of the multiple commands that are separated by sub delimiters, the MV returns multiple negative responses.
- The MV transmits a response for each command that causes an error.
- If there are multiple commands that have errors, the MV transmits negative responses separated by commas.
- The error position numbers are assigned in order to the series of commands. The first command is assigned the number 1.

5.1 Response Syntax

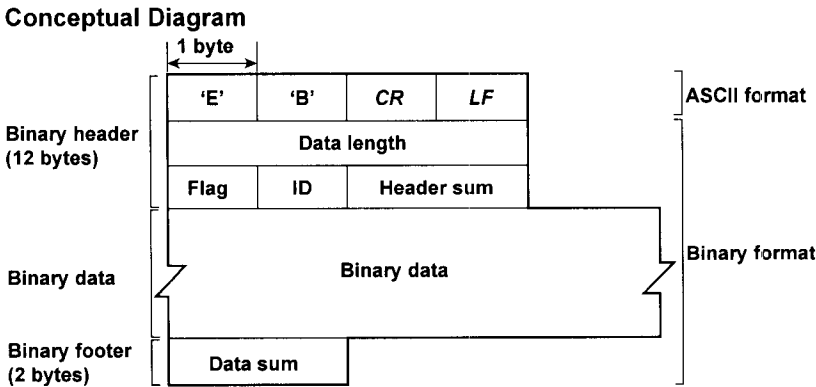
- Syntax**
`E2_ee:nnnCRLF` (When there is only one error)
`E2_ee:nnn,ee:nnn,...,ee:nnnCRLF` (When there are multiple errors)
 `ee` Error position (01 to 10)
 `nnn` Error number (001 to 999)
 `_` Space
- Example**
`E2 02:001`

Text Output

For information about text data types and data formats, see section 5.2.

- Syntax**
`EACRLF`
.....`CRLF`
:
.....`CRLF`
.....`CRLF`
`ENCRLF`

Binary Output



EBCRLF
Indicates that the data is binary.

Data Length
The number of bytes in "flag + identifier + header sum + binary data + data sum."

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

Binary Value
For information about output formats of various data types, see section 5.3.

Data Sum

The sum value of the binary data.

Note

The MV transmits the data length in the binary header section according to the byte order that is specified with the BO command.

Flag

Bit	Name (Abbreviation)	Flag 0	1	Meaning of the Flag
7	BO	MSB	LSB	Output byte order
6	CS	No	Yes	Checksum availability
5	—	—	—	
4	—	—	—	
3	—	—	—	
2	—	—	—	
1	—	—	—	
0	END	Middle	End	In the middle of or at the end of continuous data

- When the BO flag is 0, the MV transmits the high byte first. When the BO flag is 1, the MV transmits the low byte first.
- If checksum is enabled (parameter = 1) using the CS command parameter, a sum value is inserted in the header sum and data sum sections. If checksum is disabled (parameter = 0), a zero is inserted in the header sum and data sum sections. For a sample function that calculates the sum value, see “Calculating the Sum Value” on the next page.
- If the amount of data to be transmitted in response to an ME command is large, the MV may not be able to transmit all the data in one output request (parameter GET). If this happens, the END flag is set to 0. You must request for subsequent data (parameter NEXT) until the END flag becomes 1.
- The bits whose name and flag are indicated as “—” are not used. Their values are undefined.

ID

An ID number indicating the binary data type. The table below indicates the data types and the corresponding output commands. Binary data files that are not indicated in the table below are considered undefined files.

ID Number	Binary Data Type	Type	Format	Output Command
0	Undefined file	File (*.*)	—	ME
1	Instantaneous data	Data	Yes	FD
1	FIFO data	Data	Yes	FF
13	Screen data file	File (*.PNG)	□	ME, FC
15	Display data file (binary)	File (*.DAD)	No	ME
16	Event data file (binary)	File (*.DAE)	No	ME
17	Manually sampled file	File (*.DAM)	Yes	ME, MO
18	Report file	File (*.DAR)	Yes	ME, MO
19	Setup data file	File (*.PDL)	No	ME, FE4
25	Configured channel information output	Data	Yes	FE5
26	Configured alarm information output	Data	Yes	FE6
29	Display data file (text)	File (*.TDD)	Yes	ME
30	Event data file (text)	File (*.TDE)	Yes	ME

Yes: Disclosed. No: Undisclosed. —: Common format.

- The table above shows the different types of binary data.
- There are two binary data types: data and file.
 - **Data**
 - You can transmit measured/computed data by using the FD command.
 - You can transmit FIFO data by using the FF command.
 - The data format is disclosed. See section 5.3 for details.

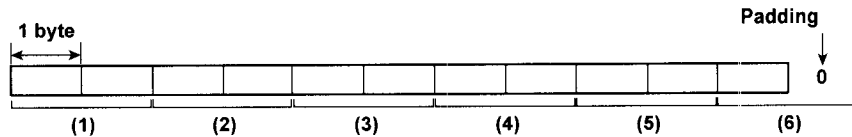
- **File**
 - Display data (binary), event data (binary), and setup data files can be used on the DXA120 DAQSTANDARD that comes with the package. For details, see the *DXA120 DAQSTANDARD User's Manual IM04L41B01-61E*.
 - Files in a general format can be opened using commercially-sold software programs.
 - Other files are in text format. You can use any text editor to open these files.

Calculating the Sum Value

If you set the CS command parameter to 1 (enabled), the MV transmits the checksum value only during serial communications. The checksum is used in TCP/IP and is derived according to the following algorithm.

Buffer for Calculating the Sum Value

- The header sum is calculated from the data length, flag, and ID (fixed to 6 bytes).
- The data sum is calculated from the binary data.



If the data length of the buffer is odd, a zero is padded so that it is even. (1) through (6) indicated in the figure above are summed as unsigned two-byte integers (unsigned short). If the digit overflows, 1 is added. Finally, the result is bit-wise inverted.

Sample Function

Below is a sample function that determines and returns the sum value. Your program can compare the value returned by the sample function with the header sum of the output binary header section and the data sum of the output binary footer section to see if they are correct.

```
/*
 * Sum Calculation Function (for a 32-bit CPU)
 *
 * Parameter buff: Pointer to the head of the data for calculating the sum
 *               len: Length of the data for calculating the sum
 * Returned value: The 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 the number of data points is odd. */
    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-422/RS-485 Responses

The following table shows RS-422/RS-485 interface commands and their responses.

Command Syntax	Description	Response
<i>ESC Oxx CRLF</i>	Opens a device	<ul style="list-style-type: none"> • Response from the device with the specified address <i>ESC Oxx CRLF</i> • No response if the device with the specified address does not exist*
<i>ESC Cxx CRLF</i>	Closes a device	<ul style="list-style-type: none"> • Response from the device with the specified address <i>ESC Cxx CRLF</i> • No response if the device with the specified address does not exist*

* Possible reasons for not finding a device with the specified address are: (1) there is an error in the command, (2) the specified address does not match the device address, (3) the device is not turned ON, and (4) the device is not connected via the serial interface.

- The "xx" in the table indicates the device address. Specify the address that is assigned to the device in the range of 01 to 99.
- You can only open one device at any given time.
- If a device is opened with the ESC O command, all commands are enabled on the device.
- If a device is opened with the ESC O command, any other device that is open is automatically closed.
- Normally, either CR+LF or LF can be used for the terminator in communication commands. However, the terminator for these commands must be set to CR+LF.

Note

The ASCII code for ESC is 1BH. See appendix 1 for details.

5.2 Text Data Output Format

The table below lists the available text data types. This section will explain each format. The table below indicates the data types and the corresponding output commands.

Data Type	Corresponding Output Command
Setting data/basic setting data	FE0, FE2
Decimal place and unit information	FE1
Measured, computed, and external input data	FD0
Relay and internal switch status	FD6
Communication log	FLCOM
FTP client log	FLFTPC
Operation error log	FLERR
Login log	FLLOGIN
Web operation log	FLWEB
E-mail log	FLEMAIL
SNTP access log	FLSNTP
DHCP access log	FLDHCP
Modbus communication log	FLMODBUS
Alarm summary	FLALARM
Message summary	FLMSG
Status information	IS0, IS1
Ethernet information	FAIP
File list	MEDIR
Check disk result	MECHKDSK
Manually sampled data and report data information	MODIR
User information	FU0, FU1

Note

"CRLF" used in this section denotes carriage return line feed.

Setting Data/Basic Setting Data

- The MV returns the setting/basic setting data in response to an FE command.
- The MV returns the data in order as listed in the table in section 4.2, "A List of Commands." However, the MV does not return the setting data for the following commands.
 - Setting commands (setting)
SD and FR commands
 - Setting commands (control)
All commands from BT to IR
 - Basic setting commands
XE, YO, YE, and YC commands
- The output format of the setting/basic setting data conforms to the syntax of each command.
- The MV returns multiple lines for some commands (for example, commands that are specified for each channel).
- **Syntax**
The MV returns the two-character command name and subsequent parameters in the following syntax.

```
EACRLF  
ttsss...sCRLF  
.....  
ENCRLF
```

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

• Example

EA
SR001,VOLT,20mV,0,20
SR002,VOLT,20mV,0,20
.....
EN

Decimal Place and Unit Information

- The MV returns decimal place and unit information in response to an FE command.
- You can use the CB command to specify whether or not the MV will return the data of measurement channels set to SKIP and computation channels set to OFF.

• Syntax

The MV returns the data for each channel in the following syntax.

EACRLF
s_cccuuuuu,ppCRLF
.....
ENCRLF

s Data status (N, D, or S)
N: Normal
D: Differential input
S: Skip (When the measurement range is set to SKIP for a measurement channel or when the channel is turned OFF for a computation channel)

ccc Channel number (3 digits)
001 to 048: Measurement channel
101 to 160: Computation channel
201 to 440: External input channel

uuuuuu Unit information (six characters, left-justified)
mV____: mV
V____: V
^C____: °C
xxxxxx: (User-defined character string)

pp Decimal place (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, Computed, and External Input Data

- The MV returns measured, computed, and external input data in response to an FD command.
- You can use the CB command to specify whether or not the MV will return the data of measurement channels set to SKIP and computation channels set to OFF.

- **Syntax**

The MV returns the data along with the date and time information for each channel in the following syntax.

EACRLF

DATE_YY/mo/ddCRLF

TIME_hh:mm:ss.mmmtCRLF

s_ccca1a2a3a4uuuuuufdddddE-ppCRLF

.....

ENCRLF

YY	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
mmm	Millisecond (000 to 999. A period is placed between seconds and milliseconds.)
t	Reserved (Space.)
s	Data status (N, D, S, O, E, or B)
	N: Normal
	D: Differential input
	S: Skip
	O: Overflow
	E: Error
	B: Burnout
ccc	Channel number (3 digits)
	001 to 048: Measurement channel
	101 to 160: Computation channel
	201 to 440: External input channel
a1a2a3a4	a1 Alarm status (level 1)
	a2 Alarm status (level 2)
	a3 Alarm status (level 3)
	a4 Alarm status (level 4)
	(Each status is set to H, L, h, l, R, r, T, t, or space.)
	((H: high limit alarm, L: low limit alarm, h: difference high-limit alarm, l: difference low-limit alarm, R: high limit on rate-of-change alarm, r: low limit on rate-of-change alarm, T: delay high limit alarm, t: delay low limit alarm, space: no alarm)
uuuuuu	Unit information (six characters, left-justified)
	mV____: mV
	V____: V
	^C____: °C
	xxxxxx: (User-defined character string)
f	Sign (+, -)

dddd Mantissa (00000 to 99999, 5 digits)

- Eight digits for computed data.
- For abnormal data (data status is E) or data whose mantissa or exponent exceeds the range (data status is O), the mantissa is set to 99999 (99999999 for computed data).

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 -67890E-01
S 003
EN
```

Note

- The MV does not return data for channels that do not exist (not even the channel number).
- For channels set to skip, the values from the alarm status to exponent will be spaces.

Relay and Internal Switch Status

The MV returns the relay status and internal switch status in response to an FD command.

• **Syntax**

```
EACRLF
I01-I06:aaaaaaCRLF
I11-I16:aaaaaaCRLF
I21-I26:aaaaaaCRLF
I31-I36:aaaaaaCRLF
S01-S30:aaa...CRLF
ENCRLF
```

aaa... Indicates the relay statuses in ascending order by relay number from the left.

- 1: Relay ON
- 0: Relay OFF
- : Relay not installed

• **Example 1**

When relays I01 to I04 are ON, and I05 and I06 are not installed (for the RD-MV1000)

```
EA
I01-I06:1111--
I11-I16:-----
I21-I26:-----
I31-I36:-----
S01-I30:00000000000000000000000000000000
EN
```

Communication Log

- The MV returns the communication log in response to an FL command.
- The MV returns logs of setting/basic setting/output commands and responses. The MV retains a maximum of 200 logs. Logs that exceed 200 are cleared from the oldest ones.

• Syntax

EACRLF

yy/mo/dd_hh:mm:ss_n_uuu...ufd_mmm...mCRLF
.....

ENCRLF

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
n	Connection ID. A number used to identify the user that is connected. 0: Serial 1 to 3: Ethernet
uuu...u	User name (up to 20 characters)
f	Multiple command flag Space: Single *: Multiple (If you transmit multiple commands separated by sub delimiters at once, this flag is set to an asterisk. The MV divides the multiple commands into individual commands and stores a log for each command and a log for each response.
d	Input/Output >: Input <: Output
mmm...m	Message (up to 20 characters) <ul style="list-style-type: none">• The communication log contains only the error number and not the error message section.• Normally, the MV returns the data as-is, but in some cases, it returns a special message. The special messages are described below.

Reception

(Over length):	Command length exceeded.
(Over number):	Number of commands exceeded.
(Serial error):	Received an error character through serial communications.

Transmission

(ddd byte):	Data output (where ddd is the number of data values)
(Login):	Login
(Logout):	Logout
(Disconnected):	Forced disconnection (occurs when the connection is disconnected when transmitting data via the Ethernet interface).
(Time out):	Timeout, keepalive, TCP retransmission, etc.

E1 nnn:	Single negative response (where nnn is the error number)
E2 ee:nnn:	Multiple negative response (where ee is the error position and nnn is the error number)
Space	

• Example

The following example shows the log that is generated when you transmit "B01;???;PS0" (multiple commands separated by sub delimiters). The commands are separated and returned in order with the multiple command flag "*" attached.

```
EA
99/05/11 12:31:11 1 12345678901234567890*> B01
99/05/11 12:31:11 1 12345678901234567890*< E0
99/05/11 12:31:11 1 12345678901234567890*> ???
99/05/11 12:31:11 1 12345678901234567890*< E2 01:124
99/05/11 12:31:11 1 12345678901234567890*> PS0
99/05/11 12:31:11 1 12345678901234567890*< E0
EN
```

FTP Client Log

- The MV returns the FTP client log in response to an FL command.
- The MV retains a maximum of 50 file transfer logs. Logs that exceed 50 are cleared from the oldest ones.
- For a description of the error codes, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

• Syntax

```
EACRLF
yy/mo/dd_hh:mm:ss_nnn_XXXXXXXX_k_ffffffff...CRLF
.....
ENCRLF
```

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
nnn	Error code (001 to 999)
XXXXXXXX	Detailed code (nine characters)
k	Server type (P, S) P: Primary S: Secondary
fff...	File name (up to 51 characters including the extension)
Space	Space

• Example

```
EA
99/07/26 10:00:00 P display.dsp
99/07/27 10:00:00 P setting.pnl
99/07/28 10:00:00 123 HOSTADDR P trend.png
EN
```

Operation Error Log

- The MV returns the operation error log in response to an FL command.
- The MV retains a maximum of 50 operation error logs. Logs that exceed 50 are cleared from the oldest ones.
- The MV does not return other communication messages (400 to 999) and status messages (500 to 599).
- For a description of the error codes, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

- **Syntax**

```
EACRLF
yy/mo/dd_hh:mm:ss_nnn_uuu...uCRLF
.....
ENCRLF

YY      Year (00 to 99)
mo      Month (01 to 12)
dd      Day (01 to 31)
hh      Hour (00 to 23)
mm      Minute (00 to 59)
ss      Second (00 to 59)
nnn     Error code (001 to 999)
uuu...u Error message
_       Space
```

- **Example**

```
EA
99/05/11 12:20:00 212 "Range setting error"
99/05/11 12:30:00 217 "Media access error"
EN
```

Login Log

- The MV returns the log of users that have logged in and logged out in response to an FL command.
- The MV retains a maximum of 50 login/logout logs. Logs that exceed 50 are cleared from the oldest ones.
- If the power goes down while you are logged in, you will be logged out. In this case, however, this logout will not be recorded in the log.

- **Syntax**

```
EACRLF
yy/mo/dd_hh:mm:ss_XXXXXXXXXX_nnn_uuu...uCRLF
.....
ENCRLF

YY      Year (00 to 99)
mo      Month (01 to 12)
dd      Day (01 to 31)
hh      Hour (00 to 23)
mm      Minute (00 to 59)
ss      Second (00 to 59)
```

```
xxxxxxxxx Returns a login history left-justified.
Login:      Login
Logout:     Logout
NewTime:    New time
TimeChg:    Time change
PowerOff:   Power Off
PowerOn:    Power On
TRevStart:  Start of gradual time adjustment
TRevEnd:    End of gradual time adjustment
TimeDST:    Switching of the daylight savings time
SNTPtimset: Time change by SNTP

nnn         Operation property
KEY:        Key operation
COM:        Communication
REM:        Remote
ACT:        Event action
SYS:        System

uuu...u     User name (up to 20 characters)
-           Space
```

• **Example**

```
EA
99/05/11 12:20:00 Login      KEY administrator
99/05/11 12:30:00 Logout    KEY administrator
99/05/11 12:20:00 Login      COM user
99/05/11 12:30:00 Logout    COM user
EN
```

Web Operation Log

- The MV returns the log of operations on the Web screen in response to an FL command.
- The MV retains a maximum of 50 operations. Logs that exceed 50 are cleared from the oldest ones.

• **Syntax**

```
EACRLF
yy/mo/dd_hh:mm:ss_ffffff_eee_???...?CRLF
.....
ENCRLF
```

```
yy      Year (00 to 99)
mo      Month (01 to 12)
dd      Day (01 to 31)
hh      Hour (00 to 23)
mm      Minute (00 to 59)
ss      Second (00 to 59)
ffffff  Requested operation
SCREEN:  Screen change
KEY:     Key operation
MSG:     Message assignment/write
CREATE:  File generation
```

5.2 Text Data Output Format

eee Error code when executing the requested operation
All spaces: Success
001 to 999: Failure (error code)

???...? Parameter for each event (see below)

- When fffffff = SCREEN
yy/mo/dd_hh:mm:ss_ffffff_eee_dddd_nnCRLF
dddd Screen type
TREND: Trend display
DIGIT: Digital display
BAR: Bar graph display
HIST: Historical trend display
OV: Overview display
nn Group number (01 to 36)
- When fffffff = KEY
yy/mo/dd_hh:mm:ss_ffffff_eee_kkkkkCRLF
kkkkk Type of key that was used
DISP: DISP/ENTER key
UP: Up key
DOWN: Down key
LEFT: Left key
RIGHT: Right key
HIST: HISTORY key
- When fffffff = MSG
yy/mo/dd_hh:mm:ss_ffffff_eee_mmm...mCRLF
mmm...m Message (up to 32 characters)
- When fffffff = CREATE
yy/mo/dd_hh:mm:ss_ffffff_eee_kkkkkkkkkkCRLF
kkkkkkkkkk File type
DisplayFile: Display data file
EventFile: Event data file

— Space

• Example

EA
01/02/11 12:20:00 SCREEN 275 TREND 01
01/02/11 12:21:00 SCREEN BAR
01/02/11 12:30:00 KEY UP
01/02/11 12:31:00 KEY RIGHT
01/02/11 12:40:00 MSG Hello-Hello
EN

E-mail Log

- The MV returns the e-mail transmission log in response to an FL command.
- The MV retains a maximum of 50 operations. Logs that exceed 50 are cleared from the oldest ones.

- **Syntax**

EACRLF

yy/mo/dd_hh:mm:ss_ffffff_eee_n_uuu...uCRLF

.....

ENCRLF

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
ffffff	E-mail type
	ALARM: Alarm mail
	TIME: Scheduled mail
	REPORT: Report timeout mail
	FAIL: Power failure recovery mail
	FULL: Memory full mail
	TEST: Test mail
	ERROR: Error message mail
eee	Error code
	All spaces: Success
	001 to 999: Error code
n	Recipient list
	1: List 1
	2: List 2
	+: List 1 and list 2
uuu...u	Series of recipient e-mail addresses (up to 30 characters)
_	Space

- **Example**

When list 1 is "user1@daqstation.com user2@daqmaster.com" and

list 2 is "adv1@daqmaster.com adv2@daqstation.com"

EA

01/05/11 12:20:00 ALARM + user1 user2 adv1 adv2

01/05/11 12:30:00 REPORT 375 1 user1 user2

EN

SNTP[®] Log

- The MV returns the SNTP log in response to an FL command.
- The MV retains a maximum of 50 accesses to the SNTP server.

- **Syntax**

EACRLF

yy/mo/dd_hh:mm:ss_nnn_XXXXXXXXXXCRLF

.....

ENCRLF

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
nnn	Error number (000 to 999)
XXXXXXXXXX	Detailed code (nine characters)
SUCCESS:	Success
OVER:	Over the limit
DORMANT:	Internal processing error
HOSTNAME:	Failed to look up the host name
TCPIP:	Internal processing error
SEND:	Failed to send the request
TIMEOUT:	A response timeout occurred
BROKEN:	Packet was corrupt
LINK:	The data link is disconnected
	Space

- **Example**

EA

01/05/11 12:20:00 SUCCESS

01/05/11 12:21:00 SUCCESS

01/05/11 12:30:00 292 HOSTNAME

EN

DHCP Log

- The MV returns the DHCP log in response to an FL command.
- The MV retains a maximum of 50 accesses to the DHCP server.

- **Syntax**

EACRLF

yy/mo/dd_hh:mm:ss_nnn_XXXXXXXXXCR LF

.....

ENCRLF

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
nnn	Error number (000 to 999)
	Description given in the table.
XXXXXXXXX	Detailed code (nine characters)
	Description given in the table.
—	Space

The table below shows the contents of the log for normal operation.

Error Number	Detail Code	Description
562	ON	Detected that an Ethernet cable was connected.
	OFF	Detected that an Ethernet cable was disconnected.
563	RENEW	Requesting address renewal to the DHCP server.
	RELEASE	Requesting address release to the DHCP server.
564	RENEWED	Address renewal complete.
	EXTENDED	Address release extension request complete.
	RELEASED	Address release complete.
565	IPCONFIG	IP address configured.
566	NOREQUEST	Configured not to register the host name.
567	UPDATE	Registered the host name to the DNS server.
568	REMOVE	Removed the host name from the DNS server.

5.2 Text Data Output Format

The table below shows the contents of the log when an error occurs.

Error Number	Detail Code	Description
295	REJECT	Address obtained by DHCP is inappropriate.
296	ESEND	Failed to send to the DHCP server.
	ESERVER	DHCP server not found
	ESERVFAIL	No response from the DHCP server.
	ERENEWED	Address renewal rejected by the DHCP server.
	EEXTENDED	Address lease extension request rejected by the DHCP server.
	EEXPIRED	Address lease period expired by the DHCP server.
297	INTERNAL	Host name registration failure (transmission error reception timeout, etc.)
	FORMERR	Host name registration failure (format error: DNS message syntax error)
	SERVFAIL	Host name registration failure (server failure: DNS server processing error)
	NXDOMAIN	Host name registration rejection (non existent domain)
	NOTIMP	Host name registration rejected (not implemented)
	REFUSED	Host name registration rejected (operation refused)
	YXDOMAIN	Host name registration rejected (name exists)
	YXRRSET	Host name registration rejected (RR set exists)
	NXRRSET	Host name registration rejected (RR set does not exist)
	NOTAUTH	Host name registration rejection (not authoritative for zone)
	NOTZONE	Host name registration rejection (different from zone section)
298	NONAME	Host name not entered on the MV.
	INTERNAL	Host name removal failure (transmission error, reception timeout, etc.)
	FORMERR	Host name removal failure (format error: DNS message syntax error)
	SERVFAIL	Host name removal failure (server failure: DNS server processing error)
	NXDOMAIN	Host name removal rejection (non existent domain)
	NOTIMP	Host name removal rejected (not implemented)
	REFUSED	Host name removal rejected (operation refused)
	YXDOMAIN	Host name removal rejected (name exists)
	YXRRSET	Host name removal rejected (RR set exists)
	NXRRSET	Host name removal rejected (RR set does not exist)
	NOTAUTH	Host name removal rejection (not authoritative for zone)
	NOTZONE	Host name removal rejection (different from zone section)
	NOTLINKED	Physical layer was disconnected when removing the host name.

• Example

```
EA
01/05/11 12:20:00 563 RENEW
01/05/11 12:20:01 564 RENEWED
01/05/11 12:20:01 565 IPCONFIG
01/05/11 12:21:02 567 UPDATE
EN
```


Modbus Communication Log

- The MV returns the Modbus communication log in response to an FL command.
- The MV retains a maximum of 50 Modbus communication events.

• Syntax

EACRLF

yy/mo/dd_hh:mm:ss_c_XXXXXX_kkkk_nn_dCRLF

.....

ENCRLF

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
c	Communication type (C or M) C: Modbus client (Ethernet) M: Modbus master (serial)
XXXXXX	Event that occurred (seven characters) DROPOUT: Communication could not keep up, and a dropout occurred. ACTIVE: Activated. READY: Command ready state. CLOSE: Disconnected. HALT: Command halted.
kkkk	Detail (four characters) GOOD: Normal operation NONE: No response from the slave device. FUNC: Received a function error. REGI: Received a register error. ERR: Received a packet error. LINK: Ethernet cable disconnected (Modbus client). HOST: Unable to result the IP address from the host name (Modbus client). CNCT: Failed to connect to the server (Modbus client). SEND: Failed to send the command (Modbus client). BRKN: Failed to receive the command.
	Space At command start
nn	Command number (1 to 16, space)
d	Command type (R, W, space) R: Read W: Write
—	Space

• Example

```
EA
01/05/11 12:20:00 C DROPOUT
01/05/11 12:21:00 C READY      NONE 01 R
01/05/11 12:25:00 C HALT      NONE 01 R
EN
```

Alarm Summary

- The MV returns the alarm summary in response to an FL command.
- The MV retains a maximum of 1000 alarm events.
Alarm events that exceed 1000 are cleared from the oldest ones.

• Syntax

EACRLF
yy/mo/dd_hh:mm:ss_kkk_ccc_ls_nnnnnnnnnnCRLF
.....
ENCRLF

yy/mo/dd hh:mm:ss	Time when the alarm occurred
yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
kkk	Alarm cause
OFF:	Alarm release
ON:	Alarm occurrence
ACK:	Alarm acknowledge
ccc	Measurement, computation, or external input channel number
l	Alarm level (1 to 4)
s	Alarm type (H, h, L, l, R, r, T, or t)
nnnnnnnnnn	Alarm sequence
—	Space

For all-channel alarms, the channel number, alarm level, and alarm status items are all set to asterisk.

• Example

EA
01/05/11 12:20:00 ON 001 1L 1
01/05/11 12:30:00 OFF 131 3t 2
01/05/11 12:31:00 OFF *** ** 2
01/05/11 12:32:00 ACK 4
EN

Message Summary

- The MV returns the message summary in response to an FL command.
- The MV retains a maximum of 100 messages. Messages that exceed 100 are cleared from the oldest ones.

- **Syntax**

EACRLF

yy/mo/dd_hh:mm:ss_mmm..._ggg..._zzz_uuu..._nnn...CRLF

.....

ENCRLF

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
mmm...	Message (32 characters. Spaces are padded when the number of characters is less than 32 characters.)
ggg...	Message write destination group (11 characters)
xx,xx,xx,xx:	Displays groups that have message written in, each group separated by a comma (up to four groups)
ALL:	All groups
zzz	Operation property
KEY:	Key operation
COM:	Communication
REM:	Remote
ACT:	Event action
SYS:	System
uuu...	User name (up to 20 characters)
nnn...	Message sequence number (0 for add messages)
_	Space

- **Example**

EA

```
01/05/11 12:20:00 operation-start 01,02,03,04 KEY admin 11
01/05/11 12:20:00 operation-start 01,02 KEY admin 11
01/05/11 12:20:00*0123456789abcdefg 01,02,03,04 KEY admin 12
```

EN

Status Information

- The MV returns the operation status of the recorder in response to an IS command. The output format varies between IS0 and IS1.
- For details on status information, see section 5.2, "The Bit Structure of the Status Information."

Output in response to the IS0 command

- **Syntax**

EACRLF

aaa.bbb.ccc.dddCRLF

ENCRLF

<i>aaa</i>	Status information 1 (000 to 255)
<i>bbb</i>	Status information 2 (000 to 255)
<i>ccc</i>	Status information 3 (000 to 255)
<i>ddd</i>	Status information 4 (000 to 255)

- **Example**

EA

000.000.032.000

EN

Output in response to the IS1 Command

- **Syntax**

EACRLF

aaa.bbb.ccc.ddd.eee.fff.ggg.hhhCRLF

ENCRLF

<i>aaa</i>	Status information 1 (000 to 255)
<i>bbb</i>	Status information 2 (000 to 255)
<i>ccc</i>	Status information 3 (000 to 255)
<i>ddd</i>	Status information 4 (000 to 255)
<i>eee</i>	Status information 5 (000 to 255)
<i>fff</i>	Status information 6 (000 to 255)
<i>ggg</i>	Status information 7 (000 to 255)
<i>hhh</i>	Status information 8 (000 to 255)

- **Example**

EA

000.000.032.000.000.000.000.000

EN

- Status information 3, 4, 7, and 8 are edge operation. They are cleared when read using the IS command.
- Status information 1, 2, 5, and 6 are level operation. They are not cleared when read. They are cleared when the causing event clears.
- The status information is made up of bits that correspond to each event. Each bit can be turned ON/OFF with a filter.
- If an event occurs for a bit set to OFF by the filter, status information 3, 4, 7, and 8 ignore the event. Status information 1, 2, 5, and 6 hold the event.
- The default filter setting is ON for all bits.

Ethernet Information

- The MV returns the Ethernet information in response to an FA command.

- Syntax**

```
EACRLF
IP_Address_____:xxx.xxx.xxx.xxxCRLF
Subnet_mask_____:xxx.xxx.xxx.xxxCRLF
Default_Gateway_:xxx.xxx.xxx.xxxCRLF
Primary_DNS_____:xxx.xxx.xxx.xxxCRLF
Secondary_DNS___:xxx.xxx.xxx.xxxCRLF
Host_____:yyy.....CRLF
Domain_____:zzz.....CRLF
ENCRLF
```

xxx IP address number (000 to 255)
 yyy... Host name (up to 64 characters)
 zzz... Domain name (up to 64 characters)

File List

- The MV returns the file list or the file data sizes for the specified directory on the MV's external storage medium in response to the ME command.

- Syntax**

```
EACRLF
yy/mo/dd_hh:mm:ss_ssssssss_fff..._0_xxx...CRLF
.....
ENCRLF
```

yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
ssssssssss	Data size of the file (_____0 to 99999999) [byte(s)]
fff...	File name (51 characters including the extension. If it is less than 51, spaces are entered.)
	If this is a directory, the characters <DIR> are shown at the position displaying the file data size.
xxx...	Data serial number (16-digit hexadecimal)
-	Space

The data serial number is included for files in the DATA directory in the internal memory. For other files, the data serial number is spaces.

5.2 Text Data Output Format

- **Example 1**

File list output of an external storage medium

```
EA
05/02/24 20:07:12      1204 setting.pnl
05/02/24 20:18:36      <DIR> DATA0
EN
```

- **Example 2**

File list output of the DATA directory in the internal memory

```
EA
05/02/24 20:07:12  1204 006607_050101_000402.DAD  0      1ABCDE123
05/02/24 20:07:12  1204 006608_050101_000403.DAD  0 1234567890123456
EN
```

Check Disk Result

The MV returns the free space on the storage medium in response to an ME command.

- **Syntax**

```
EACRLF
zzz..._Kbyte_freeCRLF
ENCRLF
```

```
zzz...  Free space on the storage medium (16 digits)
_       Space
```

- **Example**

```
EA
12345678 Kbyte free
EN
```

Manually Sampled Data and Report Data Information

The MV returns manually sampled and report data information in response to an MO command.

• Syntax

```

EACRLF
slll..._yy/mo/dd_hh:mm:ss_bbbb_fff...CRLF
.....
ENCRLF

```

s	Data flag
Space	Confirmed data
+:	Data that was overwritten
*:	Data being added
lll...	File number (10 digits)
yy	Year (00 to 99)
mo	Month (01 to 12)
dd	Day (01 to 31)
hh	Hour (00 to 23)
mm	Minute (00 to 59)
ss	Second (00 to 59)
bbbb	Number of events (four characters)
fff...	File name (up to 48 characters including the extension)
_	Space

• Example

```

EA
+      6 05/03/04 00:00:00 20 aaaa30312345.DAR
      7 05/03/05 00:00:00 20 30400005.DAR
      8 05/03/06 00:00:00 20 30500005.DAR
*      9 05/03/06 13:00:00 20 uuuu0005.DAR
EN

```

User Information

- The MV returns the user name, user level, and other information in response to an FU command.

- **Syntax**

EACRLF

p_l_uuu...CRLF

ENCRLF

p	Login method
E:	Ethernet
S:	RS-232 or RS422/RS485
K:	Login using keys
l	User level
A:	Administrator
U:	User
uuu...	User name (up to 20 characters)
_	Space

- **Example 1**

When you send the `FU0` command, the MV returns only the information about the user himself or herself that is logged in.

EA

E A admin

EN

- **Example 2**

When you send the `FU1` command, the MV returns information about all users logged in through a general-purpose service or through keys.

EA

K A admin_abc

E A admin_def

E U user0033

E U user0452

EN

5.3 Binary Data Output Format

This section describes the binary data output format that is disclosed.

For information about other binary data, see section 5.1.

- Instantaneous data (measured/computed/external input) and FIFO data
- Configured channel information data
- Configured alarm information data
- Manual sample file
- Report sample file
- Display data (text)
- Event data (text)

The MV returns measured data and computed data using signed 16-bit integer and signed 32-bit integer, respectively. These integers can be understood as physical values by adding a decimal point and unit. The decimal place can be determined using the FE command.

Examples of Obtaining Physical Values from Binary Data

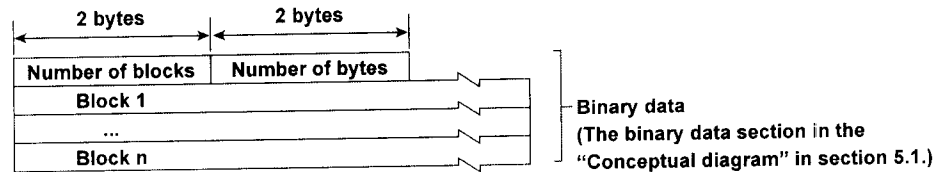
Binary Value	Decimal Place Code	Physical Value (Measured Value)
10000	0	10000
10000	1	1000.0
10000	2	100.00
10000	3	10.000
10000	4	1.0000

Note

"CRLF" used in this section denotes carriage return line feed.

Measured/Computed Data and FIFO Data

- The MV returns the measured/computed data in response to an FD command.
- The MV returns the FIFO data in response to an FF command.
- You can use the CB command to specify whether or not the MV will return data of measurement channels set to skip and computation and external input channels set to OFF.
- The ID number of the output format is 1. See "ID" in section 5.1.



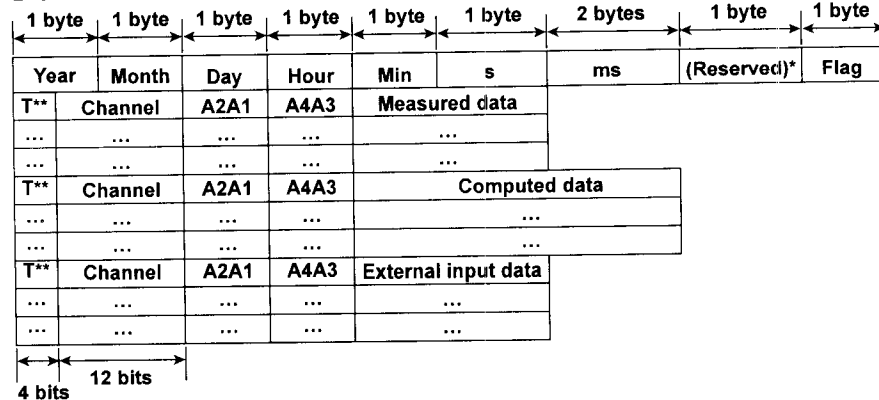
Number of Blocks

This is the number of blocks.

Number of Bytes

This is the size of a block in bytes.

Block



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

** Abbreviation of "Type" for the purpose of this figure.

Flag

A description of each flag is given in the table below. The flags are valid for FIFO data output. The flags are undefined for other cases.

Bit	Flag		Description
	0	1	
7	No	Yes	Indicates that the screen snapshot was executed.
6	—	—	
5	—	—	
4	—	—	
3	—	—	
2	No	Yes	Indicates that the decimal place or unit information was changed during measurement.
1	No	Yes	Indicates that the FIFO acquiring interval was changed with the FR command during measurement.
0	No	Yes	Indicates that the internal process took too much time (computation, for example) and that the measurement could not keep up at the specified scan interval.

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
(Reserved)	Undefined
Type	0x0: 16-bit integer (measurement channel/external input channel) 0x8: 32-bit integer (computation channel)
Channel	1 to 48, 101 to 160, or 201 to 440
Alarm status*	
A1 (Bit 0 to 3)	
A2 (Bit 4 to 7)	0 to 8
A3 (Bit 0 to 3)	
A4 (Bit 4 to 7)	
Measured data/external input data	0 to 0xFFFF
Computed data	0 to 0xFFFFFFFF

* A binary value 0 to 8 is entered in the upper and lower 4 bits of a byte (8 bits) for the alarm status. The binary values 0 to 8 correspond to H (high limit alarm), L (low limit alarm), h (difference high-limit alarm), l (difference low-limit alarm), R (high limit on rate-of-change alarm), r (low limit on rate-of-change alarm), T (delay high limit alarm), and t (delay low limit alarm) as follows:
0: no alarm, 1: H, 2: L, 3: h, 4: l, 5: R, 6: r, 7: T, and 8: t.

Special Data Values

The measured/computed data takes on the following values under special conditions.

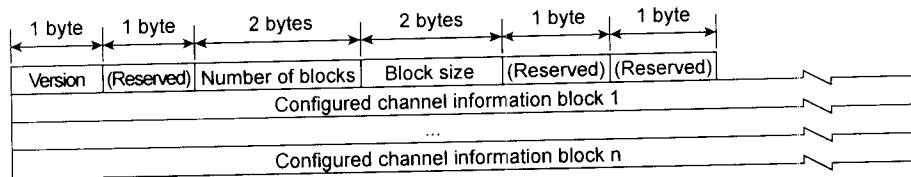
Special Data Value	Measured Data	Computed Data
+Over	7FFFH	7FFF7FFFH
–Over	8001H	80018001H
Skip	8002H	80028002H
Error	8004H	80048004H
Undefined	8005H	80058005H
Burnout (up setting)	7FFAH	7FFF7FFFH
Burnout (down setting)	8006H	80018001H

The MV returns the number of blocks, the number of bytes, and the measured/computed data according to the byte order specified by the BO command.

5.3 Binary Data Output Format

Configured Channel Information Data

- The MV returns the configured channel information data in response to an FE5 command.
- The ID number of the output format is 25.
- You can use the CB command to specify whether or not the MV will return data of measurement channels set to skip and computation channels set to OFF.
- The figure below indicates the format.



Format Details

Item	Description	Output Value
Version	Format version	1
Number of blocks*	Number of configured channel information blocks	Up to 348
Block size*	Size of the of configured channel information blocks	72
Block 1 to n	Configured channel information blocks	Up to 25056 bytes See Block Details.

* Returned in the byte order specified by the BO command.

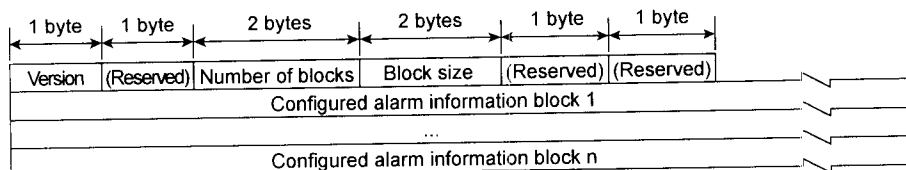
Block Details

Item	Number of Bytes	Description
Channel number*	2	1 to 440
Decimal place	1	0 to 4
(Reserved)	1	0
Channel type*	4	2H for measurement and external input channels and 4H for computation channels. This value is ORed with 800H when the range mode is DI or 8000H when the range mode is skip.
Unit information	8	The terminator is '\0.'
Tag information	24	The terminator is '\0.'
Minimum input value*	4	Measurement channels: Allowable input range under the current setting
Maximum input value*	4	Computation channels: -9999999, +99999999 (fixed) External input channels: -30000, +30000 (fixed)
Span lower limit*	4	Measurement channels (when scaling is not used): Same value as the MV span setting
Span upper limit*	4	Measurement channels (when scaling is used): Same value as the MV scale setting Computation and external input channels: Same value as the MV span setting
Scale lower limit*	4	Measurement channels: Same value as the span
Scale upper limit*	4	Computation and external input channels: Same value as the span
FIFO type*	2	1
Area in the FIFO*	2	Indicates the position of its own channel in the FIFO block of one sample. The value starts from zero.
(Reserved)	4	0

* Returned in the byte order specified by the BO command.

Configured Alarm Information Data

- The MV returns configured alarm information data in response to an FE6 command.
- The ID number of the output format is 26.
- The figure below indicates the format.



Format Details

Item	Description	Output Value
Version	Format version	1
Number of blocks*	Number of configured alarm information blocks	Up to 348
Block size*	Size of the of configured alarm information blocks	24
Block 1 to n	Configured alarm information blocks	Up to 8352 bytes See Block Details.

* Returned in the byte order specified by the BO command.

Block Details

Item	Number of Bytes	Notes
Channel number*	2	1 to 440
Decimal place	1	0 to 4
(Reserved)	1	0
Alarm type	4	The following settings are entered in order from level 1 to 4. 0: Setting off, 1: H (high limit), 2: L (low limit), 3: h (difference high limit), 4: l (difference low limit), 5: R (high limit on rate-of-change), 6: r (low limit on rate-of-change), 7: T (delay high limit), 8: t (delay low limit)
Alarm value*	4×4	The alarm values are entered in order from level 1 to 4.

* Returned in the byte order specified by the BO command.

Manually Sampled Data

- The MV returns the manually sampled data in response to the ME or MO command.
- The ID number of the output format is 17. See section 5.1 for details.
- For the data format, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

Report Data

- The MV returns the report data in response to the ME or MO command.
- The ID number of the output format is 18. See section 5.1 for details.
- For the data format, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

Display Data (Text)

- The MV returns the display data in response to an ME command.
- The ID number of the output format is 29. See section 5.1 for details.
- For the data format, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

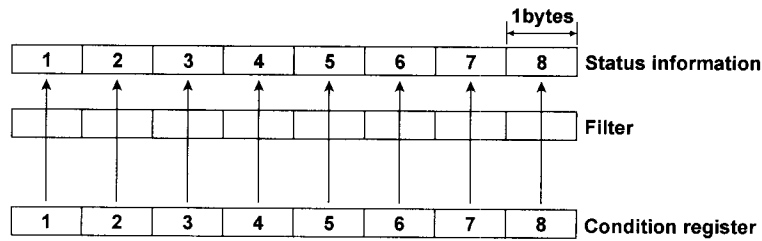
Event Data (Text)

- The MV returns the display data in response to an ME command.

- The ID number of the output format is 30. See section 5.1 for details.
- For the data format, see the *RD-MV1000/RD-MV2000 User's Manual (IM RD-MV1000-01E)*.

6.1 Status Information and Filter

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



- You can use the IF command to set the filter.
- When an event described on the following page occurs, the corresponding bit in the condition register is set to 1. The status information is the logical AND of the condition register and the filter.
- You can use the IS command to get the status information. Status information bytes 3, 4, 7, and 8 are cleared when you get the information. Status information bytes 1, 2, 5, and 6 are not. They will remain 1 while the event is occurring.
- If multiple connections are established, you can set a filter for each connection. This allows the status information to be held for each connection.
- An empty bit, indicated as "–," is fixed to 0.

6.2 Status Information Bit Structure

The MV returns the following four status information groups in response to an IS command, which is a status information output request command. For the output format, see "Status Information" in section 5.2, "Text Data Output Format."

Status Information 1

Bit	Name	Description
0	Basic setting	Set to 1 when the MV is in Basic Setting Mode.
1	Memory sampling	Set to 1 while the MV is acquiring data to the internal memory.
2	Computing	Set to 1 while the MV is computing.
3	Alarm activated	Set to 1 while an alarm is active.
4	Accessing medium	Set to 1 while the MV is saving a display, event, manual sampled, report, or screen image data file to an external storage medium.
5	E-mail started	Set to 1 while the MV is sending e-mail.
6	—	—
7	—	—

Status Information 2

Bit	Name	Description
0	—	—
1	—	—
2	Memory end	Set to 1 while the free space in the internal memory or external storage medium is low.
3	Logged in through keys	Set to 1 while logged in through keys.
4	—	—
5	—	—
6	Detecting measurement error	Set to 1 while the A/D converter is detecting an error or burnout.
7	Detecting communication error	Set to 1 if any command is stopping the communication on the Modbus master or Modbus client.

Status Information 3

Bit	Name	Description
0	Measurement dropout	Set to 1 when the MV cannot keep up with measurements.
1	Decimal place/unit information change	Set to 1 when the decimal place or 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 while executing a command.
4	SNTP error when memory start is executed	Set to 1 when the time cannot be adjusted using SNTP when the MV starts memory sampling.
5	—	—
6	—	—
7	—	—

Status Information 4

Bit	Name	Description
0	A/D conversion complete	Set to 1 when the A/D conversion of a measurement is complete.
1	Medium access complete	Set to 1 when the MV completes the saving of the display, event, manual sampled, report, or screen image data file to an external storage medium. Set to 1 when the MV successfully completes the saving or loading of setup data.
2	Report generation complete	Set to 1 when the MV completes a report generation.
3	Timeout	Set to 1 when the timer expires.
4	—	—
5	—	—
6	USER key detection	Set to 1 when the USER key is pressed.
7	—	—

Status Information 5 to 8

All bits are zeroes.

7.1 Ethernet Interface Specifications

Basic Specifications

Electrical and mechanical specifications:	Conforms to IEEE 802.3 (Ethernet frames conform to the DIX specification)
Transmission medium type:	10BASE-T
Protocol:	TCP, IP, UDP, ICMP, ARP, FTP, HTTP, SNMP, SMTP

Maximum Number of Connections and Number of Simultaneous Uses

The following table indicates the maximum number of connections, the number of simultaneous uses (number of users that can use a function simultaneously), and the MV port number for each function.

Function	Maximum Number of Connections	Number of Simultaneous Uses		Port number ⁴
		Administrator	User	
Setting/measurement server	3	1	2 ¹	34260/tcp ²
Maintenance/test server	1	1	1 ¹	34261/tcp ²
FTP server	2	2	2 ¹	21/tcp ³
Web server (HTTP)	1	–	–	80/tcp ³
SNTP server	–	–	–	123/udp ³
Modbus server	2	–	–	502/tcp ³
Instrument information server	–	–	–	34264/udp ²

1 Users have limitations. See section 1.1 for details.

2 The port number is fixed.

3 The default port number. You can set a value in the range of 1 to 65535. Use the default port number unless there is a specific reason not to do so.

4 Make sure that each port number is unique.

7.2 Serial Interface Specifications

RS-232 Specifications

Connector type:	D-Sub 9-pin plug
Electrical and mechanical specifications:	Conforms to the EIA-574 standard (for the 9-pin interface of the EIA-232 (RS-232) standard)
Connection:	Point-to-point
Transmission mode:	Half-duplex
Synchronization:	Start-stop synchronization
Baud rate:	Select 1200, 2400, 4800, 9600, 19200, or 38400 [bps].
Start bit:	1 (fixed)
Data length:	Select 7 or 8 bits (To output data in BINARY format, be sure to set the data length to 8 bits.)
Parity:	Select odd, even, or none
Stop bit:	1 (fixed)
Hardware handshaking:	Select whether to fix the RS and CS signals to TRUE or to use them for flow control.
Software handshaking:	Select whether to use the X-ON and X-OFF signals to control only the transmitted data or both the transmitted and received data. X-ON (ASCII 11H), X-OFF (ASCII 13H)
Receive buffer size:	2047 bytes

RS-422/485 Specifications

Terminal block type:	6 terminals, terminal screws: ISO M4/nominal length 6 mm
Electrical and mechanical specifications:	Conforms to EIA-422 (RS-422) and EIA-485 (RS-485) standards
Connection:	Multidrop Four-wire type 1:32 Two-wire type 1:31
Transmission mode:	Half-duplex
Synchronization:	Start-stop synchronization
Baud rate:	Select 1200, 2400, 4800, 9600, 19200, or 38400 [bps].
Start bit:	1 (fixed)
Data length:	Select 7 or 8 bits
Parity:	Select odd, even, or none
Stop bit:	1 (fixed)
Receive buffer size:	2047 bytes
Escape sequence:	Open and close
Electrical characteristics:	FG, SG, SDB, SDA, RDB, and RDA (six terminals) SG, SDB, SDA, RDB, and RDA terminals are functionally isolated from the MV internal circuit. The FG terminal is frame ground.
Communication distance:	Up to 1.2 km
Terminator:	External: recommended resistance 120 Ω , 1/2 W

7.3 Modbus Protocol Specifications

Modbus Client Function

Basic Operation

- The MV, operating as a Modbus client device, communicates with Modbus servers periodically by sending commands at specified intervals.
- This function is independent of the Modbus master function operating over the serial interface.
- The supported functions are (1) reading data from the input registers and hold registers on a server and (2) writing data into the hold registers on a server.

Modbus Client Specifications

Communication available via ModbusTCP

Communication media: Ethernet 10Base-T

Read cycle: Select from the following:
125 ms, 250 ms, 500 ms, 1 s, 2 s, 5 s, and 10 s

Connection retries: Select the how long to wait before reconnecting after the connection is dropped due to the expiration of the connection wait time.
OFF, 10 s, 20 s, 30 s, 1 min, 2 min, 5 min, 10 min, 20 min, 30 min, and 1 h

Connection timeout value: 1 minute
However, if the IP address has not been obtained from the DHCP server, a communication error results immediately.

Command timeout value: 10 seconds

Server: Register up to 16 servers

Supported functions: The table below contain functions that the MV supports. To use the functions, the server device must also support them.

Function Code	Function	Operation
3	Reads the hold register (4xxxx, 4xxxxx)	The MV reads from the server device hold register into the communication input channel or external input channel.
4	Reads the input register (3xxxx, 3xxxxx)	The MV reads from the server device input register into the communication input channel or external input channel.
16	Writes to the hold register (4xxxx, 4xxxxx)	The MV writes the measured or computed data to the server device hold register.

Commands

Command type: R, R-M, W, and W-M

Number of commands: Set up to 16 commands

Data type: See the table below.

Symbol	Description
INT16	16-bit signed integer
UINT16	16-bit unsigned integer
INT32_B	32-bit signed integer (big endian)
INT32_L	32-bit signed integer (little endian)
UINT32_B	32-bit unsigned integer (big endian)
UINT32_L	32-bit unsigned integer (little endian)
FLOAT_B	32-bit floating point (big endian)
FLOAT_L	32-bit floating point (little endian)

- **Reading Values into External Input Channels (RD-MV2000 only)**
 - External input channels are an RD-MV2000 option (/MC1).
 - Reads values from the server register into the MV external input channels.
 - The data type of external input channels is 16-bit signed integer.
 - The measurement range and unit are set on the external input channels. The decimal place is determined by the external input channel's span lower settings.

MV2000		Server	
Access method	External Input data	Register	Data type
R	Number: 201 to 440 Data type: 16-bit signed integer	30001 to 39999	INT 16, UINT 16,
		300001 to 365536	INT 32_B, INT 32_L,
		40001 to 49999	UINT 32_B, UINT 32_L,
		400001 to 465536	

Read

External Input Channel Values

The range of external input channel values is –30000 to 30000 after removing the decimal. If a value is outside this range, the value is set to positive or negative range-out.

Server Register Value	External Input Channel Value
Greater than 30000	Positive range-out (7FFFH)
–30000 to 30000	–30000 to 30000
Less than –30000	Negative range-out (8001H)

- **Reading Values into Communication Input Channels**
 - Reads values from the server register into the MV communication input channels.
 - Communication input data is an option (/M1 or /PM1).
 - The data type of communication input data is 32-bit floating point.
 - Communication input data can be displayed on a computation channel by writing an expression that contains the data in an MV computation channel (/M1 or /PM1 option). The measurement range and unit are also set on a computation channel.

MV1000 and MV2000		Server	
Access method	Communication input data	Register	Data type
R-M	Number: C01 to C24 (MV1000) C01 to C60 (MV2000) Data type: 32-bit floating point	30001 to 39999	INT 16, UINT 16,
		300001 to 365536	INT 32_B, INT 32_L,
		40001 to 49999	UINT 32_B, UINT 32_L,
		400001 to 465536	FLOAT_B, FLOAT_L

Read

- **Writing Measured Values of Measurement Channels**
 - Writes measured values of measurement channels to server registers.
 - The data type of measured values is 16-bit signed integer.

MV1000 and MV2000		Server	
Access method	Measurement channel	Register	Data type
W	Number: 001 to 024 (MV1000) 001 to 048 (MV2000) Data type: 16-bit signed integer	40001 to 49999	INT 16, UINT 16,
		400001 to 465536	FLOAT_B, FLOAT_L

Write

Specified Data Type and Write Operation

The MV writes the measured values of measurement channels according to the specified data type as follows:

Specified Type	Measured Value	Value Written
INT16	Writes all values directly.	
FLOAT_L FLOAT_B	+Over*	7f800000H(+∞)
	-Over*	ff800000H(-∞)
	Skip*	ff800002H(Nan)
	Error*	ff800004H(Nan)
	Undefined data*	ff800005H(Nan)
	Burnout(Up)*	7f800006H(Nan)
	Burnout(Down)*	ff800006H(Nan)
	Other values	Writes the value including the decimal place in FLOAT data type.

* For details on values, see section 5.3, "Binary Data Output Format."

• Writing Computed Values of Computation Channels

- The computation function is an option (/M1 or /PM1).
- Writes computed values of computation channels to server registers.
- The data type of computed values is 32-bit signed integer.

MV1000 and MV2000		Server	
Access method	Computation channel	Register	Data type
W-M	Number: 101 to 124 (MV1000) 101 to 160 (MV2000)	40001 to 49999	INT 16, UINT 16,
	Data type: 32-bit signed integer	400001 to 465536	INT 32_B, INT 32_L, FLOAT_B, FLOAT_L

Write

Specified Data Type and Write Operation

The MV writes the computed values of computation channels according to the specified data type as follows:

Specified Type	Computed Value	Value Written
INT16	Less than -32768	-32768
	Greater than 32767	32767
	+Over*	32767
	-Over*	-32768
	Skip*	
	Error*	
	Other values	Writes the value in INT16 data format.
UINT16	Less than 0	0
	Greater than 65535	65535
	+Over*	65535
	-Over*	0
	Skip*	
	Error*	
	Other values	Writes the value in UINT16 data format.
INT32_L INT32_B	Writes all values directly.	
FLOAT_L FLOAT_B	+Over*	7f800000H(+∞)
	-Over*	ff800000H(-∞)
	Skip*	ff800002H(Nan)
	Error*	ff800004H(Nan)
	Other values	Writes the value including the decimal place in FLOAT data type.

* For details on values, see section 5.3, "Binary Data Output Format."

Modbus Server Function

Modbus Server Specifications

Communication available via ModbusTCP

Communication media: Ethernet 10Base-T

Port: 502/tcp (default value)

Command wait timeout: 1 minute. However, the timeout to receive the entire command after starting to receive a command is 10 seconds.

Maximum number of connections: 2

Supported functions: The table below contain functions that the MV supports.

Function Code	Function	Operation
3	Reads the hold register (4XXXX)	The client device reads the communication input data and external input channel data from the MV.
4	Reads the input register (3XXXX)	The client device reads the computed, measured, alarm, and time data from the MV.
6	Writes once to hold register (4XXXX)	The client device writes data to the communication input channel and external input channel on the MV.
8	Loopback test	The client device performs a loopback test on the MV.
16	Writes to hold register (4XXXX)	The client device writes data to the communication input channel and external input channel on the MV.

Register Assignments (shared with the Modbus slave function)

Data type		MV input register	
		Number	Data type
Measurement channel	Measured data	30001 to 30048	16-bit signed integer
	Alarm status	31001 to 31048	Bit string
Computation channel	Computed data	32001 to 32120	32-bit signed integer
	Alarm status	33001 to 33060	Bit string
External input channel	Measured data	34001 to 34240	16-bit signed integer
	Alarm status	35001 to 35240	Bit string
Measurement channel	Alarm list	36001 to 36012	Bit string
Computation channel	Alarm list	36021 to 36035	Bit string
External input channel	Alarm list	36041 to 36100	Bit string
Time		39001 to 39008	16-bit signed integer

Read

Client

Data type		MV hold register	
		Number	Data type
Communication input data		40001 to 40060	16-bit signed integer
		40301 to 40420	32-bit floating point
Measured data of external input channel		41001 to 41240	16-bit signed integer

Write

Read

Client

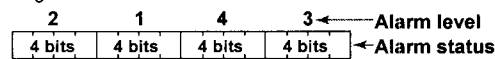
Input Register (shared with the Modbus slave function)

- Common Items
 - The client device can only read the input registers.
 - The readout data does not include decimal place and unit information. Specify them on the client device.
 - External input channels are an RD-MV2000 option (/MC1).

• Details

Input Register	Data	Data Type
30001 | 30048	Measured data of measurement channel 001 Measured data of measurement channel 048	16-bit signed integer
31001 | 31048	Alarm status of measurement channel 001 Alarm status of measurement channel 048	Bit string

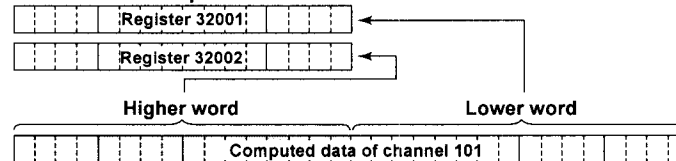
- Register structure and alarm status values



4-bit value	Meaning
0	No alarm
1	High limit alarm
2	Low limit alarm
3	Difference high limit alarm
4	Difference low limit alarm
5	High limit on rate-of-change alarm
6	Low limit on rate-of-change alarm
7	Delay high limit alarm
8	Delay low limit alarm

32001 | 32002	Lower word of the computed data of computation channel 101 Higher word of the computed data of computation channel 101	32-bit signed integer
32119 | 32120	Lower word of the computed data of computation channel 160 Higher word of the computed data of computation channel 160	

- Register structure

Channel 101 example

- There is no decimal place information.

33001 | 33060	Alarm status of computation channel 101 Alarm status of computation channel 160	Bit string
---------------------	--	------------

- Register structure and alarm status values: Same as those of measurement channels.

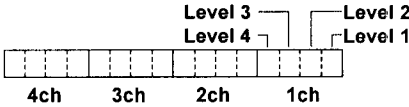
34001 | 34240	Measured data of external input channel 201 Measured data of external input channel 440	16-bit signed integer
---------------------	--	-----------------------

- There is no decimal place information.
- The data in these registers are the data in the MV external input channels. If linear scaling is enabled, the values are those after linear scaling.

35001 | 35240	Alarm status of external input channel 201 Alarm status of external input channel 440	Bit string
---------------------	--	------------

- Register structure and alarm status values: Same as those of measurement channels.

7.3 Modbus Protocol Specifications

Input Register	Data	Data Type
36001	List of alarms of measurement channels 001 to 004	Bit string
36012	List of alarms of measurement channels 045 to 048	
<ul style="list-style-type: none"> Register structure 		
 <p>Indicates the alarm statuses of four channels in a register. Set to 1 when alarm is activated. The figure above is an example of register 36001 (measurement channels 001 to 004).</p>		
36021	List of alarms of computation channels 101 to 104	Bit string
36035	List of alarms of computation channels 157 to 160	
<ul style="list-style-type: none"> Register structure: Same as the list of alarms of measurement channels. 		
36041	List of alarms of external input channels 201 to 204	Bit string
36100	List of alarms of external input channels 437 to 440	
<ul style="list-style-type: none"> Register structure: Same as the list of alarms of measurement channels. 		
<ul style="list-style-type: none"> Input registers 36001 to 36100 can be accessed consecutively. All unassigned register bits are read as zeroes. 		

Input Register	Data	Data Type
39001	Year	16-bit signed integer
39002	Month	
39003	Day	
39004	Hour	
39005	Minute	
39006	Second	
39007	Millisecond	
39008	(Reserved)	

Hold Register (shared with the Modbus slave function)

• Common Items

- The client device can read and write to the hold registers.
- Communication input data is an option (/M1 or /PM1).
- External input channels are an RD-MV2000 option (/MC1).

To Write Data

- Communication input data can be handled on a computation channel by writing an expression that contains the data in an MV computation channel.
- External input channel data can be handled on an external input channel.

• Details

Hold Register	Data	Data Type
40001 | 40060	Communication input data C01 Communication input channel C60	16-bit signed integer
	<ul style="list-style-type: none"> • Precautions to be taken when a client device reads data The MV communication input data is in floating point format, but the data is converted to 16-bit signed integer when the data is read. • Precautions to be taken when a client device writes data A client device can only write data in 16-bit signed integer format. A client device cannot write a floating point value. 	
40301 | 40419 40420	Lower word of communication input data C01 Higher word of communication input data C01 Lower word of communication input data C60 Higher word of communication input data C60	32-bit floating point
	<ul style="list-style-type: none"> • Precautions to be taken when a client device writes data Input range: -9.9999E29 to -1E-30, 0, 1E-30 to 9.9999E29 If values outside this range are used on a computation channel, a computation error occurs. 	
41001 | 41240	External input channel write register 201 External input channel write register 440	16-bit signed integer
	<ul style="list-style-type: none"> • Precautions to be taken when a client device writes data A client device can only write 16-bit signed integer data. The measurement range and unit are set on the external input channels. The decimal place is determined by the external input channel's span lower settings. 	

Modbus Error Response (common to Modbus server and Modbus slave)

The MV returns the following error codes to a client or master device.

Code	Function	Operation
1	Bad function code	Unsupported function request.
2	Bad register number	Tried to read or write to a register that does not have a corresponding channel.
3	Bad number of registers	When writing: The specified number of registers is less than or equal to zero or greater than or equal to 124. When reading: The specified number of registers is less than or equal to zero or greater than or equal to 126.

The MV does not return a response in the following cases.

- CRC error
- Errors other than those shown above.

Modbus Master Function

Basic Operation

- The MV, operating as a master device, communicates with slave devices periodically by sending commands at specified intervals.
- This function is independent of the Modbus client function operating over the Ethernet interface.
- The supported functions are (1) reading data from the input registers and hold registers on a slave device and (2) writing data into the hold registers on a slave device.

Serial Communication Specifications (same as with the Modbus slave function)

Communication available via ModbusRTU

Communication media: RS-232, RS-422, or RS-485

Control system: No flow control (none only)

Baud rate: Select 1200, 2400, 4800, 9600, 19200, or 38400.

Start bit: 1 (fixed)

Data length: 8 (fixed)

Parity: Select odd, even, or none

Stop bit: 1 (fixed)

Message termination determination:

Time equivalent to 48 bits

Modbus Master Specifications

Read cycle: Select the cycle for reading data from other devices from the following:

125 ms, 250 ms, 500 ms, 1 s, 2 s, 5 s, and 10 s

Timeout value: Select the timeout value when there is no response from a specified slave after sending a command from the MV.

125 ms, 250 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, and 1 min

Retry count: Select the retry count when there is no response from a specified device for a command sent from the MV

OFF, 1, 2, 3, 4, 5, 10, and 20

Auto recovery cycle: Select the cycle for automatically recovering from the following:

OFF, 1, 2, 5, 10, 20, 30 min, and 1 h

Wait between commands: Select the wait time* to send the next command after receiving a response to the previous command from the following:

OFF, 5, 10, 15, 45, and 100 ms

* When communicating using an RS-485 two-wire system, the signals may collide, because the master and slave device communication drivers switch in half-duplex mode. If communication does not work properly, increase the wait time.

Command type: R, R-M, W, and W-M

Command setup: Set up to 16 commands

Command items: Read channel 201 to 440, C01 to C60

Write channel 001 to 048, 101 to 160 (varies depending on the model)

Address: 1 to 247

Input registers: Same as the Modbus client function.

Hold register: Same as the Modbus client function.

Access method: Same as the Modbus client function.

Supported functions: Same as the Modbus client function.

Data type: Same as the Modbus client function.

Modbus Slave Function

Serial communication specifications:

	Same as the Modbus master function.
Slave address:	1 to 99
Supported functions:	Same as the Modbus master function.
Register assignments:	Same as the Modbus server function.
Modbus error response:	Same as the Modbus server function.

Appendix 1 ASCII Character Codes

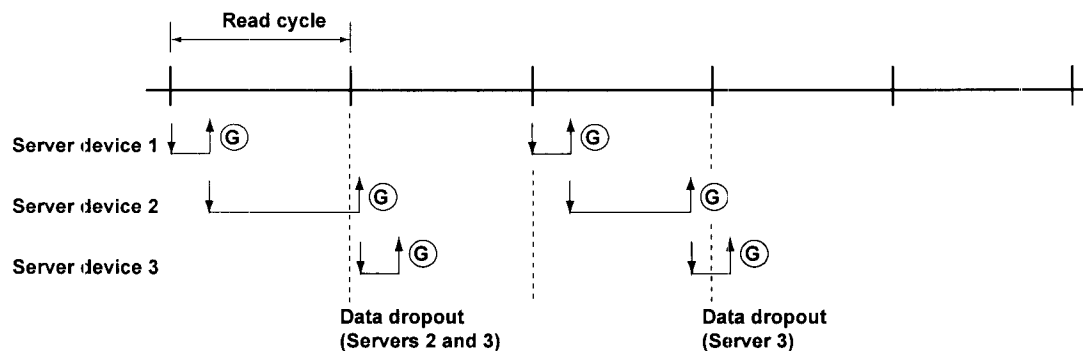
	Upper 4 bits															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4 bits	0		SP	0	@	P		p								
	1			1	A	Q	a	q								
	2			2	B	R	b	r								
	3		#	3	C	S	c	s								
	4			4	D	T	d	t								
	5		%	5	E	U	e	u								
	6		&	6	F	V	f	v								
	7			7	G	W	g	w								
	8		(	8	H	X	h	x								
	9		)	9	I	Y	i	y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

Appendix 2 Data Dropout during Modbus Communication

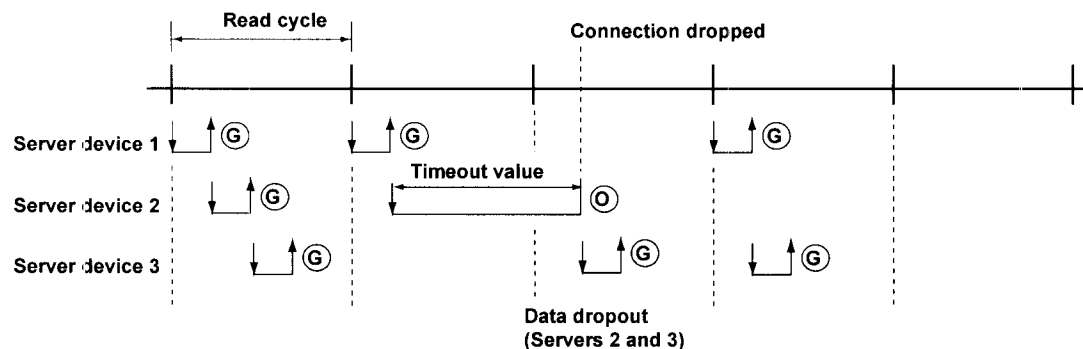
Data Dropout When Operating as a Modbus Client

If the MV tries to issue a command to a server device but has not finished receiving a response to the previous command, the MV will not be able to transmit the next command. This will cause a data dropout. Take appropriate measures to prevent dropouts by referring to the following figures.

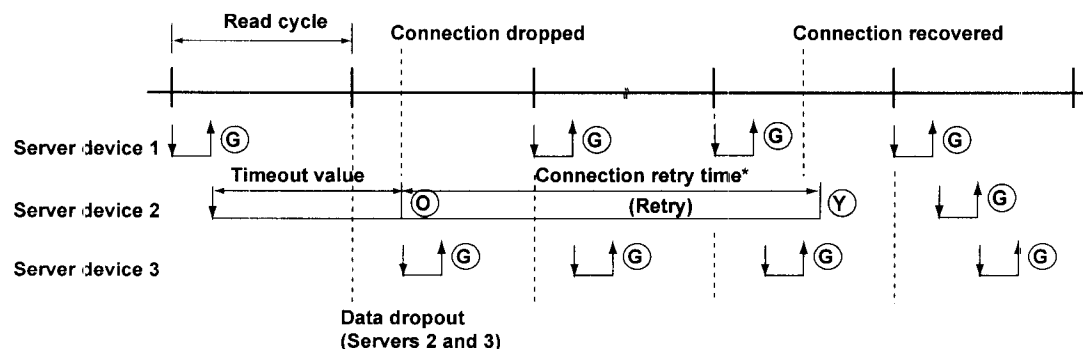
1. When the response from the server device takes a long time



2. When the connection is dropped because there is no response from the server device



3. When the communication recovers through connection retry



(G) (Y) (O) (R) : Status lamp

↓ : Command from the MV

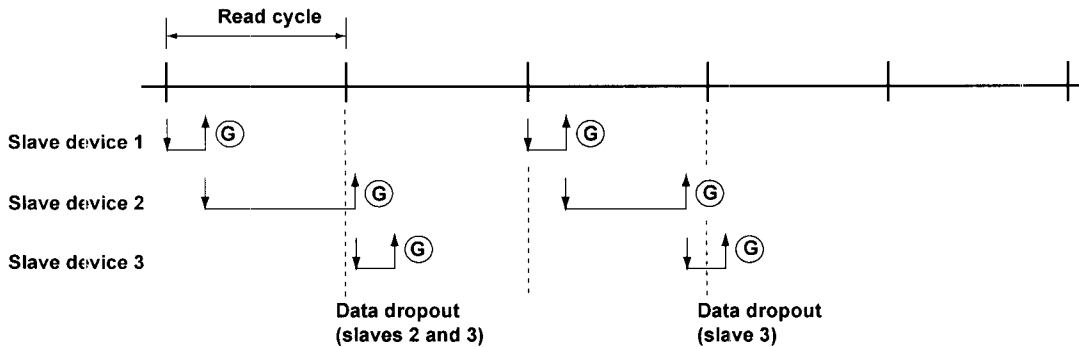
↑ : Response from the server device

* The first connection retry after the connection is dropped is shorter than the specified interval. The status lamp indications in this example apply when the connection retry function is enabled.

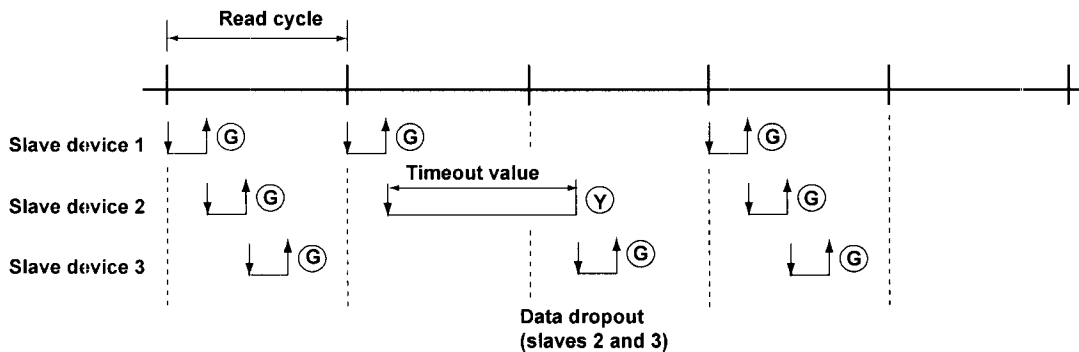
Data Dropout While Operating as a Modbus Master

If the MV tries to issue a command to a slave device but has not finished receiving a response to the previous command, the MV will not be able to transmit the next command. This will cause a data dropout. Take appropriate measures to prevent dropouts by referring to the following figures.

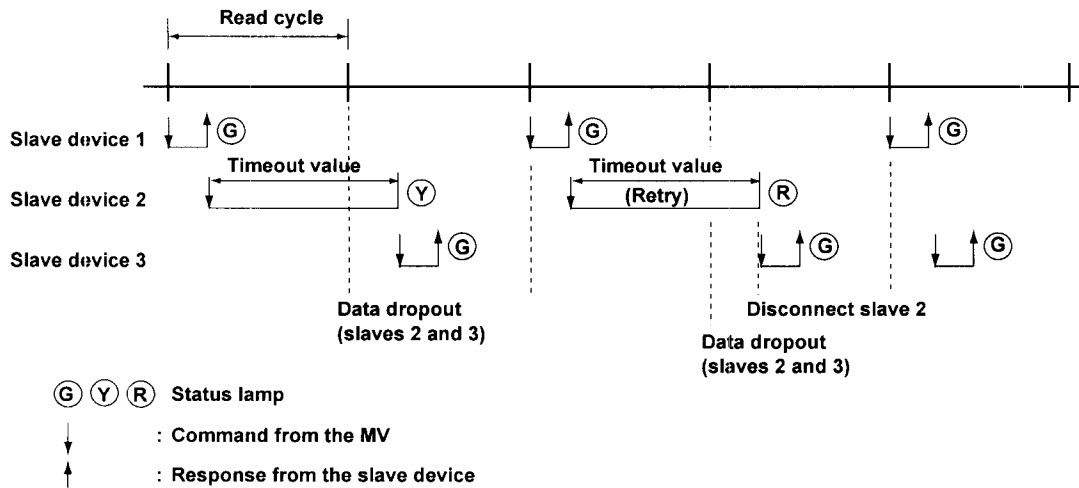
1. When the response from the slave device takes a long time



2. When there is no response from the slave device



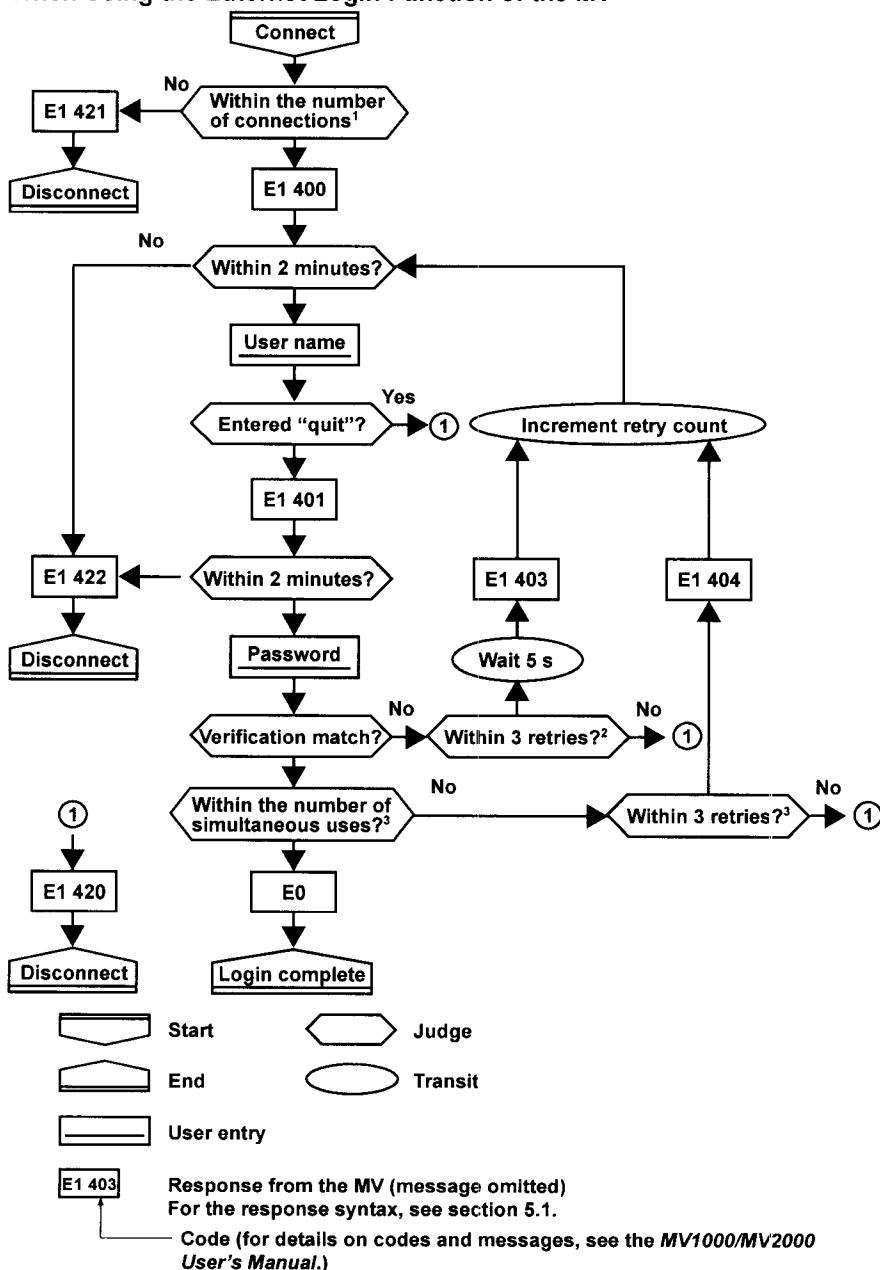
3. When the slave device that is not responding is disconnected (retry count set to 1)



Appendix 3 Login Procedure

You log into the MV from your PC to use the functionality of the setting/measurement server and the maintenance/test server via the Ethernet interface. If you complete the procedure successfully up to "Login complete" in the following figure, you will be able to use the commands given in chapter 4.

When Using the Ethernet Login Function of the MV



- 1 The maximum number of connections cannot be exceeded (see section 7.1).
- 2 If you try to log in using a wrong password four consecutive times, the connection will be dropped (the number of login retries is three).
- 3 If you try to log in when the number of simultaneous uses at the administrator or user level is exceeded (see section 7.1) four consecutive times, the connection will be dropped (even if the password is correct).

Log in as "admin" or "user."

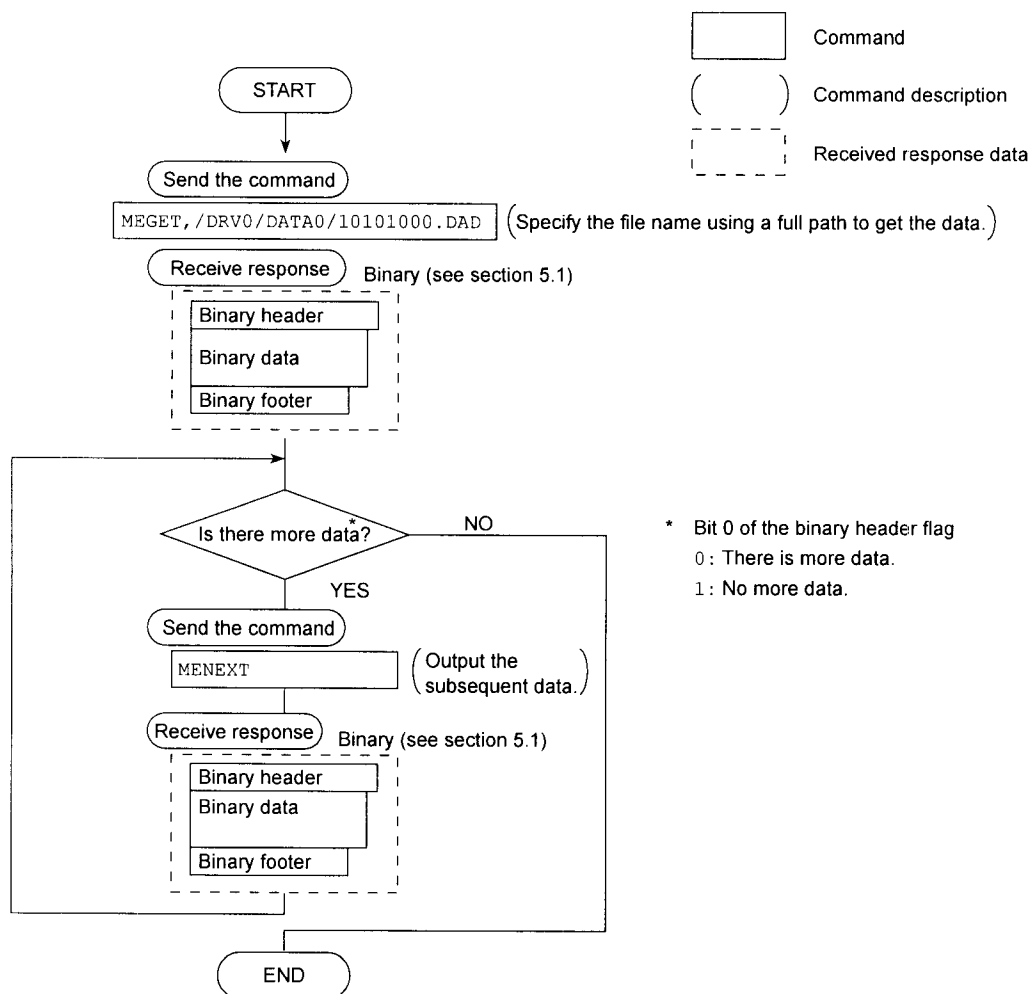
- M-4662



Appendix 4 Flowchart of How to Get Files or a File List from an External Storage Medium or Internal Memory

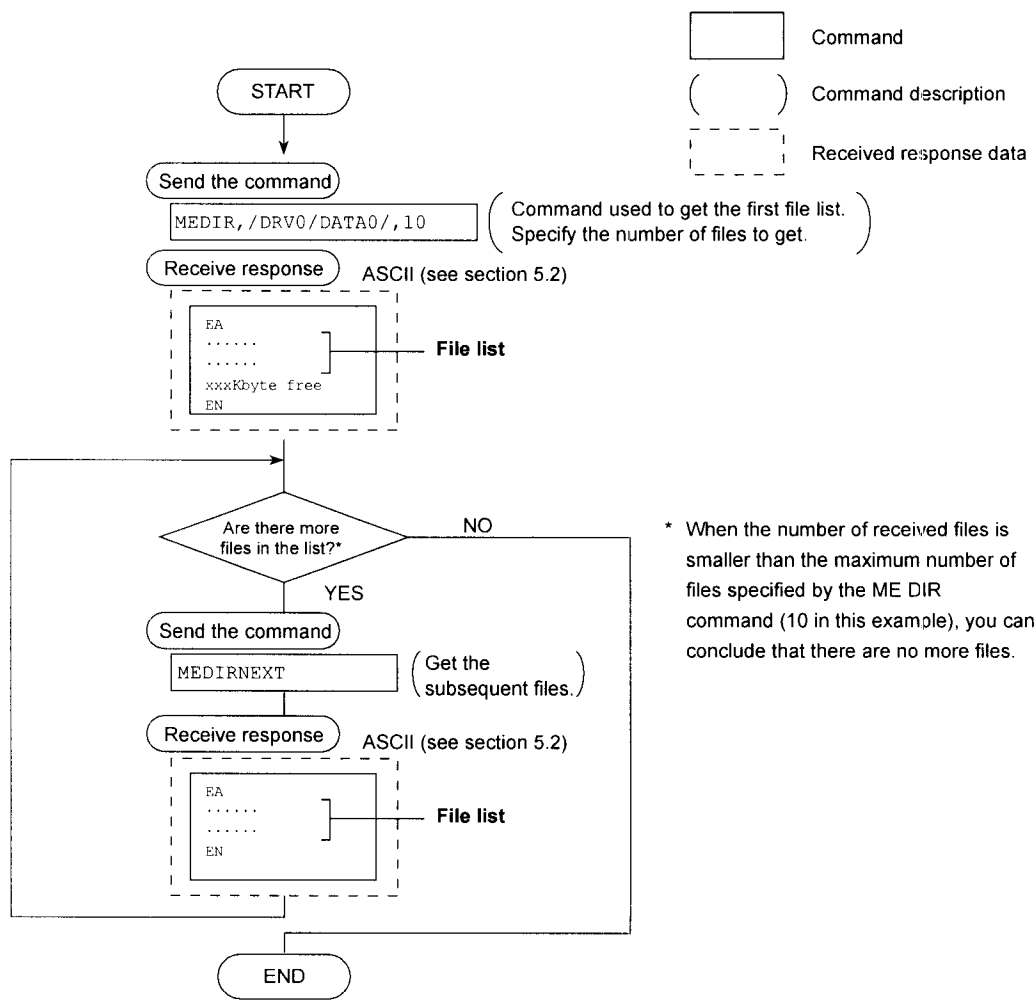
Example of How to Get the File 10101000.DAD

The following flowchart illustrates how to get file 10101000.DAD from the DATA0 directory on an external storage medium.



Example of How to Get a File List, 10 Files at a Time

The following flowchart illustrates how to get the file list of the DATA0 directory on an external storage medium, 10 files at a time.

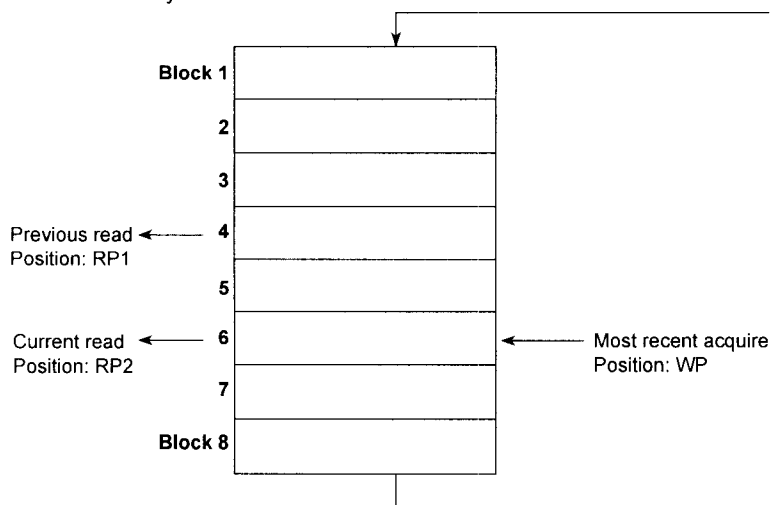


Appendix 5 Flowchart of the FIFO Data Output

FIFO Buffer Overview

The MV has an exclusive internal memory for transmitting measured/computed data. The memory has a FIFO (First-In-First-Out) structure. Measured/computed data is constantly acquired to the internal memory at the specified acquisition interval (FIFO acquisition interval, set with the FR command). By using this function, you will be able to read measured/computed data that has been saved at the specified interval, independent of when the PC reads the measured/computed data.

The following example shows the case when the acquisition interval is 1 s, and the FIFO memory can store data for 8 intervals.



- **Measured/Computed Data Acquisition**
 - The MV acquires measured/computed data to the internal memory at 1-s intervals.
 - The MV acquires measured/computed data in order to positions 1 through 8. After acquiring to position 8, the MV acquires the next data to position 1.
- **Reading the Measured/Computed Data (using the FF GET command)**

The MV transmits the data from the previous read position (RP1) to the most recent acquisition position (WP).

In this example, more than 2 seconds has elapsed from the previous read operation. Therefore, the MV transmits the data from blocks 5 and 6.

The amount of internal memory allocated for the FIFO buffer (FIFO buffer data size) varies depending on the model.

Model	Data size
RD-MV1004, RD-MV1008, RD-MV2008	For 1200 intervals (30 s at the fastest acquisition interval of 25 ms)
RD-MV1006, RD-MV1012, RD-MV1024, RD-MV2010, RD-MV2020, RD-MV2030, RD-MV2040, RD-MV2048	For 240 intervals (30 s at the fastest acquisition interval of 125 ms)
Models with the external channel input option	For 60 intervals (60 s at the fastest acquisition interval of 1 s)

Appendix 6 Network Terminology

Network Terminology

Term	Explanation
IP address	An ID that is assigned to each PC or communication device on an IP network such as the Internet or an intranet. The address is a 32-bit value expressed using four octets in decimal notation (each 0 to 255), each separated by a period as in 211.9.36.148.
Subnet mask	TCP/IP networks such as the Internet are often divided up into smaller networks called sub networks. The subnet mask is a 32 bit value that specifies the number of bits of the IP address used to identify the network address.
Default gateway	A representative router or computer that is used when accessing a computer outside its own network. If the access destination IP address does not specify a specific gateway, data is sent to the host designated as the default gateway.
DNS	An acronym for Domain Name System. A computer that converts the domain name, which is the name of the computer on the Internet, to four octets called the IP address. Each name server contains a mapping table of domain names and IP addresses in the network that the server manages and responds to external inquiries.
DHCP	An acronym for Dynamic Host Configuration Protocol. It is a protocol that allocates IP address and other settings that a PC needs to connect temporarily to the Internet. The DHCP server provides the information to a computer (client) that accesses the server. If a client finishes the communication, the server withdraws the address and assigns it to another computer.
HTTP	An acronym for HyperText Transfer Protocol. A protocol used to exchange data between a Web server and a client (Web browser, etc.). HTML documents as well as image, sound, and video files that are linked to them can be exchanged along with formatting information.
SNTP	An acronym for Simple Network Time Protocol. One of the protocols used to synchronize the computer clock via the TCP/IP network. It is an abbreviated version of NTP. NTP is a protocol that configures time information servers in a hierarchy and synchronizes the clock by exchanging information. SNTP omits the complicated sections of the NTP specifications and specializes in serving clients that query time information.
SMTP	An acronym for Simple Mail Transfer Protocol. A protocol used to transmit e-mail over the Internet. It is used to exchange mail between servers and used by the client to send mail to the server.
FTP	An acronym for File Transfer Protocol. A protocol used to transfer files over a TCP/IP network such as the Internet.
POP3	An acronym for Post Office Protocol version 3. A protocol used to receive mail over the intranet or Internet from a server that stores e-mail.
POP before SMTP	One of the user authentication methods for e-mail transmission. Access to the SMTP server is granted after a specific POP3 server is accessed first.
PASV mode	Passive mode of the file transfer protocol FTP (method by which the FTP server notifies the port for making the connection). This mode is required when transferring files across a firewall. Check with your network administrator on whether or not you need to set PASV mode.

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