
User's Manual



Models MV1004/MV1006/MV1008/MV1012/MV1024

MV2008/MV2010/MV2020/MV2030/MV2040/MV2048

MV1000/MV2000

Thank you for purchasing the MV1000/MV2000 (hereafter referred to as the MV). This manual explains how to use the MV1000/MV2000 (except for communication features). Please read this manual thoroughly so that you can use the MV properly. The following MV1000/MV2000 manuals are available.

- **Paper Manuals**

Manual Title	Manual No.	Description
MV1000 First Step Guide	IM MV1000-02E	Explains how to set up the MV1000 for making measurements using the quick settings function. Connection diagrams are also provided to help you with the setup.
MV2000 First Step Guide	IM MV2000-02E	Explains how to set up the MV2000 for making measurements using the quick settings function. Connection diagrams are also provided to help you with the setup.
Control of Pollution Caused by the Product	IM MV1000-91C	Provides information about pollution control.

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

Manual Title	Manual No.	Description
MV1000 First Step Guide	IM MV1000-02E	Same content as the paper manual.
MV2000 First Step Guide	IM MV2000-02E	Same content as the paper manual.
MV1000/MV2000 User's Manual	IM MV1000-01E	Explains how to use all the MV1000 and MV2000 features (except for communication and network features).
MV1000/MV2000 Communication Interface User's Manual	IM MV1000-17E	Explains how to use the Ethernet and serial interface communication features.

- **DAQSTANDARD Manuals**

All manuals other than IM 04L41B01-66EN are contained in the DAQSTANDARD CD.

Manual Title	Manual No.
DAQSTANDARD Data Viewer User's Manual	IM 04L41B01-63EN
DAQSTANDARD Hardware Configurator User's Manual	IM 04L41B01-64EN
DAQSTANDARD DX100P/DX200P Configurator User's Manual	IM 04L41B01-65EN
Installing DAQSTANDARD	IM 04L41B01-66EN

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.
- 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 YOKOGAWA dealer.
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Revisions

1st Edition: December 2007

2nd Edition: August 2010

MV's Version and Functions Described in This Manual

MV's Version and Functions

For the procedure to check the version, see section 9.3.

Edition	MV	Addition and change to functions	Refer to
1	Style number 1	New	-
2	Version number 1	Compatible with the DAQSTANDARD R8.21.	page i and First Step Guide.
		Acquire the contents of the Notice of Alterations (rechargeable battery model, etc).	Section 2.4 and First Step Guide.

How to Use This Manual

Content Summary

This user's manual consists of the chapters listed below. For information about the communication features and the accompanying software DAQSTANDARD, read the respective manual.

Chapter	Title and Contents
1	Feature Overview The MV features.
2	Installation and Wiring How to install the MV, how to wire input terminals, and how to connect the power cable.
3	Measurement Channels and Alarms How to set measurement conditions and how to set alarms.
4	Measurement and Recording How to record and store measured values and other values. This chapter also explains how to load measured data or setup data from a CF card or USB flash memory.
5	Screen Operations How to use the operation screen.
6	Display Configuration How to change the displayed information on the operation screen and how to write a message.
7	Event Action How to make the MV perform a specific action in response to an event, a remote control signal input, or a pressing of the USER key.
8	Security Features How to use the key lock feature and the feature that allows only registered users to operate the MV.
9	Environment Settings How to configure the time settings and how to operate the MV by using a keyboard.
10	Computation and Report Functions (/M1 and /PM1 options) How to use computation channels and how to create various reports, such as hourly, daily, weekly, and monthly reports.
11	External Input Channels (/MC1 option) How to use external input channels.
12	Troubleshooting and Maintenance Explains error messages and troubleshooting measures.
13	Specifications Lists the MV specifications.
Appendix	Describes measured data file sizes, text file formats, etc.
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Note

- This user's manual covers information about MVs that have a suffix code for language "-2" (English).
 - For language configuration instructions, see section 9.4, "Changing the Language."
-

The following symbols are used in this manual.

Unit

K	Denotes 1024. Example: 768 KB (file size)
k	Denotes 1000.

Markings



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 attention 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.



This mark is used to indicate a reference to a related procedure or explanation.

Subheadings

Bold characters Denotes key or character strings that appear on the screen. Example: **Volt**

Aa#1

Indicates character types that can be used.

A Uppercase alphabet, **a** lowercase alphabet, **#** symbols, **1** numbers.

Procedure

Carry out the procedure according to the step numbers.

Explanation

All procedures are written with inexperienced users in mind; depending on the operation, not all steps need to be taken. Explanation gives information such as limitations related the procedure.

Display

Indicates the display and explains the settings. A detailed description of the function is not provided in this section.

Settings

For details on the function, see chapter 1.

Procedural Explanations

This manual mainly describes the MV1000 procedures. Where procedures differ between the MV2000 and MV1000, the MV2000 procedures (menu operations) are also provided.

High-Speed and Medium-Speed Input Model Groupings

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

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

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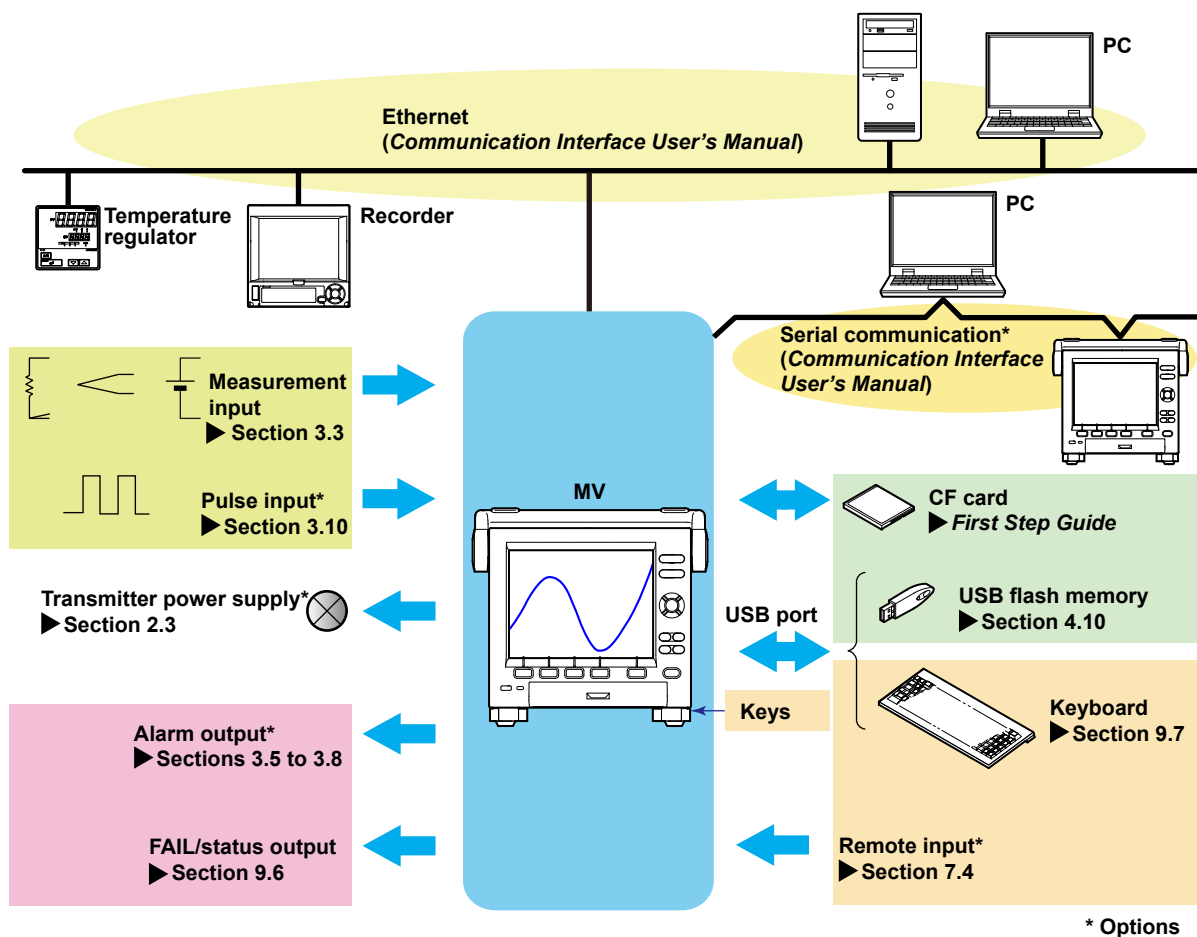
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1.1 System Overview

System Configuration

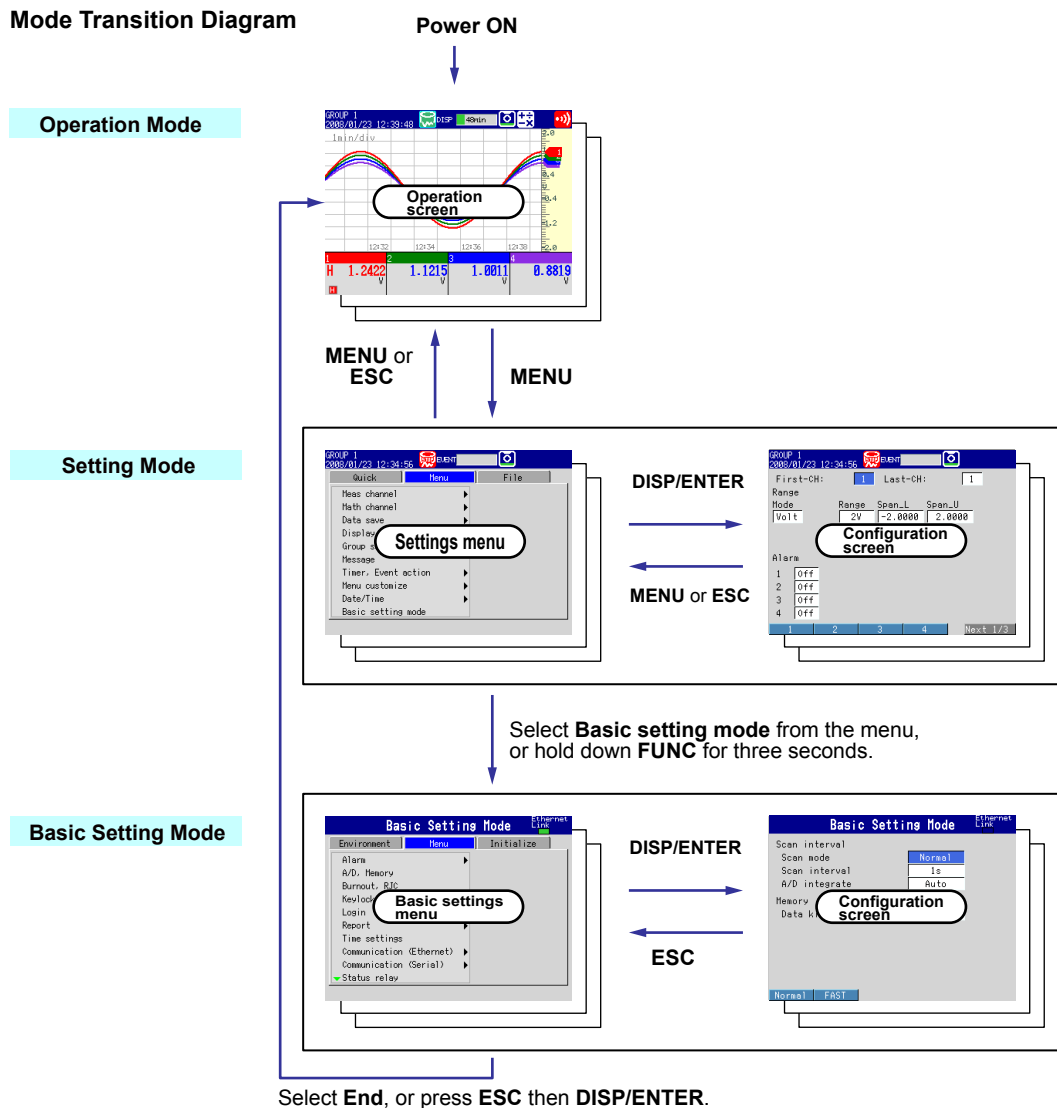
The MV can be used to construct a system like the one shown below. The MV can make voltage and temperature measurements by itself. It can also transfer data to other devices via Ethernet or a serial interface, and it can acquire data from multiple channels using the Modbus protocol.



Terminology

- **Memory sampling**
Recording measured data.
- **Memory start**
A command to start memory sampling.
- **Memory stop**
A command to stop memory sampling.
- **Display data**
The waveform data displayed on the MV screen. It is essentially measured data that is recorded at the display data sampling rate.
- **Event data**
Measured data that is recorded at a set sampling rate that differs from that of the display data.

Mode Transition Diagram



Mode	Description
Operation Mode	For performing measurements.
Setting Mode	For configuring settings, such as the input range and the measurement method. You can change most of the settings in this mode while the MV is engaged in memory sampling.
Basic Setting Mode	For configuring fundamental settings, such as the scan interval and the measured data save method. You cannot switch to this mode while the MV is engaged in memory sampling.

*For a list of the contents of Setting Mode and Basic Setting Mode, see the First Step Guide.

1.2 Input

Measurement Channels

- **Number of Channels vs. Scan Interval**

The MV acquires data by sampling measurement channel input signals at the set scan interval. The following is a list of the scan intervals available with different numbers of channels.

Model	Number of Measurement Channels	Scan Interval		
		Normal Mode		Fast Sampling Mode
MV1004	4	125 ms, 250 ms		25 ms
MV1008	8			
MV1006	6	1 s, 2 s, 5 s	2 s, 5 s	125 ms
MV1012	12			
MV1024	24			
MV2008	8	125 ms, 250 ms		25 ms
MV2010	10	1 s, 2 s, 5 s	2 s, 5 s	125 ms
MV2020	20			
MV2030	30			
MV2040	40			
MV2048	48			
A/D converter integration time		60 Hz/50 Hz	100 ms	600 Hz (fixed)

► For configuration instructions, see section 3.1.

- **A/D Converter Integration Time**

The MV uses an A/D converter to convert sampled analog signals to digital signals. You can effectively eliminate the influence of power supply noise by setting the A/D converter's integration time to the same length as or to an integral multiple of the power source period.

- Because 100 ms is an integral multiple of both 16.7 ms and 20 ms, you can effectively eliminate the influence of power supply noise from both 50- and 60-Hz frequencies by setting the integration time to 100 ms.
- Power supply noise elimination is less effective in fast sampling mode than it is in normal mode. When measuring in an environment susceptible to power supply noise, we recommend that you measure in normal mode.

► For configuration instructions, see section 3.1.

Input Types and Computation Functions

You can measure the following types of input.

Input Type	Description
DC voltage	You can measure DC voltages in the range of ± 20 mV to ± 50 V.
DC current	You can measure a DC current signal by converting it to a voltage signal using a shunt resistor attached to the input terminal. ¹ The converted signal can be measured within the DC voltage range (see above).
Thermocouple	You can measure temperatures using these thermocouple types: R, S, B, K, E, J, T, N, W, L, U, and WRe3-25. It is also possible to measure using other thermocouples, such as PR40-20 and PLATINEL. ²
RTD	You can measure temperatures using RTD types Pt100 and JPt100. It is also possible to measure using other RTD types such as Cu10 and Cu25, ³ and Pt50 and Ni100. ²
ON/OFF input	You can display contact input or voltage input signals correlated to 0% or 100% of the display range. Contact input: A closed contact is ON (1). An open contact is OFF (0). Voltage input: Less than 2.4 V is OFF (0). 2.4 V or more is ON (1).
Pulse input ⁴	You can count pulses.

1 Shunt resistor sold separately. For example, you can use a 250- Ω shunt resistor to convert a 4- to 20-mA signal to a 1- to 5-V signal.

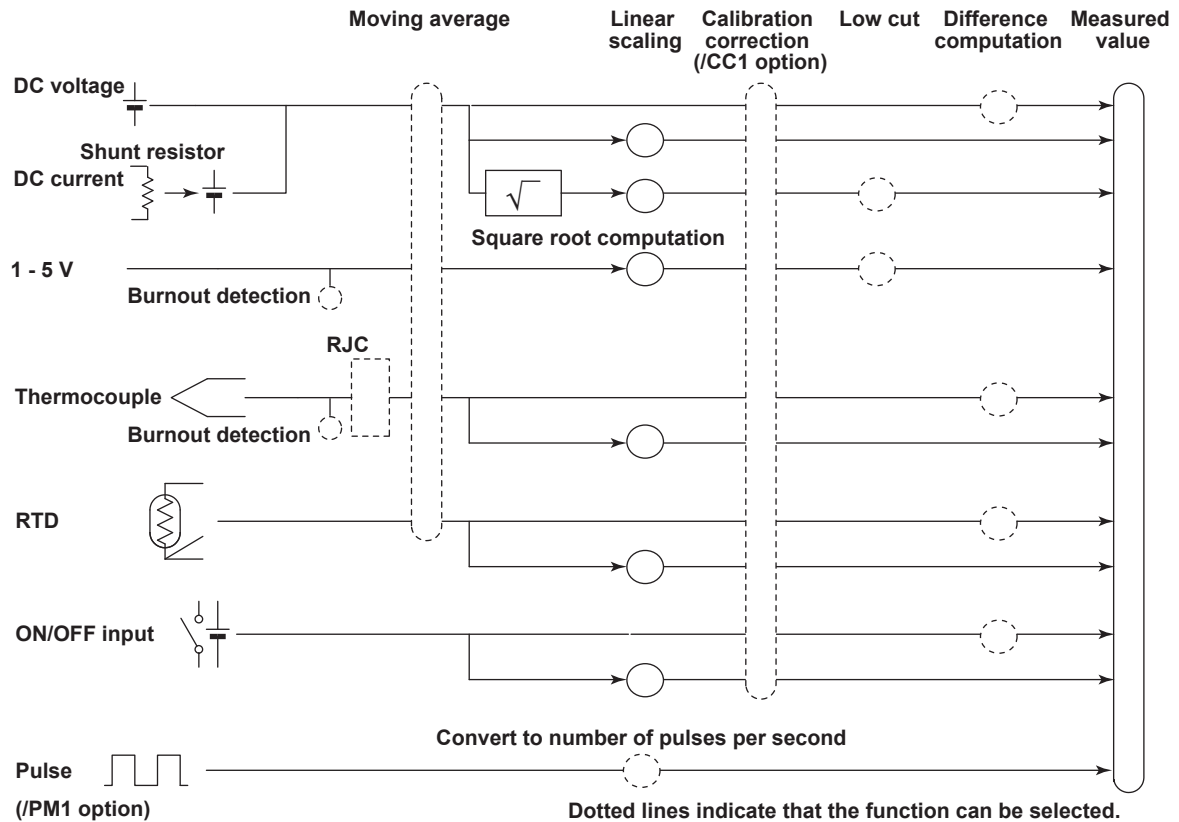
2 /N3 option

3 /N1 option

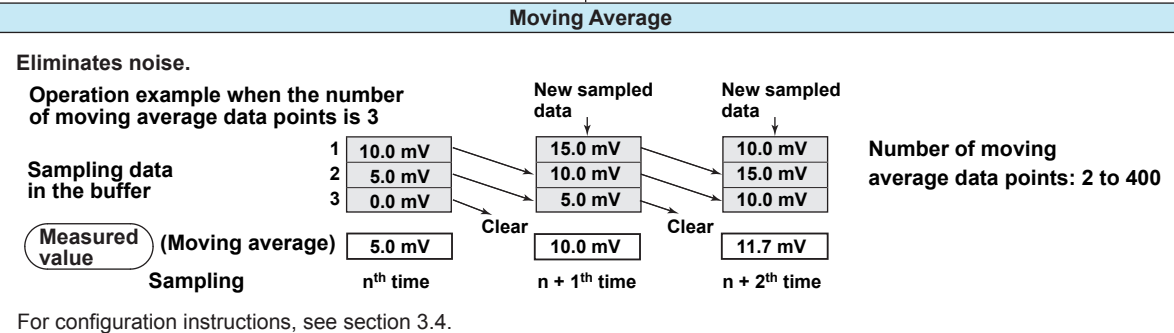
4 /PM1 option

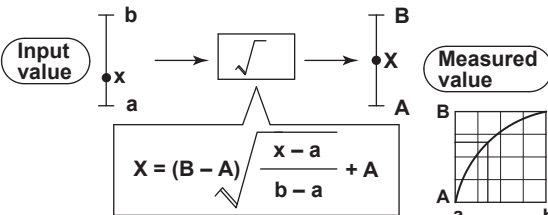
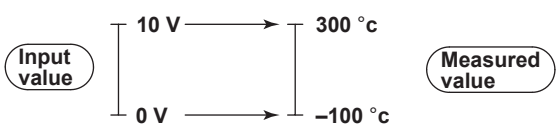
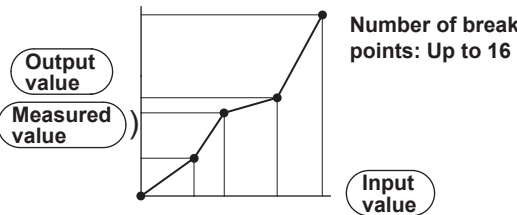
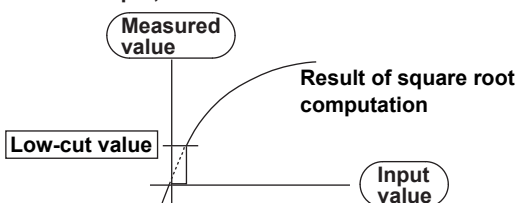
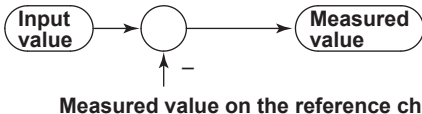
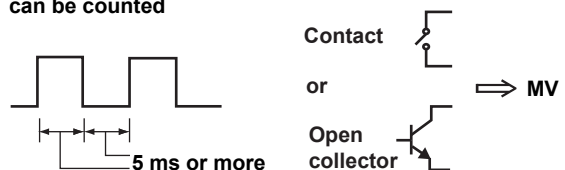
1.2 Input

The following input processing and math operations are available.



Reference Junction Compensation	Burnout Detection
<p>Performs reference junction compensation on a thermocouple.</p> <p>Thermocouple</p> <p>Thermocouple</p> <p>MV</p> <p>Internal reference junction</p> <p>External reference junction</p> <p>For configuration instructions, see section 3.2.</p>	<p>Detects and indicates a sensor burnout.</p> <p>Burnout</p> <p>1 - 5 V</p> <p>Detected on the 1-5 V value.</p> <p>Indicated as Burnout.</p> <p>Burnout</p> <p>Thermoelectromotive force</p> <p>Indicated as Burnout.</p> <p>For configuration instructions, see section 3.2.</p>



<p>Square Root Computation</p> <p>Takes the square root of the input value and converts the unit to obtain the measured value.</p>  <p>$X = (B - A) \sqrt{\frac{x - a}{b - a}} + A$</p> <p>For configuration instructions, see section 3.3.</p>	<p>Linear Scaling</p> <p>Converts the unit to obtain the measured value.</p>  <p>For configuration instructions, see section 3.3.</p>
<p>Calibration Correction (/CC1 Option)</p> <p>Corrects the input value with the characteristics specified by segments to obtain the measured value.</p>  <p>For configuration instructions, see section 3.9.</p>	<p>Low-cut</p> <p>For square root computation, measured values below the specified value are cut. For 1-5 V input, values below 0 % are cut.</p>  <p>For configuration instructions, see section 3.3.</p>
<p>Difference Computation</p> <p>The measured value of the channel is set to the difference with respect to the measured value of the reference channel.</p>  <p>For configuration instructions, see section 3.3.</p>	<p>Pulse Input (/PM1 Option)</p> <p>Counts pulses. Pulses of 100 Hz or less can be counted</p>  <p>Count on the MV The contact changes from open to closed. The signal level at the input terminal changes from high to low.</p> <p>For configuration instructions, see section 3.10.</p>

Note

You can use difference computation even if the reference channel and difference computation channel's input types and ranges are different. Difference computation takes place using the difference computation channel's decimal place and unit.

Example 1: If the input value of the difference computation channel is 10.00 and the measured value of the reference channel is 100.0, the result is 10.00–100.0=–90.00.

Example 2: If the input value of the difference computation channel is 10.00 V and the measured value of the reference channel is 5.00 mV, the computed result is 10.00 V – 5.00 mV = 5.00 V.

1.3 Alarms

This function generates an alarm when the measured data meets a set condition. You can set a maximum of four different alarms on each channel.

Alarm Types

You can use the types of alarms listed below. The letters contained in parentheses are used as abbreviations for the alarms.

► For alarm configuration instructions, see section 3.7.

High Limit Alarm (H) 	Low Limit Alarm (L)
Delay High Limit Alarm (T) 	Delay Low Limit Alarm (t)
High Limit on Rate-of-Change Alarm (R) 	Low Limit on Rate-of-Change Alarm (r)
Difference High Limit Alarm (h) 	Difference Low Limit Alarm (l)

- **Hysteresis**

You can set a difference between the value that activates an alarm and the value that deactivates it.

► For configuration instructions, see section 3.5.

- **Delay High Limit Alarm and Delay Low Limit Alarm**

If the measured value remains above or below the set alarm value for the set period of time (the delay time), an alarm is activated.

- **High Limit on Rate-of-Change Alarm and Low Limit on Rate-of-Change Alarm**

The MV checks the rate-of-change of the measured values over a set period of time (the interval) and activates an alarm if the rate-of-change in the rising or falling direction is greater than or equal to the set value.

The alarm value of the rate-of-change alarm is set using an absolute value. The interval is derived from the sampling count using the following equation:

$$\text{Interval} = \text{scan interval} \times \text{sampling count}$$

► For instructions on how to set the interval, see section 3.5.

- **Difference High Limit Alarm and Difference Low Limit Alarm**

The MV activates an alarm when the difference between the values of two channels goes above or below the set value. You can use this alarm on measurement channels set to difference computation.

Alarm display

Alarm conditions are indicated in operation windows (trend, digital, bar graph, overview, etc.) and by icons in the status display section. The alarm summary displays detailed alarm information.

• Hold/Nonhold of Indication

When alarm conditions cease, their indicators can be set to either:

- Stop as soon as the alarm condition ceases (Nonhold).
 - Continue until the execution of an alarm output release (AlarmACK) operation (Hold).
- The default setting is Nonhold.

► For configuration instructions, see Section 3.5.

• Alarm Hide Function

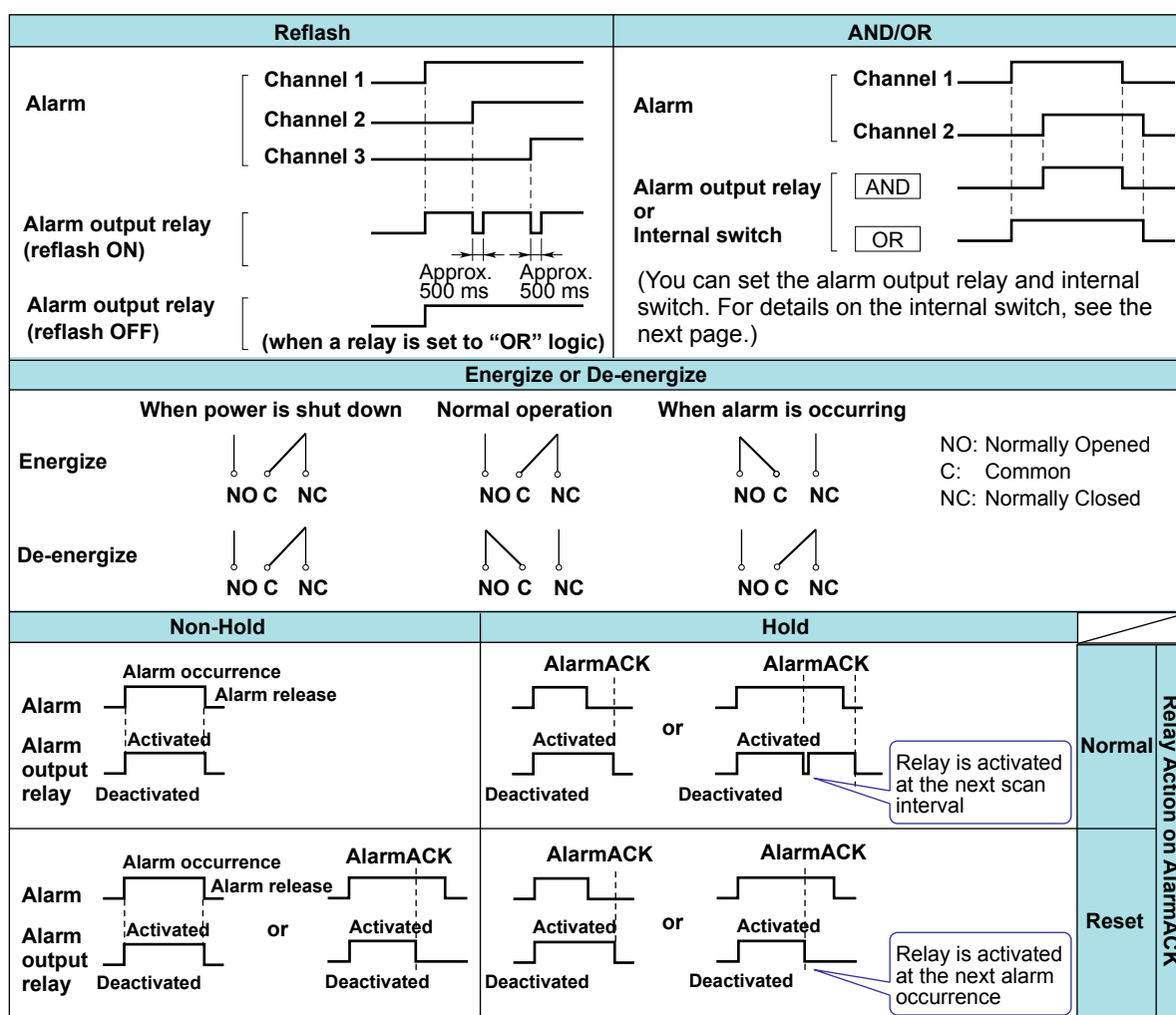
If this function is enabled, the MV will not display alarm condition information or record it in the alarm summary. However, the MV will output alarm information to a relay (/A options) or internal switch. You can set this function for each channel and alarm.

► For configuration instructions, see Section 3.6.

Alarm Output Relay Operation

The MV can generate a contact signal from an alarm output relay (/A options) when an alarm occurs. The alarm output relay operation can be changed.

► For configuration instructions, see Section 3.5.



- **Reflash**

This function enables a single alarm output relay with multiple alarms assigned to it to indicate all alarm occurrences. After the first alarm, subsequent alarms are indicated by the brief release (approximately 500 ms) of the output relay.

The reflash function affects the first three output relays.*

* I01 to I03 or I11 to I13. With the /A1 option, I01 and I02.

Note

When reflash is enabled, the first three output relays are used exclusively as reflash relays.

The first three output relays are set to OR logic and to the Nonhold operation regardless of the AND/OR or Nonhold/Hold settings explained below.

- **AND/OR**

When multiple alarms are assigned to one output relay, you can choose to activate the alarm in one of the following ways (you can also use AND/OR with internal switches):

- AND: Activate the relay when all of the alarms assigned to it occur simultaneously.
- OR: Activate the relay when any of the alarms assigned to it occur.

- **Energize or De-energize Operation**

You can choose whether to energize or de-energize alarm output relays when an alarm occurs. If you select de-energize, the alarm output relays will be in the same state when the power is shut off as they are when an alarm occurs. This setting applies to all alarm output relays.

- **Nonhold/Hold**

When an alarm condition is no longer met, alarm relays can be set to:

- Turn OFF immediately (Nonhold).
- Remain ON until the execution of an alarm output release (AlarmACK) operation (Hold).
This setting applies to all alarm output relays.

- **Alarm Output Release Operation**

The alarm output release operation (AlarmACK) stops the display and the relay output of all alarms. For information about how alarm display and output relay operations respond to an AlarmACK operation, see the previous page.

Note

When you enter Basic Setting Mode, the alarm output relay remains at its current active/released state. In Basic Setting Mode, alarms are not detected and the AlarmACK operation is invalid.

Internal Switch

The MV can transmit the alarm status to software switches (30 internal switches). Internal switch values are shown below. As with AlarmACK, you can apply an AND or OR operation (see the previous page).



Internal switches can be used as events with the event action function (for details, see section 1.7). Internal switches can also be written into computation channel (/M1 and /PM1 options) expressions.

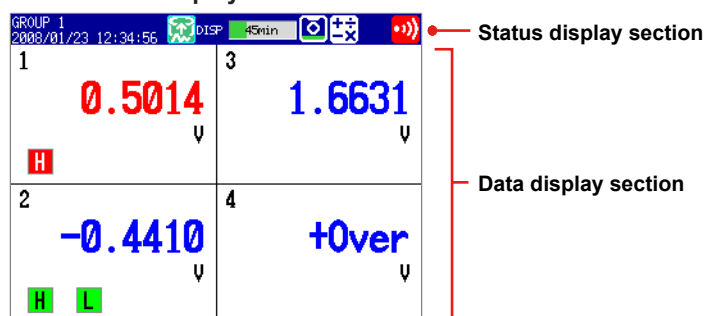
1.4 Display

Common Display functions

- **LCD Display and Its Layout**

The MV1000 has a 5.5-inch (240 × 320 dot resolution) TFT color LCD. The MV2000 has a 10.4-inch (480 × 640 dot resolution) TFT color LCD. The display consists of a status display section and a data display section.

The MV1000 Display



- **Status Display Section**

The status display section indicates the display name, date/time, batch name (when using the batch function), user name (when using the login function), internal memory and CF card usage, alarm occurrence, computation status (/M1 or /PM1 option), key lock status, and e-mail transmission.

- **Data Display Section**

The data display section shows measured data using numbers, waveforms, and bar graphs. It displays a configuration screen when you are configuring a function.

- **Group Display**

On the trend, digital, and bar graph displays, channel data is displayed in preset groups. With the MV1000, you can register up to 10 groups, each with up to 6 channels. With the MV2000, you can register up to 36 groups, each with up to 10 channels. The same groups are used for the trend, digital, and bar graph displays. Displayed groups can be switched automatically at specified intervals (5 s to 1 min).

► For configuration instructions, see section 6.1.

- **Channel Number Display and Tag Name Display**

You can choose to label displayed channels according to their tag names or according to their channel numbers. This setting applies to all channels.

► For configuration instructions, see section 6.2.

- **Update Interval of Measured Values**

Measured values are updated every second. However, if the scan interval is longer than 1 s, measured values are updated at the scan interval.

► For configuration instructions, see section 6.3.

- **Alarm Indication**

The MV regularly checks for the alarms set to each channel and indicates alarms with the following symbols:

Alarm Type	Symbol	Alarm Type	Symbol
High limit alarm	H	High limit on rate-of-change alarm	R
Low limit alarm	L	Low limit on rate-of-change alarm	r
Difference high limit alarm	h	Delay high limit alarm	T
Difference low limit alarm	l	Delay low limit alarm	t


Status Display Section


The status display section contains the following information when the MV is in Operation or Setting Mode.


Memory Sampling Status

Data type
DISP: Display data
EVENT: Event data


Memory sampling icon


No memory sampling 

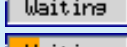
Memory sampling in progress 

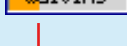
Display paused (memory sampling continues) 

The green bar indicates the memory sampling progress.
The frame represents either the length of one file save interval (with display data) or the length of one data segment (with event data).

 Internal memory error. Contact your nearest YOKOGAWA dealer for repairs.

 The remaining memory sampling time.


 Indicates that the MV is waiting for an event data trigger.


 When an event data pre-trigger is set, the part of the bar that represents the length of the pre-trigger section will be displayed in orange.

Display or group name
If all channels are being displayed with trend display, the group name display shows "ALL".

Date and time
If the function that gradually adjusts the time is enabled, the time is displayed in yellow.


When using the batch function


AAA-1234-000541  **Batch name** (displayed alternately with the display name)

2008/01/23 12:34:56  **Date/time***


If the batch and lot numbers exceed 20 characters, the date/time area will also be used to display the batch and lot.


When using the login function

Admin1  **Current user name**

2008/01/23 12:34:56  **Date/time*** (displayed alternately with the display name)


When using the login and batch functions


Admin1  **Current user name**

AAA-1234-000542  **Batch name** (displayed alternately with the display name and date/time*)


* With the MV2000, the date/time and batch name are displayed on different lines.


Alarm Icons


 At least one alarm condition has been met. This icon blinks when an alarm condition is met and AlarmACK has not been executed. (Red)

 After an alarm condition has been met, all alarms have been released, but there is still at least one alarm for which an AlarmACK operation has not been performed. (Green)


Status Icon
(Displayed alternately on models with the /M1 or /PM1 option)


 Key lock is on.

 E-mail notification has been activated.


 The condition set to the status output relay (/F1 option) has been met.


Math icon (/M1 and /PM1 options)


 White icon: Math in progress


 Yellow icon: Math data dropout

CF Card Icons

 Accessing the CF card.

 Waiting.

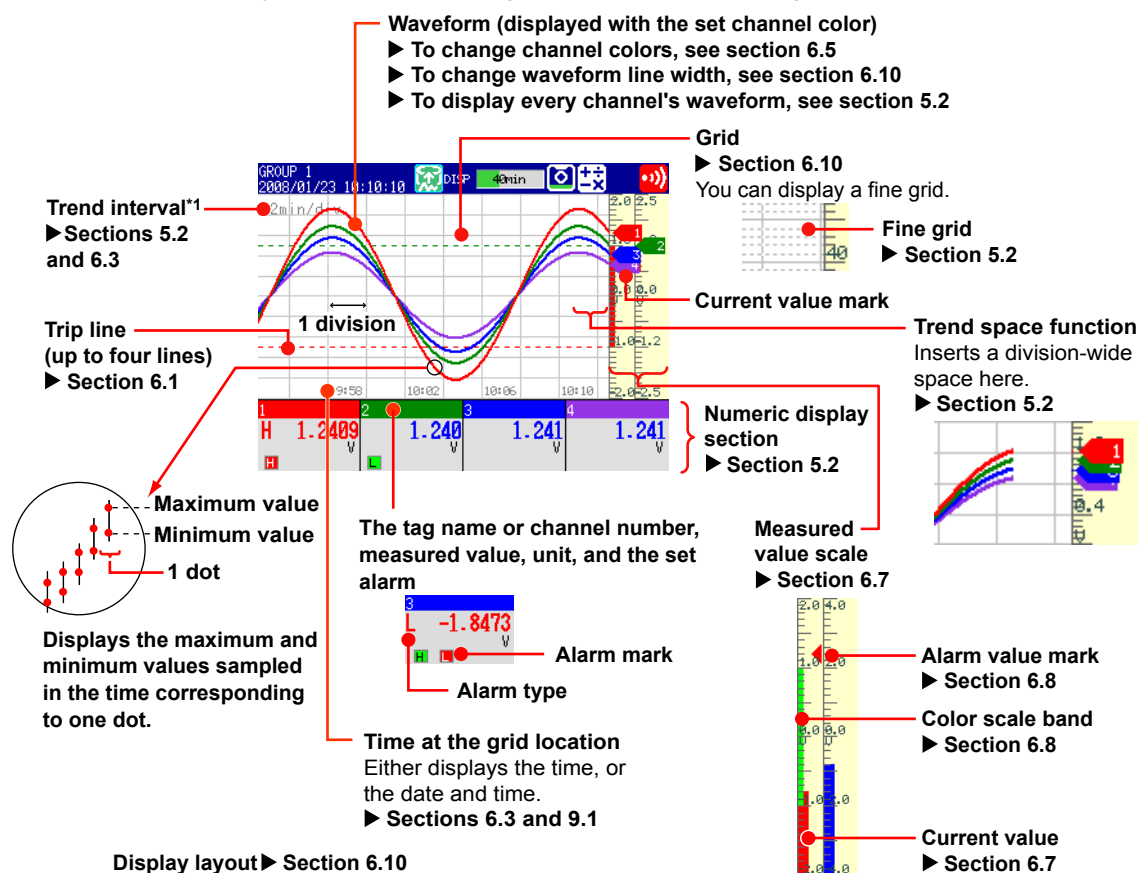
 Light blue icon: There is a CF card in the slot, but it is not connected properly.

 Remove the CF card, and then reinsert it. There is a CF card error. To return the CF card icon to normal, perform the following:

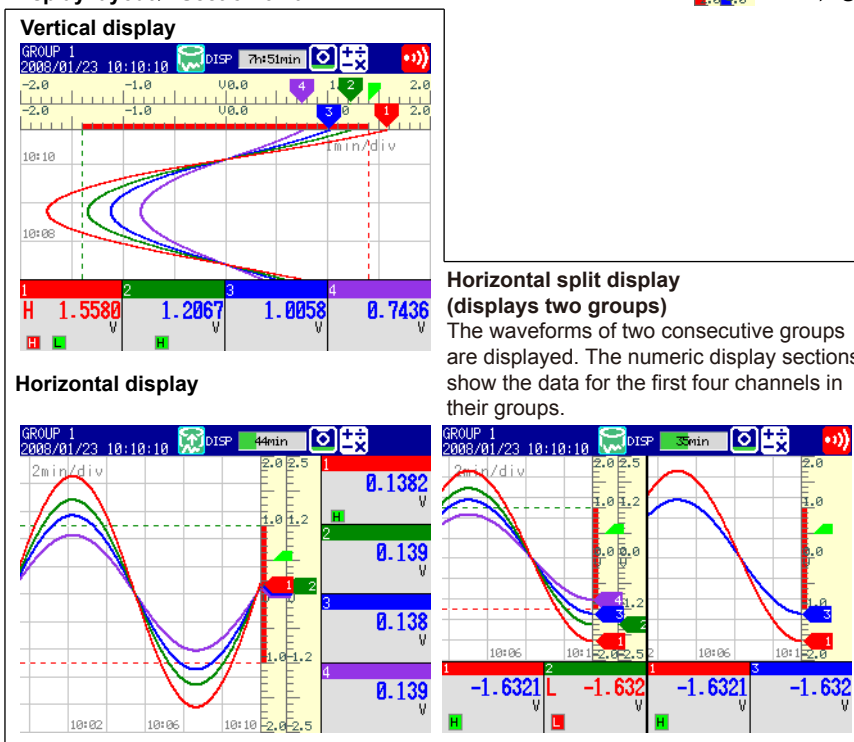
- Remove the CF card, and then reinsert it.
- Exchange it with a functional CF card.
- Use the MV to format the CF card (the CF card data will be deleted).

Trend Display (T-Y)

Displays measured data using waveforms. (For operating instructions, see section 5.2.)



Display layout ▶ Section 6.10



*1 When the trend interval is changed, only the time axis display changes. The sampling interval when recording display data (section 1.5) is specified by the Trend/Storage interval (section 4.1).

1.4 Display

• Waveform Updating

Every 30 dots makes up one division (also referred to as DIV) on the time axis. The waveform update interval is the time corresponding to one dot. The time corresponding to one dot depends on the time set to one division (the trend interval). The relationship between the trend interval and the speed of waveform movement in the display is as follows:

Trend interval (per DIV)	5 s ¹	10 s ¹	15 s ²	30 s	1 min
Time corresponding to one dot (in seconds)	0.125	0.25	0.5	1	2
Speed of waveform movement (approximation in mm/h)	10000	5000	2500	1250	625
Trend interval (per DIV)	2 min	5 min	10 min	15 min	20 min
Time corresponding to one dot (in seconds)	4	10	20	30	40
Speed of waveform movement (approximation in mm/h)	312	156	78	42	31
Trend interval (per DIV)	30 min	1 h	2 h	4 h	10 h
Time corresponding to one dot (in seconds)	60	120	240	480	1200
Speed of waveform movement (approximation in mm/h)	21	10	5.2	2.6	1.0

- 1 40 dots per division. Available on high-speed input models of the MV.
- 2 Available on medium-speed input models of the MV when in fast sampling mode.

Switching Trend Intervals (For instructions on how to set the second interval, see section 6.3.)

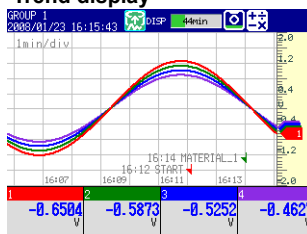
You can press T/DIV to change the trend interval. You can also switch from the ordinary trend interval to the secondary trend interval, and vice versa, while the MV is collecting data.

• Writing Messages

Preset messages

1	Start
2	Material 1
3	
4	

Trend display



Free messages

You can enter non-preset messages.

Preset Messages (For configuration and operating instructions, see section 6.4.)

You can choose preset messages to be written on the waveform.

Max. number of messages: 100 (Messages 1 through 10 are free messages.)

Free Messages (For configuration and operating instructions, see section 6.4.)

You can enter non-preset messages.

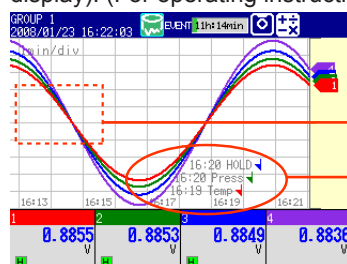
Max. number of free messages: 10

Automatically written messages (For configuration instructions, see sections 6.3 and 6.17.)

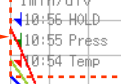
- The MV will automatically write a message to indicate when the trend update rate has been switched during memory sampling.
- The MV will automatically write a message to indicate when power has been restored after a power failure that occurs during memory sampling.

Message Display Options

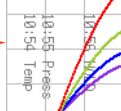
- When using horizontal or horizontal split display, messages can be displayed either vertically or horizontally. (For configuration instructions, see section 6.10.)
- Messages can be displayed as a group in the upper left corner of the screen (list display). (For operating instructions, see section 5.2.)



List display



Vertical display

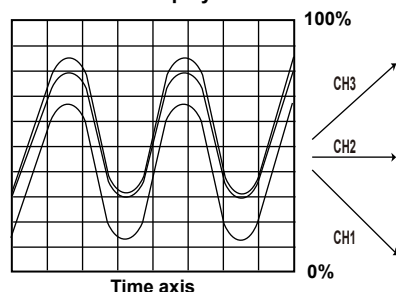


• Zone Display

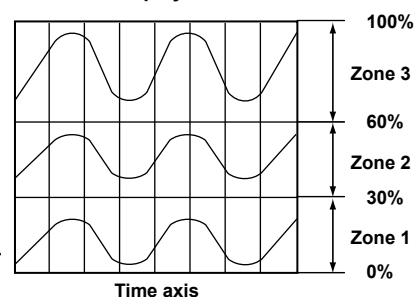
You can display channels in specified zones. This allows you to separate waveforms so that they don't overlap.

In the following example, channel 1 is set to 0-30%, channel 2 is set to 30-60%, and channel 3 is set to 60-100%.

Without zone display



With zone display



► For configuration instructions, see section 6.6.

Auto Zone (For operating instructions, see section 5.2.)

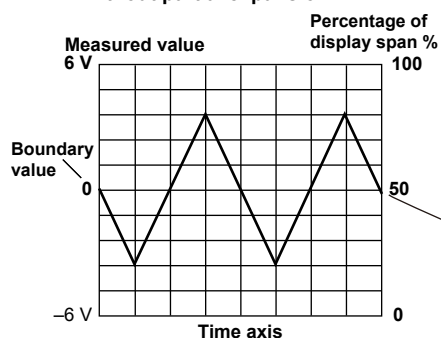
You can divide the trend display area evenly between each channel in a group.

• Partial Expansion

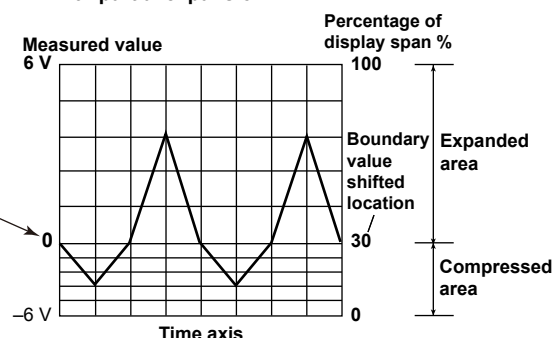
This function enables you to compress part of the display and expand the rest of it.

In the following example, the display below 0 V (the boundary value) is shifted to the bottom 30% of the screen. The bottom 30% of the screen displays -6 V to 0 V, while the top 70% displays 0 V to 6 V.

Without partial expansion



With partial expansion



► For configuration instructions, see section 6.9.

• Alarm Display

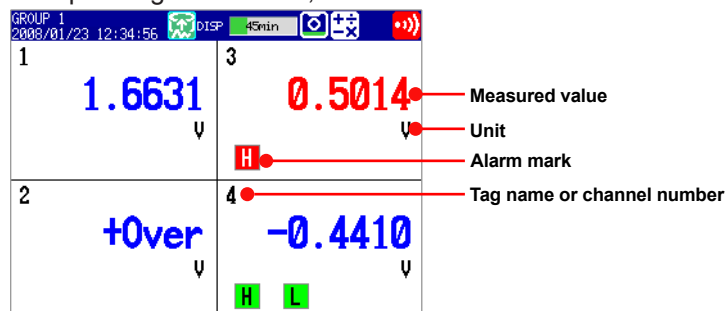
The alarm mark, alarm type, and measured values are displayed in the following ways, depending on the alarm condition.

Alarm	Indication not held				Indication held							
	Occurrence	Release			AlarmACK	AlarmACK			AlarmACK	AlarmACK		
Alarm mark	Green	Red	Green	Green	Blinking red	Blinking green	Green	Green	Blinking red	Red	Green	
Alarm type	None	Red	None	None	Red	None	None	None	Red	Red	None	
Measured value	Blue	Red	Blue	Blue	Red	Blue	Blue	Blue	Red	Red	Blue	

Digital Display

Displays measured data using large numeric symbols.

► For operating instructions, see section 5.2.



Note

- **Measurement Channel Numeric Value Display**

When the MV detects a range-out (see below), the display is either “+Over” or “-Over.”

When the MV detects a burnout on a channel that has been set to be checked for burnouts, the display is “Burnout”. All other values are displayed numerically.

Range-outs are detected on measurement channels in the following circumstances.

- If the DC voltage input value goes above the measurable range $\pm 5\%$, a range-out is detected. For example, when the measurement range is 2 V, the measurable range is -2.000 to 2.000 V. If the voltage exceeds 2.200 V, a positive range-out is detected. If it goes below -2.200 V, a negative range-out is detected.
- If the input type is thermocouple or RTD, a range-out is detected when the temperature goes 10°C above or below the measurable range. For example, when the measurement range is set to R, the measurable range is 0.0 to 1760.0°C . If the temperature exceeds 1770.0°C , “+Over” will be displayed. If the temperature goes below -10.0°C , “-Over” will be displayed.
- On channels that use linear scaling, the range-out values, ignoring the decimal point, are above 30000 and below -30000 . However, you can also set the range-out values to 105% or greater, and -5% or less of the scale width, as long as those values fall within ± 30000 .

► For configuration instructions, see section 3.11.

- **Computation Channel Numeric Value Display**

► See section 1.9.

- **External Input Channel Numeric Value Display (/MC1 option)**

The range of displayable values, ignoring the decimal point, is -30000 to 30000 . The decimal place is determined by the location of the decimal point on the external input channel's minimum span value. Regardless of maximum and minimum span value settings, all values within the range of -30000 to 30000 will be displayed. If the value exceeds 30000 , “+Over” will be displayed. If the value goes below -30000 , “-Over” will be displayed.

- **Alarm Display**

The alarm mark and measured values are displayed in the following ways depending on the alarm condition.

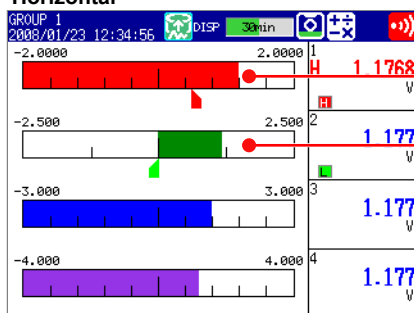
Indication not held					Indication held						
Alarm	Occurrence				AlarmACK			AlarmACK			
	Release										
Alarm mark	Green	Red	Green	Green	Blinking red	Blinking green	Green	Green	Blinking red	Red	Green
Measured value	Blue	Red	Blue	Blue	Red	Blue	Blue	Blue	Red	Red	Blue

Bar Graph Display

Displays measured data using bar graphs.

► For operating instructions, see section 5.2.

Horizontal



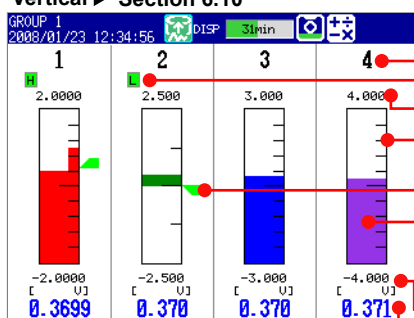
The bar graph base position is set to Normal, Lower, or Upper.

► Section 6.11

The bar graph base position is set to Center.

► Section 6.11

Vertical ► Section 6.10



Tag name or channel number

Alarm mark

Maximum value

Scale

► Section 6.7

Alarm value mark

Bar
(displayed with the set channel color)

► Section 6.11

Unit of measurement and minimum value

Measured value

The bar graph base position is set to Center.

► Section 6.11

The bar graph base position is set to Normal, Lower, or Upper.

► Section 6.11

• Bar Graph Display Updating

The bar graph display is updated at the same rate as numeric values.

• Alarm Display

The alarm mark, alarm value mark, and measured values are displayed in the following ways, depending on the alarm condition.

Alarm	Occurrence Release	Indication not held				Indication held					
		AlarmACK		AlarmACK		AlarmACK		AlarmACK		AlarmACK	
Alarm mark	Green	Red	Green	Green	Blinking red	Blinking green	Green	Green	Blinking red	Red	Green
Value mark	Green	Red	Green	Green	Red	Green	Green	Green	Red	Red	Green
Measured value	Blue	Red	Blue	Blue	Red	Blue	Blue	Blue	Red	Red	Blue

Historical Trend

The MV can display the waveforms of past measured data (display or event data) stored in internal or external memory. This function is called *historical trend*.

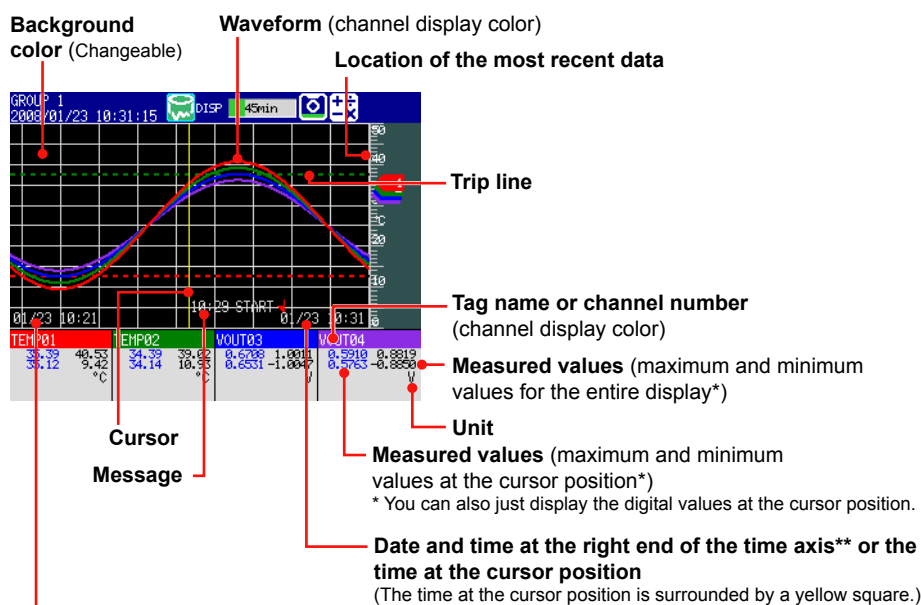
• Historical Trend Display Options

There are five ways that you can display measured data stored in internal memory:

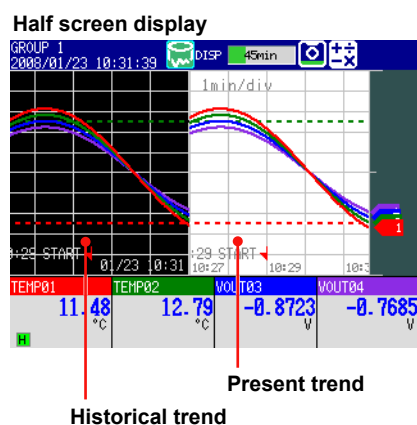
- From the alarm summary display. ► See section 5.7.
- From the message summary display. ► See section 5.8.
- From the memory summary display. ► See section 5.9.
- From the display selection menu. ► See section 5.3.
- By pressing HISTORY.

You can also display measured data stored to external memory. ► See section 4.8.

• Display Contents



** You can also set this area to display the time relative to the start of recording.



Item	Description
Alarm summary	Displays a summary of the displayed data's alarms.
Message summary	Displays a summary of the displayed data's messages.
Memory summary	Displays the properties (file name, sample start time, end time, etc.) of the displayed data.

• Add Message

You can enter added messages.

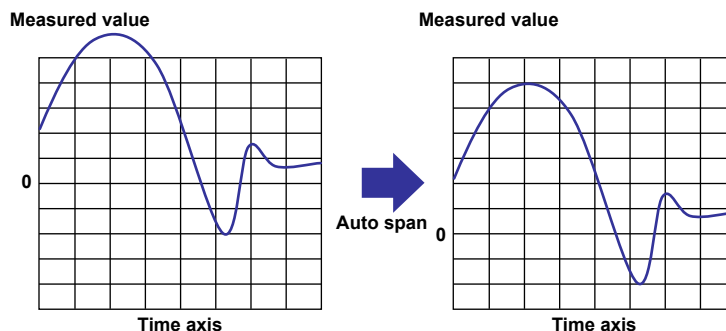
► For operating instructions, see section 6.4.

- **Auto Span**

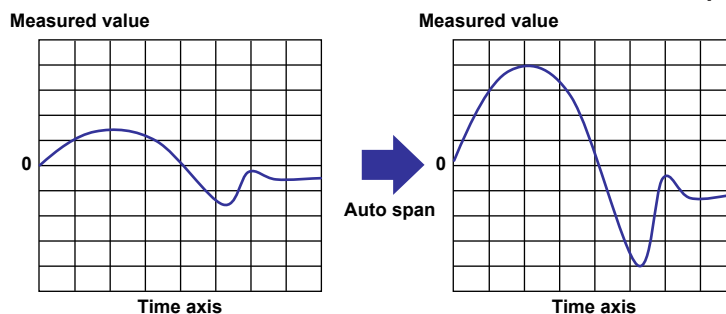
The MV can automatically adjust the display span of the selected channel.* It sets the span based on the maximum and minimum displayed historical data values. Auto span is deactivated when you switch to another group.

* Auto span affects channels that are in the same scale position as the selected channel.

When the maximum or minimum values are outside of the set display span



When the maximum or minimum values are within the set display span



If the maximum or minimum data value falls outside the maximum selectable display span, the MV adjusts the display span to the maximum or minimum possible value. The MV responds in the same way when it encounters overflow data.

- **Top Channel**

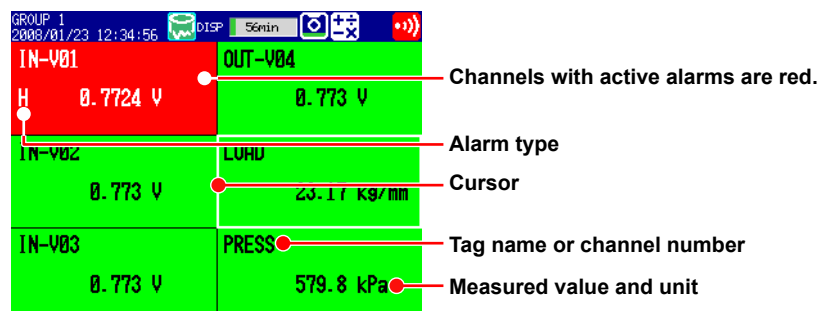
Displays the selected channel's historical trend waveform in front of all of the others. This setting is deactivated when you switch to another group.

Overview

Displays a list that shows the conditions of all channels.

You can select a channel to access the trend, digital, or bar graph display of its group.

► For operating instructions, see section 5.4.



• Alarm Indication

The channel display area, channel number, tag name, alarm type, and measured value all change in appearance based on alarm conditions in the following ways.

Alarm	When indication is set to non-hold				When indication is set to hold						
	Occurrence	Release			Alarm ACK		Alarm ACK				
Tag/Channel	Black	White	Black	Black	Blinking white	Blinking black	Black	Black	Blinking white	White	Black
Channel area	Green	Red	Green	Green	Red	Green	Green	Green	Red	Red	Green
Alarm type	None	White	None	None	White	None	None	None	White	White	None
Measured value	Black	White	Black	Black	White	Black	Black	Black	White	White	Black

Alarm Summary

You can list up-to-date alarm information.

- The data of up to 1000 alarms can be displayed.
- You can select alarm information to access the historical trend of the display data or event data that contains the alarm.

► For operating instructions, see section 5.7.

	Channel	Type	Alarm Time
OFF	1	1H	2008/01/23 10:07:51
ON	1	1H	2008/01/23 10:07:44
OFF	2	1L	2008/01/23 10:05:38
ON	2	1L	2008/01/23 10:03:45
ACK			2008/01/23 10:01:38
ON	1	1H	2008/01/23 09:49:02
OFF	2	1L	2008/01/23 09:46:57
ON	2	1L	2008/01/23 09:45:05
OFF	1	1H	2008/01/23 09:42:59
ON	1	1H	2008/01/23 09:40:23
OFF	2	1L	2008/01/23 09:38:19
ON	2	1L	2008/01/23 09:36:26

To the historical trend display

Date/time of alarm occurrence/release

Alarm number (1, 2, 3, 4) and type (H, L, h, l, R, r, T, t)

Channel

▲ ON : Alarm occurrence
(▲ blinks until the AlarmACK operation is carried out if Indicator is set to Hold.)

▼ OFF : Alarm release

● ACK : Alarm output release (when blinking is cleared through the AlarmACK operation)

Cursor (selects an alarm)

The alarm information number of the alarm on the screen's bottom line and the number of alarm entries in internal memory.

Message Summary

You can display a list of messages and when they were written.

- Up to 450 messages can be displayed.
- Up to 50 added messages can be displayed.
- You can select message information to access the historical trend of the display data or event data that contains the message.

► For operating instructions, see section 5.8.

Message	Time	Grp
POWER OFF	08/01/23 10:09	1
STOP	08/01/23 10:08	A
DANGER	08/01/23 10:06	A
BATTERY	08/01/23 10:03	2
POWER ON	08/01/23 10:02	A
HIGH VOLTAGE	08/01/23 10:01	A

To the historical trend display

Message
Added message (blue)

Date and time when the message was written

The groups on which the message was written
Displays a group number, or A for all groups

Cursor (used to select a message)

The message number displayed on the screen's bottom line and the number of message entries in internal memory.

Switching Displayed Items

You can switch between two sets of displayed items.

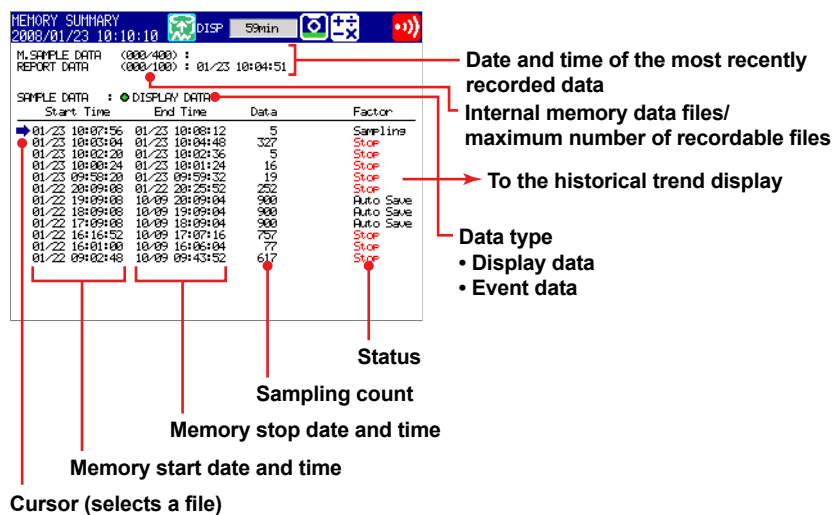
- Message, date and time, and group
- Message and the name of the user who wrote the message

Memory Summary

You can display a list of the display and event data that is stored in internal memory.

- You can select a display data or event data entry to access its historical trend display.
- The MV displays the number of manually sampled data and report data (/M1 and /PM1 options) samples.

► For operating instructions, see section 5.9.



• Switching Displayed Items

You can switch between two lists of information.

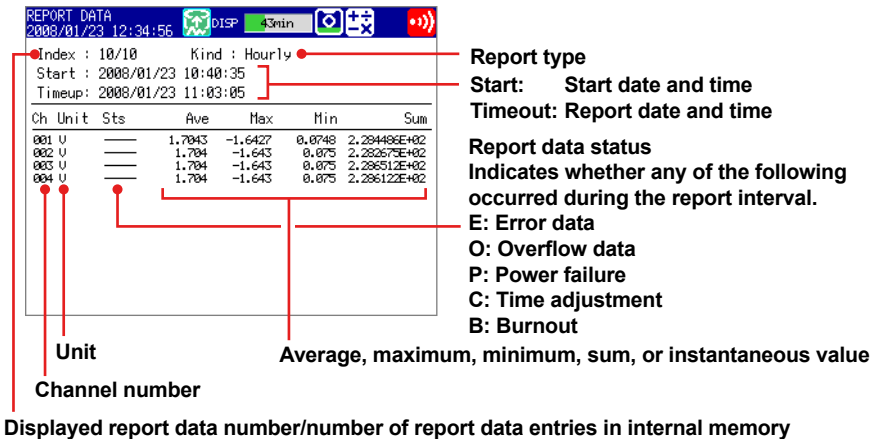
- Start and stop times
- File names

• Data Storage

You can save the data in the internal memory to a CF card or to USB flash memory.

Report Data (/M1 and /PM1 options)

You can display report data stored in the internal memory.
► For operating instructions, see section 5.5.



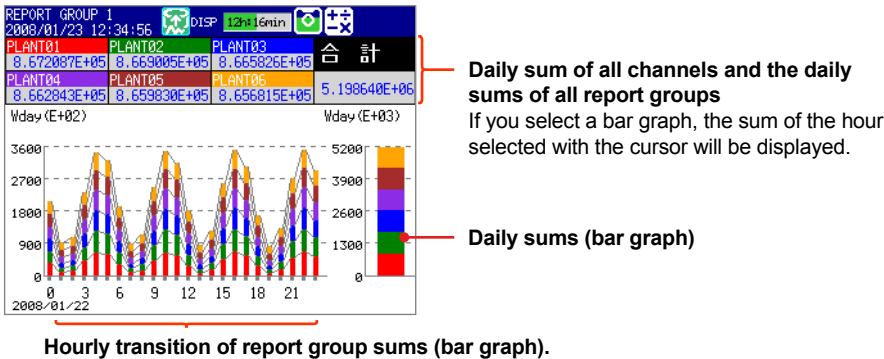
Stacked Bar Graph (/M1 and /PM1 options)

You can display the report data of each report group in a stacked bar graph.
► For operating instructions, see section 5.6.
► For information on report groups, see section 10.5.

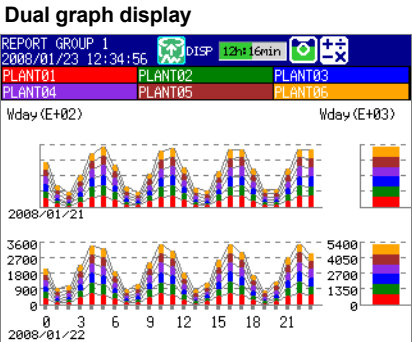
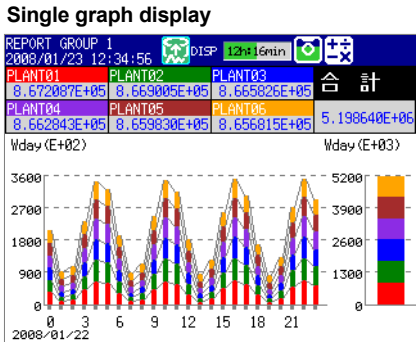
- **Displayed Data Type**
The type of data that is displayed is determined by the report type (Report kind), which is set using the report function.

Report kind	Displayed Data
Hourly, or hourly + daily	Sums for each hour and sums for the day
Daily + weekly	Sums for each day and sums for the week
Daily, or daily + monthly	Sums for each day and sums for the month

Example: Hourly + daily display



- **Display Modes**
You can switch the bar graph between single graph and dual graph display.



Status Display

These are the available status displays.

► For operating instructions, see section 5.5.

- **Relay Status Display**
Displays the status of the alarm output relay and the internal switch.
- **Modbus Client Status Display and Modbus Master Status Display**
Display the command status.

Log Display

Displays all logs (operation histories).

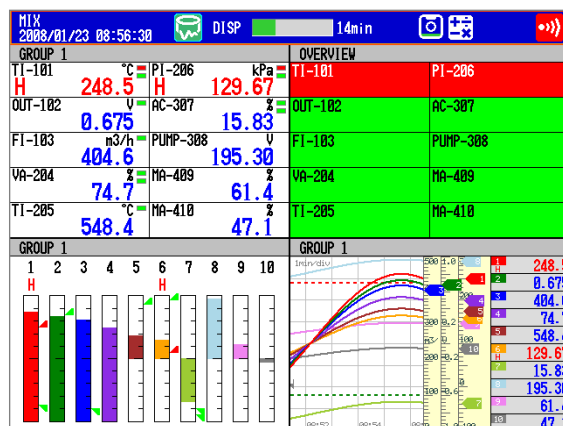
► For operating instructions, see section 5.10.

Log Type	Description
Login	Login and logout history, time setting history, power failure history
Error	Error message history
Communication	Communication command history
FTP	FTP transfer history
WEB	Web operation history
E-mail	E-mail transfer history
SNTP	SNTP server access history
DHCP	DHCP server access history
MODBUS	Modbus master and client transfer history

4-Panel Display (only with the MV2000)

You can view four different displays on one screen. The displays are all 1/4 of their ordinary size, so they have content, format, and command limitations.

► For operating instructions, see section 5.11.



Displayable Screens	Limitations
Trend	No automatic group switching. Cannot display all channels. No message display. Number of displayable scales is six or less.
Digital	No automatic group switching.
Bar graph display	No automatic group switching. No numeric value display. Displays one representative alarm letter.
Overview	No operations. No numeric display for more than 260 channels.
Alarm summary	Cannot use the cursor.
Message summary	
Memory summary	
Modbus client status display	
Modbus master status display	
Relay status display	-
Report display	Cannot use the cursor.
Stacked bar graph display	Sums of each channel (numeric value display), report group sums (numeric value display)

• Registering Display Configurations

You can name and register up to four 4-panel display configurations. You can access the registered configurations by their names.

The default configurations are as follows:

Configuration Name	Displays
MIX	Trend (group 1), digital (group 1), bar graph (group 1), overview
ALL TREND	All trend displays (groups 1 through 4)
ALL DIGITAL	All digital displays (groups 1 through 4)
ALL BAR	All bar graph displays (groups 1 through 4)

Other Useful Functions

- Automatic Return to a Specified Display**
 If there is no user activity within a set time period, the MV will automatically switch back to a specified display.
 ► For configuration instructions, see section 6.14.
- Favorite Display Key**
 You can access often-used displays easily by registering them to the HISTORY key. This function is available if you set the HISTORY key operation to Favorite.
 ► For configuration instructions, see section 6.15.
- Menu Customization**
 You can change the contents of the function menu, which is displayed when you press the FUNC key, and the display selection menu, which is displayed when you press the DISP/ENTER key.
 ► For configuration instructions, see section 6.17.
- Display Pause**
 You can pause the display at any time. Sampling continues while the display is paused.

LCD Display Condition Settings

You can set the LCD Display conditions.

Display Attribute	Settings
Operation screen background color	You can set the screen's background color to either black or white. The default value is white. ► For configuration instructions, see section 6.13.
Historical trend screen background color	You can select white, cream, black, or light gray as the background color. The default value is black. ► For configuration instructions, see section 6.13.
LCD brightness	You can set the LCD brightness. MV1000: Eight levels MV2000: Six levels The default brightness level is 2. ► For configuration instructions, see section 9.8.
Backlight saver	If there is no user activity within a set time period, you can tell the MV to automatically turn OFF or dim the LCD backlight. This helps to extend the backlight's life. The occurrence of an alarm or the pressing of a key will return the screen to its ordinary brightness. You can also activate the backlight saver using the FUNC key. The backlight saver is disabled by default. ► For configuration instructions, see section 9.8.

1.5 Data Storage Functions

This section explains the types of data that the MV can record and how to store them.

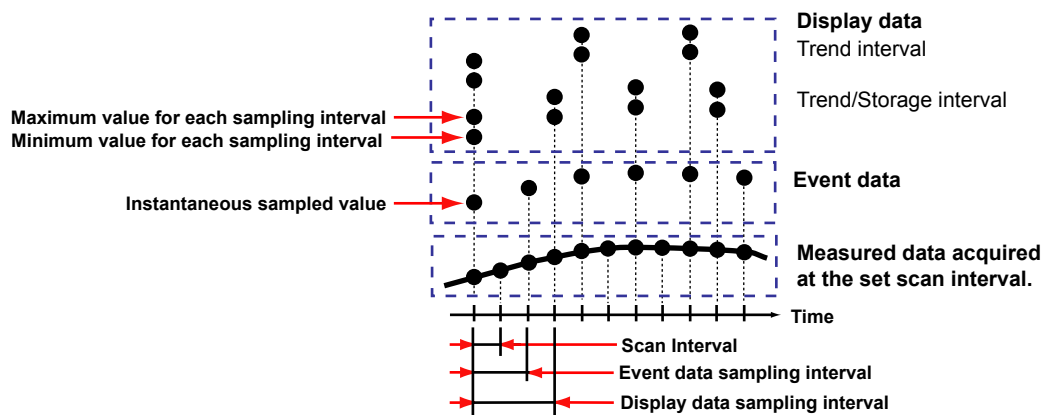
Data Types

The MV can record the following types of data.

Data Type	Description
Display data	<ul style="list-style-type: none">This is the waveform data that appears on the trend display. Measured data is recorded at the set sampling intervals. Sampling intervals are determined by the Trend/Storage interval.The maximum and minimum values measured within each sampling interval are stored.You can write a header character string into the file (shared with other files).Contains alarm and message information.Data formats: Text and binary (undisclosed).
Event data	<ul style="list-style-type: none">Measured data acquired at each set sampling interval. There are two modes: one in which recording starts when a trigger event occurs, and another in which recording takes place continuously.You can write a header character string into the file (shared with other files).Contains alarm and message information.Data formats: Text and binary (undisclosed).
Manually sampled data	<ul style="list-style-type: none">The instantaneous measured data values when a manual sample operation is performed.You can write a header character string into the file (shared with other files).Data format: Text
Report Data (/M1 and /PM1 options)	<ul style="list-style-type: none">This is hourly, daily, weekly, and monthly data. Report data is recorded at specific intervals (once a day, once a week, and so on).You can write a header character string into the file (shared with other files).Data format: Text
Snapshot data (screen image data)	<ul style="list-style-type: none">The image data from the MV display screen when a snapshot operation is performed.Can be saved to a CF card.Data format: PNG (Portable Network Graphics)
Setup data	<ul style="list-style-type: none">The MV setup data.Data format: Binary (undisclosed)

- Display Data and Event Data**

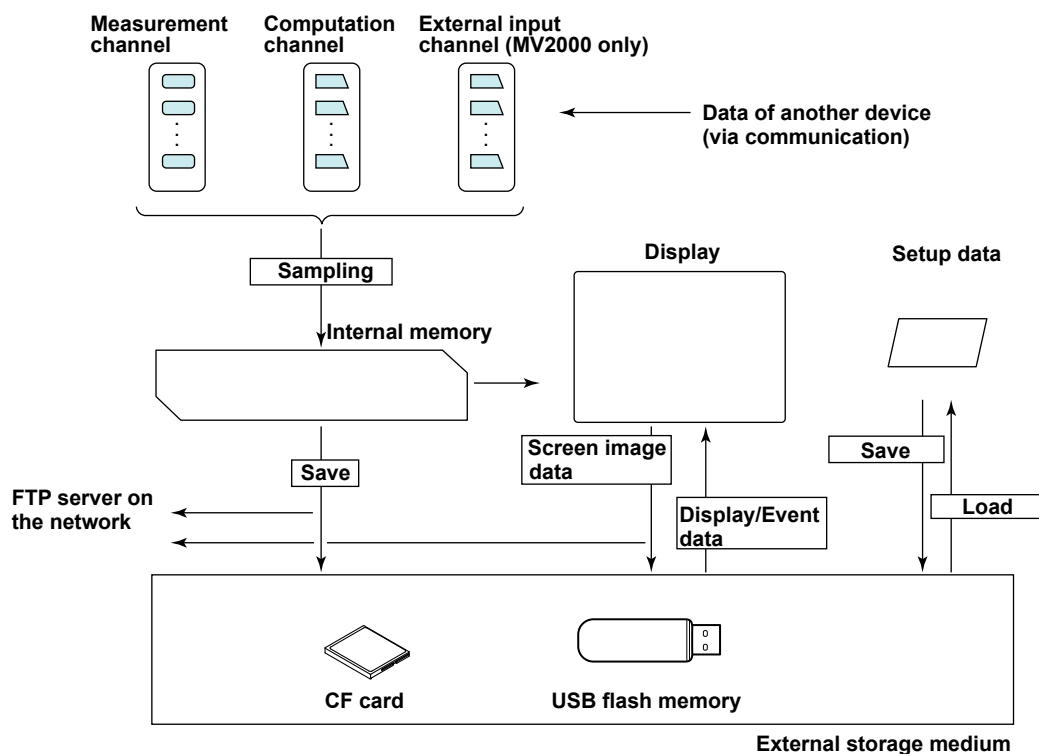
Display data is similar to the conventional chart-sheet recording of the past and is useful for long-term recording. Event data is useful for when you want to record measured data in detail.



For the trend interval, only change the time axis display in the trend display.

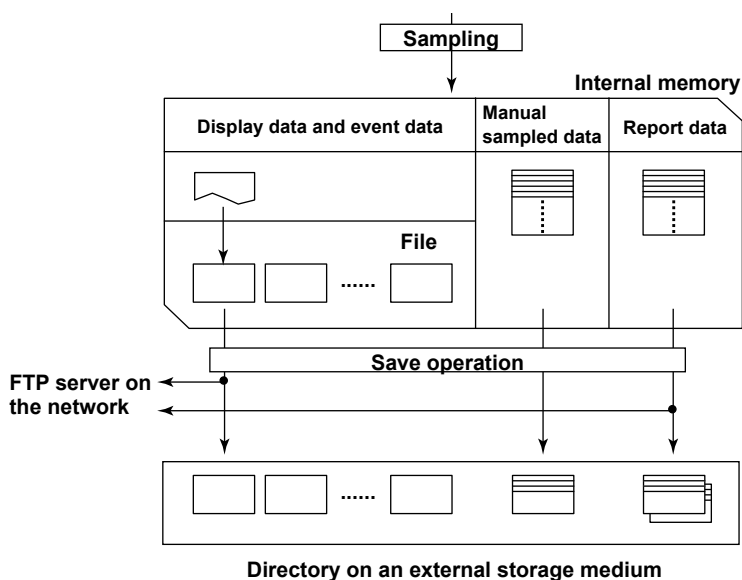
Data Recording and Storage Flowchart

Measured data is recorded to internal memory and then saved to external memory.



Internal Memory

Display data and event data are saved as files in internal memory. They are also saved as files to an external storage medium.



Display and Event Data Recording Methods

► For configuration instructions, see section 4.1. For operating instructions, see section 4.4.

Types of Recorded Data

You can choose to record display data only, event and display data, or event data only.

Choosing What Type of Data to Record

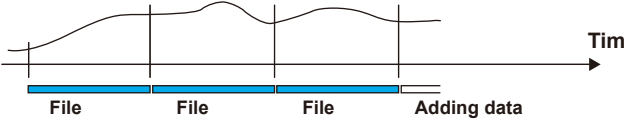
Record the type of data that meets your needs. Use the following examples for reference.

- Example 1 To record continuous waveform data only, just like conventional chart recorders:
Record display data.
- Example 2 To record waveform data continuously and record more detailed data before and after an alarm event:
Record display data continuously and use an alarm to trigger the recording of event data.
- Example 3 To continuously record data that is as detailed as possible:
Set the sampling interval and record event data.
- Example 4 If there is no need to record data continuously but you want to record data when an alarm occurs:
Use an alarm to trigger the recording of event data.

Internal Memory

Measured data is partitioned and saved to files at set intervals. If the internal memory is full or if the number of display data files and event data files exceeds 400, files are overwritten from the oldest file.

Display Data Recording Conditions

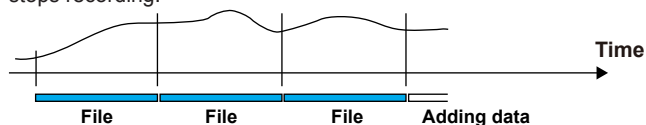
Item	Description
Channel type	You can set the channel type to measurement, computation, or (only with the MV2000) external input.
Sampling interval	Determined by setting the Trend/Storage interval. Choices are available in the range of 5 s to 10 h. You cannot choose an interval that is faster than the scan interval.
File generation	Files are generated at the set file save interval. <div></div> <div>Files are also generated in these cases:</div> <ul style="list-style-type: none">• When you generate a file manually.• When there is a memory stop.• When a file is generated using the event action function.• After recovering from a power failure.
Memory start/stop	Pressing START/STOP starts recording (memory start). Pressing START/STOP again stops recording (memory stop).

• Event Data Recording Conditions

Item	Description
Channel type	Same as with display data.
Sampling interval	Choices are available in the range of 25 ms to 600 s. However, you cannot choose an interval that is faster than the scan interval.
File generation	A file is generated when the set data length is reached. Files are also generated in these cases: <ul style="list-style-type: none"> • When you generate a file manually. • When there is a memory stop. • When a file is generated using the event action function. • After recovering from a power failure.
Modes	Recording varies depending on the mode. The following modes are available:

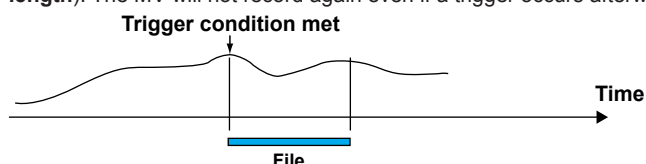
Free

Pressing START/STOP starts recording. Pressing START/STOP again stops recording.



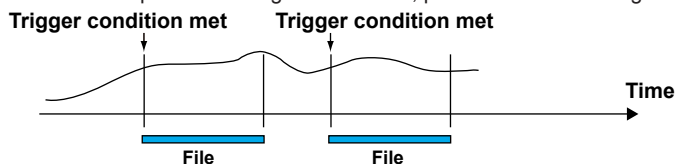
Single

Pressing START/STOP puts the MV into a trigger-wait state. After a trigger event occurs, the MV will record data for the set time (**Data length**). The MV will not record again even if a trigger occurs afterwards.



Repeat

Pressing START/STOP puts the MV into a trigger-wait state. After a trigger event occurs, the MV will record data for the set time (**Data length**). After that, the MV will return to a trigger-wait state and will record data for the set time (**Data length**) whenever a trigger event occurs. To stop the recording of event data, press START/STOP again.

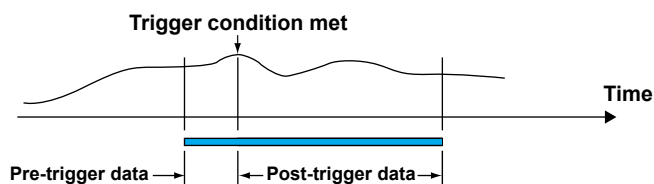


Event Data Pre-trigger

The event data pre-trigger can be configured for use with triggers.

It is a function that records the data before a trigger event as event data. It is useful for when you want to record the data before the occurrence of an alarm or other event.

The pre-trigger is set as a percentage of the event data recording time (data length). You can set it to 0, 5, 25, 50, 75, 95, or 100%. If you set the pre-trigger to 0%, the MV will only record the data after the trigger event.



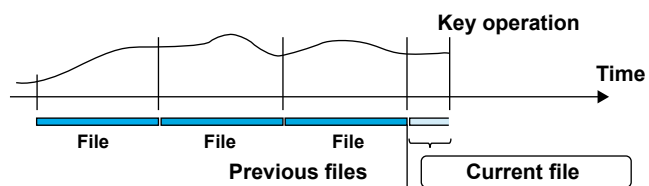
Event Data Recording Start Triggers

You can configure a variety of conditions as triggers for starting event data recording.

Example: Key operations, alarm occurrence, time, remote control

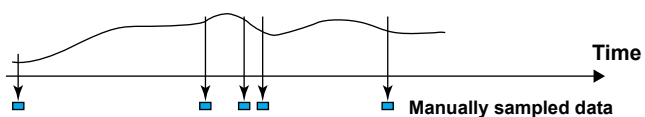
- **Key Initiated File Generation**

You can use key operations to tell the MV to generate a file.



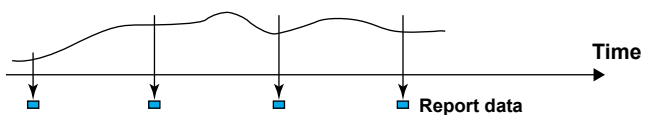
Manually Sampled Data

Manually sampled data is stored to internal memory. When the number of manually sampled data files exceeds 400, the oldest data files are overwritten.



Report Data

Report data is stored to internal memory. When the number of report data files exceeds 100, the oldest data files are overwritten.



Saving to External Storage Media

► For configuration instructions, see section 4.2. For operating instructions, see section 4.4.

Types of external storage media

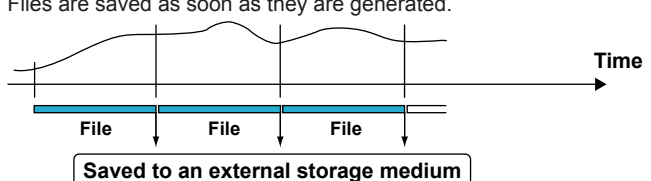
- CF card (32 MB or more)
- USB flash memory

Auto Save

The data in the internal memory is automatically saved to a CF card as long as the card is left in the drive.

Auto Save Timing

Data Type	Description
Display data	Files are saved as soon as they are generated.



Event data	Same as display data.
Manually sampled data	A manually sampled data file is generated on the CF card when manual sampling first occurs. Data is added to that file whenever manual sampling occurs. A file is created every 100 data values. ► For operating instructions, see section 4.4.

Report data	Report data is stored in a report data file that is generated on the CF card when report data is first produced. Report data is added to this file at the report filing time.
-------------	---

Report File Division

At the set time, the MV stops recording to the current file and begins recording to a new file. Files can be divided in the following ways.

Report Type	Report File	File for Each Type
Hourly	<input type="checkbox"/> One day's hourly report data	
Daily	<input type="checkbox"/> One month's daily report data	
Hourly and daily	<input type="checkbox"/> One day's hourly and daily report data	<input type="checkbox"/> A file for each daily report <input type="checkbox"/> One day's hourly report data
Daily and weekly	<input type="checkbox"/> One week's daily and weekly report data	<input type="checkbox"/> A file for each weekly report <input type="checkbox"/> One week's daily report data
Daily and monthly	<input type="checkbox"/> One month's daily and monthly report data	<input type="checkbox"/> A file for each monthly report <input type="checkbox"/> One month's daily report data

Save Destination

CF card

Directory That Data is Saved To

You can specify the name of the directory that data will be saved to (the default directory is "DATA0"). The MV will create the directory on the CF card and save data to it.

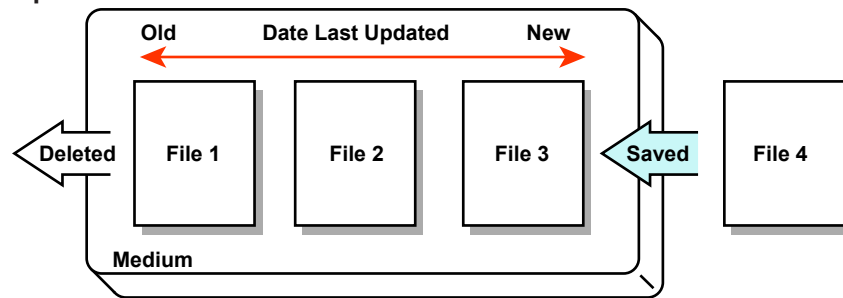
Save Operation (when not using media FIFO)

If there is not enough free space on the CF card, internal memory data cannot be saved. Before the internal memory data is overwritten, change CF cards and save the data.

Save Operation (always retain most recent data file/media FIFO)

When the MV saves data files automatically, it can save files so that the newest data files are always retained. With this method, the MV can be used continuously, and the CF card does not need to be changed.

- **Operation**

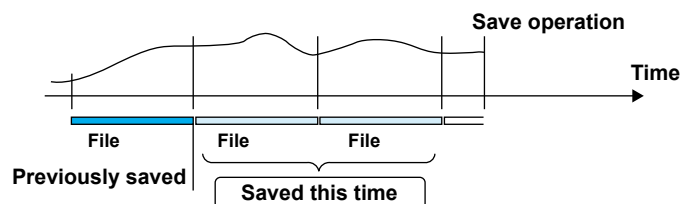


When saving data to the CF card, if there is not enough space to save a new file, the oldest files are deleted and then a new file is saved. This operation is referred to as FIFO (First In First Out).

- FIFO is only used when the following files are saved automatically. When files are saved using other methods, FIFO is not used.
Display data files, event data files, report data files, manually sampled data files, and screen snapshot data files.
- Files subject to deletion
All files in the destination directory, except for the ones listed below, are subject to deletion.
Files not subject to deletion: Hidden files, read-only files, and files contained within subdirectories in the destination directory.
- The most recent 1000 files are retained. If there are more than 1000 files in the destination directory, even if there is enough free memory, older files will be deleted so that the file number remains at or below 1000.
- When there are already more than 1000 files in the destination directory, one or more files are deleted before the new file is saved. In this case, the number of files is not kept at or below 1000.

- **Manual Save (collectively storing unsaved data)**

Unsaved data in the internal memory is saved to an external storage medium connected to the MV when a certain operation is carried out.



When using manual save, it is important that you save the data in the internal memory to the external storage medium before the data is overwritten. Be aware of the condition of the internal memory, and save data to the external storage medium at the appropriate times.

Save Destination

You can select a CF card or USB flash memory.

Directory That Data Is Saved To

You can specify the name of the directory that data will be saved to (the default directory is "DATA0").

- **File Names**

The MV can name measured data files automatically saved to the CF card in one of the following three ways.

Type	Description	
Date	Display data Event data Manual sampled data Snapshot data	<div>7-digit</div> <div>Specified string</div> <div>Date</div> <div>Extension</div> Ex.: 000123_AAAAAAAAAAAAA050928_174633.DAD
	Report data	<div>7-digit</div> <div>Specified string</div> <div>Date</div> <div>Type</div> <div>Extension</div> Ex.: 000123_AAAAAAAAAAAAA050928_174633HD.DAR
Sequence	Display data Event data Manual sampled data Snapshot data	<div>7-digit</div> <div>Specified string</div> <div>Extension</div> Ex.: 000123_AAAAAAAAAAAAA.DAD
	Report data	<div>7-digit</div> <div>Specified string</div> <div>Type</div> <div>Extension</div> Ex.: 000123_AAAAAAAAAAAAAHD.DAR
Batch name	Display data Event data	<div>7-digit</div> <div>Batch name</div> <div>Extension</div> Ex.: 000123_BBBBBBBBBBBBBBBBBBBBBB.DAD
	Report data	<div>7-digit</div> <div>Date</div> <div>Type</div> <div>Extension</div> Ex.: 000123_050928_174633HD.DAR
	Manual sampled data Snapshot data	<div>7-digit</div> <div>Date</div> <div>Extension</div> Ex.: 000123_050928_174633.DAM

Item	Description	
7-digit	Consists of a 6-digit number and 1-character delimiter.	
	6-digit number 1-character delimiter	A sequence number in the order of occurrence. The number ranges from 000001 to 999999. If the number reaches 999999, it returns to 000000. Starts with ‘_’ and takes on the following values: A to Z and 0 to 9. If a file with the same name exists in the specified directory, the file is saved by changing the delimiter to prevent overwriting. Example: If a file named “000123_AAAAAAAAAAAAA.DAD” already exists, the file is saved to the name “000123AAAAAAAAAAAAA.DAD.”
Date	YYMMDD_hhmmss	YY: Year (lower two digits), MM: Month, DD: Day hh: Hour, mm: Minute, ss: Second
Specified string	AAAAAAAAA...A	Up to 16 alphanumeric characters can be used
Batch name	BBBBBBBBBBB...B	Up to 40 alphanumeric characters can be used
Type	H_, D_, W_, M_, HD, DW, DM	Report data type H_: Hourly, D_: Daily, W_: Weekly, M_: Monthly, HD: Hourly and daily, DW: Daily and weekly, DM: Daily and monthly
Extension	Display data: DAD, TDD Event data: DAE, TDE Manual sampled data: DAM	Report data: DAR Snapshot data: PNG Setup data: PDL

- **Saving Data with Key Operations (DATA SAVE MODE)**

The following data save operations can be performed whether in auto save or manual save mode.

► For operating instructions, see section 5.9.

Data Save Type	Description
SELECT SAVE	Saves the selected display data or event data file.
ALL SAVE	Saves all data in the internal memory.
M.SAMPLE SAVE	Saves all manually sampled data in the internal memory.
REPORT SAVE	Saves all report data in the internal memory.

You can switch to DATA SAVE MODE immediately after connecting USB flash memory.

► For operating instructions, see section 4.10.

Save Destination

You can select a CF card or USB flash memory.

Directory That Data Is Saved To

A directory is made with the same name as the destination directory plus the date and time added on at the end. Then, data is saved to that directory.

Directory name: [Specified directory name]_YYMMDD_HHMMSS

Example: If a file is saved on January 30, 2008 at 17:06:42, the file will be saved to a directory with the name DATA0_080130_170642. (If DATA0 is the ordinary destination directory name).

Note

The number of directories that can be created on an external storage medium depends on the length of the directory names. When the specified directory name is five characters long, about 170 directories can be created. When it is 20 characters long, about 120 directories can be created. An error will occur if the limit is exceeded.

Other Types of Saveable Data

- **Setup Data**

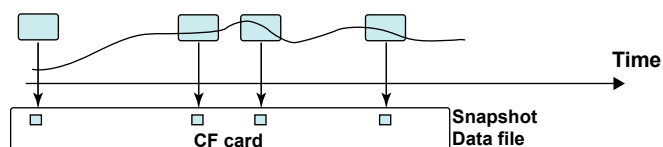
You can save the MV setup data to a CF card or to USB flash memory. The setup data is saved to the root directory.

Setup data file name	Specified . PDL Example: ABCD10005.PDL
----------------------	---

► For operating instructions, see section 4.9.

- **Snapshotdata**

The MV display is saved to the CF card as a PNG file. It is saved in the same directory as display and event data. For information about file naming, see the previous page.



► For operating instructions, see section 4.6.

Saving Data via an Ethernet Network

Using the FTP client function, display data, event data, report data (/M1 or /PM1 option), and screen image data (snapshot data) can be automatically transferred and saved to an FTP server via an Ethernet network. Display data and event data are sent as files in the same format (binary or text, see section 4.2 for the setting) as the "File format." The MV can also function as an FTP server. You can access the MV from a personal computer and retrieve and store data files from both internal and external memory.

► See the *Communication Interface User's Manual IM MV1000-17E*.

1.6 Batch Function

You can add the batch information listed below to display data and event data files. You can use batch information to manage display and event data files.

► For configuration and operation instructions, see section 4.3.

Batch Information

- **Batch Number and Lot Number**

Display data and event data files can be recognized by their batch and lot numbers (hereinafter referred to as batch name). The lot number does not have to be specified.

- Batch number (up to 32 characters)
- Lot number (up to eight digits)

- **Automatic Lot Number Incrementation**

The lot number can be automatically incremented when memory sampling is stopped.

- **Text Field**

You can enter eight text fields into a file. Each text field consists of the following:

- Field title (up to 20 characters)
- Field string (up to 30 characters)

Text fields can be shown on the MV screen with key operations.

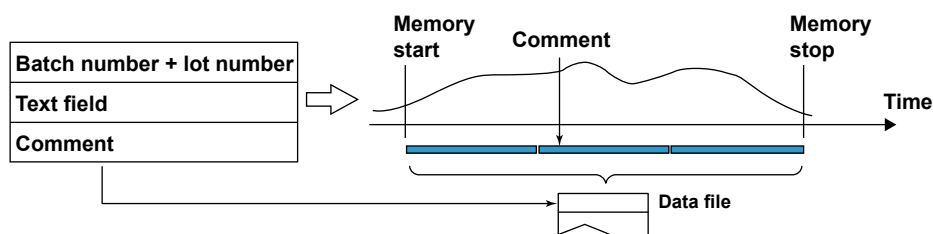
- **Batch Comment**

You can enter three comments into a file. Each comment can be entered once while memory sampling is in progress.

- Comment 1, Comment 2, and Comment 3 (up to 50 characters each)

Using the Batch Function

See the figure below. You could enter the operator and administrator in the text field.



1.7 Event Action Function

The event action function performs a specified action when a specified event occurs. The remote control function (/R1 option) is configured using the event action function.

► For configuration instructions, see section 7.1.

Event

- **List of Events**

You can choose from the following events:

Event	Level/edge*	Description
Remote	Level/edge	Remote control input ON or OFF.
Relay	Level/edge	Alarm output relay activation or deactivation.
Switch	Level/edge	The internal switch value (0 or 1).
Timer	Edge	Timer timeout
MatchTimeTimer	Edge	When a specified time is reached.
Alarm	Level/edge	An alarm is occurring/no alarms are occurring
UserKey	Edge	When the USER key is pressed.

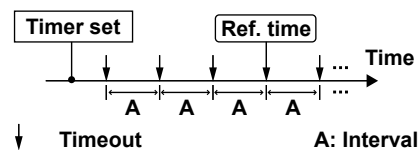
* For a description of level and edge, see "Miscellaneous" in this section.

- **Timers**

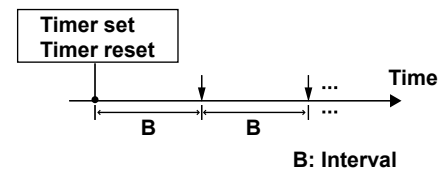
There are four kinds of timers. They are also used with the TLOG computation function (/M1 and /PM1 options).

Types of Timers

Absolute timer



Relative timer



- **Absolute Time Mode**

The timer expires at the times determined by the reference time and the interval. The reference time can be set to the hour (00 to 23).

Example: Reference time: 00:00

Interval: 10 min

The timer expires at 00:00, 00:10, 00:20, ... 23:40, and 23:50. For example, if the timer is set at 09:36, the timer expires at 09:40, 09:50, 10:00, and so on.

- **Relative Time Mode**

Timing begins when the timer is set, and the timer expires and then begins timing again at each interval. With this mode, the timer will stop when there is a power failure and will not resume afterwards.

Example: Interval: 00:15

The timer expires every 15 minutes.

- **Match Time Timer**

You can set four match time timers. Specify the date/time using the method described below. For each timer, you can select whether to use the timer once or continuously. The timers are also used with the TLOG computation function (/M1 and /PM1 options).

Specified Date/Time	Description
Month, day, hour	Occurs once a year.
Day and hour	Occurs once a month.
Day of the week and hour	Occurs once a week.
Hour	Occurs once a day.

Actions

- **List of Actions**

You can choose from the following actions.

Action	Level/Edge*	Description
MemoryStart/Stop	Level	Starts or stop memory sampling.
MemoryStart	Edge	Starts memory sampling.
MemoryStop	Edge	Stops memory sampling.
Trigger	Edge	Triggers the recording of event data. Valid when recording event data in a triggered mode. See the next page for more details.
AlarmACK	Edge	Stops alarm output. Valid when the MV is configured to use the alarm output release (AlarmACK) operation.
MathStart/Stop**	Level	Starts or stops computation.
MathStart**	Edge	Starts computation.
MathStop**	Edge	Stops computation.
MathReset**	Edge	Resets the values on all computation channels.
SaveDisplay	Edge	Saves the display data currently being recorded to internal memory. This is the same as saving data by pressing FUNC.
SaveEvent	Edge	Saves the event data currently being recorded to internal memory. This is the same as saving data by pressing FUNC.
Message	Edge	Writes a message. Can be executed during memory sampling.
Snapshot	Edge	Saves an image of the screen.
DisplayRate1/2	Level	Switches between the first and second trend intervals. Valid when the MV is set to be able to switch between trend intervals.
ManualSample	Edge	Executes manual sampling.
TimerReset	Edge	Resets the relative timer. Timing begins again from the point where the timer is reset. See the next page for more details.
DisplayGroupChange	Edge	Changes the display group in the trend, digital, or bar graph display.
Flag**	Level	When the event is a level operation, the flag is zero for normal conditions and 1 when an event occurs. When the event is an edge operation, the value alternates between 0 and 1 whenever an event occurs. The flag can be written in a calculation expression of a computation channel.
PanelLoad	Edge	Reads the setup data file in the root directory of the CF card and uses it to configure the MV. See the next page for more details.
TimeAdjust	Edge	Sets the time to the closest hour. See the next page for more details.

* For a description of level and edge, see "Miscellaneous" in this section.

**This is an option.

About TimerReset

If Event is set to Relay, Switch, MatchTimeTimer, or Alarm, TimerReset will not result in a timeout (an action will not be executed even if the timer is used as an event).

If Event is set to Remote or UserKey, a timeout will occur (if the timer is used as an event, an action will be executed).

About PanelLoad

PanelLoad can only be specified as an action when Event is set to Remote.

PanelLoad loads a setup data file, LOAD1.PDL, LOAD2.PDL, or LOAD3.PDL, in the root directory of the CF card onto the MV, and uses it to configure the MV. Only settings that pertain to Setting Mode are updated.

You must create a setup file and save it to the CF card in advance.

Event Trigger Operation

When Event is set to Relay, Switch, or Alarm:

The Trigger action will always occur when an output relay is activated, when an internal switch is set to 1, or when an alarm occurs. However, the number of times the trigger is activated depends on the event data mode (Single or Repeat).

About TimeAdjust

TimeAdjust can only be specified as an action when Event is set to Remote.

TimeAdjust sets the MV internal clock to the closest hour.

• Operation When the MV is Not Memory Sampling

Difference from the Nearest Hour	Operation
0 s to 1 min 59 s	Truncates the minutes and seconds. Example: 10 hours 01 min 50 s becomes 10 hours 00 min 00 s.
2 min to 57 min 59 s	The time is not changed.
58 min to 59 min 59 s	Rounds up the minutes and seconds. Example: 10 hours 59 min 50 s becomes 11 hours 00 min 00 s.

• Operation When the MV is Memory Sampling (See section 1.11 for details.)

If the time difference between the time when the remote control signal is applied and the nearest hour is within the preset time, the time is gradually corrected.

Otherwise, the time is corrected immediately.

Miscellaneous

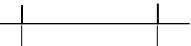

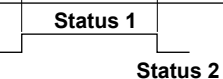
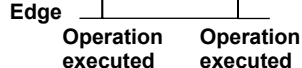
• Limitations on Event and Action Combinations

The checked combinations are valid.

Action \ Event	Remote	Relay	Switch	Timer	MatchTime Timer	Alarm	UserKey
AlarmACK	✓			✓	✓		✓
TimerReset	✓	✓	✓		✓	✓	✓
PanelLoad	✓						
TimeAdjust	✓						
Other actions	✓	✓	✓	✓	✓	✓	✓

• Level and Edge

The levels and edges of events affect the levels and edges of actions as shown below.

Type	Operation	
Event	Edge	
	Level	
Action	Level	
	Edge	

Level and Edge of the Remote Control Input Signal



For contact inputs, the remote signal rises when the contact switches from open to closed and falls when the contact switches from closed to open. For open collector signals, the remote signal rises when the collector signal (voltage level of the remote terminal) goes from high to low and falls when the collector signal goes from low to high.

1.8 Security Functions

Key Lock

The Keylock function prohibits key operations. You must enter a password to release the key lock.

► For configuration instructions, see section 8.1.

Key Lock Item	Description
Keys	The following keys can be locked independently. START/STOP, MENU, USER, DISP/ENTER (prohibits switching operation screens), HISTORY, and T/DIV.
Access to memory devices	Prohibits all operations listed below. <ul style="list-style-type: none">• The manual saving of data• The loading of display and event data files• The loading of setup data files• The listing of files stored to memory• The deletion of files stored to memory• The formatting of memory devices
PanelLoad	Only prohibits the loading of a setup file from a media device.
Action of Function	The following FUNC key operations can be locked independently. <ul style="list-style-type: none">• AlarmACK• Message, Free message, Batch, Add message, Add free message, and Text field• Math start, Math stop, Math reset, and Math ACK• Save display, Save event, Manual sample, Trigger, Snap shot, Timer reset, and Save stop• E-Mail start, E-Mail stop, E-mail test, FTP test, and operations to request or release network information• SNTP and Time settings (Setting Mode operations)• Favorite regist, 4Panel, Standard display, Second speed, Normal speed, Pause Display, LCD Saver

Login Function

With the login function, only registered users can operate the MV. Access from communication functions can also be limited to users registered here.

- For configuration instructions, see section 8.2. For operating instructions, see section 8.3.

• Login and Logout

You enter your user name and password to log into the MV in the following cases.

MV Access Method	When the Method is Required
Keys	<ul style="list-style-type: none"> • When the power is turned ON • When logging in after exiting Basic Setting Mode • When logging in after logging out
Communication	When accessing the setting/measurement server, FTP server, maintenance/test server, or Web server.

Auto Logout (when logged in using keys)

After logging in by using keys, you are automatically logged out when there is no key operation for a specified time. If you are automatically logged out from Setting Mode, the setting changes are cancelled. Automatic logout does not occur while in Basic Setting Mode.

Operations Available while Logged Out

When logged out, you can switch operation screens by using DISP/ENTER, and HISTORY.

• User Levels

There are two user levels: "Admin," and "User."

Administrator

Administrators can perform all operations on the MV. At least one administrator must be registered to use the login function.

Item	Description
Number of users that can be registered	5
Limitations	No limitations.
Login method	Select key operation, via communication, or Web server login.
ID information	User name and password

User

0001

Item	Item														
Number of users that can be registered	30														
Limitations	Key operations														
	<table><tr><th colspan="2">Operation</th><th>Limitations</th></tr><tr><td colspan="2">Basic Setting Mode</td><td>Not allowed</td></tr><tr><td rowspan="2">Setting Mode</td><td>Menu customize</td><td>Not allowed</td></tr><tr><td>Other operations</td><td>Specified with user privileges</td></tr><tr><td>Operation mode</td><td>Key operation</td><td>Specified with user privileges</td></tr></table>	Operation		Limitations	Basic Setting Mode		Not allowed	Setting Mode	Menu customize	Not allowed	Other operations	Specified with user privileges	Operation mode	Key operation	Specified with user privileges
	Operation		Limitations												
	Basic Setting Mode		Not allowed												
	Setting Mode	Menu customize	Not allowed												
		Other operations	Specified with user privileges												
	Operation mode	Key operation	Specified with user privileges												
<ul style="list-style-type: none">• User privileges You can set operation privileges for each user. The available settings are the same as those available for the key lock function.															
Operations via communication See the <i>Communications Interface User's Manual</i> .															
Login method	Select key operation, via communication, or Web server login.														
ID information	User name and password														

1.9 Computation and Report Functions (/M1 and /PM1 options)

Computation Functions

Expressions can be defined in special computation channels by using measured data or computed data as variables. The computation channel data can be displayed or saved.

► For configuration instructions, see section 10.1.

• Dedicated Computation Channels

Model	Number of Channels	Channel Numbers
MV1004, MV1008, MV2008	12	101 to 112
MV1006, MV1012, MV1024	24	101 to 124
MV2010, MV2020, MV2030, MV2040, MV2048	60	101 to 160

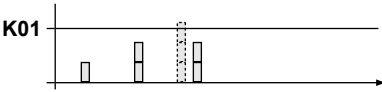
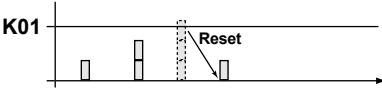
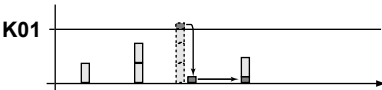
• Operations

In the table below, [001] represents the measured value of channel 001.

Type	Example	Description of the Example
Basic arithmetic	001+002	Determines the sum of [001] and [002].
	001-002	Determines the difference between [001] and [002].
	001*002	Determines the product of [001] and [002].
	001/002	Divides [001] by [002].
Power	001**002	Determines [001] to the power of [002]. $y=X^n$
Square root	SQR(001)	Determines the square root of [001].
Absolute value	ABS(001)	Determines the absolute value of [001].
Common logarithm	LOG(001)	Determines the common logarithm of [001]. $y=\log_{10}x$
Natural logarithm	LN(001)	Determines the natural logarithm of [001]. $y=\ln x$
Exponent	EXP(001)	Determines e to the power of [001]. $y=e^x$
Relational computation	001.LT.002	The result is 1 when [001] is less than [002] and 0 otherwise.
	001.LE.002	The result is 1 when [001] is less than or equal to [002] and 0 otherwise.
	001.GT.002	The result is 1 when [001] is greater than [002] and 0 otherwise.
	001.GE.002	The result is 1 when [001] is greater than or equal to [002] and 0 otherwise.
	001.EQ.002	The result is 1 when [001] is equal to [002] and 0 otherwise.
	001.NE.002	The result is 1 when [001] is not equal to [002] and 0 otherwise.
Logical computation	001AND002	The result is 1 when [001] and [002] are nonzero and 0 otherwise.
	001OR002	The result is 1 when [001] or [002] is nonzero and 0 when neither of them are.
	001XOR002	The result is 0 when [001] and [002] are both zero or both nonzero, and 1 otherwise.
	NOT001	The result is 1 when [001] is zero and 0 otherwise.
TLOG computation*	TLOG.SUM(001)	Determines the sum of [001].
	TLOG.MAX(001)	Determines the maximum value of [001].
	TLOG.MIN(001)	Determines the minimum value of [001].
	TLOG.AVE(001)	Determines the average value of [001].
	TLOG.P-P(001)	Determines the difference between the maximum value and minimum value of [001].

* See page 1-43 for information on how to use this function.

1.9 Computation and Report Functions (/M1 and /PM1 options)

Type	Example	Description of the Example
CLOG computation	CLOG.SUM(001.002.003)	Determines the sum of [001], [002], and [003].
	CLOG.MAX(001.002.003)	Determines the maximum value among [001], [002], and [003].
	CLOG.MIN(001.002.003)	Determines the minimum value among [001], [002], and [003].
	CLOG.AVE(001.002.003)	Determines the average value of [001], [002], and [003].
	CLOG.P-P(001.002.003)	Determines the difference between the maximum value and the minimum values among [001], [002], and [003].
	CLOG.P-P(001.002.003)	Determines the difference between the maximum value and the minimum values among [001], [002], and [003].
Special computation:	PRE(001)	Determines the previous value of [001].
	101=HOLD(001.GT.K01):TLOG.SUM(001)	Under normal conditions, TLOG.SUM(001) is carried out to derive the computed value. When [001] exceeds K01, the previous computed value is held.
		
	Explanation HOLD(a):b	When a is zero, b is carried out to derive the computed value. Otherwise, the previous computed value is held.
	RESET(101.GT.K01):TLOG.SUM(001)	Under normal conditions, TLOG.SUM(001) is carried out to derive the computed value. When [101] exceeds K01, the previous computed value is reset, and TLOG.SUM(001) is carried out.
		
	Explanation RESET(a):b	When a is zero, b is carried out to derive the computed value. Otherwise, the previous computed value is reset, and b is carried out to derive the computed value.
	CARRY(K01):TLOG.SUM(001)	Under normal conditions, TLOG.SUM(001) is carried out to derive the computed value. When the computed value is greater than or equal to K01, the computed result is the excess (computed value - K01).
		
	Explanation CARRY(a):b	Only TLOG.SUM can be specified for b. If the computed value X of b is less than a, the computed result is X. If X is greater than or equal to a, the computed result is the excess (X - a).
Conditional equation	[001.GT.K01?001:001+002]	When [001] is greater than K01, the computed value is set to the value of [001]. Otherwise, the computed value is set to the value of [001] + [002].
	Explanation [a?b:c]	If the computed result of a is nonzero, b is carried out. Otherwise, c is carried out.

1.9 Computation and Report Functions (/M1 and /PM1 options)

- **Data That Can Be Used in Equations**

The data listed below can be used in equations.

Data	Notation	Description
Measurement channel data	001, etc.	Specify by channel number.
Computation channel data*	101, etc.	Specify by channel number.
External input channel data*	201, etc.	Specify by channel number.
Constants	K01 to K60	Set to numeric values.
Communication input data	C01 to C60	Data set through communications.
Status of remote control* input	D01 to D08**	The value is 1 when remote control input is ON and 0 when it is OFF.
Pulse input*	P01 to P08 Q01 to Q08**	Counts the number of pulses per scan interval. Counts the number of pulses per second.
Internal switch status	S01 to S30	1 or 0.
Alarm output relay* status	I01 to I36	The value is 1 when activated and 0 when deactivated.
Flag	F01 to F08	1 or 0. Set the flag using the event action function (for details, see section 1.7).

* This is an option.

** Values such as 01 are terminal numbers.

The table below shows the data that can be used with TLOG, CLOG, and PRE.
Checked data is usable.

Math Func.	Data	Meas. CH	Comp. CH	Ext. input CH	Constant	Comm. Input	Remote	Pulse	Internal Switch	Relay	Flag
TLOG		✓	✓	✓	✓	✓	✓	✓			
CLOG		✓	✓	✓							
PRE		✓	✓	✓	✓	✓	✓	✓			
Other Functions		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

For example, TLOG.SUM(S01), CLOG.AVE(001.002.K01), and PRE(S01) are not allowed.

- **Order of Operation**

Computation functions are performed every scan interval, starting with the smallest channel number.

Example: If you specify $102 = 101 + 103$, the value of the previous scan interval is used for the 103 value.

- **How Computation Functions Handle Units**

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

- **How Computed Data Is Displayed**

You can set a span for the computed data displayed on each computation channel. Computation channels can be displayed on all operation screens, just like measurement channels.

► For configuration instructions, see section 10.3.

- **Alarms**

You can set a maximum of four different alarms on each computation channel. The alarm types are high limit alarm (H), low limit alarm (L), delay high limit alarm (T), and delay low limit alarm (t).

- **How Computed Data Is Saved**

Just as with measured data, computation channel computed data can be saved as display data, event data, manually sampled data, and report data.

- **Computation Data Dropout**

A computation data dropout occurs if a mathematical operation is not completed within the scan interval.

- The computation icon in the status display section turns yellow.
- When a computation data dropout occurs, the computed data of the scan interval in which the dropout occurred is set to the same value as the data immediately before the dropout.
- If computation data dropout occurs frequently, reduce the load on the CPU by reducing the number of computation channels or by setting a longer scan interval.

► For operating instructions, see section 10.4.

1.9 Computation and Report Functions (/M1 and /PM1 options)

• How Numeric Values Are Displayed and Recorded

The range of displayable values for computed data, ignoring the decimal point, is –9999999 to 99999999. The decimal place is determined by the location of the decimal point on the computation channel's minimum span value. Regardless of maximum and minimum span value settings, all computed values within the aforementioned range of displayable values will be displayed. Non-numeric values are displayed in these circumstances.

Display/Recorded Value	Computed Data Status
+Over	<ul style="list-style-type: none"> +Display range-out: When the computed result exceeds 99999999 +Computation range-out: When the value exceeds approximately 3.4×10^{38} in the middle of computation. When a computation error* occurs (You can select +Over or –Over.)
–Over	<ul style="list-style-type: none"> –Display range-out: When the computed result is less than -9999999 –Computation range-out: When the value goes below approximately -3.4×10^{38} in the middle of computation. When a computation error* occurs (You can select +Over or –Over.)

* Computation errors occur when the following computations are carried out.

- $X/0$, $SQR(-X)$, or $LOG(-X)$
- When a channel number set to Skip or Off is used in an expression

• Rolling Average

The computation channel's computed value is the rolling average of the computed result of the expression specified for the channel. The number of samples and the sampling interval can be specified for each computation channel. The rolling average is applied over the time corresponding to: the number of data samples \times the sampling interval. The maximum sampling interval is 1 hour, and the maximum number of samples is 1500.

• Starting Computation Operations

You can configure the MV to start computation operations when you press START/STOP.

• TLOG Computation

TLOG computation determines the sum, maximum value, minimum value, average, or the difference between the maximum and minimum values of a specific channel for each interval determined by a timer.

Timer Assignment

Timers are assigned separately to each channel.

Units in Sum Operations

When using the sum operation (TLOG.SUM), set the unit (referred to as sum scale) of the values to be summed.

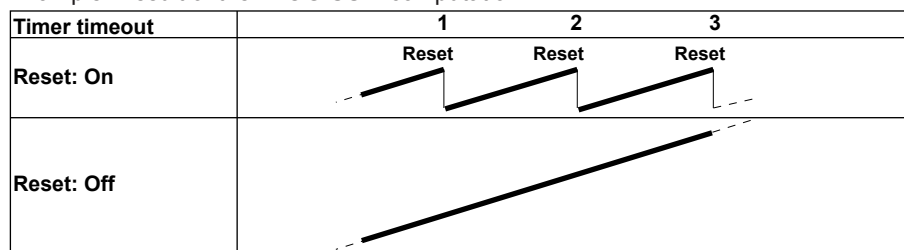
You can select from Off, /s, /min, and /h. For details, see the next page.

Resetting the TLOG Computed Value

You can select whether or not to reset the TLOG computed value at every interval.

The figure below illustrates the reset operation for sum computation (TLOG.SUM).

Example: Result of the TLOG.SUM computation



When reset is On, the sum is calculated over each interval. When reset is Off, the sum of all values since the beginning of computation is calculated.

Power Failure Operation, Handling of Abnormal Data, and Handling of Overflow Data

► See “Special Data Handling Cases and Exceptions” in this section.

Report Function

This function is used to create hourly, daily, weekly, and monthly reports.

► For configuration instructions, see section 10.5.

- **Report Data Types**

You can select four of the following types of report data: maximum value, minimum value, average value, sum value, and instantaneous value.

- **Report Types**

Type	Description
Hourly report	Produces report data for the previous one hour every hour on the hour.
Daily	Produces report data for the previous day every day at a specified time.
Weekly report	Produces report data for the previous week every week at a specified time on a specified day of the week.
Monthly report	Produces report data for the previous month at a specified day and time.

- **Combinations of Reports That Can Be Produced**

The MV can produce hourly reports, daily reports, hourly and daily reports, daily and weekly reports, and daily and monthly reports.

- **Source Channels**

You can select the source channels from measurement channels, computation channels, and external input channels. Report data is not produced for channels that are set to Skip or Off.

Model	Number of Report Channels
MV1004, MV1008, MV2008	12
MV1006, MV1012, MV1024	24
MV2010, MV2020, MV2030, MV2040, MV2048	60

- **Units in Sum Operations**

With sum operations, data is summed over the scan interval. However, for flow rate values and other values whose units are time based (/s, /min, /h, or /day), a simple summation results in the actual value not matching the computed result, because the scan interval and the time unit of the input value are different. In such cases, set the sum unit, (the **Sum scale** parameter in the MV interface), to match the unit of the input value so that a sum with the same unit as the input value is calculated.

For example, if the scan interval is 2 s, and the input value is 100 m³/min, a simple summation would add 100 every 2 s resulting in 3000 after one minute. However, if the sum unit is set to /min, then 2 s/60 s is multiplied every scan interval before the value is added giving a result that has the right time based (m³/min) unit.

The following conversion equations are used to compute the sum. The scan interval unit is seconds.

Off: $\Sigma(\text{the measured data at every scan interval})$

/s: $\Sigma(\text{the measured data at every scan interval}) \times \text{the scan interval}$

/min: $\Sigma(\text{the measured data at every scan interval}) \times \text{the scan interval}/60$

/h: $\Sigma(\text{the measured data at every scan interval}) \times \text{the scan interval}/3600$

/day: $\Sigma(\text{the measured data at every scan interval}) \times \text{the scan interval}/86400$

- **Displaying Report Data**

You can display report data by using key operations.

► For configuration instructions, see sections 5.5 and 5.6.

- **Saving Report Data**

► See section 1.5.

- **Report Data Values**

The range of displayable values for report data, ignoring the decimal point, is –9999999 to 99999999 (except -3.4×10^{38} to 3.4×10^{38} for sum values).

► For special cases and exceptions, see “Special Data Handling Cases and Exceptions” in this section.

► For details on the report file format, see appendix 3.

Special Data Handling Cases and Exceptions

This section explains special data handling cases and exceptions for TLOG computation, CLOG computation, and reports.

• Power Failure Data Handling (for TLOG and reports)

If a power failure occurs when the report function is enabled or in the middle of a TLOG operation, the report and TLOG operations resume when the MV recovers from the power failure. The operation executed after recovery varies depending on whether the MV recovers from the power failure before or after the report or TLOG data production time.

Time of Recovery	Operation
After the data production time	The report or TLOG data is produced immediately after the MV recovers. The measured data up to the time of the power failure is used. When the next report or TLOG is produced, the data after recovery from the power failure is used.
Before the data production time	After the MV recovers, the report or TLOG is produced at the data production time. The measured data is used with the data for the power failure period left out.

• Handling of Abnormal Data (TLOG, CLOG, and reports)

If an error occurs in channel or other data, the abnormal data is discarded, and the computation continues. If all of the data is abnormal, an error message is produced. The following result in abnormal data:

- When channels are set to Skip or Off.
- When an error value is returned as a measured result on a measurement channel (A/D converter failure, etc.).
- When a measurement channel is in a burnout condition
- When an error value is returned as the computed result on a computation channel.
- When an external input channel is Off or when data is not being received from it (in cases such as when communication is prohibited).

• How Overflow Data Is Handled

- * Overflow data refers to range-out values on measurement, computation, and external input channels.

For TLOG, CLOG, and reports

Channel overflow data is handled in the following ways:

Operation	Description
Average, Sum	You can choose from three methods of handling the data: ERROR, SKIP, and LIMIT. ERROR: Treats the data as a computation error. SKIP: Discards the overflow data and continues the computation. LIMIT: Replaces the data with the limit value and continues the computation. The limit value is the span upper or lower limit, or the scale upper or lower limit of the channel.
Maximum, minimum, maximum-minimum	You can choose one of two methods of handling the data: OVER, or SKIP. OVER: Performs the computation using the overflow data. SKIP: Discards the overflow data and continues the computation.

For Multiplication, and Relational Computations EQ and NE

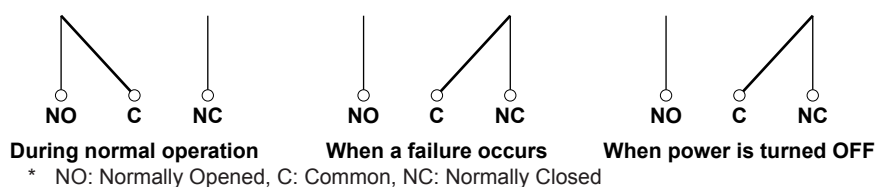
Operation Type	Calculated Values	Computed Result
Multiplication	0*(+Over)	0
	0*(-Over)	0
	(+Over)*0	0
	(-Over)*0	0
.EQ.	(+Over).EQ.(+Over)	0
	(-Over).EQ.(-Over)	0
.NE.	(+Over).NE.(+Over)	1
	(-Over).NE.(-Over)	1

1.10 FAIL/Status Output Function (/F1 Option)

FAIL Output

When a failure occurs in the MV CPU, the MV outputs a relay contact signal (1 signal). The relay is energized when the CPU is normal and de-energizes when a CPU failure occurs. Therefore, relay output is carried out when the power is turned OFF (or when there is a power failure). You cannot change this behavior.

Relay Operation



If a failure occurs, contact your nearest YOKOGAWA dealer for repairs.

Device Status Output

The following status notifications are output with a relay contact signal. You can choose whether or not to output each kind of status notification. The relay is energized when the status occurs. This cannot be changed.

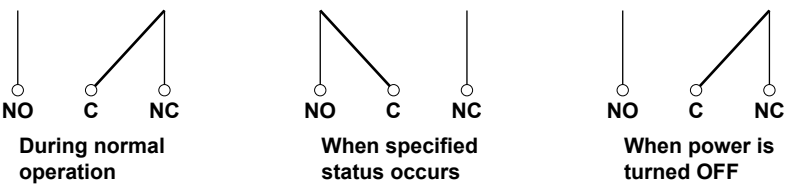
► For configuration instructions, see section 9.6.

Status	Description	Corrective Action
Status of the internal memory or CF card	Internal memory error.	Contact your nearest YOKOGAWA dealer for repairs.
	When the auto save to the CF card function is On.	
	• The free space on the CF card has dropped to 10% of the total size. (only when FIFO is disabled. For details on FIFO, see section 1.5.)	Replace the CF card.
	• CF card error.	• Replace the CF card. • Use the MV to format the CF card (the CF card data will be deleted).
	However, the status of the internal memory is output when the CF card is not inserted. • 10 MB or less of available space* remaining in internal memory. • The number of files in internal memory for which Auto Save to the CF card has not been completed has exceeded 390.	Insert a CF card.
Measurement error	When the auto save to the CF card function is Off.	
	• 10 MB or less of available space* remaining in internal memory.	Save the data in the internal memory to the CF card.
	• The number of files in internal memory that have not been manually saved has exceeded 390.	
Communication error	A/D converter error.	Contact your nearest YOKOGAWA dealer for repairs.
	Burnout detected.	Replace the thermocouple that has burned out.
Memory stop	Modbus master or Modbus client communication error.	Check the error by using the Modbus master or Modbus client display and perform corrective actions.
	FTP file transmission error.	Check the FTP log and perform corrective actions.

* The internal memory's "available space" refers to the following areas:

- Unused areas of internal memory
- Data areas for which Auto Save or Manual Save (see section 1.5 for details) has been completed.

Relay Operation



1.11 Other Functions

Time Related Functions

- **Time Correction**

The MV internal clock can be changed in the following ways.

Method	Description
Key operation	Use to set the MV to a specified time.
Event action function	Sets the MV internal clock to the closest hour.
SNTP client function	Sets the MV internal clock to the time retrieved from an SNTP server.

Time Correction Operation

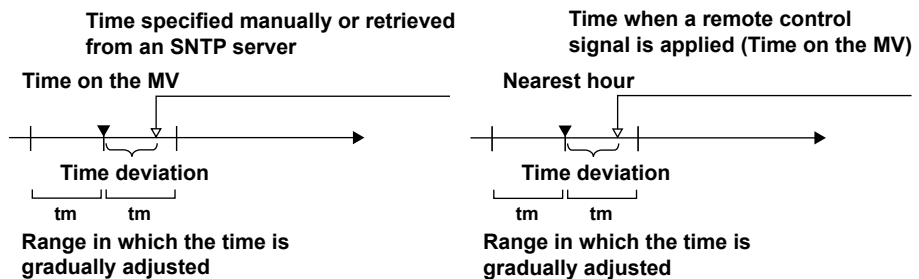
The time correction operation varies depending on whether or not memory sampling is in progress.

► For configuration instructions, see section 9.1.

Status	Operation
No memory sampling	The MV internal clock is changed immediately.
Memory sampling	The MV internal clock is gradually corrected. While the time is being gradually adjusted, the date/time in the status display section is displayed in yellow.

Gradual Correction of the Internal Clock

If the time deviation between the time of the MV internal clock and the correct time (the specified time) is within a specified value, the MV clock is adjusted gradually at 40 ms for each second. Otherwise, the clock is corrected immediately. The maximum value of time deviation (referred to as t_m in the figure below) can be selected from within the range of 10 s to 5 min.



Example: When changing the time to 12 hours 55 minutes 35 seconds when the time on the internal clock is 12 hours 55 minutes 32 seconds

The time deviation of 3 seconds is adjusted by 40 ms per second. The internal clock will be fully synchronized to the specified time after 75 seconds.

- **Date Format**

You can select from the following ways of displaying the year, month, and day: 2008/01/23, 01/23/2008, 23/01/2008, and 23.01.2008.

► For configuration instructions, see section 9.1.

- **Time Zone**

You can set the time difference between the location where the MV is used and GMT.

► For configuration instructions, see section 9.1.

- **Daylight Saving Time (DST)**

If the MV is used in a region that has DST, the time is switched automatically between DST and standard time at two user-specified times. For configuration instructions, see section 9.1.

System Display

This function displays the total number of inputs on the MV, the size of the internal memory, the communication functions, the external storage drive, the options, the MAC address, and the firmware version number.

► For operating instructions, see section 9.3.

Language

The displayed language can be set to English, Japanese, German, French, Chinese, or Korean.

► For configuration instructions, see section 9.4.

USB Interface

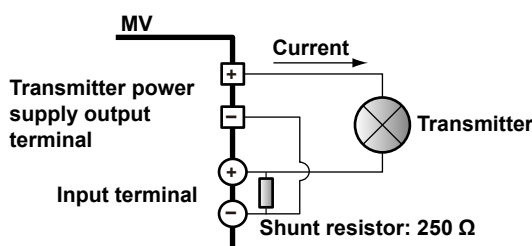
You can connect USB devices, such as keyboards and USB flash memory, to the two USB ports located on the front and back of the MV.

- You can operate the MV with a keyboard.
 - You can save and load measured data and setup data from USB flash memory.
- Connectable devices: 109/104 keyboards and USB flash memory

► For configuration instructions, see sections 4.10 and 9.7.

24 VDC Transmitter Power Supply (/TPS2, or /TPS4 option)

Provides 24-VDC power to up to two (/TPS2) or four (/TPS4) two-wire system transmitters. Transmitters output 4- to 20-mA current signals. You can connect these signals to an MV input terminal and display measured values.



External Input Channels (/MC1 option)

These channels handle measured data that is received from other devices through communication functions. 240 channels are available. External input channel data can be displayed and saved in the same ways as measurement channel data.

► For configuration instructions, see sections 11.1 and 11.2.)

Temperature Unit

When measuring temperature with a thermocouple or RTD, you can set the unit to °C or °F.

For configuration instructions, see section 9.2.

2.1 Where and How to Install

Location

Install the MV indoors in an environment that meets the following conditions:

- **Temperature of 0 to 40°C**

Install the MV in a location where the temperature is 0 to 40°C, and the humidity is 20 to 80% RH (5 to 40°C). Only use the MV when there is no condensation on it.

Note

Condensation may form when moving the MV from a low temperature/humidity environment to a high temperature/humidity environment, or when there is a sudden change in temperature. Temperature/humidity changes may also result in thermocouple measurement errors. In these kinds of circumstances, wait for at least an hour before using the MV, to acclimate it to the surrounding environment.

- **Altitude of 2,000 m or below**

- **Good ventilation**

To prevent overheating, install the MV in a well-ventilated area. We recommend that you leave 50 mm or more of space around the top, left, and right of the MV.

- **Not much mechanical vibration**

Install the MV in a location without much mechanical vibration. Placing the MV in a place that is subject to large levels of mechanical vibration will not only put added stress on its components, it may also impede ordinary measurement.

- **Flat surface**

Install the MV on a flat surface, neither leaning to the left nor to the right. The MV can be tilted if the stand is used.

Do not install the MV in the following places:

- **Outdoors**

- **In an environment with flammable or explosive gases, steam, or dust (dangerous places)**

- **In direct sunlight or near heating devices**

Install the MV in a place that is near room temperature (23°C) and that is not subject to very much temperature fluctuation. Placing the MV in direct sunlight or near heating devices can cause adverse effects on the internal circuitry.

- **In an environment with excessive amounts of soot, steam, moisture, dust, or corrosive gases**

Soot, steam, moisture, dust, and corrosive gases will adversely affect the MV and should be avoided.

- **Near strong magnetic fields**

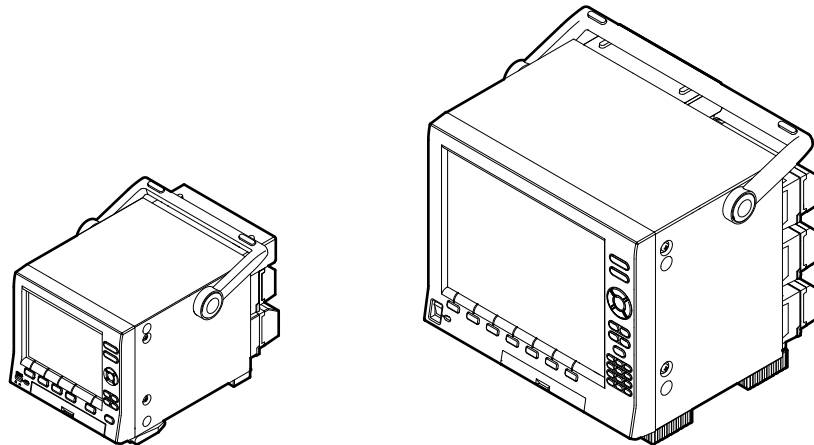
Install the MV in a place with a magnetic field of less than 400 A/m. Do not bring magnets or instruments that produce electromagnetic fields close to the MV. Operating the MV near strong magnetic fields can cause measurement errors.

- **Where the display is difficult to see**

The MV uses an LCD screen so viewing of the display from an extreme angle is difficult. Install the MV so that the user can view the display directly from the front.

Installation

Install the MV on a flat surface.

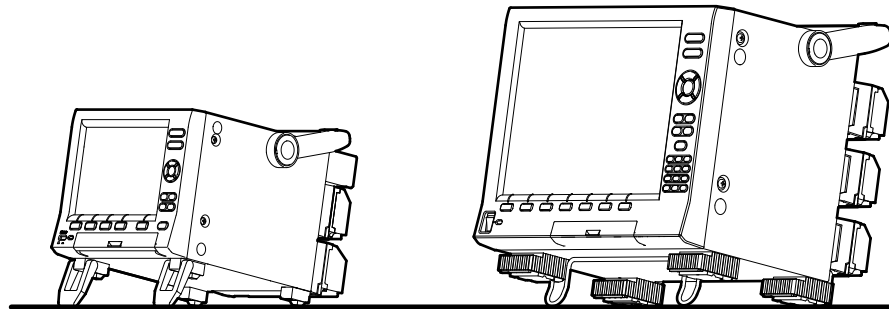


Note

- You cannot put the MV in a stack.
 - You can put rubber feet on the bottom of the MV2000. Please use the ones that come with the MV2000.
-

- **Using the stand**

When using the stand, push it out until it locks into place. When retracting the stand on the MV2000, fold the stand back while pushing inward on it.

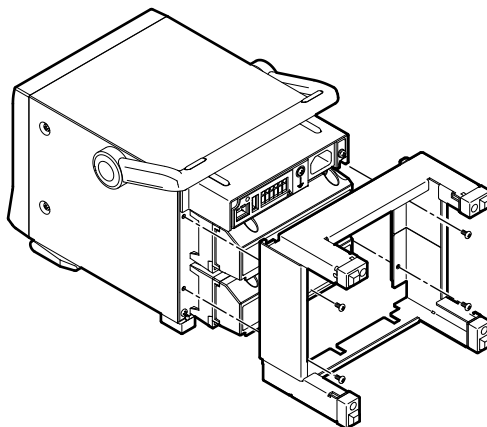


- **Using the vertical stand (MV1000 only)**

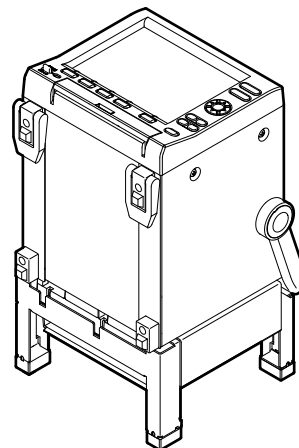
The MV1000 can be installed vertically by attaching the vertical stand (sold separately).

The appropriate screw tightening torque is 0.6 N•m. Be sure to support the instrument from the bottom when attaching the stand.

Attaching the stand



Instrument placement



- **Installing on a panel**

The MV can be installed on a panel by using the rack mount kit (sold separately).

See the external dimensions for the installation procedure.

2.2 Signal Input Terminal Wiring

Wiring to the Signal Input Terminals



WARNING

- To prevent electric shock, make sure that the power source is turned OFF.

CAUTION

- Exposing the input and output signal cables connected to the MV to high tension may damage the cables and the MV terminals. Do not stretch the cables to their limit, and make sure that the terminals are not being pulled on.
- To prevent fire, only use signal cables with a temperature rating of 70°C or above.
- Do not run a current through any of the input terminals that exceeds the voltages below. Doing so may damage the MV.
 - Maximum input voltage: ± 60 VDC
 - Maximum common mode voltage: ± 60 VDC (under measurement category II conditions)
- The MV is an installation category II product.

Wiring Precautions

Take the following precautions when wiring the input signal cables:

When using a screw terminal, we recommend that you use a crimp-on lug with an insulation sleeve (designed for 4-mm screws).



Crimp-on lug (designed for 4-mm screws) with an insulation sleeve

When using a clamp terminal, we recommend that you use the following kind of cable:

- Conductive cross-sectional area: 0.08 mm^2 to 1.5 mm^2 (AWG28 to 16)
- Stripped section: Approx. 7 mm

Take measures to prevent noise from entering the measurement circuit.

- Move the measurement circuit away from the power cable (power circuit) and ground circuit.
- Ideally, the object being measured should not generate noise. However, if this is unavoidable, isolate the measurement circuit from the object. Also, ground the object being measured.
- Shielded wires minimize the noise caused by electrostatic induction. Connect a shield to the ground terminal of the MV as necessary (make sure you are not grounding at two points).
- To minimize noise caused by electromagnetic induction, twist the measurement circuit wires at short, equal intervals.
- Make sure to ground the protective ground terminal through minimum resistance (less than 100Ω).

When using internal reference junction compensation on a thermocouple input, take measures to stabilize the temperature at the input terminal.

- Always use the terminal cover.
- Do not use thick wires which may cause large heat dissipation (we recommend a cross-sectional area of 0.5 mm^2 or less).
- Make sure that the ambient temperature remains reasonably stable. Large temperature fluctuations can occur if a nearby fan turns ON or OFF.

2.2 Signal Input Terminal Wiring

Connecting the input wires in parallel with other devices can cause signal degradation, affecting all connected devices. If you have to make a parallel connection, then

- Turn the burnout detection function OFF.
- Ground the instruments to the same point.
- Do not turn other instruments ON or OFF during operation. This can have adverse effects on the other instruments.
- Do not connect RTDs in parallel.

Wiring Procedure

There is a terminal cover screwed onto the signal input terminal block on the rear panel. It has a label indicating the terminal arrangement on it.

1. Turn the MV OFF and remove the terminal cover.
2. Connect the signal wires to the terminals.

Recommended torque for tightening the screws	Screw terminals	0.9 to 1.0 N•m
	Clamped terminals	0.22 to 0.25 N•m

3. Replace the terminal cover and fasten it with screws. The appropriate tightening torque for the screws is 0.6N•m.

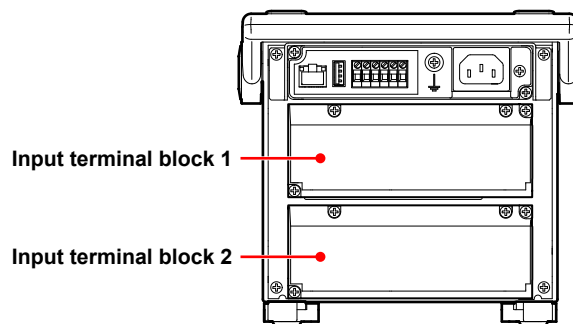
Note

It may be difficult to firmly secure input signal wires with diameters of 0.3 mm or less to clamp terminals. To secure the wires, try folding the conductive parts over when you connect them to the clamp terminal.

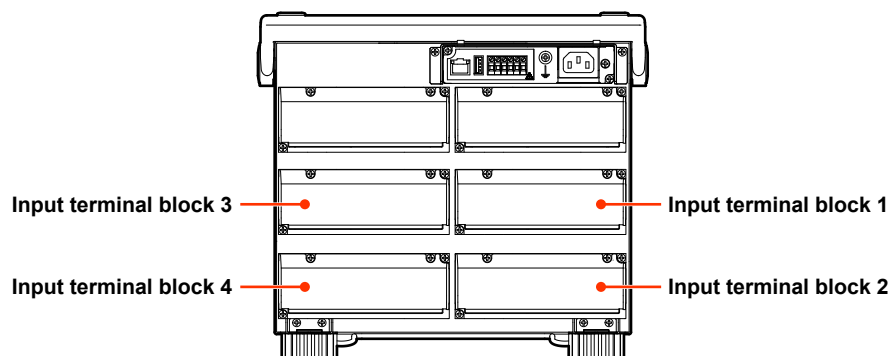
Input Terminal Arrangement

Location of the Input Terminal Blocks

- MV1000



- MV2000



2.2 Signal Input Terminal Wiring

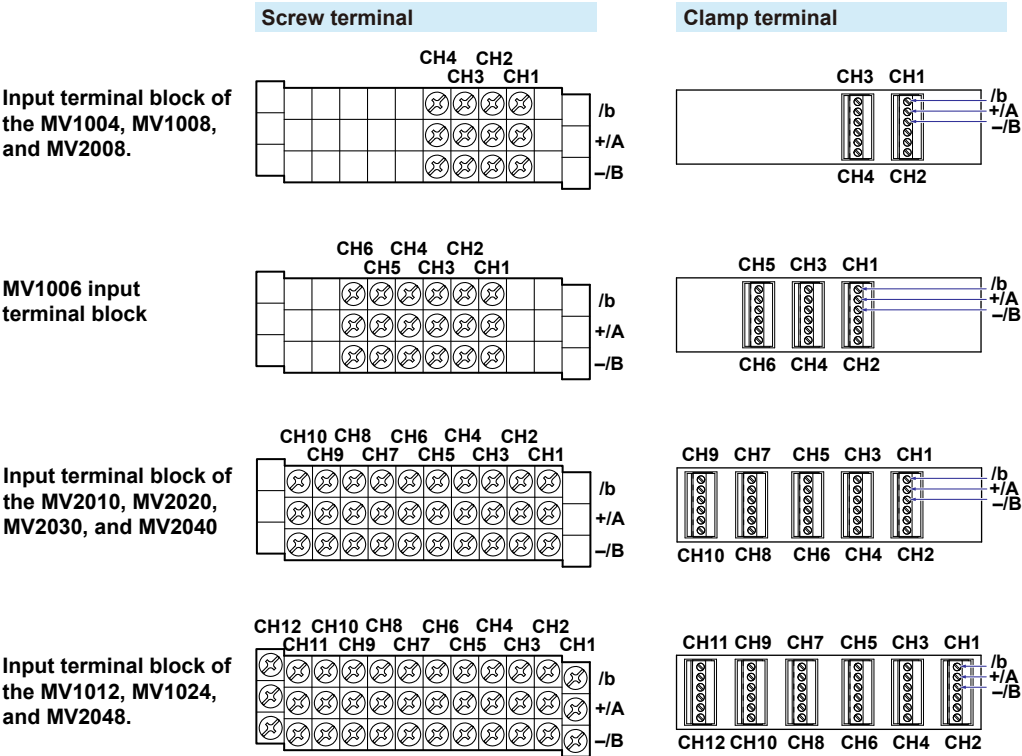
Input Terminal Block Channel Assignments

The following table shows which channels are assigned to which terminal blocks.

Input terminalblock	MV1000 Channel Assignment				
	MV1004	MV1006	MV1008	MV1012	MV1024
1			1-4		1-12
2	1-4	1-6	5-8	1-12	13-24

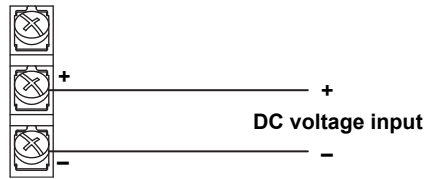
Input terminalblock	MV2000 Channel Assignment					
	MV2008	MV2010	MV2020	MV2030	MV2040	MV2048
1	1-4	1-10	1-10	1-10	1-10	1-12
2	5-8		11-20	11-20	11-20	13-24
3				21-30	21-30	25-36
4					31-40	37-48

This picture shows where the channel inputs are located on each terminal block.

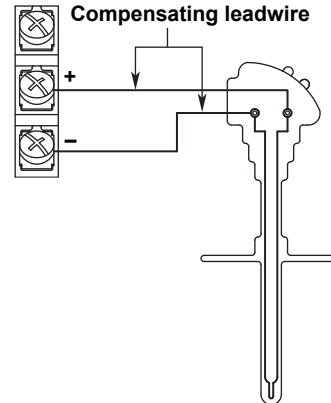


Screw Terminal Wiring

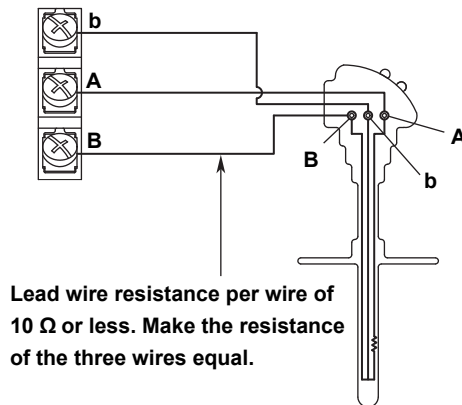
DC voltage input/DI (ON/OFF) input



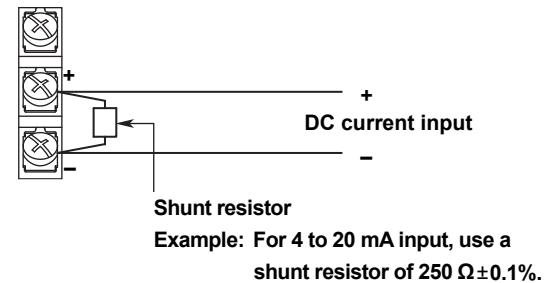
TC input



RTD input

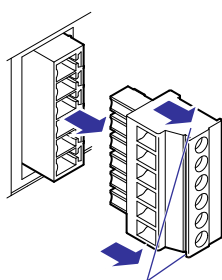


DC current input



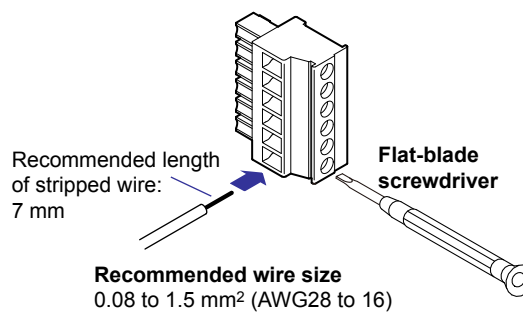
Clamp Terminal Wiring

Remove the terminal block



Hold both ends of the terminal block and pull straight.

Connect the wires

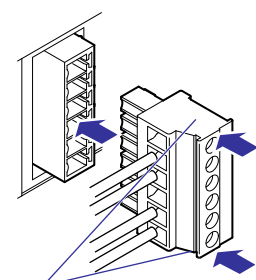


Recommended wire size
0.08 to 1.5 mm² (AWG28 to 16)

Input signal wire

First, loosen the screw at the front using a flat-blade screwdriver. Insert the input signal wire into the slit on the left side of the terminal block, and fasten the screw at the front.

Connect the terminal block



Hold both ends of the terminal block, align it with the connector, and then push it in.

Note

RTD input terminals A and B are isolated on each channel. Terminal b is shorted internally across all channels. On models with the /N1 option (Cu10, Cu25 RTD input/3-wire isolated RTD) or the /N2 option (3-wire isolated RTD), terminal b is also isolated on each channel.

2.3 Optional Terminal Wiring

Wiring to Optional Terminals



WARNING

- To prevent electric shock, make sure that the power source is turned OFF.
- If you are going to apply a voltage of more than 30 VAC or 60 VDC to the output terminals, use round crimp-on lugs with insulation sleeves on all output terminals to connect the signal cables so that the wires won't slip out even if the screws loosen. Also, use cables that comply with double insulation requirements (dielectric strength of 2300 VAC or more). For voltages below 30 VAC/ 60 VDC, use cables that comply with basic insulation requirements (dielectric strength of 1390 VAC or more). To prevent electric shock, attach the terminal cover after wiring and make sure not to touch the terminals.

CAUTION

- Use the following circuit voltages for the connection to the alarm/FAIL/status output terminal.
 - When the connection is to Mains Circuits (primary AC power source circuits): 150 V or less
 - When the connection is to circuits derived from Mains Circuits (secondary circuits): 250 V or less (keep the Mains Circuit voltage at less than 300 V, and use an isolation transformer.)
- To prevent fire, only use signal cables with a temperature rating of 70°C or above.
- Exposing the input and output signal cables connected to the MV to high tension may damage the cables and the MV terminals. Do not stretch the cables to their limit, and make sure that the terminals are not being pulled on.
- Do not short the transmitter power supply output terminal or apply external voltage to it. Doing so may damage the MV.
- When using the transmitter power supply output terminal, do not use current that exceeds the maximum output current (25 mADC). Doing so may damage the MV.

Note

For remote control wiring, use shielded wires to reduce noise. Connect the shield to the functional ground terminal or to the ground terminal of the MV.

Wiring Precautions

We recommend that you use crimp-on lugs (designed for 4 mm screws) with insulation sleeves to connect to the optional terminals.



Crimp-on lug (designed for 4-mm screws) with an insulation sleeve

Wiring Procedure

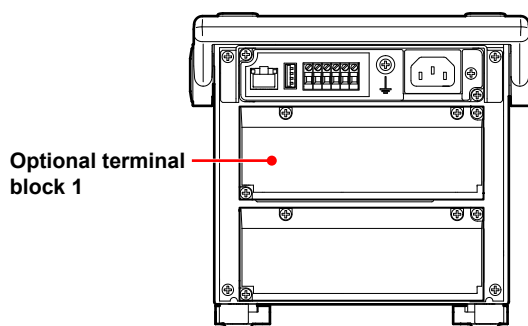
As shown in the figure below, the optional terminal block is located on the rear panel. The MV is only equipped with an optional terminal block when an option that requires input/output, such as the alarm output relay (/A options), FAIL/status output relay (/F1 option), and remote control function (/R1 option), is installed. There is a terminal cover screwed onto the optional terminal block. It has a label indicating the terminal arrangement on it.

1. Turn OFF the MV and remove the terminal cover.
2. Connect the signal wires to the terminals. The recommended torque for tightening the screws is 0.9 to 1.0 N•m.
3. Replace the terminal cover and fasten it with screws. The appropriate tightening torque for the screws is 0.6 N•m.

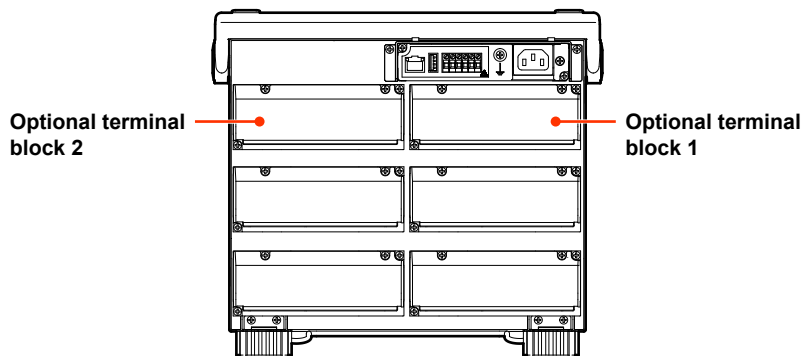
Optional Terminal Arrangement

Location of the Optional Terminal Blocks

- MV1000

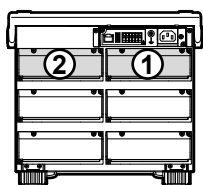


- MV2000

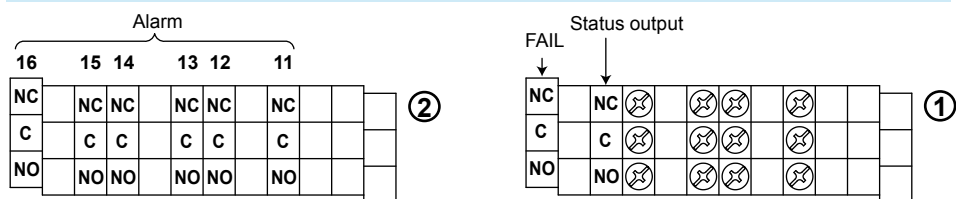


2.3 Optional Terminal Wiring

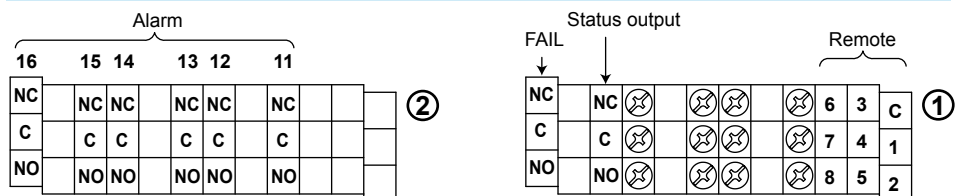
Options that use terminal blocks 1 and 2



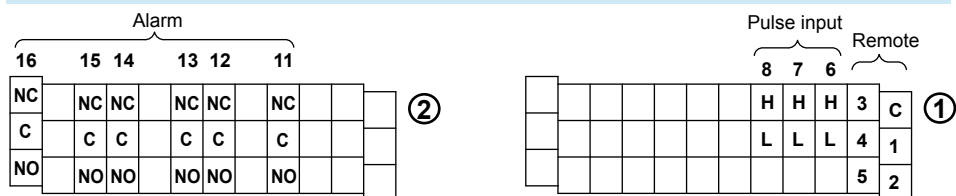
/A3/F1



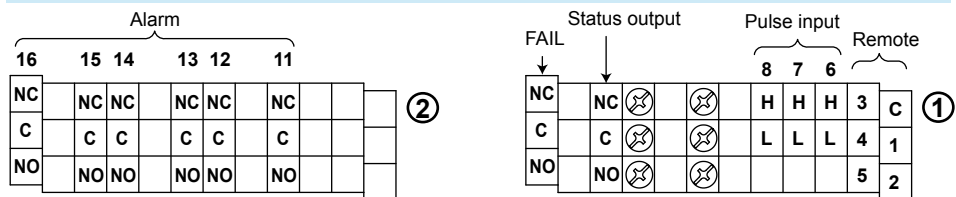
/A3/F1/R1



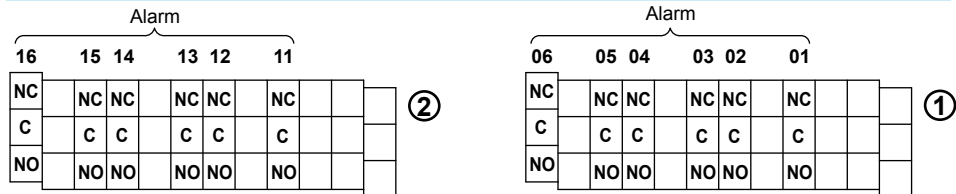
/A3/PM1



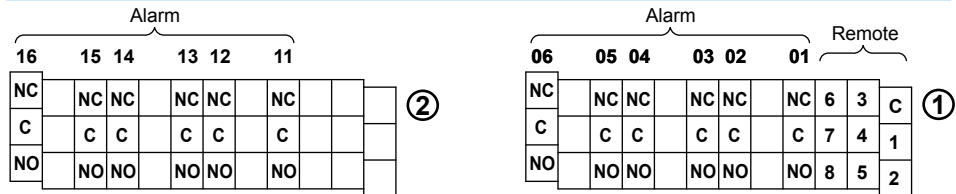
/A3/F1/PM1



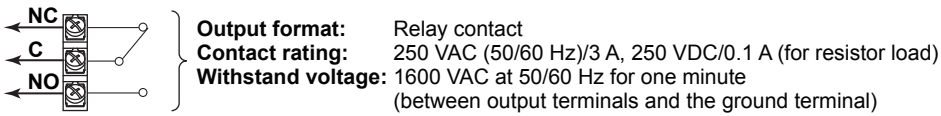
/A4



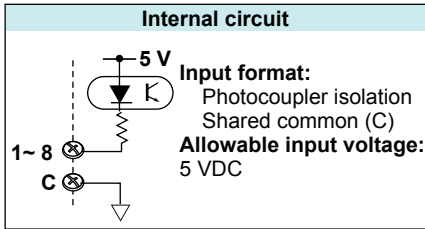
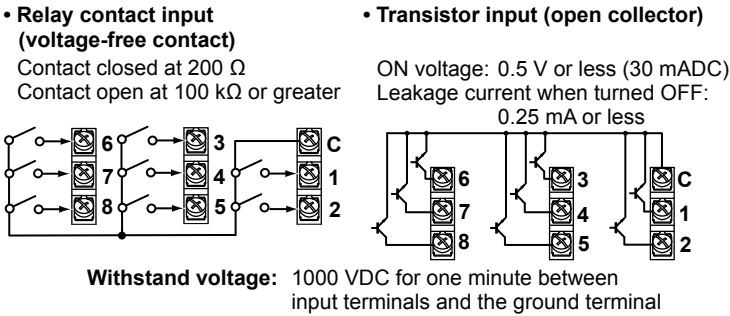
/A4/R1



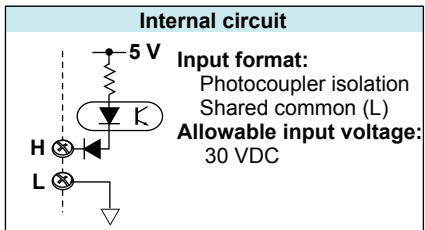
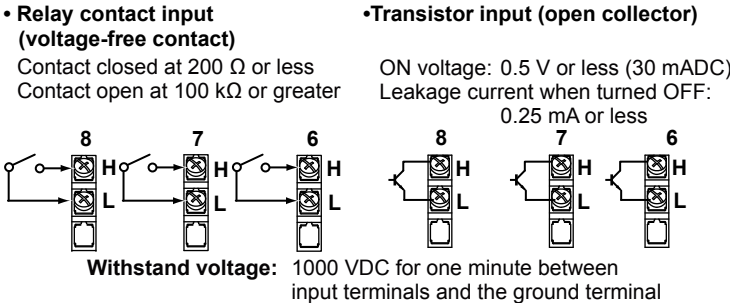
Alarm Output Terminal, FAIL Output Terminal, and Status Output Terminal (/A1, /A2, /A3, /A4, and /F1)



Remote Control Input Terminal (/R1)

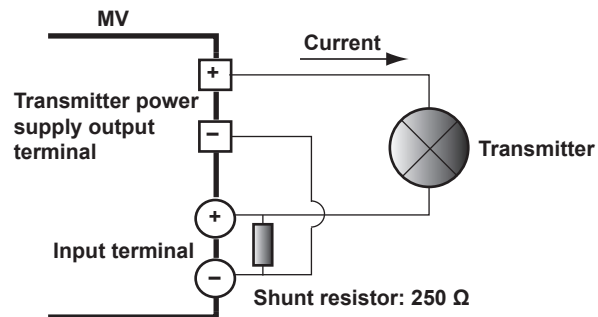


Pulse Input Terminal (/PM1)



24 VDC Transmitter Power Supply Terminal (/TPS2, /TPS4)

Connect the MV to the transmitter as shown below:



Note

To reduce noise, use a shielded cable for wiring. Connect the shield to the functional ground terminal or to the ground terminal of the MV.

2.4 Connecting the Power Supply

Connecting the Power Cord (if the power supply suffix code is -1)

- **Precautions to Be Taken While Connecting the Power Supply**

Make sure to follow the warnings below when connecting the power supply. To prevent electric shock and damage to the MV, observe the following warnings.



WARNING

- Make sure that the power supply voltage matches the MV rated supply voltage and is within the maximum voltage range specified for the power cord.
- Confirm that the power switch is OFF before connecting the power cord.
- To prevent electric shock, be sure to use a power cord provided by YOKOGAWA for use with the MV.
- To prevent electric shock, make sure to ground the MV. Insert the desktop power cord into a grounded 3-prong outlet.
- Do not use an ungrounded extension cord. If you do, the device will not be grounded.

Use a power supply that meets the following conditions:

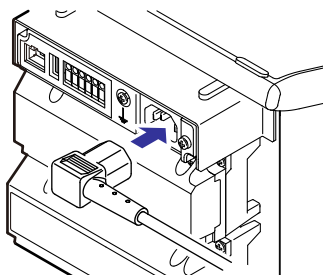
Item	Condition
Rated supply voltage	100 to 240 VAC
Operating supply voltage range	90 to 132, 180 to 264 VAC
Rated supply frequency	50/60 Hz
Power supply frequency range	50/60 Hz \pm 2%
Maximum power consumption	MV1000:45 VA (100 V), 60 VA (240 V) MV2000:65 VA (100 V), 90 VA (240 V)

Note

Avoid using a power supply voltage of 132 to 180 VAC with the MV because such a power supply voltage may reduce measurement accuracy.

- **Connection Procedure**

1. Check that the power switch is OFF.
2. Connect the MV power cord to the power inlet on the rear panel.



3. Make sure that the power outlet meets the conditions listed above and that the power supply voltage is within the maximum voltage range specified for the power cord. Then, plug the power cord into the power outlet. Use a grounded 3-prong outlet.

Wiring to the Power Terminal (if the power supply suffix code is -2)

When Using an AC Adapter

- **Precautions to Be Taken While Connecting the Power Supply**
Make sure to follow the warnings below when connecting the power supply. To prevent electric shock and damage to the MV, observe the following warnings.



WARNING

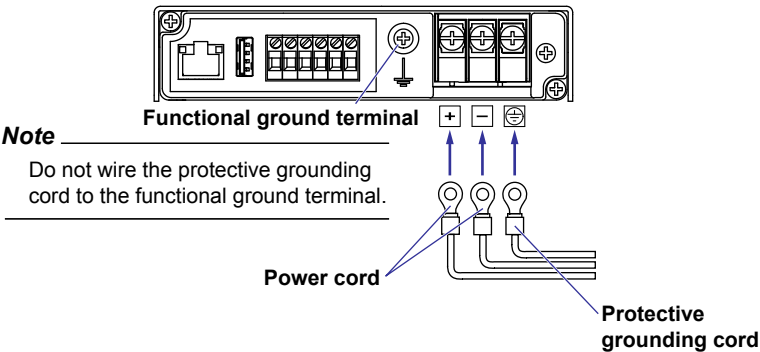
- To prevent electric shock, make sure that the power source is turned OFF.
- Only use the power cord that YOKOGAWA provides for use with the MV.
- Confirm that the power source voltage matches the specifications of the AC adapter before connecting the power cord.
- When you do not plan on using the MV for a while, remove the AC adapter cord from the AC outlet.
- Only use a YOKOGAWA AC adapter.
- Do not place objects on top of the AC adapter or power cord, and keep them away from heat sources.
- When removing the plug from the power outlet, do not pull on the cord. Pull from the plug. If the power cord is damaged, contact your nearest YOKOGAWA dealer.

Use a power supply that meets the following conditions:

Item	Condition
Rated supply voltage	100 to 240 VAC
Operating supply voltage range	90 to 264 VAC
Rated supply frequency	50/60 Hz
Power supply frequency range	48 to 62Hz
Maximum power consumption	MV1000: 45 VA (100 V), 60 VA (240 V) MV2000: 65 VA (100 V), 90 VA (240 V)

• Connection Procedure

1. Check that the power switch is OFF.
2. Connect the power cord and the protective ground cord to the power terminal.
Use a round crimp-on lug (designed for 4-mm screws) with an insulation sleeve.
The appropriate tightening torque for the screws is 1.4 to 1.5 N/m.



3. Attach the power terminal cover (transparent), and fasten it with screws.

When Using a DC Power Supply

- **Precautions to Be Taken While Connecting the Power Supply**

Make sure to follow the warnings below when connecting the power supply. To prevent electric shock and damage to the MV, observe the following warnings.

**WARNING**

- To prevent electric shock, make sure that the power source is turned OFF.
- To prevent fire, use cables with a cross-sectional area of 0.5 mm² (AWG20) or more.
- Use crimp-on lugs (designed for 4 mm screws) with insulation sleeves to connect both the power cord and the protective ground.
- To prevent electric shock, be sure to attach the electrical wiring cover (transparent).

Use a power supply that meets the following conditions:

Item	Specification
Rated supply voltage	12 or 24 VDC
Operating supply voltage range	10 to 28.8 VDC
Maximum power consumption	MV1000: 24 VA MV2000: 35 VA

- **Wiring Procedure**

1. Make sure that the power source is OFF. Open the power terminal cover (transparent).
2. Follow the instructions in “When using an AC adapter” and connect the positive and negative cables and the protective ground cable to the power terminal.
3. Attach the power terminal cover (transparent), and fasten it with screws.

Rechargeable Battery Model (if the power supply suffix code is -3)

Recycle Mark

The Ni-MH battery that is used by the MV1000 is recyclable.

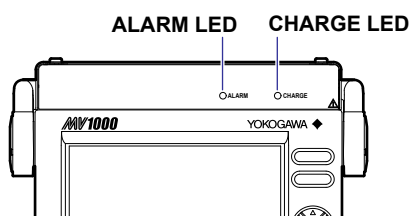
The following recycle mark is used on the battery and in this user's manual to indicate that it is recyclable.



Ni-MH

Indication of recharging

When the battery needs recharging after it is used over a given period, the ALARM LED (red) turns ON. The operation time from the point when the ALARM LED turns ON until the battery becomes empty is normally 10 minutes to 15 minutes. However, this varies depending on how it is used. If the battery was not fully charged, the battery may become empty in less than 5 minutes. Therefore, charge the battery immediately when the ALARM LED turns ON.



When an external storage medium is in operation, the ALARM LED may turn ON due to the changes in the load of the battery voltage.

If the ALARM LED turns ON while data is being saved, you can continue the save operation until the battery is empty.

The MV1000 has a built-in over-discharge protection circuit. To prevent the battery from over discharge, a shutdown operation is performed to cut off the current from the battery after a short time after the ALARM LED turns ON.

Thus, the power to the MV1000 is automatically turned OFF after the ALARM LED turns ON. If you leave the MV1000 in this condition for an extended time, the battery may over discharge due to the minute consumption of power by the internal circuit operation. If the MV1000 automatically turns OFF after the ALARM LED turns ON, make sure to turn the power switch of the MV1000 to the OFF position.

Charging of the battery starts when the AC adapter is connected to the MV1000. In this case, the CHARGE LED and the ALARM LED may blink simultaneously, but the ALARM LED will turn OFF after charging the battery for awhile. When fully charged, the CHARGE LED blinks.

Additionally, while the battery is installed, the battery power is consumed through minute current even if the power switch of the MV1000 is turned OFF. If you are not using the MV1000 for an extended time, remove and store the battery.

Note

With Ni-MH batteries, a phenomenon called memory effect occurs in which the apparent battery capacity decreases when shallow charge and discharge cycles are repeated followed by a deep discharge. In such case, the capacity recovers by repeating the cycle of operating the MV100 until shutdown (discharge the battery until the end-of-discharge voltage) and recharging several times.

The battery is charged by leaving the AC adapter connected, whether the power switch is ON or OFF. The battery voltage is different during AC adapter operation and battery operation. The ALARM LED does not turn ON during AC adapter operation even when recharging is necessary. Note the following points.

2.4 Connecting the Power Supply

When the AC adapter and the battery are used simultaneously, the AC adapter is used at higher priority. If the AC power supply is cut off such when a power failure occurs, the MV1000 automatically switches to battery operation. When the AC power supply recovers, the MV1000 returns to AC adapter operation. If you are using the battery as backup power, fully charge the battery before using it.

Approximate Time of Operation¹

The time of operation with the battery varies depending on the operating conditions.

Model	Operation Time ²			
	Operating Condition	Minimum consumption	Normal consumption	Maximum consumption
MV1004		10 hours	8 hours	4 hours
MV1008, MV1024		9 hours	7 hours	5 hours
MV1012		13 hours	9 hours	4 hours

1 Reference values when operated at room temperature.

2 See "Power Supply" in the specifications for the instrument's operating conditions.

Battery Life

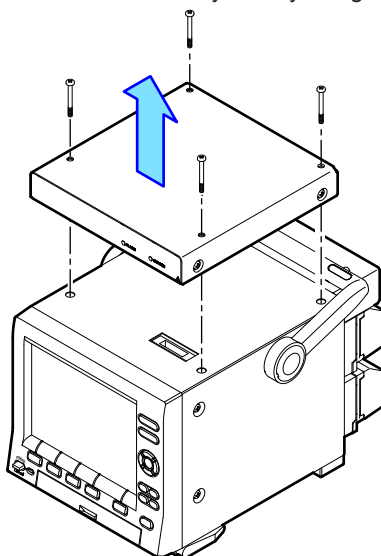
The number of times the battery can be recharged is approximately 300 (depends on the condition in which it is used). If the operation time is short even when it is fully charged, the battery is dead. Replace with a new battery.

Name	Part Number	Qty.	Notes
Battery box	B8805HA	1	When using the MV1000 with power supply suffix code -3

Replacing the Battery

Follow the procedures below to replace the battery box.

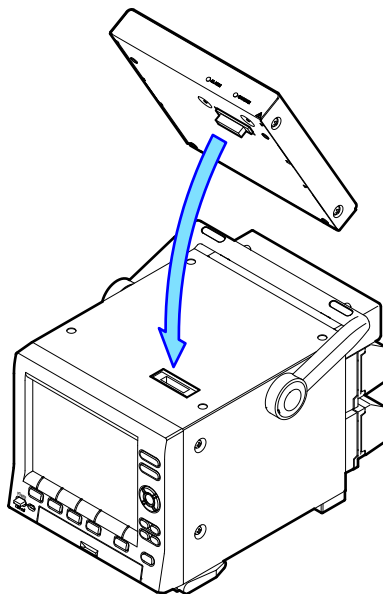
1. Check that the power to the MV1000 is OFF.
2. If you are using an AC adapter, remove the AC adapter's power cord from the outlet.
3. Remove the four mounting screws from the battery box.
4. Remove the battery box by lifting straight up.



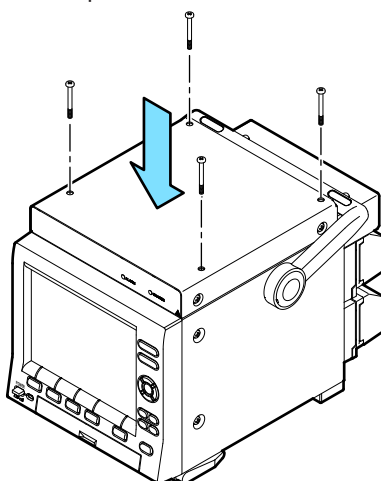
5. Prepare the new battery box.

2.4 Connecting the Power Supply

6. Align the new battery box connector with the connector on the MV1000, then connect the battery box to the MV1000.



7. Fasten the battery box in using four screws. The appropriate screw tightening torque is 0.6 N•m.



WARNING

Do not disassemble the battery box.

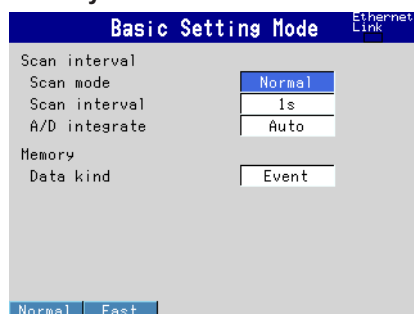
3.1 Setting the Scan Interval and the A/D Converter Integration Time

This section explains how to set the scan interval and the A/D converter integration time.

► For an explanation of these functions, see section 1.2.

Display

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > A/D, Memory**.



Settings

- **Scan interval>Scan mode**

Normal: Measures at the normal mode scan interval.

Fast: Measures at a scan interval of 25 ms (MV1004, MV1008, and MV2008) or 125 ms (MV1006, MV1012, MV1024, MV2010, MV2020, MV2030, MV2040, MV2048). Fast sampling mode is not available on models equipped with external input channels (/MC1). For details, see section 1.2.

- **Scan interval>Scan interval**

The selectable settings appear.

- **Scan interval>A/D integrate**

When the scan mode is set to Normal, select an appropriate A/D integration time. Only the selectable settings are displayed.

Setting	Description
Auto	The MV automatically detects the power supply frequency and sets the integration time to 16.7 ms for 60Hz and 20 ms for 50 Hz. The integration time is fixed at 20 ms (50 Hz) if you are using a 12-VDC power supply.
50Hz	Sets the integration time to 20 ms.
60Hz	Sets the integration time to 16.7 ms.
100ms	Sets the integration time to 100 ms (when the scan interval is 2 s or 5 s).
600Hz	The A/D integration time for fast sampling mode. You cannot change this value.

3.2 Setting Burnout and Reference Junction Compensation

This section explains how to set the function that detects sensor burnouts in thermocouple and 1-5V inputs as well as how to set the reference junction compensation method of the thermocouple.

Display

Press **MENU** then select **Menu** tab > **Basic setting mode** > **Menu** tab > **Burnout, RJC**.

Basic Setting Mode

First-CH: 1 Last-CH: 1

Burnout set Off

RJC Mode External

RJC Volt 0 μ V

1 2 3 4 Next 1/3

Settings

- **First-CH, Last-CH**

Select the target channels.

- **Burnout > Mode**

Detects thermocouple and 1-5V input sensor burnouts.

Setting	Description
Off	Does not detect sensor burnouts.
Up	When the MV detects a burnout, it sets the measured result to "+Over." The measured value is displayed as "Burnout." For 1-5V input, the MV detects a sensor burnout when the measured value exceeds the scale upper limit by 10% of the scale width. (Example: With a scale of 0 to 100, burnout is detected at values above 110.)
Down	When the MV detects a burnout, it sets the measured result to "-Over." The measured value is displayed as "Burnout." For 1-5V input, the MV detects a sensor burnout when the measured value goes below the scale lower limit by 5% of the scale width. (Example: With a scale of 0 to 100, burnout is detected at values below -5.)

- **RJC > Mode**

Select either Internal or External as the thermocouple input reference junction compensation method.

Setting	Description
Internal	Uses the MV reference junction compensation function.
External	Uses an external reference junction compensation function. When the method is set to External, the Volt setting is displayed.

- **RJC > Volt**

If you set Mode to External, enter the compensation voltage.

Setting	Description
Voltage	The compensation voltage that is added to the input. Set the value in the range of -20000 μ V to 20000 μ V.

3.3 Setting the Input Range

This section explains how to set the input range for each channel.

Display

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

Settings

- **First-CH, Last-CH**
Select the target channels.

- **Range > Mode**

Setting	Description
Skip	Not measured.
Volt, TC, RTD, DI, 1-5V	Input type. Represents DC voltage, thermocouple, RTD, ON/OFF input, and 1-5V inputs, respectively.
Delta, Scale, Sqrt	Difference computation, linear scaling, and square root computation.

Select the checked settings for the modes listed below.

Setting	Mode								
	Volt	TC	RTD	DI	Delta	Scale	Sqrt	1-5V	Skip
Type					✓	✓			
Range	✓	✓	✓	✓	✓	✓	✓	✓	
Span Lower	✓	✓	✓	✓	✓	✓	✓	✓	
Span Upper	✓	✓	✓	✓	✓	✓	✓	✓	
Scale Lower						✓	✓	✓	
Scale Upper						✓	✓	✓	
Unit						✓	✓	✓	
Ref. CH					✓				
Low-cut							✓	✓	
Low-cut value							✓		

3.3 Setting the Input Range

- **Range > Type**

Input type when Mode is set to Delta or Scale. See the explanation of Mode.

- **Range > Range**

These are specific input settings.

Setting	Input Type	Note
20mV	–20.000 mV to 20.000 mVDC	Standard
60mV	–60.00 mV to 60.00 mVDC	
200mV	–200.00 mV to 200.00 mVDC	
2V	–2.0000 V to 2.0000 VDC	
6V	–6.000 V to 6.000 VDC	
20V	–20.000 V to 20.000 VDC	
50V	–50.00 V to 50.00 VDC	
Pt	Pt100	
JPt	JPt100	
Level	ON/OFF (Voltage)	
Contact	ON/OFF (Contact)	
1-5V	0.800 V to 5.200 V	

Setting	Input Type	Note
R	Type R	Standard
S	Type S	
B	Type B	
K	Type K	
E	Type E	
J	Type J	
T	Type T	
N	Type N	
W	Type W	
L	Type L	
U	Type U	
WRe	Type WRe	

Setting	Input Type	Note
K	Kp vs Au7Fe	/N3 option
PLATI	PLATINEL	
PR	PR40-20	
NiMo	NiNiMo	
W/WRe	W/WRe26	
N2	Type N (AWG14)	
Pt50	Pt50	
Ni1	Ni100 (SAMA)	
Ni2	Ni100 (DIN)	
Ni3	Ni120	
J263	J263*B	
Cu53	Cu53	
Cu100	Cu100: a = 0.00425 at 0°C	
Pt25	Pt25	

Setting	Input Type	Note
Cu1	Cu10 (GE)	/N1 option
Cu2	Cu10 (L&N)	
Cu3	Cu10 (WEED)	
Cu4	Cu10 (BAILEY)	
Cu5	Cu10: a = 0.00392 at 20°C	
Cu6	Cu10: a = 0.00393 at 20°C	
Cu25	Cu25: a = 0.00425 at 0°C	

- **Range > Span Lower, Span Upper**

The input range. The range of available settings will be displayed on the screen.

Note

- You cannot set Span Lower and Span Upper to the same value.
- When Mode is set to 1-5V or Sqrt, you can only set Span Lower to a value that is less than Span Upper.

- **Range > Scale Lower, Scale Upper**

The input range after unit conversion.

You can set the scale values to anywhere from –30000 to 30000. The decimal place is determined by the Scale Lower setting. It can be set to the following positions: X.XXXX, XX.XXX, XXX.XX, XXXX.X, or XXXXX.

Note

- The MV converts the measured value to a value within the range set by the Scale Lower and Scale Upper values with their decimal points removed. For example, if you set the scale range to –5 to 5, the range of converted values will be 10, but if you set the scale range to –5.0 to 5.0, the range of converted values will be 100. The resolution of values converted within the range of 10 will be less than that of values converted within the range of 100. For a clear view, set the scale values so that the range of converted values is greater than 100.
- You cannot set Scale Lower and Scale Upper to the same value.
- When Mode is set to 1-5V or Sqrt, you can only set Scale Lower to a value that is less than Scale Upper.

- **Range > Unit**

Set the unit (up to six characters, `Aa#1`)

- **Range > Ref. CH**

The reference channel for difference computation.

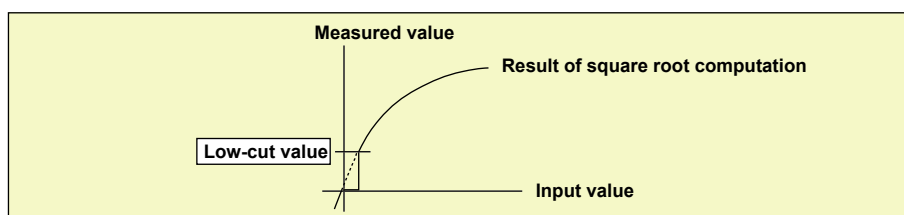
- **Range > Low-cut**

Select On to use the low-cut function.

* The low-cut value for 1-5 V input is fixed at 0% of the input span.

- **Range > Low-cut value**

With square root computation, set the low-cut value in the range of 0.0% to 5.0% of the input span.



3.4 Setting the Moving Average of the Input

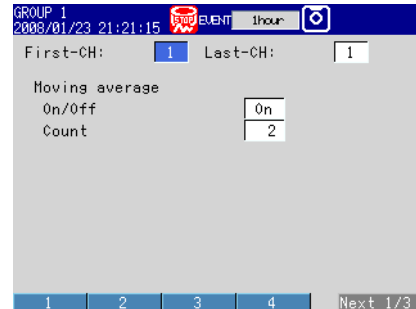
This section explains how to set the measurement channel moving average function.

This function suppresses the effects of noise.

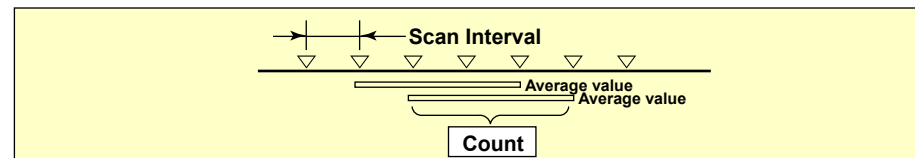
► For an explanation of this function, see section 1.2.

Display

Press **MENU** and then select > **Menu tab** > **Meas channel** > **Moving average**.



Settings



- **First-CH, Last-CH**
Select the target channels.
- **Moving average > On/Off**
Select On to use the moving average function.
- **Moving average > Count**
Set the number of moving average data points from within the range of 2 to 400.

3.5 Setting the Auxiliary Alarm Function

This section explains how to configure alarm display and output relays.

► For an explanation of these functions, see section 1.3.

Display

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Alarm settings > Basic setting > Switch, Relay or Hysteresis**.

Basic Setting Mode Ethernet Link

Basic setting

Reflash

Rate of change

Decrease

Increase

Indicator

Basic Setting Mode Ethernet Link

Internal Switch

AND

Relay

AND

Action

Hold

Relay Action on ACK

Basic Setting Mode Ethernet Link

Hysteresis

Meas CH

High/Low %

Delta High/Low %

Math CH

High/Low %

MV2000

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

Basic Setting Mode Ethernet Link

Alarm

Basic setting

Reflash

Rate of change

Decrease

Increase

Indicator

Hysteresis

Meas CH

High/Low %

Delta High/Low %

Math CH

High/Low %

Ext. CH

High/Low %

Switch, Relay

Internal Switch

AND

Relay

AND

Action

Hold

Relay Action on ACK

Settings

- **Basic setting > Reflash**

To set the reflash operation on alarm output relays, select On. The reflash function affects the first three output relays.

3.5 Setting the Auxiliary Alarm Function

- **Basic settings > Rate of change**

- **Decrease**

Set the interval for the rate-of-change calculation of the low limit on rate-of-change alarm by the number of sampled data points (1 to 32). The actual interval is obtained by multiplying the value specified here by the scan interval.

- **Increase**

Set the interval for the rate-of-change calculation of the high limit on rate-of-change alarm in the same manner as the interval for the low limit on rate-of-change alarm.

- **Basic settings > Indicator**

You can choose to make the alarm displays behave in the following ways.

Setting	Description
Nonhold	Stop when the alarm condition is released (return to normal condition).
Hold	Continue until an alarm output release (AlarmACK) operation is performed.

- **Switch, Relay**

- **Internal Switch > AND**

Select the internal switches you want to set to AND logic. Select how many switches after and including the first switch will be set to AND logic. All other switches will be set to OR logic.

- **Relay > AND**

Select the relays you want to set to AND logic. Select how many relays after and including the first alarm output relay will be set to AND logic. All relays after the selected last relay will be set to OR logic. Available settings are None, I01 (I01 only), I01-I02 (I01 and I02), I01-I03 (I01 to I03), etc. Only alarm output relays that are installed are valid.

Note

When reflash is turned ON, the operation of the first three output relays is fixed to OR logic. Specifying AND produces no effect.

- **Relay > Action**

Select whether to energize or de-energize the alarm output relay when an alarm occurs. This setting applies to all alarm output relays.

- **Relay > Hold**

You can choose to make the alarm output relays behave in the following ways. This setting applies to all relays.

Setting	Description
Nonhold	Stop when the alarm condition is released (return to normal condition).
Hold	Stay ON until an alarm output release (AlarmACK) operation is performed

Note

When reflash is turned ON, the operation of the first three output relays is fixed to Nonhold. Specifying Hold produces no effect.

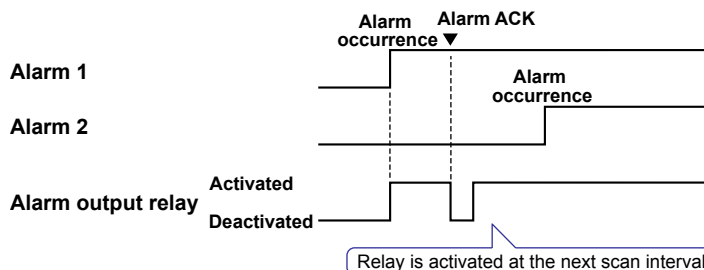
- **Relay > Relay Action on ACK**

You can select the relay output status that is enabled after the AlarmACK operation from the following two settings.

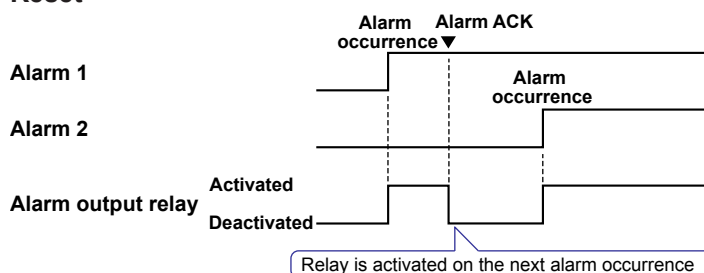
Setting	Description
Normal	The relay output is deactivated when the AlarmACK operation is executed. If the condition for activating the alarm output relay is met in the next scan interval, the relay output is activated. The operation only applies when the alarm output relay is set to Hold.
Reset	The relay output is deactivated when the AlarmACK operation is executed. If a new condition for activating the alarm output relay is met, the relay is activated.

An example of the relay action when AlarmACK is executed is shown below. This example is for the case when the output relay **AND** item is set to **None**.

Normal



Reset



- **Hysteresis > Meas CH**

- **High/Low**

The hysteresis width for alarm occurrence/release of the high/low limit alarm that is set for measurement channels.

Selectable range: 0.0% to 5.0% of the span or scaling width.

- **Delta High/Low**

The hysteresis width for alarm occurrence/release of the difference high/low limit alarm that is set for measurement channels.

Selectable range: 0.0% to 5.0% of the span.

- **Hysteresis > Math CH (/M1 and /PM1 options), Ext. CH (/MC1 option)**

The hysteresis width for the alarm occurrence/release of the high/low limit alarm that is set for computation channels and external input channels.

Selectable range: 0.0% to 5.0% of the measurement span.

3.6 Hiding the Alarm Indication

This section explains how to select whether or not to hide alarm indication.

► For an explanation of this function, see section 1.3.

Display

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Input, Alarm.**

Basic Setting Mode

Input

Value on over-range

Alarm

No logging

Free Over

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message, Input, Alarm.**

Basic Setting Mode

Environment > View, Message, Input, Alarm

View

Trend type

Partial

Trend rate switching

Input

Value on over-range

Alarm

No logging

Message

Write group

Power-fail message

Change message

On Off

Settings

- **Alarms > No logging**

Select **On** to hide alarm indication. Detect will appear in the alarm setting screen (see section 3.7).

This function disables the alarm indicator and the logging of alarm events to the alarm summary.

- **How to set for each channel and each alarm**

► See section 3.7

3.7 Setting Alarms on Channels

Configure alarms after you have set the range. A channel's alarm settings are reset when the following occur:

- When the input type (Volt, TC, etc.) is changed.
- When the input range is changed.
- When the upper or lower limit of the span or scale is changed on channels that are set to linear scaling, square root computation, or 1-5V input (this includes changes in the decimal place).

► For an explanation of this function, see section 1.3.

Display

• Alarms for Each Channel

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

Alarm	Type	Value	Relay	No.	Detect
1	On	H	0.0000	On	I01
2	Off				
3	Off				
4	Off				

• Alarm Delay

MV1000

Press **MENU** and then select > **Menu tab** > **Meas channel** > **Tag, Memory, Delay**.

MV2000

Press **MENU** and then select > **Menu tab** > **Meas channel** > **Tag, Memory sample, Alarm delay**.

Settings

- **First-CH, Last-CH**

Select the target channels. All of the alarm settings selected here will be applied to these channels.

- **Alarm > 1, 2, 3, 4**

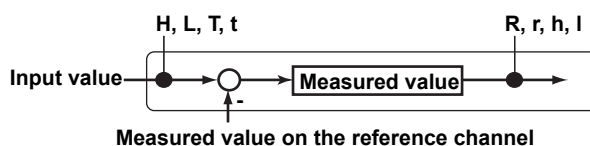
Select On for the Alarms that you want to use.

- **Alarm > Type**

Select the alarm type.

Setting	Name	Description
H	High limit alarm	–
L	Low limit alarm	–
h	Difference high limit alarm	You can use this alarm on measurement channels set to difference computation.
l	Difference low limit alarm	You can use this alarm on measurement channels set to difference computation.
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 alarms for channels set to difference computation can be activated by the values at the positions indicated below.



- **Alarms > Value**

Set the value depending on the type of alarm.

When the Channel Mode Is Volt, TC, RTD, or DI

Type	Value	Alarm Value Range Example
H, L	Within the measurable range.	–2.0000 to 2.0000 V for 2 V range
R, r	Min: The smallest number expressible, given the decimal place. Max: The value that is equal to the width of the measurable range (but cannot exceed 30000 after removing the decimal point)	0.0001 to 3.0000 V for 2 V range 0.1 to 1760.0°C for type R thermocouples
T, t	Same as H and L	Same as H and L

When the Channel Mode Is Delta

Type	Alarm Value	Alarm Value Range Example
H, L	Within the measurable range.	–2.0000 to 2.0000 V for 2 V range
h, l	Within the measurable range.	–1760.0 to 1760.0°C for type R thermocouples
R, r	Min: The smallest number expressible, given the decimal place. Max: The value that is equal to the width of the measurable range (but cannot exceed 30000 after removing the decimal point)	0.0001 to 3.0000 V for 2 V range 0.1 to 1760.0°C for type R thermocouples
T, t	Same as H and L	Same as H and L

When the Channel Mode Is Scale, Sqrt, or 1-5V

Type	Alarm Value	Alarm Value Range Example
H, L	From –5% to 105% of the scale width. But within the range of –30000 to 30000, ignoring the decimal point.	–5.0 to 105.0 for a scale of 0.0 to 100.0. –120.00 to 300.00 for a scale of –100.00 to 300.00.
R, r	Within the range of 1 to 30000, ignoring the decimal point.	0.1 to 3000.0 for a scale of 0.0 to 100.0. 0.01 to 300.00 for a scale of –100.00 to 300.00.
T, t	Same as H and L	Same as H and L

- **Alarms > Relay**

Turn relay output On or Off.

- **Alarms > No.**

Select the output relay or internal switch number when Relay is On.

- **Alarms > Detect**

The Detect setting is displayed if the alarm hide function (for details, see section 3.6) is enabled. To display notifications when alarms are activated, select On. If you select Off, when an alarm is activated, a signal will be sent to the alarm output relay and internal switch, but no notification will be displayed. And the alarm will not be recorded in the alarm summary.

- **Alarm delay > Time (for delay high/low limit alarms)**

Set the alarm delay time to an integer in the range of 1 to 3600 s.

Note

- The alarm delay time takes on a value that is an integral multiple of the scan interval. For example, if the alarm delay time is set to 5 s when the scan interval is 2 s, the actual delay time is 6 s.
- The delay alarm has the following special operations.
 - If a delay alarm is set on a computation channel and computation is stopped when the computed value exceeds the alarm setting, the alarm is turned On after the specified period (delay period) elapses.
 - The alarm detection operation is reset if a power failure occurs. The operation restarts after the power recovers.
 - If the alarm setting of the delay high limit alarm is changed when an alarm is already activated and the input is greater than or equal to the new setting, the alarm continues. For all other cases, the alarm detection operation starts using the new setting. This is also true for the delay low limit alarm.

3.8 Releasing Alarm Output

This operation is valid when:

- Indicator is set to Hold in Basic Setting Mode
 - Relay Hold is set to Hold and Relay Action on ACK is set to Normal in Basic Setting Mode
 - Relay Action on ACK is set to Reset in Basic Setting Mode.
- For Hold and Relay Action on ACK configuration instructions, see section 3.5.

Procedure

Perform this operation after an alarm occurs.

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **AlarmACK** soft key.
The alarm output is released.

Explanation

- **Alarm Output Release (AlarmACK)**
When an AlarmACK operation is carried out, the indications and outputs (relays and switches) of all activated alarms are cleared.

3.9 Calibrating Input Values (/CC1 option)

This section explains how to calibrate input values to produce measured values.

► For an explanation of this function, see section 1.2.

Display

Press **MENU** and then select > **Menu tab** > **Meas channel** > **Calibration correction**.

GROUP 1
2008/01/23 22:01:54

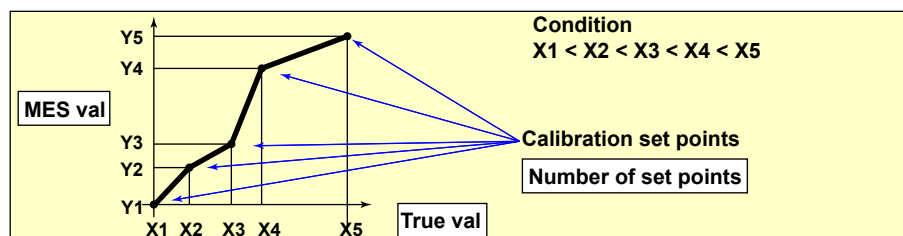
First-CH: 1 Last-CH: 1

Number of set points: 5

	MES val	True val
1	-2.0000	-2.0000
2	-2.0000	-2.0000
3	-2.0000	-2.0000
4	-2.0000	-2.0000
5	-2.0000	-2.0000

Off 2 3 4 Next 1/4

Settings



- **First-CH, Last-CH**

Select the target channels. You can set consecutive channels whose range is set to the same value as that of the first channel.

- **Number of set points**

Select the number of points (including the start and end points) that will be used to divide segments, from within the range of 2 to 16.

To disable calibration correction, select Off.

3.9 Calibrating Input Values (/CC1 Option)

- **Number of set points > Mes val, True val**

Press the **Input** soft key and enter the value.

For **Mes val** (measured value), set a value that is greater than the previous value.

Press the **Measure** soft key to set the current measured value to **Mes val**. If you press the **Measure** soft key when you are setting the calibration function for more than one channel, the measured value of the channel set to **First-CH** is used as the **Mes val** for all channels.

Range of Selectable Values for Mes val and True val

- **On Channels Set to Linear Scaling**

–30000 to 30000 (decimal place is the same as that set for the scale)

- **On All Other Channels**

The measurable range

Example: If the range is 2 V, –2.0000 to 2.0000

Note

- If you change the Mode or Range settings, calibration correction (the **Number of set points** setting) is switched Off.
 - You cannot set calibration correction for a channel that is set to Skip.
-

3.10 Counting Pulses (/PM1 option)

This section explains how to use computation channels to count pulses that are received from pulse input terminals.

► For an explanation of this function, see section 1.2.

Display

Press **MENU** and then select > **Menu tab** > **Math channel** > **Calculation expression**, **Alarm**.

Settings

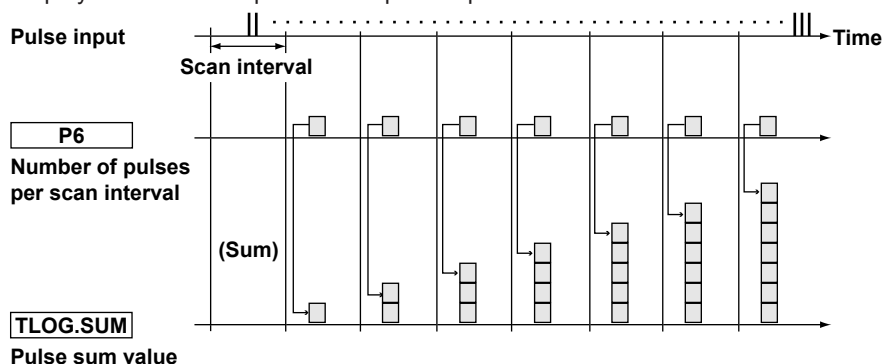
- **First-CH, Last-CH**
Select the target channels.
 - **Math range > Math On/Off**
Select **On**.
 - **Math range > Calculation expression**
You can use the following variables in equations.
Q01 to Q08: The number of pulses per second.
P01 to P08: The number of pulses per scan interval.
* The numbers 01 to 08 refer to the pulse input terminal numbers.
- For computation channel configuration instructions, see section 10.1.

There are examples on the next page to help explain configuration options.

3.10 Counting Pulses (/PM1 option)

- **Example 1: Pulse Sum**

Display the sum of the pulses from pulse input terminal 6.



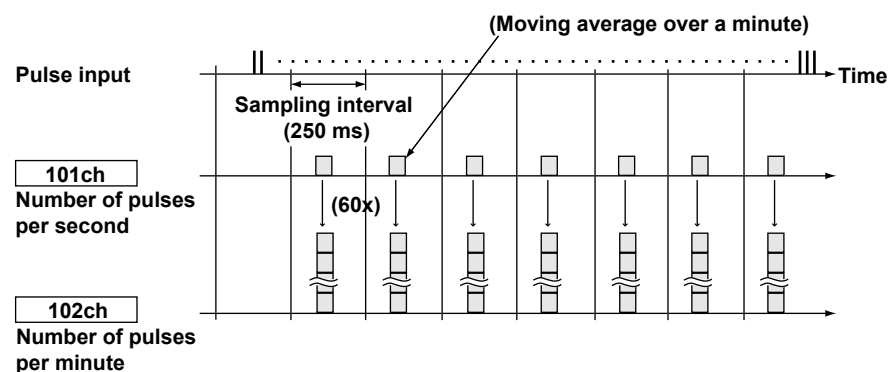
Calculation Expression

Select the channel and set the calculation expression. Set an appropriate **Span Lower**, **Span Upper**, and **Unit**.

Channel	Calculation Expression	Description
101	TLOG.SUM(P6)	The sum of the number of pulses in each scan interval.

- **Example 2: Pulses Per Minute**

Using the MV2008 (scan interval 250 ms), count the number of pulses received by pulse input terminal 6, and calculate the number of pulses per minute.



Calculation Expression

This table shows which calculation expressions to assign to which channels. Set an appropriate **Span Lower**, **Span Upper**, and **Unit**.

Channel	Calculation Expression	Description
101	Q6	Number of pulses per second
102	101*K01	Number of pulses per minute
Constant	Value	Description
K01	60	The coefficient for converting pulses per second to pulses per minute.
Channel	Rolling Average	Description
101	Interval: 1 s	Moving average over a minute
	Number of samples: 60	

Channel

Computation starts with the smallest channel number at every scan interval.

Assign larger channel numbers to computation channels that calculate pulses per minute than you assign to computation channels that calculate pulses per second.

• **Example 3: Reset if the Pulse Sum Exceeds a Set Value**

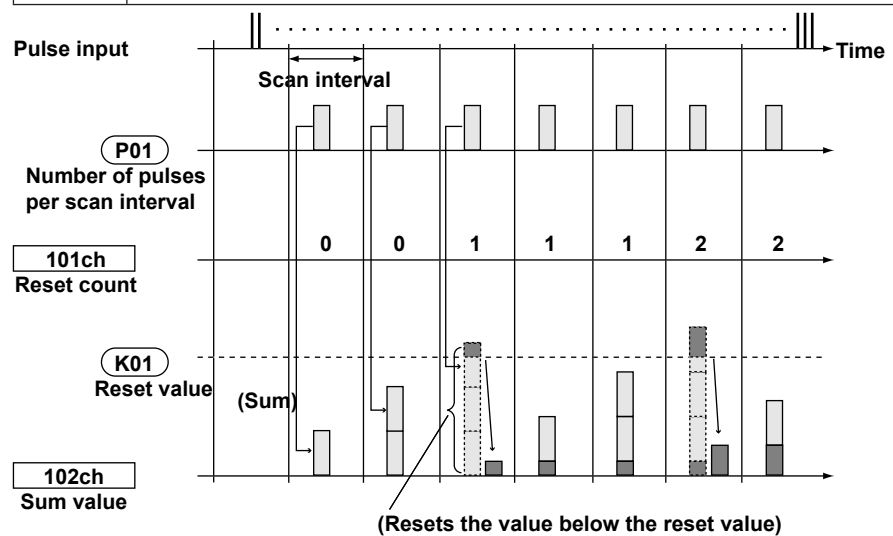
If the pulse sum exceeds a set value (the reset value), reset the sum and carry over the value that exceeds the reset value. Count the number of resets, and calculate the total pulse sum.

Calculation Expression

This table shows which calculation expressions to assign to which channels and what constants to set.

Channel	Calculation Expression	Description
101	$((102+P01).GE.K01)+101$	Number of pulse sum resets
102	$CARRY(K01):TLOG.SUM(P01)$	Pulse sum
103	$K01*101+102$	The total pulse sum

Variable	Description
P01	The number of pulses per scan interval.
K01	A constant. The reset value. Values that exceed it are reset.



Channel 101: Reset Count

Calculates the number of pulse sum resets.

$((102+P01).GE.K01)$ returns a value of 1 when the value of the previous pulse sum (102) + the current pulse count (P01) is greater than or equal to the reset value (K01). Otherwise, it returns a value of zero. The value of Channel 101 increases by 1 whenever the pulse sum exceeds the reset value.

Channel 102: Pulse Sum

Calculates the pulse sum.

This channel normally calculates the pulse sum, $TLOG.SUM(P01)$. If the pulse sum goes above the reset value (K01), the excess value is set as the new pulse sum.

Channel 103: Total Pulse Sum

This channel multiplies the reset value (K01) by the reset count (101) and adds the pulse sum (102) to get the total pulse sum.

Note

- Computation starts with the smallest channel number at every scan interval. If a channel number in a calculation expression is greater than or equal to the number of the channel that contains the expression, the previous computed result (the previous value) of the channel with that number will be used in the expression.
- The MV will not compute values correctly if the pulse input value of a scan interval is larger than the reset value.

3.11 Setting Range-Out Detection for Linearly Scaled Measurement Channels

Display

MV1000

Press **MENU** > then select **Menu tab** > **Basic setting mode** > **Environment tab** > **Input, Alarm**

Basic Setting Mode Ethernet Link

Input
Value on over-range Free

Alarm
No logging On

Free Over

MV2000

Press **MENU** and then select **Menu tab** > **Basic setting mode** > **Environment tab** > **View, Message, Input, Alarm**.

Basic Setting Mode Ethernet Link

Environment > View, Message, Input, Alarm

View
Trend type T-Y
Partial Off
Trend rate switching Off

Input
Value on over-range Free

Message
Write group Common
Power-fail message Off
Change message Off

Alarm
No logging Off

Free Over

Settings

• Input > Value on over-range

Setting	Description
Free	Ignoring the decimal point, less than -30000 is a negative range-out, and above 30000 is a positive range-out. They are displayed as -Over and +Over.
Over	A value less than -5% of the scale is a negative range-out, and a value greater than 105% of the scale is a positive range-out. They are displayed as -Over and +Over. Example: If the scale is 0.0 to 200.0, a value less than -10.0 is a negative range-out, and a value greater than 210.0 is a positive range-out.

Note

With computation and report functions such as TLOG and CLOG, you can specify how the MV will handle scale range out values.

► See section 10.1.

4.1 Setting the Recording Conditions of Measured Data

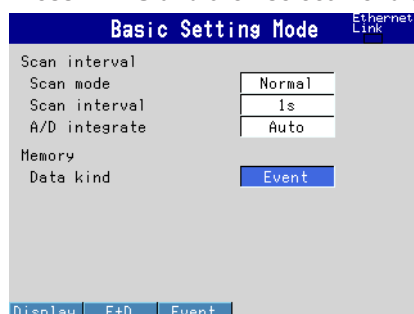
This section explains how to select a method for recording measured data.

► For an explanation of the recording function, see section 1.5.

Display

• Data Type

Press **MENU** and then select **Menu tab > Basic setting mode > A/D, Memory**.



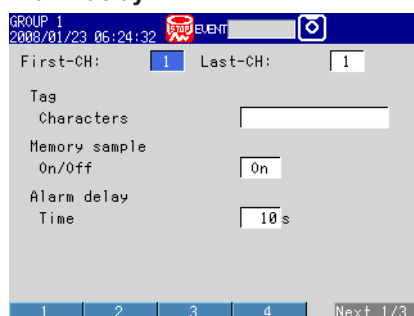
• Measurement Channels

MV1000

Press **MENU** and then select **> Menu tab > Meas channel > Tag, Memory, Delay**.

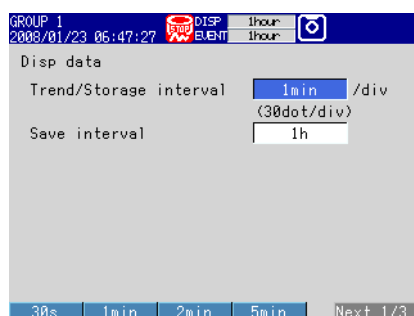
MV2000

Press **MENU** and then select **> Menu tab > Meas channel > Tag, Memory sample, Alarm delay**.



• Trend/Storage interval and Save interval (for display data)

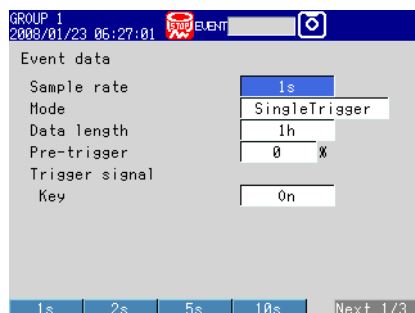
Press **MENU** and then select **> Menu tab > Data save > Disp data**.



4.1 Setting the Recording Conditions of Measured Data

- **Event Data Recording Conditions**

Press **MENU** and then select > **Menu tab** > **Data save** > **Event data**.



Settings

- **Memory > Data Kind**

Setting	Description
Display	Records display data.
E+D	Records display data and event data. You cannot select this setting if the trend interval switching function (Trend rate switching) is set to on On (see section 6.3 for details)
Event	Records event data.

- **Memory sample > On/Off**

Select **On** for the target channels.

- **Disp data > Trend/Storage interval**

Set the display trend/storage interval. For the trend/storage intervals that can only be set on high-speed input models, 5 s/div and 10 s/div, 1 division (div) is equal to 40 dots.

You can only set trend/storage intervals that are longer than the scan interval you set in Basic Setting Mode.

- **Disp data > Save interval (when recording display data)**

Set the size of recorded data files. Recorded data is divided into files of the size specified here. The values that you can set here vary depending on the Trend/Storage interval setting.

Trend/Storage interval ¹	5s ²	10s ²	15s ³	30s	1min
Sampling interval	125ms	250ms	500ms	1s	2s
Selectable Save Interval Values	10 min to 12 h	10 min to 1 day	10 min to 3 days	10 min to 7 days	10 min to 14 days
Trend/Storage interval ¹	2min	5min	10min	15min	20min
Sampling interval	4s	10s	20s	30s	40s
Selectable Save Interval Values	10 min to 14 days	10 min to 31 days	10 min to 31 days	10 min to 31 days	1 h to 31 days
Trend/Storage interval ¹	30min	1h	2h	4h	10h
Sampling interval	1 min	2 min	4 min	8 min	20 min
Selectable Save Interval Values	1 h to 31 days	1 h to 31 days	2 h to 31 days	4 h to 31 days	8 h to 31 days

1 You can only set a data interval that corresponds to a sampling interval that is slower than the scan interval.

2 Only available on high-speed input models of the MV.

3 Selectable in fast sampling mode on medium-speed input models of the MV.

4.1 Setting the Recording Conditions of Measured Data

- **Event Data**

- **Sample rate**

Select the data recording interval. Use the table under “Data length” for reference.

- **Mode**

Setting	Description
Free	Records data continuously.
Single	Records data when a trigger condition is met.
Repeat	Records data whenever a trigger condition is met.

- **Data length**

Set the size of recorded data files. Recorded data is divided into files of the size specified here. The data lengths that you can set here vary depending on the Sample rate setting.

Sample rate ¹	25ms ²	125ms	250ms	500ms	1s
Selectable data lengths	10 min to 4 h	10 min to 1 day	10 min to 2 days	10 min to 3 days	10 min to 7 days
Sample rate ¹	2s	5s	10s	30s	1min
Selectable data lengths	10 min to 14 days	10 min to 31 days	10 min to 31 days	1 h to 31 days	1 h to 31 days
Sample rate ¹	2min	5min	10min		
Selectable data lengths	1 h to 31 days	1 h to 31 days	1 h to 31 days		

¹ You cannot choose an interval that is faster than the scan interval.

² Only available on high-speed input models of the MV.

- **Pre-trigger**

Select the amount of data before each trigger activation that you want to record. You can select 0, 5, 25, 50, 75, 95, or 100% of the set Data length. If you do not want to record any data before trigger activations, choose **0%**.

- **Trigger signal > Key**

To activate a trigger with key operations, select **On**.

Note

- You can activate triggers with the event action function (see section 7.1 for details).
- If a trigger condition is met when the START/STOP key is pressed, recording will begin.

4.2 Setting the Save Method for Measured Data

This section explains how to select a method for saving measured data to memory.

► For an explanation of the save function, see section 1.5.

Display

- **Auto save**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Security, Media save.**

Basic Setting Mode		Ethernet Link
Security		
Key	Off	
Communication	Off	
Save		
Auto save	On	
Media FIFO	On	
Off Login Keylock		

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Security, Media save, Batch.**

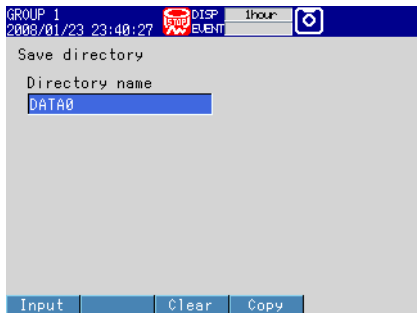
Basic Settings Mode		Ethernet Link
Environment > Security, Media save, Batch		
Security		
Key	Off	
Communication	Off	
Save		
Auto save	On	
Media FIFO	Off	
Batch		
On/Off	Off	
On Off		

- **Display/Event Data File format, File header, and Data file name**

Press **MENU** and then select **> Menu tab > Data save > File settings.**

GROUP 1		2008/01/23 06:29:50	EVENT
Disp/Event File			
File format	Binary		
File header			
Characters			
Data file name			
Structure	Date		
Identified strings			
Date Serial			

- **Save directory**
Press **MENU** and then select > **Menu** tab > **Data save** > **Save directory**.



Settings

- **Save > Auto save**

Setting	Description
On	Automatically saves measured data to a CF card. Set to On when Media FIFO is enabled.
Off	Does not automatically save measured data. Manually save measured data to a CF card or to USB flash memory.

- **Save > Media FIFO**

The **Media FIFO** box appears when you set **Auto save** to **On**.

Setting	Description
On	Uses Media FIFO. With this save method, the newest data files are always kept.
Off	Does not use Media FIFO. If the free space on the CF card is low, you will need to change to a different CF card.

- **Disp/Event File > File format**

Select either Binary or Text as the format for saving display and event data.

- **File header > Characters**

Enter a comment to be written into data files (up to 50 characters, **Aa#1**).

4.2 Setting the Save Method for Measured Data

- **Data file name > Structure**

Set the structure used for generating file names.

Setting	Description
Date	Serial number + user-specified character string + date
Serial	Serial number + user-specified character string
Batch	Serial number + batch (when using the batch function)

- **Data file name > Identified strings**

Set the user-specified character string (up to 16 characters, **Aa#1**).

You can use these symbols: # % () + - . @ ° _

► For an explanation of the file naming function, see section 1.5.

- **Save directory > Directory name**

Set the name of the directory to be saved to. (up to 20 characters, **Aa#1**).

You can use these symbols: # % () + - . @ ° _

You cannot use these character combinations: "AUX" "CON" "PRN" "NUL" "CLOCK"
"COM1" to "COM9" "LPT1" to "LPT9".

4.3 Using the Batch Function

This section explains how to configure the batch function.

► For an explanation of this function, see section 1.6.

Display

- **Batch Function**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Batch**.

The screenshot shows the 'Basic Setting Mode' screen for the MV1000. The 'Batch' section is highlighted, showing the following settings:

Batch	On/Off	On
Lot-No. digit		6
Auto increment		On

At the bottom, there are buttons for 'On' and 'Off'.

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Security, Media save, Batch**.

The screenshot shows the 'Basic Setting Mode' screen for the MV2000. The 'Environment > Security, Media save, Batch' path is highlighted. The 'Batch' section is highlighted, showing the following settings:

Security	Key	Off
Communication		Off
Save	Auto save	On
Media FIFO		Off
Batch	On/Off	On
Lot-No. digit		6
Auto increment		On

At the bottom, there are buttons for 'On' and 'Off'.

- **Data file name**

Press **MENU** and then select **> Menu tab > Data save > File settings**.

The screenshot shows the 'Data file name' settings screen. The following settings are visible:

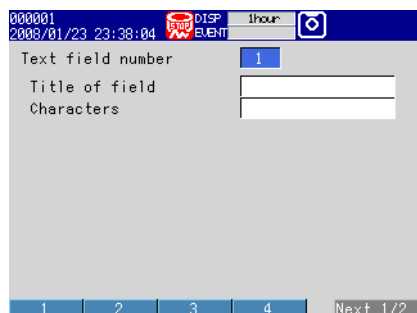
- GROUP 1
- 2008/01/23 10:31:41
- File format: Binary
- File header: Characters
- Data file name: Structure (Date)
- Identified strings

At the bottom, there are buttons for 'Date' and 'Serial'.

4.3 Using the Batch Function

- **Text Field**

Press **MENU** and then select > **Menu tab** > **Data save** > **File settings** > **Batch text**.



Settings

- **Batch > On/Off**

Select On to use the batch function.

- **Batch > Lot-No. digit**

You can set the lot number to 4, 6, or 8 digits. Select Off to disable lot numbers.

- **Batch > Auto increment**

Setting	Description
On	Automatically sets the lot number of the next measurement to the current lot number + 1.
Off	Turns auto increment off.

- **Data file name > Structure**

Batch: Creates display and event data filenames by combining the batch number with the serial number.

► For an explanation of the file naming function, see section 1.5.

- **Data file name > Identified strings**

► For an explanation of the file naming function, see section 4.2.

- **Text field number**

Select a number from 1 to 8.

- **Text field number > Title of field, Text field number > Characters**

Enter a character string.

Title of field: Up to 20 characters, **Aa#1**. Characters: Up to 30 characters, **Aa#1**.

Procedure

• Setting Batch Names (Batch number + lot number) and Comments

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Batch** soft key.
The window for entering the batch number, lot number, and comments appears.
3. Set the batch number (up to 32 characters, **Aa#1**).
You can use these symbols: # % () + - . @ ° _

You can also set the lot number.
4. Set batch comments 1, 2, and 3 (up to 50 characters, **Aa#1**).
5. Press **DISP/ENTER**.

Note

- After memory sampling begins, the batch number and lot number cannot be changed.
- You can change comments freely before memory sampling starts. After memory sampling starts, you can only set comments that have not yet been set. While the window for entering comments is displayed, you can change the comments freely, but after the window is closed the comments are fixed.
- When memory sampling stops comments are cleared.
- Batch numbers, lot numbers, and comments are saved in event and data files, but not in setup files.

• Displaying Text Field Settings

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Text field** soft key.
The text field settings appear.

4.4 Starting/Stopping Recording, and Saving Measured Data

This section explains how to start recording and save measured data to external storage media.

► For an explanation of these functions, see section 1.5.

Procedure

- **Starting Recording (memory start)**

Press **START/STOP**. The internal memory icon in the status display section changes from the icon that indicates that there is no memory sampling to the icon that indicates memory sampling.

- If you are recording display or event data in Free mode, recording will start.
- If you are recording event data in a triggered mode (Single or Repeat), the MV will enter a trigger-wait state.

- **Activating the Trigger to Start Recording**

This operation can be performed while the MV is in a trigger-wait state. The MV will display “Waiting” in the status display section.

Activating the Trigger Using Keys

This operation can be performed when you are recording event data in a triggered mode (Single or Repeat) and you have set the trigger so that it can be activated with key operations.

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Trigger** soft key.
Recording begins.

Activating Triggers with Events (The event action function must be set. See chapter 7.)

Recording will start when an event occurs.

- **Saving Automatically**

Automatic saving takes place when **Auto save** is set to **On** (see section 4.2 for details).

Data is saved to the CF card.

Leave the CF card in its slot. During memory sampling, measured data in the internal memory will be automatically saved to the CF card.

When you are not using Media FIFO, if the external storage media cannot be saved to due to a lack of free space or some other problem, unsaved data will be saved along with the current data the next time that data is automatically saved.

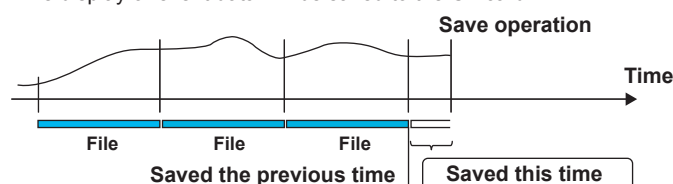
Using Key Operations to Save Display or Event Data during Memory Sampling

Data is saved to the CF card.

This operation can be performed when you are recording display data or when you are recording event data in Free mode. This operation saves the unsaved measured data in the internal memory to the CF card.

- * If you perform this operation when the **Auto save** setting is **Off**, the data in the internal memory will be saved as an individual file.

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Save display** or **Save event** soft key.
The display or event data will be saved to the CF card.



- **Saving Manually (collectively storing unsaved data)**

Perform this operation when **Auto save** is set to **Off** (see section 4.2 for details).

You can save to a CF card or to USB flash memory.

► For instructions on how to save to USB flash memory, see section 4.10.

1. Insert the CF card.

A confirmation window containing the message “There is data which is not saved to media.

Do you want to store to media?” appears.

The CF card icon appears in the status display section.

2. Select **Yes**, then press **DISP/ENTER**. A menu appears.

The unsaved data in internal memory will be saved to an external storage medium.

3. Follow these steps to remove the external storage medium.

Press **FUNC** (to display the Function menu) > **Media eject** soft key > **CF** soft key.

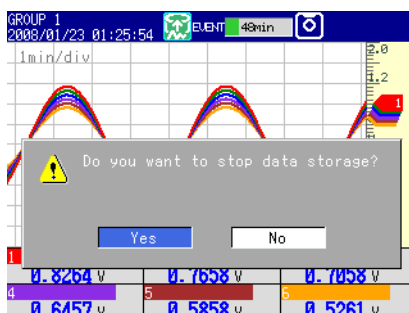
When the message “Media can be removed safely” appears, remove the storage medium.

Note

- If there is not enough space on the storage medium, the message “Not enough free space on media” appears, and the data is not saved. When this message appears, switch to another external storage medium and try saving again.
- You cannot cancel a data save operation as it is taking place.

- **Stopping Recording (Memory stop)**

1. Press **START/STOP**. A confirmation window appears.



2. Select **Yes** using the arrow keys, and then press **DISP/ENTER**.

If the MV is equipped with computation functions (/M1 and /PM1 options), select **Mem+Math** or **Memory** and press **DISP/ENTER**.

The internal memory icon in the status display section changes to the icon that indicates that there is no memory sampling.

- **Using Keys to Save Selected Data or All Data in Internal Memory**

► See section 5.9.

Explanation

- **Operations That Begin at the Same Time as Memory Sampling (Memory start)**
 - Waveform display updating on the trend display
 - Reporting (/M1 and /PM1 options)
 - Computation functions (/M1 and /PM1 options), if they are configured to do so.
 - ▶ For details, see section 10.4.
- **Operations That Stop at the Same Time as Memory Sampling (Memory stop)**
 - Waveform display updating on the trend display
 - Reporting (/M1 and /PM1 options)
 - Computation operations (/M1 and /PM1 options), if they are being performed.
- **Save Problems**

The following problems may arise when the MV is continually accessing internal or external memory. If these problems arise, the storage media access indicator will light frequently.

 - External storage media file save error
 - Access timeout

These problems can be dealt with in the following ways.

 - If you are using the event action function and saving small consecutive files, increase the size of the files being saved.
 - If you are saving multiple files to the same directory on an external storage medium, change the name of the Save directory, making sure that the number of files in the directory does not exceed 1000.
 - If data recording and display are using up resources (for example if you are recording on multiple channels using a fast sampling rate, and displaying four trend displays on the 4-panel display), use a slower sampling rate or change the display.

4.5 Saving Measured Data Manually

This section explains how to save the current values of all channels (except for channels set to Skip or Off) through key operations.

► For an explanation of this function, see section 1.5.

Procedure

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Manual sample** soft key.
Manual sampling begins.

Explanation

- **Manually Sampled Data in Internal Memory**
You can check the number of manually sampled data files in internal memory on the Memory Summary display (see section 1.4 for details).
- **Saving to a CF Card**
 - If **Auto save** is set to **On**, manually sampled data will be automatically saved to a CF card when manual sampling takes place.
 - If **Auto save** is set to **Off**, use a manual save operation (see section 4.4 for details) to save manually sampled data to a CF card or to USB flash memory.
 - No matter what **Auto save** is set to, you can always save manually sampled data to a CF card or to USB flash memory using a manual save operation (see section 5.9 for details).

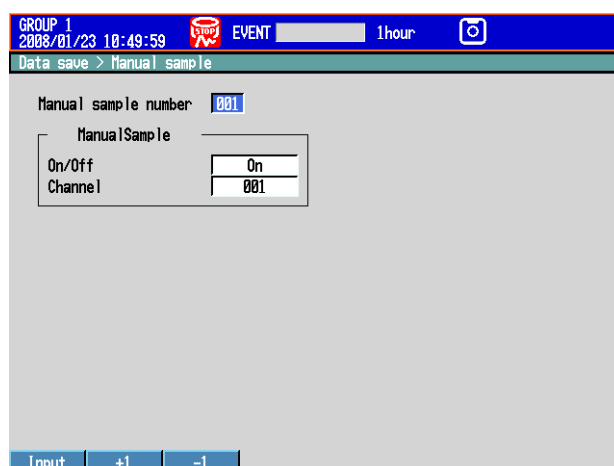
Setting Which Channels to Save Manually (only on the MV2000)

On models of the MV2000 equipped with external input channels (/MC1 option), you can set which channels' (120 channels or less) current values to save.

Display

Available on models equipped with external input channels (/MC1 option).

Press **MENU** and then select > Menu tab > Data save > Manual sample.



Settings

- **Manual Sample number**
Select a number from 001 to 120. Current channel values will be saved in this order.
- **Manual Sample**
 - **On/Off**
To assign a channel to the set **Manual Sample number**, select **On**.
 - **Channel**
Enter the channel number of a measurement, computation (/M1 and /PM1 options), or external input (/MC1 option) channel.

4.6 Saving Screen Image Data (Snapshot)

This section explains how to save the image data from the active display to a CF card. This operation is referred to as *Snapshot*, and screen image data files are referred to as *Snapshot data files*.

► For an explanation of this function, see section 1.5.

Procedure

- 1 In Operation Mode, press **FUNC**.
The function menu appears.
- 2 Press the **Snap shot** soft key.
The MV saves a snapshot data file to the CF card.
Displayed soft keys and message windows will not be saved.

Note

If you assign the Snapshot function to the USER key, you can take snapshots in all modes (Operation Mode, Setting Mode, and Basic Setting Mode). However, error messages will not be saved.

Explanation

- **File Format, Size**
Snapshot data files are saved in PNG format.
The maximum snapshot data file size is about 15 KB per screenshot.
- **File Names**
► For details, see section 1.5.

4.7 Managing Stored Files

This section explains how to display a list of stored files and the amount of available memory, how to delete files and directories, and how to format storage media.

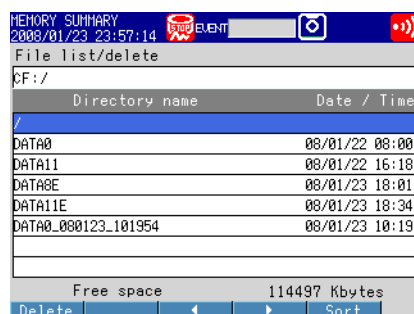
Procedure

- **Displaying Files, Deleting Files, and Checking Available Memory**

To access the display:

Press **MENU** then select **File** tab > **File list, delete**. Press the **CF** or **USB** soft key* then **DISP/ENTER**.

* When using a CF card and USB flash memory.



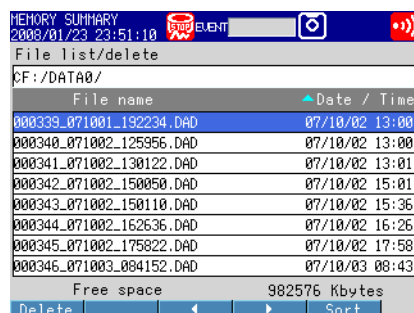
Directory name	Date / Time
/	
DATA0	08/01/22 08:00
DATA11	08/01/22 16:18
DATABE	08/01/23 18:01
DATA11E	08/01/23 18:34
DATA0_080123_101954	08/01/23 10:19

Free space 114497 Kbytes

Delete ◀ ▶ Sort

Displaying a List of Files in a Directory and Checking Available Memory

Use the arrow keys to select a directory, and then press **DISP/ENTER**. The files in the directory will appear in a list. / is the root directory.



File name	Date / Time
000339_071001_192234.DAD	07/10/02 13:00
000340_071002_125956.DAD	07/10/02 13:00
000341_071002_130122.DAD	07/10/02 13:01
000342_071002_150050.DAD	07/10/02 15:01
000343_071002_150110.DAD	07/10/02 15:36
000344_071002_162636.DAD	07/10/02 16:26
000345_071002_175822.DAD	07/10/02 17:58
000346_071003_084152.DAD	07/10/03 08:43

Free space 982576 Kbytes

Delete ◀ ▶ Sort

Changing Files and Directory Display Order

You can arrange files by the date when they were last updated.

Pressing the **Sort** soft key will switch between displaying files or directories in ascending or descending order. A marker indicating the sort order is displayed next to **Date/Time**.

Deleting Files

Use the arrow keys to select a file, and then press the **Delete** soft key. A confirmation window will appear. Select **Yes**, and press **DISP/ENTER**.

The file is deleted.

Deleting Directories

First, delete all of the files in the directory.

Select the directory. The remaining steps are the same as those for deleting a file.

Checking Available Memory

The amount of available memory is indicated at the lower right of the display.

• **Formatting Storage Media**

Formatting will remove the contents of the storage media.

1. To access the display:

Press **MENU** then select **File** tab > **Format**. Press the **CF** or **USB** soft key* then **DISP/ENTER**.

* When using a CF card and USB flash memory.



2. Enter the **Volume name** (up to 11 characters, **[A1]**), and press **DISP/ENTER**.
A confirmation window appears.
3. Select **Yes**, and press **DISP/ENTER**.
The storage device will be formatted.

Explanation

• **Format Types**

Memory Size	Type
Storage media with less than 512 MB of memory.	FAT16
Storage media with more than 512 MB of memory.	FAT32

4.8 Loading and Displaying Measured Data from External Storage Media

This section explains how to display the waveforms of display and event data that have been saved in binary format to external storage media. Loaded data will be displayed on the historical trend display.

► For historical trend display operating instructions, see section 5.3.

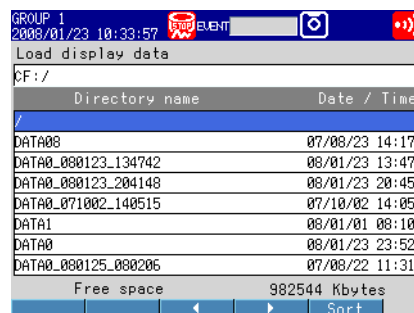
Procedure

• Loading a File

1. To access the display:

Press **MENU** and then select **File** tab > **Load display data** or **Load Event data**. Press the **CF** or **USB** soft key* and then **DISP/ENTER**.

* When using a CF card and USB flash memory.

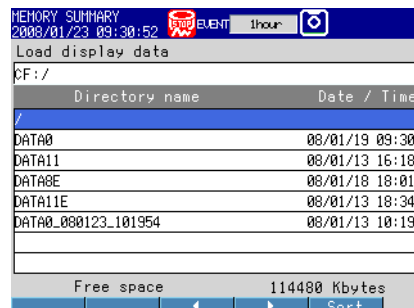


GROUP 1
2008/01/23 10:33:57
Load display data
CF:/

Directory name	Date / Time
/	
DATA08	07/08/23 14:17
DATA0_080123_134742	08/01/23 13:47
DATA0_080123_204148	08/01/23 20:45
DATA0_071002_140515	07/10/02 14:05
DATA1	08/01/01 08:10
DATA0	08/01/23 23:52
DATA0_080125_080206	07/08/22 11:31

Free space 982544 Kbytes
Sort

2. Use the arrow keys to select a directory, and then press **DISP/ENTER**. The files in the directory will appear in a list. / is the root directory.



MEMORY SUMMARY
2008/01/23 09:30:52
Load display data
CF:/

Directory name	Date / Time
/	
DATA0	08/01/19 09:30
DATA11	08/01/13 16:18
DATA0E	08/01/18 18:01
DATA11E	08/01/13 18:34
DATA0_080123_101954	08/01/13 10:19

Free space 114480 Kbytes
Sort

3. Select a file using the arrow keys, and then press **DISP/ENTER**. The MV loads the file and displays its historical trend.

Note

- The extension for display data files saved in binary format is .DAD. The extension for binary event data is .DAE.
- For details on using the Sort soft key, see section 4.7.

4.9 Saving and Loading Setup Data

This section explains how to save and load setup data from external storage media.

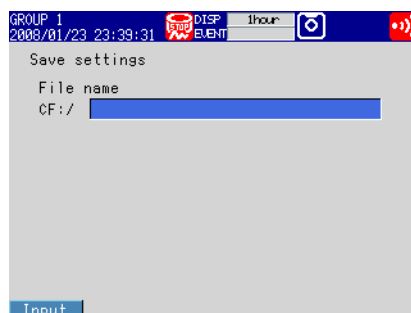
Procedure

• Saving Setup Data

1. To access the display:

Press **MENU** and then select **File** tab > **Save settings**. Press the **CF** or **USB** soft key* and then **DISP/ENTER**.

* When using a CF card and USB flash memory.



2. Enter the file name (up to 32 characters, **Aa#1**).

You can use these symbols: # % () + - . @ ° _

You cannot use these character combinations: "AUX" "CON" "PRN" "NUL" "CLOCK" "COM1" to "COM9" and "LPT1" to "LPT9".

To cancel the operation, press **ESC**.

3. Press **DISP/ENTER**.

The setup data is saved.

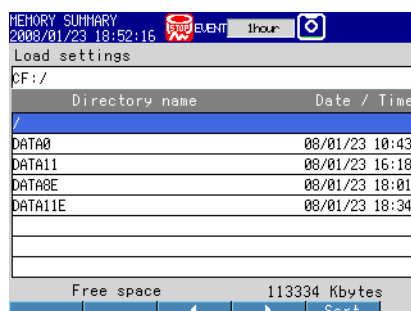
• Loading Setup Data

The MV loads all Setting Mode and Basic Setting Mode settings. When setup data is loaded, the previous settings are erased and the MV restarts with the loaded settings.

1. To access the display:

* Press **MENU** and then select **File** tab > **Load settings**. Press the **CF** or **USB** soft key* and then **DISP/ENTER**.

* When using a CF card and USB flash memory.



Note

For details on using the Sort soft key, see section 4.7.

4.9 Saving and Loading Setup Data

2. Select the setup file to be read by using the arrow keys and **DISP/ENTER**.
 - * The setup data file is in the root directory (/).
To cancel the operation, press **ESC**.
3. Press the **DISP/ENTER** key.
The setup data is loaded.

Explanation

- **Setup Data Files**
 - The setup data file extension is .PDL.
 - The maximum setup data file size is about 200 KB.
 - The following settings are also saved.
 - The current monitor display condition.
 - The Jump default display setting.
 - Favorite display key data.
- **Loading Setup Data**
 - The monitor display condition, Jump default display setting, and favorite display key settings are also loaded.
 - If the loaded setup data is not applied, check the error log (see section 5.10).
 - While setup data is being loaded, key operations, communication operations, and remote control operations cannot be executed.

4.10 Using USB Flash Memory

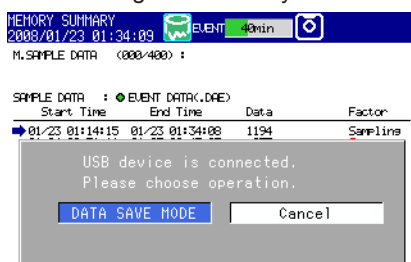
Connecting and Removing USB Flash Memory

Procedure

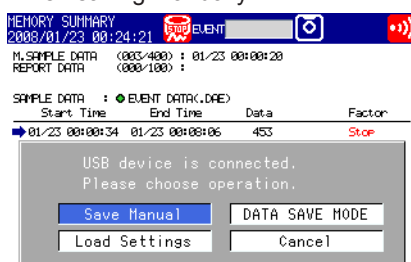
• Connecting USB Flash Memory

1. Connect a USB flash memory device to the MV USB port. The message, "USB device is connected. Please choose operation." appears, and you are able to use the USB flash memory.
2. In Operation Mode, selectable operations are displayed. Use the arrow keys to select an operation, and then press **DISP/ENTER**.

When saving automatically



When saving manually



Setting	Description
Save Manual	Saves unsaved data in the internal memory to USB flash memory.
DATA SAVE MODE	Switches to the DATA SAVE MODE display. For instructions on how to save internal memory data to an external storage medium, see section 5.9. This option is only displayed when it is available.* * You can use DATA SAVE MODE when there is display, event, report, or manually sampled data. You can change the option that is displayed here with the menu customize function. Displayable options: DATA SAVE MODE, SELECT SAVE, M. SAMPLE SAVE, REPORT SAVE, ALL SAVE.
Load Settings	Switches to the Setting Mode setup data load display. For instructions on how to load setup data, see section 4.9. Load Settings will not be displayed: <ul style="list-style-type: none"> • During memory sampling. • During computation. • During computation and memory sampling. • When Media/USB loading is locked (see chapter 8 for details). • When the MV is accessing storage media (formatting, saving, or FTP communication). • When there are no setup files in the root directory.
Cancel	Closes the operation selection window.

- **Removing USB Flash Memory**

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Media eject** soft key, and then the **USB** soft key.
The message "Media can be removed safely." appears.
3. Remove the USB flash memory.

Note

- You can connect one USB flash memory device.
 - When disconnecting a USB flash memory device, be sure to follow the procedure listed above. If you remove the USB memory without performing the above procedure, the data stored on it could be damaged.
-

Saving and Loading Data

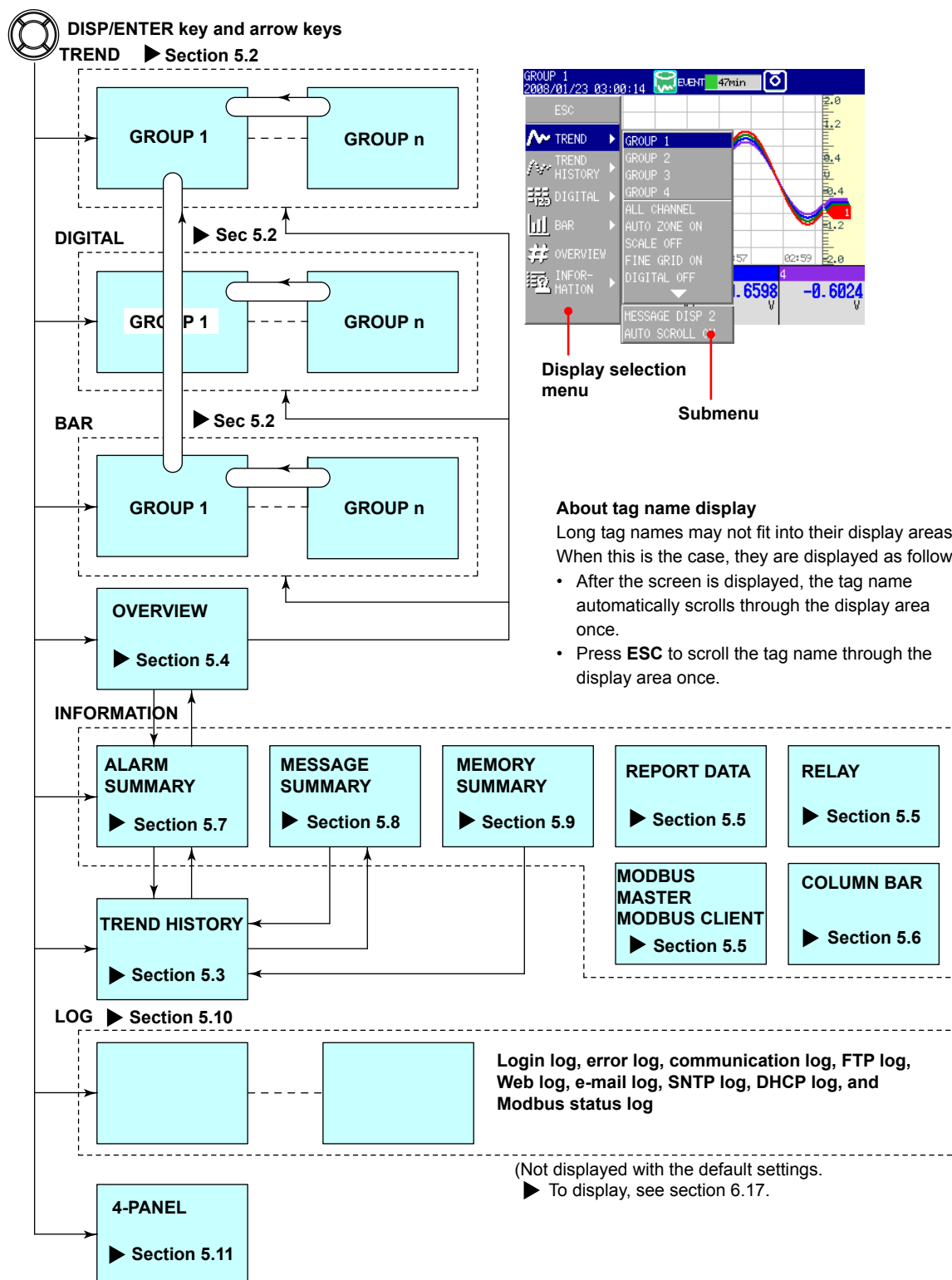
For information on:

- ▶ Saving and loading setup data files, see section 4.9.
- ▶ Saving display and event data files, see sections 5.9, and 4.4.
- ▶ Loading display and event data files, see section 4.8.
- ▶ Listing and deleting files, see section 4.7.
- ▶ Formatting storage media, see section 4.7.

5.1 Switching Between Displays

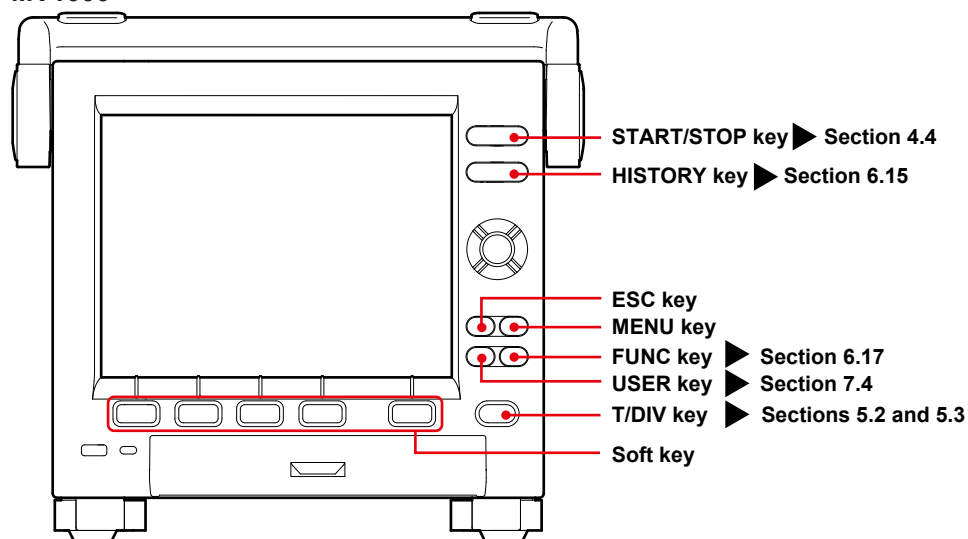
Switching between Displays Using the Arrow Keys and DISP/ENTER

Using DISP/ENTER and the arrow keys, you can open the display selection menu and its submenus and switch between displays. The following flowchart illustrates the operations that you can perform.

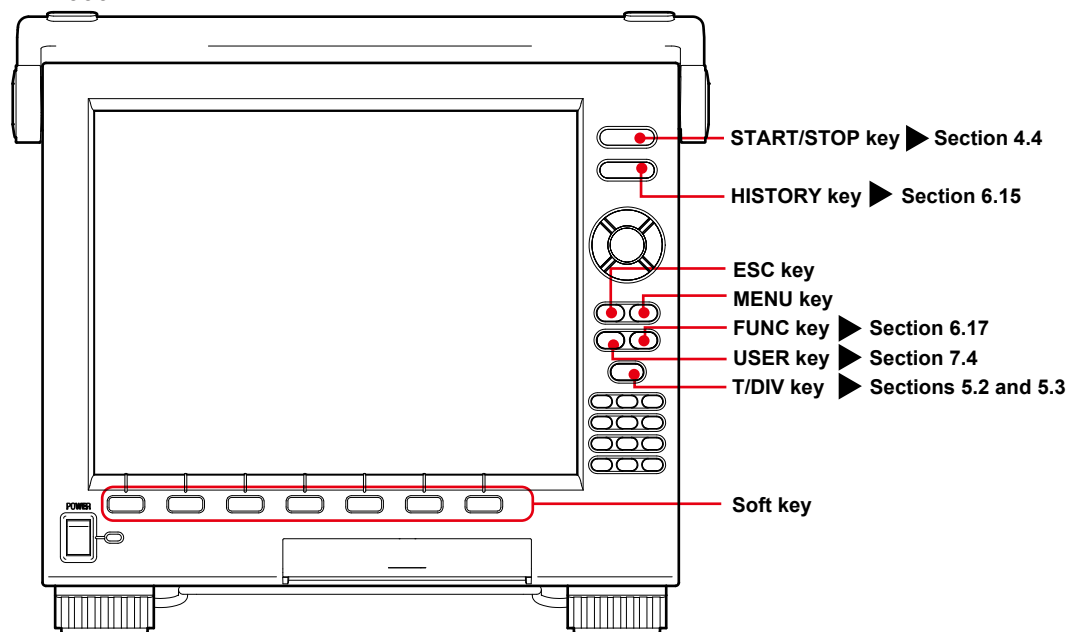


Operations Using Other Keys

MV1000

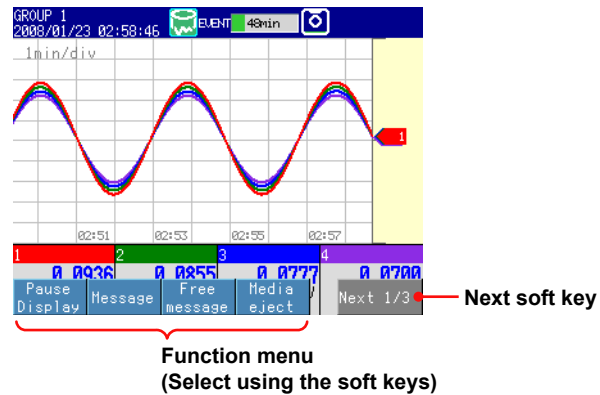


MV2000



FUNC Key Operations

Press **FUNC** to bring up the function menu at the bottom of the screen. Press the **Next** soft key to scroll through the function menu. Select the appropriate soft key for the operation you want to perform.

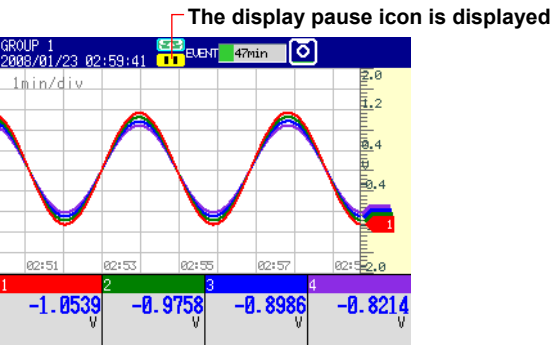


Pause Display	Message	Free message	Media eject	Snap shot	Manual sample	AlarmACK	LCD Saver	Trigger	Save display
► Sec. 5.1	Sec. 6.4	Sec. 6.4	Sec. 4.4	Sec. 4.6	► Sec. 4.5	Sec. 3.8	Sec. 9.8	Sec. 4.4	Sec. 4.4
Sec. 4.10									
Save event	Save stop	Math start	Math reset	Math ACK	Timer reset	Match T Reset	Keylock	Logout	Password change
► Sec. 4.4	Sec. 5.9	Sec. 10.4	Sec. 10.4	Sec. 10.4	► Sec. 7.2	Sec. 7.3	Sec. 8.1	Sec. 8.3	Sec. 8.3
Second speed	Batch	Text field	Favorite regist	Standard display	System info	Network info	SNTP	E-Mail start	E-Mail test
► Sec. 6.3	Sec. 4.3	Sec. 4.3	Sec. 6.15	Sec. 5.11	► Sec. 9.3	Sec. 9.3	Comm.*	Comm.*	Comm.*
FTP test					4Panel				
► Comm.*					► Sec. 5.11 (Only MV2000)				

* MV1000/MV2000 Communication Interface User's Manual.

Pausing the Display

You can pause the screen display.



Memory sampling continues even while the screen display is paused.
The Pause Display function pauses the following displays.

Display	Paused Parts of the Display
Trend	Trend waveform
	Digital values
Digital	—
Bar graph	Bar graphs
	Digital values
Overview	—
Information	Alarm summary
	Message summary
	Memory summary
	Modbus client
	Modbus master
	Relay status display
Log	Login
	Error
	Communication
	FTP
	Mail
	WEB
	SNTP
	DHCP
	MODBUS

Procedure

Press the **Pause Display** soft key listed under “FUNC Key Operations” in this section.
The screen display will pause and an icon will appear in the status display section.
To unpause the display, press any key other than the **USER** key. If you are using a USB keyboard, press any key besides the key corresponding to the USER key (Ctrl+U).

Menu Customization

You can change the contents of the function menu, which appears when you press the FUNC key, and the display selection menu, which appears when you press the DISP/ENTER key.
► For details, see section 6.17.

5.2 Displaying Measured Data with Waveforms (trend), Numbers (digital), or Bar Graphs

This section explains how to use the trend, digital, and bar graph displays.

► For an explanation of these displays, see section 1.4.

Procedure

• Opening a Display

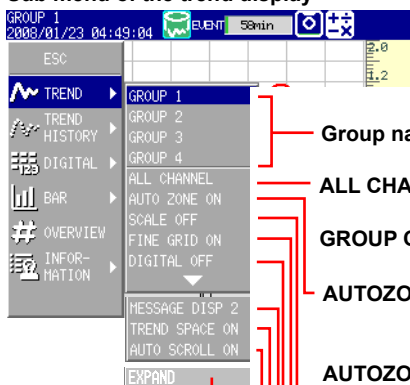
1. Press **DISP/ENTER** to open the display selection menu.
2. Select **TREND**, **DIGITAL**, or **BAR** using the arrow keys, and then press **DISP/ENTER**.

The selected display appears.

• Changing Display Settings

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select a submenu item with the up and down arrow keys.

Sub menu of the trend display



Group name: Displays the group.

ALL CHANNEL: Displays the waveforms of all channels.

GROUP CHANNEL: Displays the waveforms of the channels registered to groups.

AUTOZONE ON: Displays trend waveforms separately by assigning each channel in the group its own display area (zone).

AUTOZONE OFF: Displays trends using the set range.

SCALE ON: Displays a scale.

SCALE OFF: Clears the scale.

FINE GRID ON: Displays a fine grid.

FINE GRID OFF: Clears the fine grid.

DIGITAL ON: Displays the numeric display section.

DIGITAL OFF: Clears the numeric display section.

MESSAGE DISP1: Displays messages using display method 1.

MESSAGE DISP2: Displays messages using display method 2.

TREND SPACE ON: Inserts a space at the right edge (horizontal display) or the top edge (vertical display) in the waveform display section.

TREND SPACE OFF: Does not insert a space.

(To show these items on the menu, see section 6.17.)

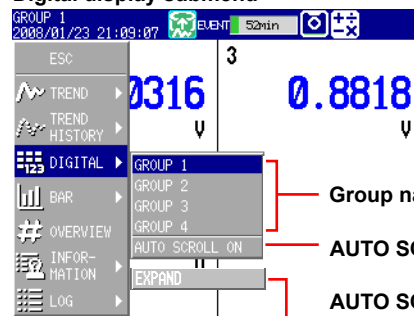
AUTO SCROLL ON: Automatically switches the displayed groups.

AUTO SCROLL OFF: Does not automatically switch the displayed groups.

EXPAND: Enlarges one of the four panels in the 4-panel display (MV2000 only).

5.2 Displaying Measured Data with Waveforms (Trend), Numbers (digital), or Bar Graphs

Digital display submenu



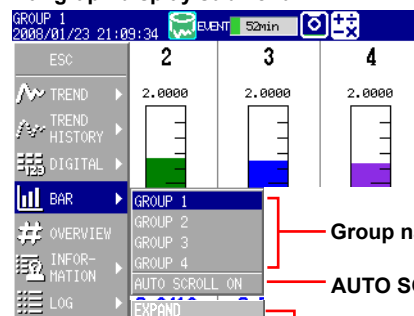
Group name: Displays the group.

AUTO SCROLL ON: Automatically switches the displayed groups.

AUTO SCROLL OFF: Does not automatically switch the displayed groups.

EXPAND: Enlarges one of the four panels in the 4-panel display (MV2000 only).

Bar graph display submenu



Group name: Displays the group.

AUTO SCROLL ON: Automatically switches the displayed groups.

AUTO SCROLL OFF: Does not automatically switch the displayed groups.

EXPAND: Enlarges one of the four panels in the 4-panel display (MV2000 only).

4. Press **DISP/ENTER** to change the display setting.

To close the menu without changing the display settings, press **ESC**.

- **START/STOP Recording Measured Values and Displaying Waveforms on the Trend Display**

Press **START/STOP** to start recording measured values and displaying waveforms on the trend display. Press **START/STOP** again to stop recording measured values and updating waveforms.

- **Writing Messages**

► For details, see section 6.4.

- **Switching Display Groups Using the Arrow Keys**

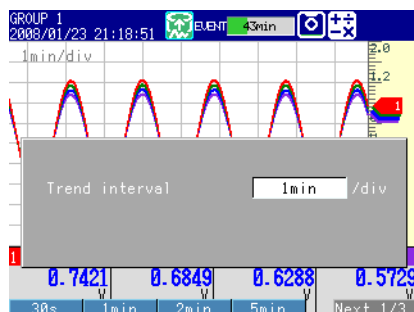
Press the right arrow key to switch from group 1, to 2, to 3, and so on. Press the left arrow key to switch groups in the opposite order.

- **Switching between the Trend, Digital and Bar Graph Displays Using the Arrow Keys**

When you are in the trend, digital, or bar graph display, press the down arrow key to switch from trend, to digital, to bar graph, to trend, and so on. Press the up arrow key to switch displays in the opposite order.

- **Changing the Trend Update Rate**

1. Press **T/DIV** to display the trend interval configuration screen.



2. Select the interval using the soft keys. Waveforms will be displayed at the set trend update rate.

Explanation

- **Trend Display: GROUP CHANNEL Display/ALL CHANNEL Display***

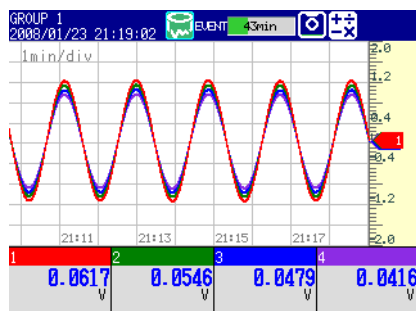
GROUP CHANNEL displays the waveforms of the selected group's channels. ALL CHANNEL displays the waveforms of all channels that have been set to be recorded. The waveforms of channels that are not assigned to the group are displayed in the waveform display area, but the scales, current value marks, and digital values of the channels are not displayed.

* On the MV2010, MV2020, MV2030, MV2040, and MV2048, if the device is equipped with external input channels (/MC1 option), all channel display is not possible with trend update rates of 15 s/div or 30 s/div.

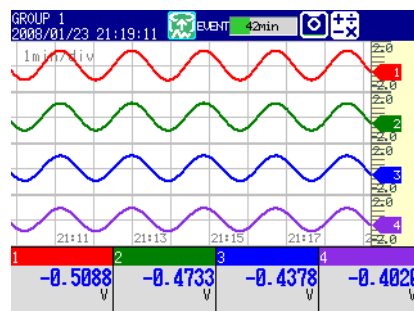
- **AUTO ZONE**

Displays trend waveforms separately by evenly dividing display areas (zones) among a group's channels.

With AUTO ZONE OFF



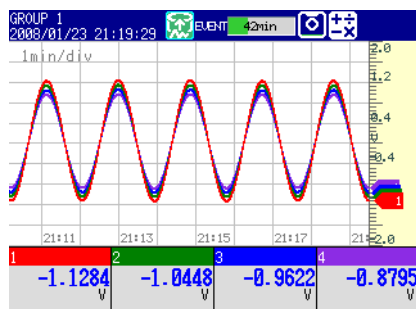
With AUTO ZONE ON



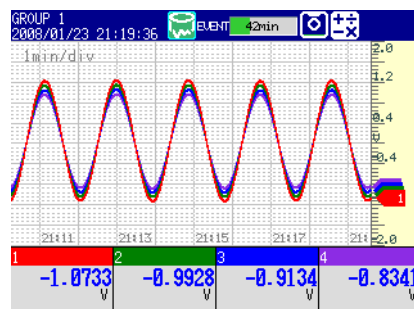
- **FINE GRID**

Display the fine grid when the normal grid is too wide for reading measured values. The fine grid can be used in the trend and historical trend displays. The fine grid places an additional four lines between the normal grid lines.

With FINE GRID OFF



With FINE GRID ON



5.2 Displaying Measured Data with Waveforms (Trend), Numbers (digital), or Bar Graphs

- **Trend Display: SCALE: ON/OFF, DIGITAL: ON/OFF**
Select whether or not to display the scale and the numeric display section.
- **AUTO SCROLL**
When AUTO SCROLL is ON, the MV automatically scrolls through the displayed groups at the set interval. The MV scrolls from group 1, to 2, to 3, and so on.
► For instructions on how to set the scrolling interval, see section 6.13.
- **Trend Display: MESSAGE DISP 1, MESSAGE DISP 2**
Select which message display method to use.
- **Conditions for Changing the Trend Update Rate**
When the displayed trend data type is **Display** or **Event**, the trend update rate can be changed. It cannot be changed when the displayed data type is **E+D** (Event+Display).
The trend interval can be changed regardless of memory sampling conditions.
The trend update rate can be changed on the following kinds of displays.
 - A display with an open menu
 - Trend display
 - Digital display
 - Bar graph display
 - Overview display
 - 4-panel display
 - All information displays accessible from the display selection menu

5.3 Displaying Previously Measured Data (TREND HISTORY)

There are five ways that you can display previously measured data.

- ▶ For an explanation of the historical trend display, see section 1.4.
- ▶ From the display selection menu. This method is explained in this section.
- ▶ By pressing HISTORY. This method is explained in this section.
- ▶ From the alarm summary. For details, see section 5.7.
- ▶ From the message summary. For details, see section 5.8.
- ▶ From the memory summary. For details, see section 5.9.
- ▶ By displaying measured data that has been saved to an external storage medium. For details, see section 4.8.

Procedure

- **Displaying Previously Measured Data by Using the Display Selection Menu**

Perform this operation during memory sampling or when there is measured data.

1. Press **DISP/ENTER** to open the display selection menu.
2. Select **TREND HISTORY** using the arrow keys, and then press **DISP/ENTER**.
The TREND HISTORY display appears.

- **Opening the Display Registered to the HISTORY Key**

Press **HISTORY**. The display switches to TREND HISTORY. Press **HISTORY** again to return to the previous display.

For instructions on how to register a display to the HISTORY key, see section 6.15.

- **Changing Display Settings**

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select a submenu item with the up and down arrow keys.

5.3 Displaying Previously Measured Data (TREND HISTORY)

TREND HISTORY submenu

EXIT ▶

TREND HISTORY ▶

INFORMATION ▶

TOP CHANNEL ▶

AUTO SCALE ▶

GROUP 1

GROUP 2

GROUP 3

GROUP 4

ALL CHANNEL

AUTO ZONE ON

SCALE OFF

FINE GRID ON

MESSAGE DISP 2

CURSOR VALUE

CURSOR TIME ON

RELATIVE TIME

EXPAND

Group name: Displays the group.

ALL CHANNEL: Displays the waveforms of all channels.

GROUP CHANNEL: Displays the waveforms of the channels registered to groups.

AUTOZONE ON: Displays trend waveforms separately by assigning display areas (zones) to the set channels.

AUTOZONE OFF: Displays trends using the set range.

SCALE ON: Displays a scale.

SCALE OFF: Clears the scale.

FINE GRID ON: Displays a fine grid.

FINE GRID OFF: Clears the fine grid.

MESSAGE DISP2: Switches to message display 2.

MESSAGE DISP1: Switches to message display 1.

DIGITAL MAX/MIN: Displays the maximum and minimum values at the cursor point as well as the maximum and minimum values within the screen, in the digital value display area.

CURSOR VALUE: With display data, shows the maximum data value at the cursor position. With event data, shows the data at the cursor position.

CURSOR TIME ON: Displays the time at the cursor position in the lower right.

CURSOR TIME OFF: Displays the date/time of the data at the right edge of the screen.

RELATIVE TIME: Shows the time that has elapsed since memory start.

ABSOLUTE TIME: Shows the time when data was recorded.

EXPAND: Enlarges one of the four panels in the 4-panel display (MV2000 only).

EXIT ▶

TREND

DIGITAL

BAR

Switches to the specified display.

Returns to the display that was shown before the historical trend.

EXIT ▶

TREND HISTORY ▶

INFORMATION ▶

TOP CHANNEL ▶

ALARM SUMMARY

MESSAGE SUMMARY

INFORMATION

ALARM SUMMARY: Displays the alarm summary in the loaded data file.

MESSAGE SUMMARY: Displays the message summary in the loaded data file.

INFORMATION: Displays the information of the loaded data file.

TOP CHANNEL

1

2

3

4

Displays the trend waveform and scale markers of the selected channel in front of all the others.

TOP CHANNEL

AUTO SCALE

1

2

3

4

OFF

AUTO SCALE

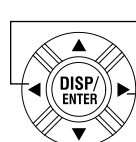
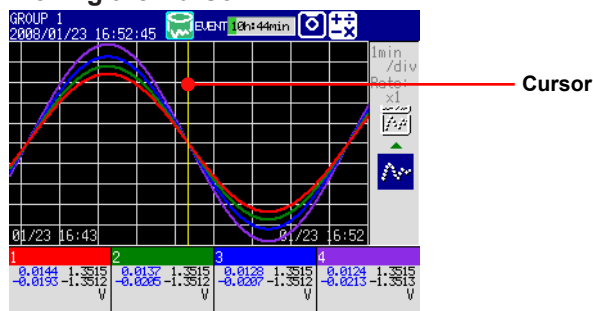
Adjusts the display span of the selected channel.

OFF

No AUTO SCALE display.

4. Press **DISP/ENTER** to change the display setting.
To close the menu without changing the display, press **ESC**.

• Moving the Cursor



Moves the cursor to the left by 1 dot.

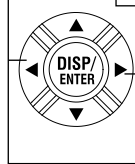
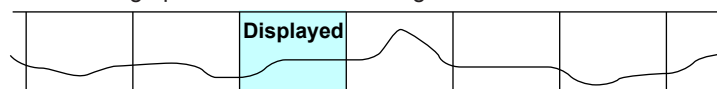
Moves the cursor to the right by 1 dot.

Hold down an arrow key to move the cursor by 2 divisions on the MV2000, or a division on the MV1000 at a time.

* Use the up and down arrow keys on the vertical trend display.

• Scrolling through Continuous Data

The trend display shows a portion of the complete data waveform on the screen. Use the following operations to scroll through continuous data.



Move the cursor to the end of the waveform and press the arrow key again to shift half a page and display the continuing data.

Move the cursor to the end of the waveform and press the arrow key again to shift half a page and display the continuing data.

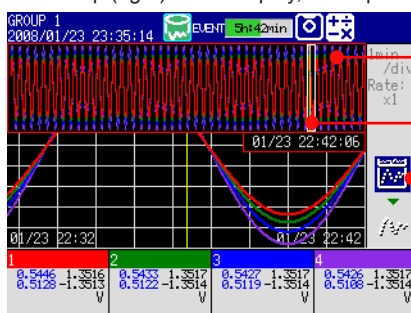
* Use the up and down arrow keys on the vertical trend display.

• Selecting What Portion of the Data to Display

Perform the following operations to select what data to display. Use the items in parenthesis if you are using vertical display.

1. Press the up (right) arrow key.

At the top (right) of the display, a complete data waveform appears.



Complete data waveform

All of the data in the display memory.

Frame indicating the display range

Displayed highlighted.

These icons are not displayed if the scale is displayed.

2. Use the left and right (up and down) arrow keys to move around the frame that indicates the display range, and select the portion of the data that you want to display.

3. Press the down (left) arrow key.

The portion of the data that you selected is displayed.

5.3 Displaying Previously Measured Data (TREND HISTORY)

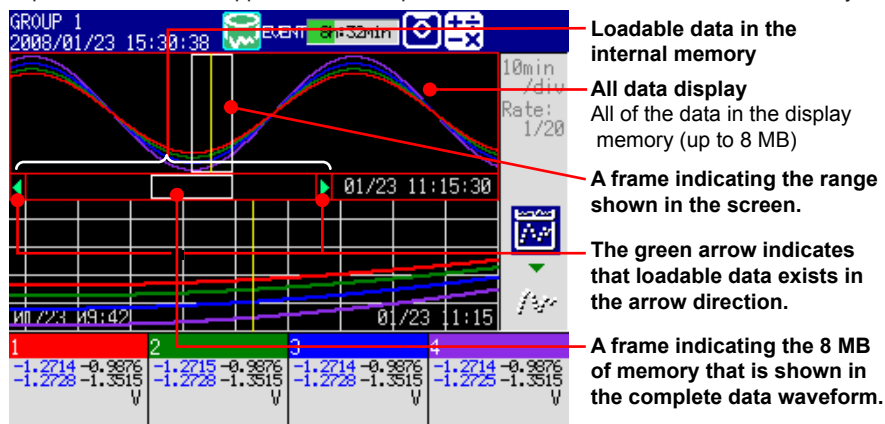
- **When Not All of the Data Fits in the Complete Data Waveform**

Move through the complete data waveform to the part that you want to display.

As an example, this is how you would display data that is older than the data that you are currently displaying. Items in parenthesis are for vertical display.

1. Press the up (right) arrow key.

At the top (right) of the display, the complete data waveform appears. The data portion that can be loaded from internal memory also appears. If there is more than 8 MB of data, the MV will indicate the 8 MB worth of data displayed in the complete data waveform with a square frame that will appear in the data portion that can be loaded from internal memory.



2. Use the left (down) arrow key to move the frame that represents the portion of the data that will be displayed to the beginning of the complete data waveform. Press the left (down) arrow key to move the frame beyond the edge of the waveform. The message "Overwrite old data?" will appear.

3. Select **Yes** using the arrow keys, and then press **DISP/ENTER**.

The 4 MB worth of memory used for the display will be overwritten, and the data will be displayed.

4. Use the left and right (up and down) arrow keys to move around the waveform and select the portion of the data to display.

5. Press the down (left) arrow key.

The portion of the data that you selected is displayed.

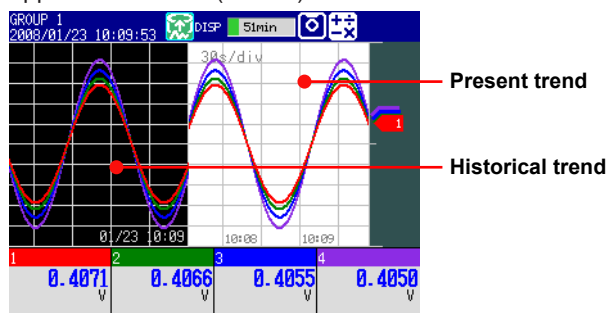
- **Splitting the Display in Two and Viewing the Current Trend and the Historical Trend Together**

You can only do this with the historical trend of display data. Items in parenthesis are for vertical display.

* You cannot view the two trends together when the scale is displayed.

Press the down (left) arrow key.

The current trend appears on the right (top) half of the screen. The historical trend appears on the left (bottom) half of the screen.



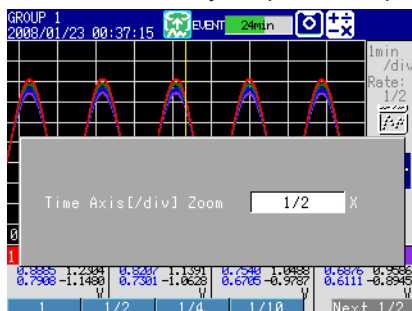
To return to the previous display, press the up (right) arrow key.

- **Writing Added Messages**

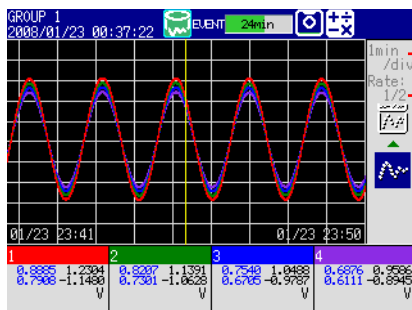
► For instructions on how to use this function, see section 6.4.

- **Changing the Time Axis Zoom**

1. Press the **T/DIV** key to open the display for setting the time axis zoom.



2. Select the time axis zoom using the soft keys. The waveform will appear with the new time axis zoom.



Historical trend display rate of the zoomed display.

Set time axis zoom

Explanation

- **ALL CHANNEL/GROUP CHANNEL Display**

Switches between displaying the waveforms of the selected group's channels and displaying the waveforms of all channels that have been set to be recorded. The waveforms of channels that are not registered to the group are displayed, without any additional information, in the waveform display area.

- **SCALE ON/OFF**

Select whether or not to display the scale. The scale's current value mark indicates the value at the cursor location.

- **MESSAGE DISP 1, MESSAGE DISP 2**

Select which message display method to use.

- **AUTO SPAN**

For details, see section 1.4.

- **Changing the Time Axis Zoom**

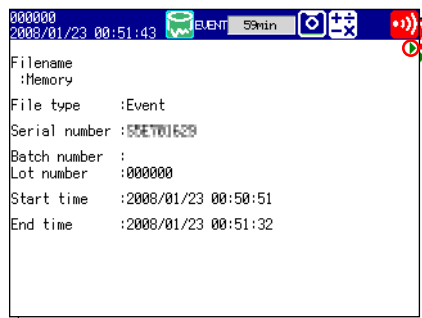
Displays a historical trend with a zoomed time axis.

If the display interval with the new time axis is 5 s/div or 10 s/div, 1 division is equal to 40 dots.

5.3 Displaying Previously Measured Data (TREND HISTORY)

- **INFORMATION (information about the displayed measured data)**

The following information is displayed.



Page switch mark

When using the batch function, a comment field and a text field are displayed on the second and third pages.

Use the left and right arrow keys to switch the page.

Item	Description
Filename	Displays "Memory" for data stored to internal memory. Displays the file name for data stored to an external storage medium.
File type	Displays "Display" for display data or "Event" for event data.
Serial number	The serial number of the MV that was used.
Batch number, Lot number	Displayed for files that use batch functions.
Start time, End time	The time when recording started/stopped.
User name	The name of the user that operated the MV. This item is displayed if the login function was used.

Note

If you display the measured data from an external storage medium, the serial number displayed will be that of the MV that saved the data.

- **Historical Trend Background Color**

You can change the background color of the historical trend display.

► For configuration instructions, see section 6.12.

- **TOP CHANNEL**

The displayed scale marker and grid are those of the channel selected as the top channel.

If you switch from TREND HISTORY display to another display, the TOP CHANNEL setting is cleared. Channels other than the top channel are displayed in the order set within their display groups. (Set in Group set, Trip line which can be opened from the MENU tab after pressing MENU.)

5.4 Viewing All Channels on One Display (OVERVIEW)

This section explains how to use the OVERVIEW display.

► For an explanation of this display, see section 1.4.

Procedure

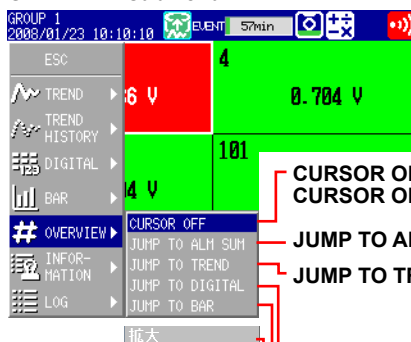
• Opening the Display

1. Press **DISP/ENTER** to open the display selection menu.
2. Select **OVERVIEW** using the arrow keys, and then press **DISP/ENTER**.
The OVERVIEW display appears.

• Changing Display Settings

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select a submenu item with the up and down arrow keys.

OVERVIEW submenu



CURSOR ON: Displays the cursor.

CURSOR OFF: Clears the cursor.

JUMP TO ALM SUM: Switches to the alarm summary.

JUMP TO TREND: Switches to the trend display of the smallest group number that includes the channel selected with the cursor.

JUMP TO DIGITAL: Switches to the digital display of the smallest group number that includes the channel selected with the cursor.

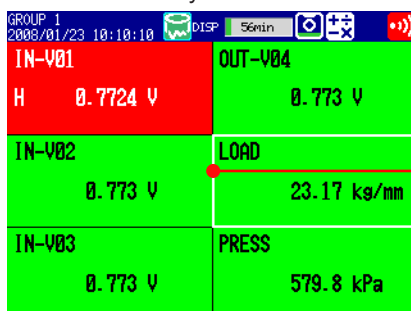
JUMP TO BAR: Switches to the bar graph display of the smallest group number that includes the channel selected with the cursor.

(Not displayed with the default settings. To display, see section 6.17.)

EXPAND: Enlarges one of the four panels in the 4-panel display (MV2000 only).

4. Press **DISP/ENTER** to change the display setting.
To close the menu without changing the display settings, press **ESC**.
- #### • Switching to a Trend, Digital, or Bar Graph Display that Contains the Selected Channel

1. Use the arrow keys to move the cursor and select a channel.



Cursor (white frame)

2. Use the operations outlined in "Changing Display Settings" to switch to the trend, digital, or bar graph display.

5.5 Displaying Various Information

This section explains how to display reports (/M1 and /PM1 options) and how to use the various status displays.

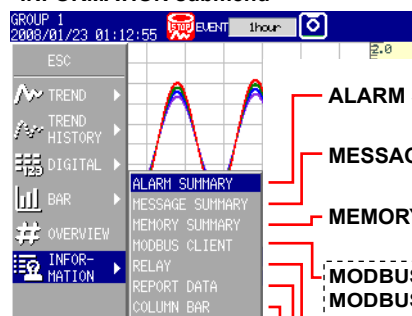
► For an explanation of these displays, see section 1.4.

Procedure

• Opening the Display

1. Press **DISP/ENTER** to open the display selection menu.
2. Select **INFORMATION** with the up and down arrow keys.
3. Press the right arrow key to open the INFORMATION submenu.
4. Select a submenu item with the up and down arrow keys.
To close the menu without changing the display, press **ESC**.

INFORMATION submenu



ALARM SUMMARY: Displays an alarm summary.
► Section 5.7

MESSAGE SUMMARY: Displays a message summary.
► Section 5.8

MEMORY SUMMARY: Displays a memory summary.
► Section 5.9

MODBUS CLIENT: Displays the Modbus client status.

MODBUS MASTER: Displays the Modbus master status.

RELAY: Displays the relay status.

(Not displayed with the default settings. To display, see section 6.17.)

REPORT DATA: Displays report data.

COLUMN BAR: Displays the report in a stacked bar graph.
► Section 5.6

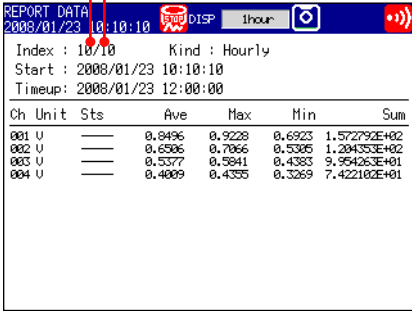
5. Press **DISP/ENTER**.
The selected display appears.

- **Report Display**
 - **Switching Displayed Report Data**

“The displayed report data number/the number of report data entries in internal memory” is displayed next to **Index**. The report with the largest report data number is the most recent report.

Displayed report data number

Number of report data entries in internal memory



REPORT DATA						
2008/01/23 10:10:10						
Index : 10/10 Kind : Hourly						
Start : 2008/01/23 10:10:10						
Timeup: 2008/01/23 12:00:00						
Ch	Unit	Sts	Ave	Max	Min	Sum
001	U	—	0.8496	0.9228	0.6923	1.572790E+02
002	U	—	0.6506	0.7066	0.5305	1.204353E+02
003	U	—	0.5377	0.5941	0.4383	9.954263E+01
004	U	—	0.4009	0.4335	0.3269	7.422102E+01

You can switch the displayed report data with the following operations.

- Up arrow key:** Switch to the next greatest report number.
- Down arrow key:** Switch to the next lowest report number.
- Left arrow key:** Switch to the report number that is greater than the current number by 10.
- Right arrow key:** Switch to the report number that is lower than the current number by 10.

Note

- The display will not be updated while a report is displayed, even if new report data is created. You can update the display by performing one of the following operations.
- Holding the left arrow key until the display is updated.
 - Pressing DISP/ENTER and reselecting REPORT DATA from the display selection menu.

- **Changing Report Channels**

You can display up to 30 report channels on one display. If the number of report channels in the report is greater than 30, you can change the displayed report channels.

 1. Press **DISP/ENTER** to open the display selection menu.
 2. Press the right arrow key to open the submenu.
 3. Select **CHANGE REPORT CH.** with the up and down arrow keys.
 4. Press **DISP/ENTER**.

The displayed report channels change.

5.5 Displaying Various Information

• Relay Status Display

Displays the status of alarm output relays and internal switches. You cannot perform operations in this display.

RELAY STATUS
2008/01/23 10:10:10

1hour

Red: ON
Green: OFF

I01	S01	S16
I02	S02	S17
I03	S03	S18
I04	S04	S19
I05	S05	S20
I06	S06	S21
	S07	S22
	S08	S23
	S09	S24
	S10	S25
	S11	S26
	S12	S27
	S13	S28
	S14	S29
	S15	S30

• Modbus Status Display

Displays a list of Modbus client or Modbus master command statuses.

► For configuration instructions, see the *Communication Interface User's Manual (IM MV1000-17E)*.

MODBUS CLIENT
2008/01/23 10:10:10

1hour

Communication conditions

Read cycle : 1s
Connect.retry : 10min

No.	Status	Comm.Data	Server name	Registers
		First	Last	
1	R ● Good	C01	C08	modbus.dawstati 30001
2	U ○ None	1	4	192.168.1.80 40001
3	U ○ None	101	105	192.168.1.80 40010
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Communication destination

MV channels

Status

Command

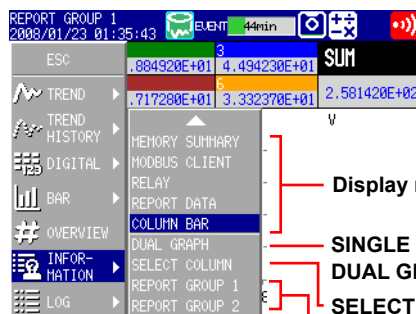
5.6 Displaying Stacked Bar Graphs (COLUMN BAR)

This section explains how to use the bar graph display (**COLUMN BAR**).

Procedure

• Changing Display Settings

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select a submenu item with the up and down arrow keys.



Display name: Switches to the specified display.

SINGLE GRAPH: Displays a single graph.

DUAL GRAPH: Displays two graphs.

SELECT GROUP: Use the arrow keys to switch between displayed report groups.

SELECT COLUMN: Use the arrow keys to select a bar graph.

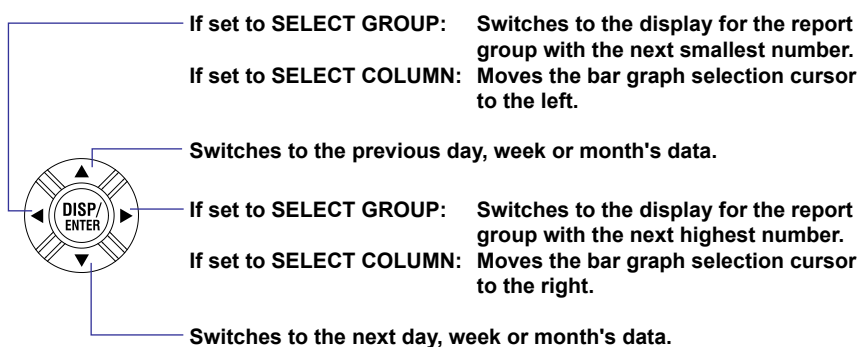
REPORT GROUP 1 to 6*: Switch between displayed report groups.

* Varies according to model. For more information about report channels, see section 10.5.

4. Press **DISP/ENTER** to change the display setting.
To close the menu without changing the display, press **ESC**.

• Changing Groups, Selecting Bar Graphs, and Moving the Cursor

The amount of data that the up and down arrow keys scroll through depends on the type of report data. For example, with an hourly + daily (**Hour+Day**) report, you can use the arrows to scroll through the data one day at a time.



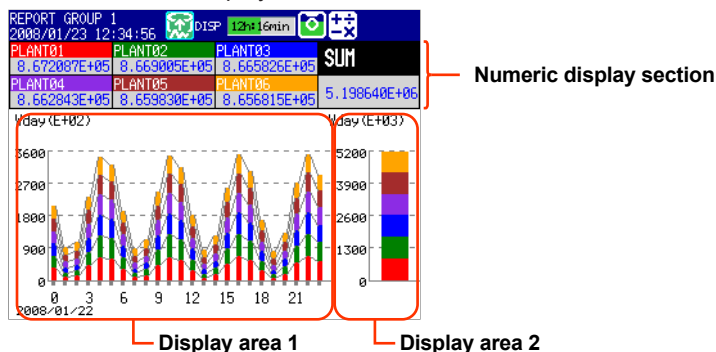
5.6 Displaying Stacked Bar Graphs (COLUMN BAR)

Explanation

- **SINGLE GRAPH/DUAL GRAPH**

You can display one or two bar graphs. The periodic sums of the first channel in a group and of all other channels that have the same unit as it are displayed.

- **SINGLE GRAPH display**



The report data displayed in display areas 1 and 2 vary depending on the report type (Report kind).

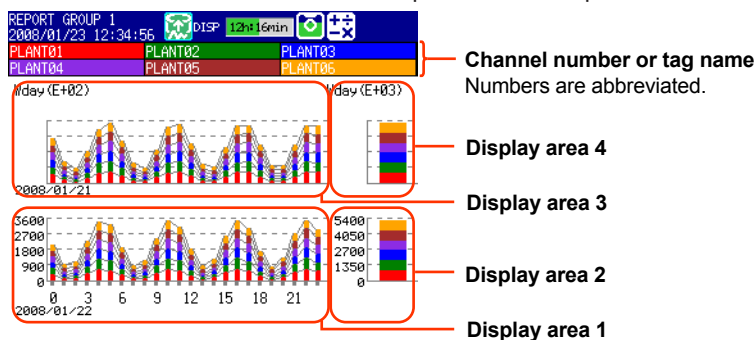
Report kind	Display Area 1	Display Area 2
Hourly, or hourly + daily	Hourly data	Daily data
Daily + weekly	Daily data	Weekly data
Daily, or daily + monthly	Daily data	Monthly data

Note

When in 4-panel display, the numeric display section only contains channel names or tag names.

- **DUAL GRAPH display**

Shows the data from two consecutive periods at the top and bottom of the display.



The data type shown in display areas 1, 2, 3, and 4 are determined based on the report type (Report kind) set in the report function. Display areas 1 and 2 contain the same report data listed above for SINGLE GRAPH display.

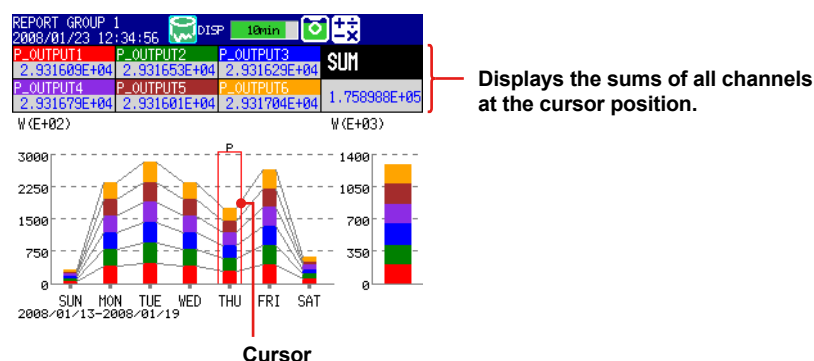
Report kind	Display Area 1	Display Area 2	Display Area 3	Display Area 4
Hourly, or hourly + daily	Hourly data	Daily data	Hourly data	Daily data
			The data of the day before the data in display area 1 and 2	
Daily + weekly	Daily data	Weekly data	Daily data	Weekly data
			The data of the week before the data in display area 1 and 2	
Daily, or daily + monthly	Daily data	Monthly data	Daily data	Monthly data
			The data of the month before the data in display area 1 and 2	

Note

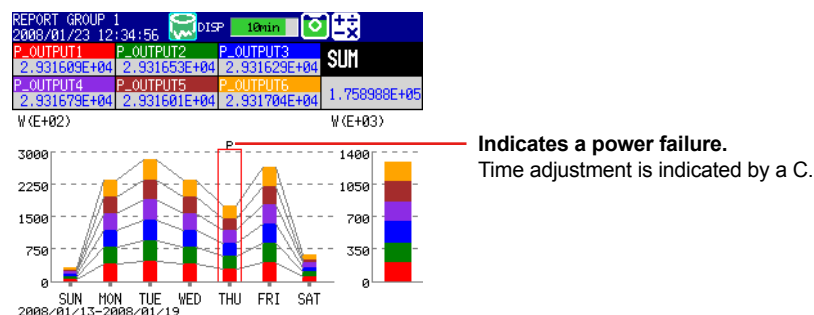
- The numbers on the vertical axis of display area 4 (the top display area) and the dates on the horizontal axis are abbreviated.
- Display area 4 can only display the data from the period immediately preceding that of display area 3.

- Selecting a Bar**

When in SINGLE GRAPH display, you can move the cursor to a bar that you want to check, and view the sums of each channel.



- Power Failure and Time Adjustment Indication**



- Power Failure**
A "P" indicates when a power failure occurred and a report was supposed to be filed. A "P" also indicates when the MV recovered from a power failure and the next report was filed.
- Time Adjustment**
When a time adjustment causes a report to be filed twice because the time was moved back, the time adjustment is marked with a "C," and the bar graph of the report that was filed first is used.
If the data for a period does not exist because of a power failure or time adjustment, a bar graph for the period will not be displayed.

5.7 Using the Alarm Summary

This section explains how to use the alarm summary.

► For an explanation of this display, see section 1.4.

Procedure

• Changing Display Settings

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select a submenu item with the up and down arrow keys.

The screenshot shows the 'ALARM SUMMARY' screen with a table of alarm events. The table has columns for 'channel', 'Type', and 'Alarm Time'. The 'Alarm Time' column has a red circle around the header, with a line pointing to the text 'Sort symbol' and '▲ Ascending sort ▼ Descending sort'. Below the table is a menu with options: ESC, TREND, TREND HISTORY, DIGITAL, BAR, OVERVIEW, INFORMATION, TO HISTORY (EV), TO OVERVIEW, CHANGE SORT KEY, and ASCENDING ORDER. Red lines connect these menu items to their descriptions on the right.

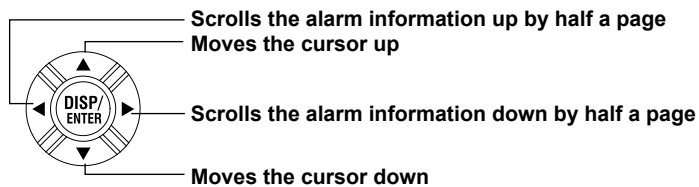
channel	Type	Alarm Time
1H		2008/01/23 20:45:00
2L		2008/01/23 20:45:44
2L		2008/01/23 20:45:03
		2008/01/23 20:44:49

Sort symbol
▲ Ascending sort
▼ Descending sort

Display name: Switches to the specified display.
TO HISTORY (EV): Switches to the historical trend display.
TO OVERVIEW: Switches to the overview display.
CHANGE SORT KEY: Sorts the alarm information by channel or alarm time.
ASCENDING ORDER: Sorts in ascending order.
DESCENDING ORDER: Sorts in descending order.

4. Press **DISP/ENTER** to change the display setting.
To close the menu without changing the display, press **ESC**.

• Moving the Cursor (➡) and Scrolling through Alarms



• Opening the Historical Trend of an Alarm Occurrence

1. Select the alarm with the cursor.
2. Use the operations outlined in “Changing Display Settings” to open the historical trend display.

Explanation

• Changing the Sort Key and the Sort Order

You can set the sort key to one of the following items and sort in either ascending or descending order. A sort symbol appears next to the sort key (see the figure above).

- Channel number: You can sort by channel number even if you use tags. The alarms of each channel are sorted by their alarm numbers.
- Alarm activation/release

5.8 Using the Message Summary

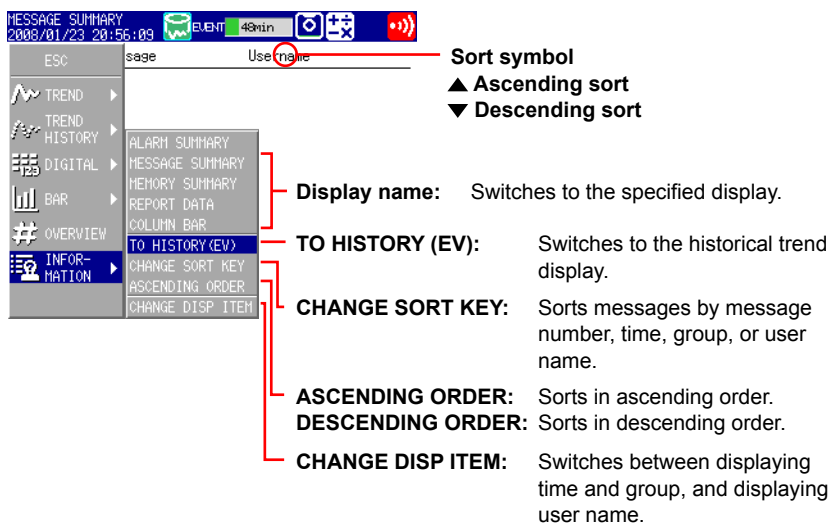
This section explains how to use the message summary.

► For an explanation of this display, see section 1.4.

Procedure

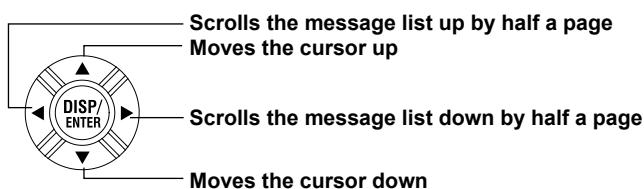
• Changing Display Settings

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select a submenu item with the up and down arrow keys.



4. Press **DISP/ENTER** to change the display setting.
 To close the menu without changing the display, press **ESC**.

• Moving the Cursor (→) and Scrolling through Messages



• Opening the Historical Trend of the Period When a Message Was Written

1. Select the message with the cursor.
2. Use the operations outlined in "Changing Display Settings" to open the historical trend display.

Explanation

• Switching Displayed Items

You can switch between displaying the following sets of items.

- Message, time, group
- Message, user name

• Changing the Sort Key and the Sort Order

You can set the sort key to any of the listed items and sort in either ascending or descending order. A sort symbol appears next to the sort key (see the figure above).

5.9 Using the Memory Summary

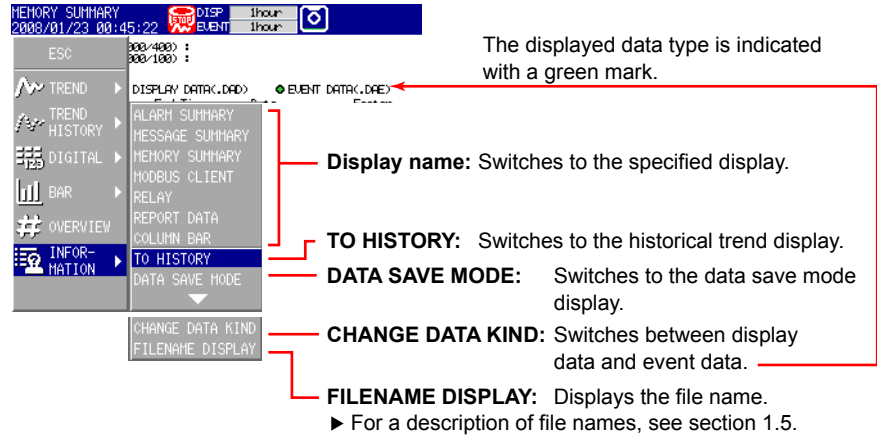
This section explains how to use the memory summary.

► For an explanation of this display, see section 1.4.

Procedure

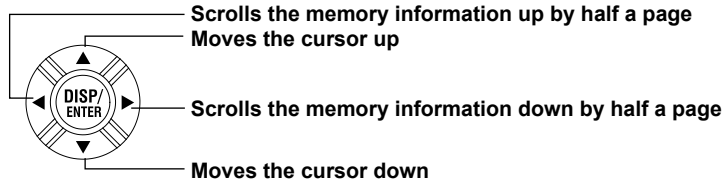
• Changing Display Settings

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select a submenu item with the up and down arrow keys.



4. Press **DISP/ENTER** to change the display setting.
To close the menu without changing the display, press **ESC**.

• Moving the Cursor (➡) and Scrolling through Memory Information



• Opening the Historical Trend of the Specified Data

1. Select the data with the cursor.
2. Use the operations outlined in "Changing Display Settings" to open the historical trend display.

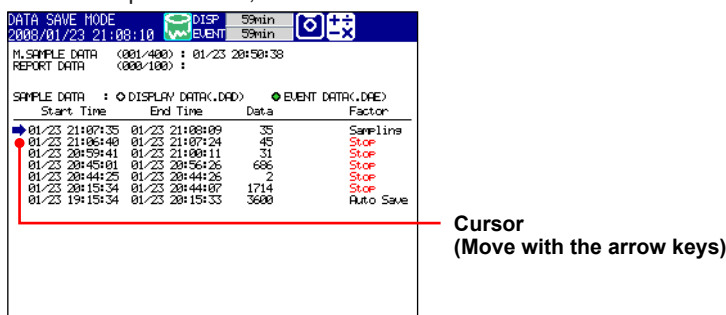
• Saving Data

To save the data in the internal memory to a CF card or to USB flash memory

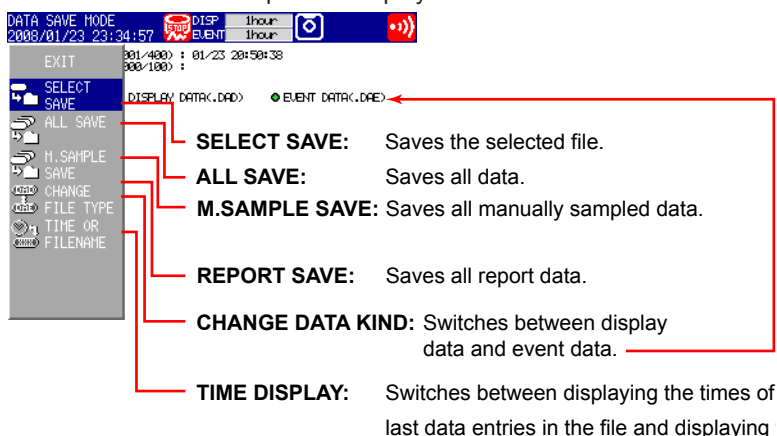
► For an explanation of this function, see section 1.4.

1. Press **DISP/ENTER** to open the display selection menu.
2. Press the right arrow key to open the submenu.
3. Select **DATA SAVE MODE** with the up and down arrow keys.
4. Press **DISP/ENTER**.
The display switches to DATA SAVE MODE.

5. To save a specified file, select it with the cursor.



6. Press **DISP/ENTER** to open the display selection menu.



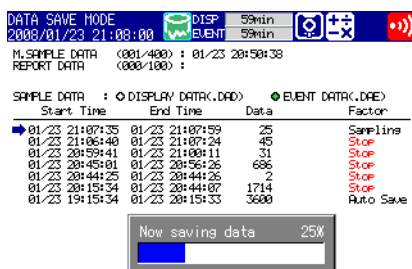
7. Use the up and down arrow keys to select **SELECT SAVE**, **ALL SAVE**, **M.SAMPLE SAVE**, or **REPORT SAVE**.

- * If you are using a CF card and USB flash memory, the message "Which media do you want save to?" appears. Use the arrow keys to select which medium you want to save to, and press **DISP/ENTER**.
 The measured data is saved.

ALL SAVE Progress Indicator

If you select **ALL SAVE*** from the memory summary, a progress indicator for the **ALL SAVE** operation will appear.

- * This function saves all of the data in the internal memory to a CF card or USB flash memory device.



5.9 Using the Memory Summary

Note

- The progress indicator only appears in the memory summary.
- Pressing **ESC** will remove the progress indicator for about 10 seconds, but it will reappear after that.
- The estimated times for the completion of the ALL SAVE operation (when the internal memory is full) are listed below. The operation may take longer depending on what other operations the MV is performing.

Memory Option	Time for ALL SAVE Completion (estimated)	
	CF Card	USB Flash Memory
Standard memory (internal memory suffix code -3)	About 20 min.	About 40 min.

- To cancel the ALL SAVE operation,
Press **FUNC** and then the **Save Stop** soft key.

Explanation

- **Saving Data**
 - Each time you save data, the MV will create a new directory to store the data in. The directory name structure is: Specified character string_YYMMDD_HHMMSS (The values of YY to SS are determined by the date and time of operation)

Directory name	Date / Time
/	
DATA08	07/08/23 14:17
DATA0_080123_134742	08/01/23 13:47
DATA0_080123_204148	08/01/23 20:45
DATA0_071002_140515	07/10/02 14:05
DATA1	08/01/01 08:10
DATA0_080123_210758	08/01/23 21:08
DATA0_080123_234104	08/01/23 23:41

Free space 981376 Kbytes

Delete Sort

File list example

Save directory

- You cannot save display or event data when it is being recorded.
- The save operation simply copies the data in the internal memory. It does not change the classification of data in the internal memory from unsaved to saved (see section 1.5, "Saving to External Storage Media," for details).
- Saving will stop if there is not enough space in the external storage medium. When saving data, make sure that the external storage medium has enough free space.
- When saving a single file:
 - The generated folder name is: name of the destination directory_date_time
 - The file is saved after you select SELECT SAVE in DATA SAVE MODE.
 - You cannot switch save folders while in DATA SAVE MODE.
 - If a file with the same name already exists, an overwrite confirmation window appears.

5.10 Viewing Operation History Logs

You can view the following kinds of logs.

Login log, error log, communication log, FTP log, Web log, e-mail log, SNTP log, DHCP log, and Modbus status log

Procedure

• Opening the LOG display

1. Press **DISP/ENTER** to open the display selection menu.
2. Select **LOG** with the up and down arrow keys.
 - * LOG is not displayed by default.
 - ▶ To display LOG on the menu, see section 6.17.
3. Press the right arrow key to open the submenu.
4. Select a submenu item with the up and down arrow keys.
 - To close the menu without changing the display, press **ESC**.
 - Submenu: LOGIN, ERROR, COMMUNICATION, FTP, MAIL, WEB, SNTP, DHCP, MODBUS
5. Press **DISP/ENTER**.
 - The selected display appears.

Explanation

• LOGIN Log

The log number of the last line and the total number of logs

(005/005)	Time	Action	Factor	Username
	01/23 00:05:08	Login	KEY	Admin1
	01/23 00:05:14	PowerOn	SYS	
	01/22 16:30:16	PowerOff	SYS	
	01/22 21:57:00	NewTime	KEY	
	01/01 00:00:01	TimeChg	KEY	

User name

Operation method (see the table below)

Operation (see the table below)

Date and time

Action	Description
Login	Login
Logout	Logout
NewTime	Time adjustment while memory is stopped
TimeChg	Time adjustment through key operation
PowerOff	Power OFF (power failure occurred)
PowerOn	Power ON (recovered from a power failure)
TrevStart	The start of the operation of gradually adjusting the time
TRevEnd	The end of the operation of gradually adjusting the time
SNTPtimset	Time adjustment by SNTP

Factor	Description
KEY	Key operation
COM	Operation using communication
REM	Operation using remote control function
ACT	Operation caused by event action
SYS	System operation

5.10 Viewing an Operation History Log

• Error Log



(005/005) Time	No.	Message
2008/01/22 21:07:15	232	There is no available da..
2008/01/22 20:49:53	120	Measured value is incorr..
2008/01/22 20:44:09	151	This action is not possi..
2008/01/22 20:42:48	210	Media has not been inser..
2008/01/22 20:15:35	294	No time correction becau..

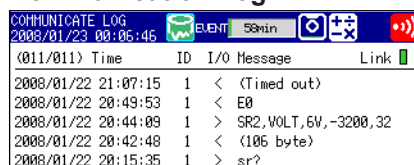
Error message*

Error code*

Date and time

* For details, see section 12.1, "List of Messages."

• Communication Log



(011/011) Time	ID	I/O	Message	Link
2008/01/22 21:07:15	1	<	<Timed out>	
2008/01/22 20:49:53	1	<	E0	
2008/01/22 20:44:09	1	>	SR2,VOLT,6V,-3200,32	
2008/01/22 20:42:48	1	<	<106 byte>	
2008/01/22 20:15:35	1	>	sr?	

Message*

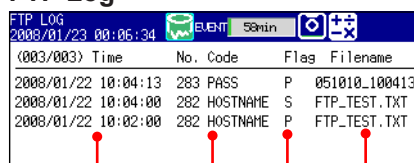
Input/output symbol (>: Input, <: Output)

User ID number (0: Serial, 1 to 3: Ethernet)

Date and time

* See the *Communication Interface User's Manual (IM MV1000-17E)*.

• FTP Log



(003/003) Time	No.	Code	Flag	Filename
2008/01/22 10:04:13	283	PASS	P	051010_100413
2008/01/22 10:04:00	282	HOSTNAME	S	FTP_TEST.TXT
2008/01/22 10:02:00	282	HOSTNAME	P	FTP_TEST.TXT

File name

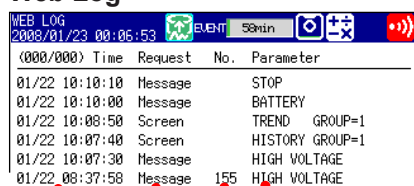
FTP connection destination
(P: Primary, S: Secondary)

Error message (detail code)*

Date and time

* For details, see section 12.1, "List of Messages."

• Web Log



(000/000) Time	Request	No.	Parameter
01/22 10:10:10	Message		STOP
01/22 10:10:00	Message		BATTERY
01/22 10:08:50	Screen		TREND GROUP=1
01/22 10:07:40	Screen		HISTORY GROUP=1
01/22 10:07:30	Message		HIGH VOLTAGE
01/22 08:37:58	Message	155	HIGH VOLTAGE

Operation (see the table on the next page)

Error code*

Requested operation (see the table below)

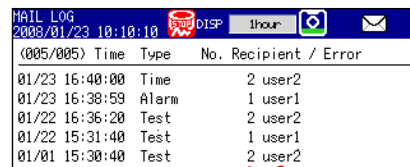
Date and time

* For details, see section 12.1, "List of Messages."

Request	Description
Screen	Screen switch
Key	Key operation
Message	Message assignment/write
Makefile	Event file/display file

Parameter	Description
TREND	Trend display
DIGIT	Digital display
BAR	Bar graph display
HIST	Historical trend display
OV	Overview display
DISP	DISP/ENTER key
UP	Up arrow key
DOWN	Down arrow key
LEFT	Left arrow key
RIGHT	Right arrow key
HISTORY	Historical trend display/Favorite display selection
Messages	Written message character strings

• E-mail Log



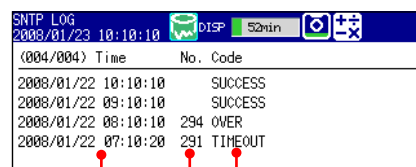
MAIL LOG				
2008/01/23 10:10:10				
{005/005}	Time	Type	No.	Recipient / Error
01/23	16:40:00	Time	2	user2
01/23	16:38:59	Alarm	1	user1
01/22	16:36:20	Test	2	user2
01/22	15:31:40	Test	1	user1
01/01	15:30:40	Test	2	user2

Recipient (mail address, message)
 Recipient (1: Recipient 1, 2: Recipient 2)
 Error code*
 E-mail type (see the table below)
 Date and time

* For details, see section 12.1, "List of Messages."

Type	Description
Alarm	Alarm e-mail
Time	Scheduled e-mail
Report	Report timeout mail
Fail	Power failure recovery e-mail
Full	Memory full e-mail
Test	Test e-mail
Error	Error message e-mail

• SMTP Log



SMTP LOG		
2008/01/23 10:10:10		
{004/004}	Time	No. Code
2008/01/22	10:10:10	SUCCESS
2008/01/22	09:10:10	SUCCESS
2008/01/22	08:10:10	294 OVER
2008/01/22	07:10:20	291 TIMEOUT

Error message (detail code)*
 Error code*
 Date and time

* For details, see section 12.1, "List of Messages."

5.10 Viewing an Operation History Log

• DHCP Log

(004/004) Time	No.	Code
2008/01/22 08:15:24	297	NONAME
2008/01/22 08:15:24	565	IPCONFIG
2008/01/22 08:08:24	564	RENEWED
2005/01/22 08:08:18	565	IPCONFIG

Error message (detail code)*

Error code*

Date and time

* For details, see section 12.1, "List of Messages."

• Modbus Status Log

(012/000) Time	Kind	Factor	Command
2008/01/22 06:36:36	M	NONE	03 W
2008/01/22 06:36:36	M	Dropout	Dropout
2008/01/22 18:50:06	C	GOOD	02 R
2005/01/22 18:50:06	C	GOOD	01 R
2005/01/22 18:50:05	C	GOOD	02 R

Command number, command type
(R: Read, W: Write)

Communication status*

Communication type (C: Client, M: Master)

Date and time

* See the *Communication Interface User's Manual (IM MV1000-17E)*.

5.11 Using the 4-Panel Display (MV2000 only)

This section explains how to use the 4-panel display.

► For an explanation of this display, see section 1.4.

Procedure

• Opening the Display

1. Press **DISP/ENTER** to open the display selection menu.
2. Use the arrow keys to select **4Panel** and then select **MIX**, **ALL TREND**, **ALL DIGITAL**, or **ALL BAR**. Press **DISP/ENTER**. If you have changed the display names, select the name that the display was changed to (see “Changing the 4-Panel Display Configuration Names” on the next page for details).
The selected display appears.

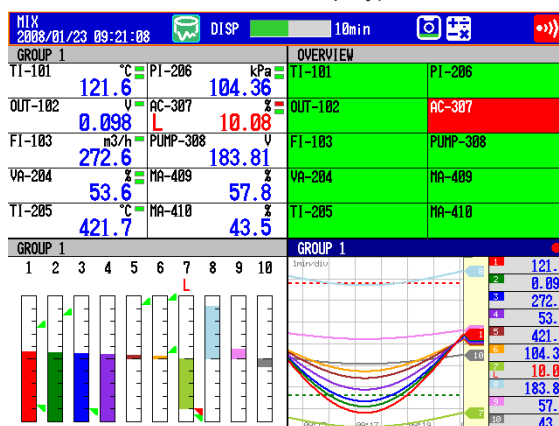
• Switching between Displays

Press the right arrow key to switch from MIX, to ALL TREND, to ALL DIGITAL, to ALL BAR, to MIX and so on. Press the left arrow key to switch displays in the opposite order. If you have changed the display names, select the name that the display was changed to (see “Changing the 4-Panel Display Configuration Names” on the next page for details).

• Changing the 4-Panel Display Configurations

Perform these operations while in the 4-panel display.

1. Press **DISP/ENTER**.
The title of one of the four displays will turn blue.
2. Use the arrow keys to move to the display you want to change (the display with the blue title is the selected display).



The selected area's heading is displayed in dark blue.

3. Press **DISP/ENTER** to open the display selection menu.
4. Use the arrow keys to select a new display.
5. Press **DISP/ENTER** to assign the new display to the old display's location.
To close the menu without changing the display, press **ESC**.

• Registering a New Display Configuration

Perform the operation outlined under “Changing the 4-Panel Display Configuration Names” on the next page.

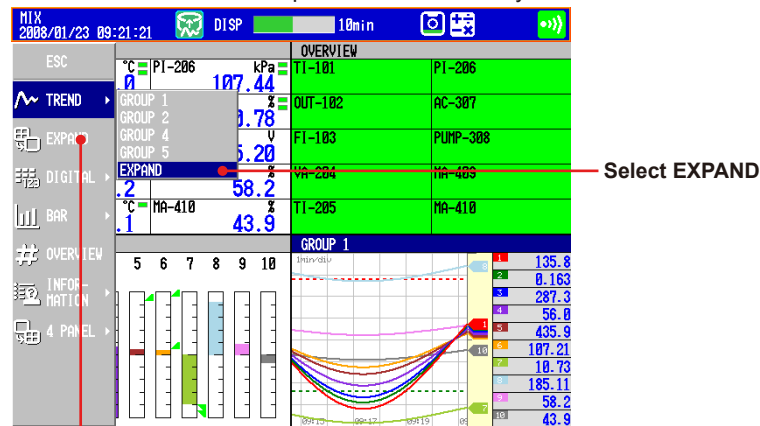
- * If you do not perform this operation and switch to another display, the changes made to the current display configuration will not be retained.

Note

When the four panel display is showing, screens that you cannot assign to the four panel display (LOG and TREND HISTORY) do not appear in the menu.

• Expanding and Viewing a Single Display

1. Press **DISP/ENTER**.
The title of one of the four displays will turn blue.
2. Use the arrow keys to move to the display you want to expand (the display with the blue title is the selected display).
3. Press **DISP/ENTER** to open the display selection menu.
4. Press the right arrow key to open the submenu.
5. Select **EXPAND** with the up and down arrow keys.

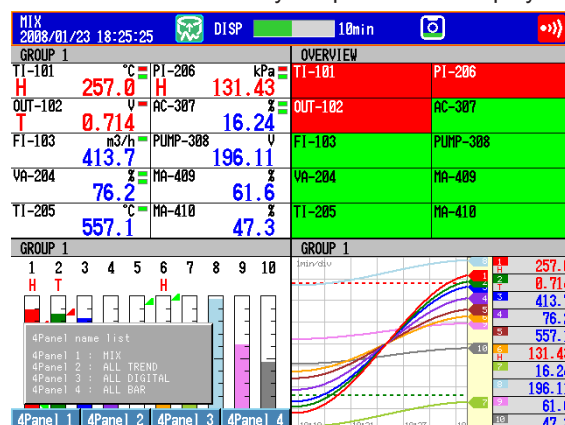


EXPAND is not displayed by default. You can display it by performing the following:
Press **MENU** and then select **Menu customize > Display menu > EXPAND**.
Then, press the **Select** soft key.

► To display **EXPAND** on the menu, see section 6.17.

6. Press **DISP/ENTER** to view the single selected display.
To close the menu without expanding the display, press **ESC**.
- **Changing the 4-Panel Display Configuration Names**
If you change a display configuration's name, the new name will appear in the display selection menu.
Perform these operations while in the 4-panel display.

1. Press **FUNC** to open the function menu.
2. Press the **4Panel** soft key to open a list of display configurations.



3. Choose a configuration and press its soft key (from **4Panel 1** to **4Panel 4**). The configuration name input window appears.
4. Enter the display configuration name (up to 16 characters, **Aa#1**).
5. Press **DISP/ENTER** to set the configuration name to the name you entered. You will return to the 4-panel display.
To cancel the configuration name change, press **ESC**.

6.1 Setting a Display Group

This section explains how to assign channels to a display group and how to name the group. It also explains how to set lines at specified positions in the waveform display range on the trend display.

Display

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

	Position	Color	Width
1	On	50 %	Red
2	Off		2 dot
3	Off		
4	Off		

Settings

- **Group number**
Select the target group number (from 1 to 10 on the MV1000 and 1 to 36 on the MV2000).
- **Group set**
 - **On/Off**
Select On to use the group.
 - **Group name**
Set the group name (up to 16 characters, **[Ala#1]**).
 - **CH set**
Select measurement channels, computation channels (/M1 and /PM1 options), and external input channels (/MC1 option) that you want to assign to the group. You can set up to 6 channels on the MV1000 and up to 10 channels on the MV2000.
 - Enter channel numbers using two or three digits.
 - Separate each channel number with a period.
 - To specify a range of consecutive channels numbers, use a hyphen.
Example: To assign channel 1 and channels 5 through 8, enter "001.005-008."

Note

- The MV displays the channels in the specified order on the trend, digital, and bar graph displays.
- You can assign a channel to multiple groups.
- You cannot assign a channel twice to the same group.

6.1 Setting a Display Group

Note

You can copy the channel settings of a display group to another group.

GROUP 1
2008/01/23 02:00:06
EVENT 1hour

Group number: 1
Group set: On/Off
On/Off: On
Group name: GROUP 1
CH set: 001,002,003,004,005,006
Trip line:
1 Off
2 Off
3 Off
4 Off

Input Clear Copy

Procedure

1. Select the **CH set** box of the copy source.
2. Press the **Copy** soft key.
3. Select the **CH set** box of the copy destination.
4. Press the **Paste** soft key. The copied channel settings are pasted.

- **Trip line**

You can set lines at specified positions in the waveform display range of the trend display.

- **1, 2, 3, and 4**

Select On for the trip lines you want to display.

- **Position**

Set the position in the range of 0 to 100% of the display width.

- **Color**

The default colors for 1, 2, 3, and 4 are red, green, blue, and yellow, respectively.

To change a color, select from the 24 available colors.

- **Width**

Set the line width of the trip line in dots (1 to 3).

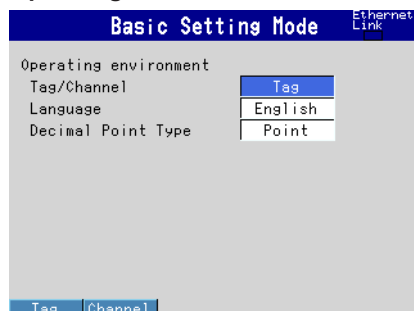
6.2 Displaying Tags or Channel Numbers

This section explains how to display channels using tags or channel numbers.

Display

- **Tag/Channel**

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Operating environment**.



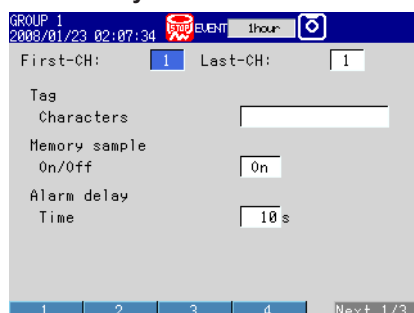
- **Tag**

- **MV1000**

- Press **MENU** and then select **Menu tab > Meas channel > Tag, Memory, Delay**.

- **MV2000**

- Press **MENU** and then select **Menu tab > Meas channel > Tag, Memory sample, Alarm delay**.



Settings

- **Operating environment > Tag/Channel**

Setting	Description
Tag	Displays tags. Channel numbers are displayed for channels that do not have tags set.
Channel	Displays channel numbers.

- **First-CH, Last-CH**

- Select the target channels. The settings selected here will be applied to these channels.

- **Tag > Characters**

- Set the tag (up to 16 characters, **Aa#1**).

6.3 Setting the Secondary Trend Interval

This section explains how to switch the trend interval to the secondary interval during memory sampling. You can configure the MV to automatically write a message when the trend interval is switched.

► For an explanation of these functions, see section 1.4.

Display

- **Switching the Trend Interval and Writing a Message (when using the secondary trend interval)**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message**.

Basic Setting Mode	
View	
Trend type	T-Y
Partial	Off
Trend rate switching	Off
Message	
Write group	Common
Power-fail message	Off
Change message	Off
On Off	

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message, Input, Alarm**.

Basic Setting Mode	
Environment > View, Message, Input, Alarm	
View	
Trend type	T-Y
Partial	Off
Trend rate switching	Off
Input	
Value on over-range	Free
Alarm	
No logging	Off
On Off	

- **Second interval [/div]**

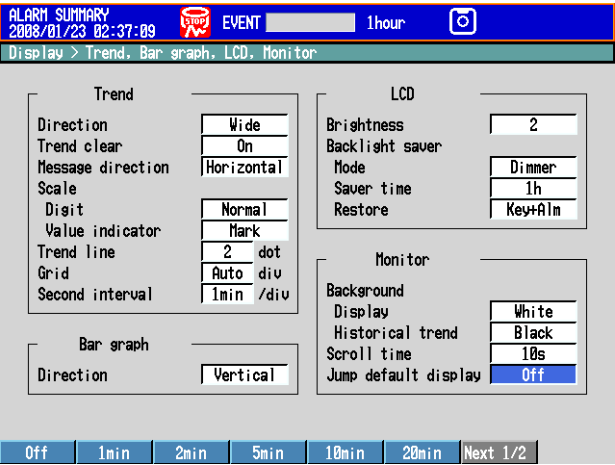
MV1000

Press **MENU** and then select **Menu tab > Display > Trend**.

Trend	
Direction	Wide
Trend clear	On
Message direction	Horizontal
Scale	
Digit	Normal
Value indicator	Mark
Trend line	2 dot
Grid	Auto div
Second interval	1min /div
30s 1min 2min 5min Next 1/3	

MV2000

Press **MENU** and then select **Menu tab > Display > Trend, Bar graph, LCD, Monitor**.



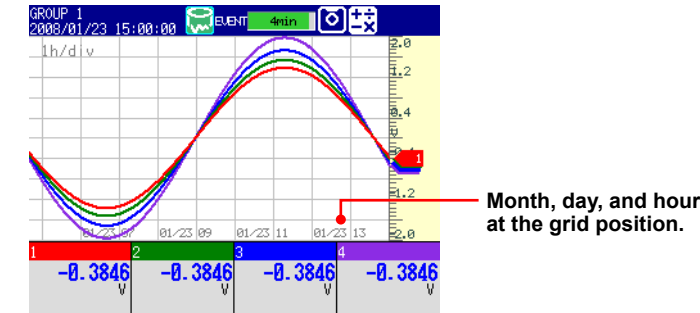
Settings

- **View > Trend rate switching**
On: Enables the switching of the trend interval during memory sampling. The Second interval [/div] item appears in the Setting Mode menu.
 - * When the trend rate switching function is On, the MV cannot be configured to record both display and event data (see section 4.1 for details).
- **Message > Change message**
On: Writes a message containing the time and the new trend interval when the trend interval is switched.
- **Trend > Second interval [/div]**
Select the time corresponding to a division of the time axis on the trend display from below: You cannot set a trend interval that is faster than the scan interval.
5s*, 10s*, 15s**, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min, 1h, 2h, 4h, 10h
 - * Available on high-speed input models.
 - ** Available on high-speed input models and on medium-speed input models set to fast sampling mode.

If the trend interval on a high-speed input model is set to 5 s/div or 10 s/div, one division is displayed with 40 dots.

Note

If the trend interval is set to greater than or equal to 1h/div, the MV displays the month, day, and hour at the grid position. You can change the display format by changing the date format.



Procedure

- **Switching the Trend Interval**

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Second speed** soft key or the **Normal speed** soft key.
The trend display update interval is changed. A message appears on the trend display (when the MV is configured to write a message).
Display example: 10:53 1min/div

Note

You can also switch the trend interval by using the event action function. For event action configuration instructions, see chapter 7.

6.4 Writing a Message

This section explains how to write a message in the trend display.

Display

- **Message Write Group**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message.**

Basic Setting Mode	
View	
Trend type	T-Y
Partial	Off
Trend rate switching	On
Message	
Write group	Common
Power-fail message	Off
Change message	Off

Common Separate

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message, Input, Alarm.**

Basic Setting Mode	
Environment > View, Message, Input, Alarm	
View	
Trend type	T-Y
Partial	Off
Trend rate switching	On
Input	
Value on over-range	Free
Alarm	
No logging	Off
Message	
Write group	Common
Power-fail message	Off
Change message	Off

Common Separate

- **Registering Messages**

Press **MENU** > select the **Menu tab > Message.**

GROUP 1	
2003/01/23 02:41:58 STOP B.B.M. 1hour	
Message No. 1-10	
1	START
2	STOP
3	Pressure
4	Decompress
5	
6	
7	
8	
9	
10	

1-10 11-20 21-30 31-40 Next 1/3

Settings

- **Message**

- **Write group**

This setting applies only to messages that are written using keys.

Setting	Description
Common	Writes messages to all groups.
Separate	Writes messages to the displayed group.

- **Power-fail message**

▶ See section 6.16 for details.

- **Change message**

▶ See section 6.3 for details.

- **Message No.**

Select a message number (1 to 100). Message numbers 1 to 10 are used for free messages. If you set a free message, the corresponding message number will be overwritten.

* Messages that are created and written on the spot.

- **Message > Characters**

Set the message (up to 32 characters, **Aa#1**).

Procedure

- **Writing a Message**

You cannot write a message when memory sampling has stopped.

1. Display the group that you want to write a message to.

- Even when Write group is set to Separate, a message is written to all groups if the MV is showing a display unrelated to a group (such as the overview display). When the MV is showing a 4-panel display, a message is written to the displayed group.
- When Write group is set to Common, a message is written to all groups.

2. Press **FUNC**.

The function menu appears.

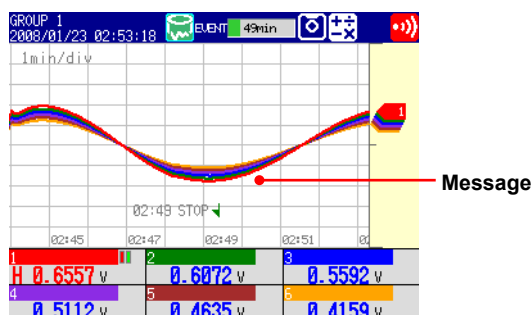
3. Press the **Message** soft key.

4. Press the soft key corresponding to the desired message number range (example: [1-10]).

A list of messages appears.



- Press the soft key corresponding to the number of the message you want to write. A message mark, time, and message appear on the trend display.



• Writing a Free Message

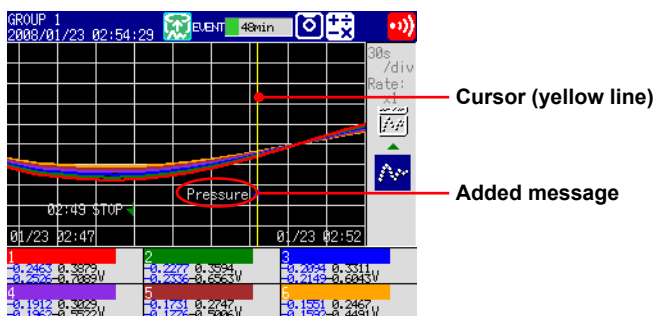
You can create and write a message on the spot.

- Display the group that you want to write a message to.
- Press **FUNC**.
The function menu appears.
- Press the **Free message** soft key.
- Press a message number soft key.
The message entry window opens.
- Enter a message (up to 32 characters, **[Aa#1]**).
- Press **DISP/ENTER**.
A message mark, time, and message appear on the trend display.

• Writing an Add Message

You can add a message to a previously measured data. You can do this on a previously measured portion of a waveform that is currently being memory sampled.

- Carry out the procedure below to display the historical trend of the data that is currently being memory sampled.
Press **DISP/ENTER** and select **TREND HISTORY > (group name) > DISP/ENTER**.
- Press the arrow keys to move the cursor to the position where you want to write a message.
- Write a message according to the procedure given in “Writing a Message” or “Writing a Free Message.” Use the **Add Message** or **Add Free Message** soft key.



Explanation

• **Message Colors**

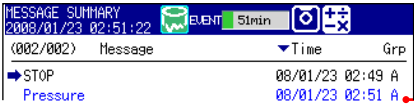
The message colors on the trend display are shown below. You cannot change them.

No.	1	2	3	4	5	6	7	8	9	10
Color	Red	Green	Blue	Blue-violet	Brown	Orange	Yellow-green	Light blue	Violet	Gray

The colors for messages 11 to 100 are repetitions of the colors above.

• **Add Message**

- The message timestamp is the time when the message was written. It is not the timestamp at the data position.



Message summary display example

Added message (displayed in blue)

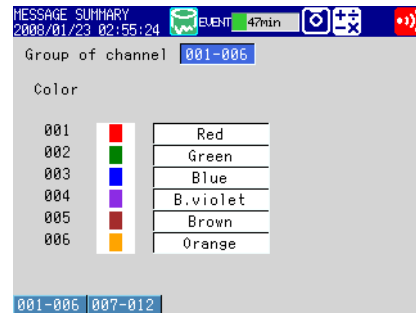
- You can write up to 50 messages.
- You cannot add messages to data in the internal memory that has been saved to a file or to data that has been loaded from an external storage medium.

6.5 Changing Channel Display Colors

This section explains how to change channel display colors. The color settings are applied to the trend and bar graph displays.

Display

Press **MENU** and then select **Menu tab > Meas channel > Color**.



Settings

- **Group of channel**
Select the target channels.
- **Color**
To change a color, select from the following 24 colors.
Red, green, blue, blue violet, brown, orange, yellow-green, light blue, violet, gray, lime, cyan, dark blue, yellow, light gray, purple, black, pink, light brown, light green, dark gray, olive, dark cyan, and spring green

6.6 Using Display Zones

This section explains how to assign each channel to a waveform display zone so that waveforms do not overlap.

► For an explanation of this function, see section 1.4.

Display

MV1000

Press **MENU** and then select **Menu tab > Meas channel > Zone, Scale**.

MESSAGE SUMMARY
2008/01/23 02:55:48 EVENT 47min

First-CH: 1 Last-CH: 1

Zone
Lower 0 %
Upper 100 %

Scale
Position 1
Division 10

Input

MV2000

Press **MENU** and then select **Menu tab > Meas channel > Zone, Scale, Bar graph**.

ALARM SUMMARY
2008/01/23 03:01:35 EVENT 1hour

Meas channel > Zone, Scale, Bar graph

First-CH 001 Last-CH 001

Zone
Lower 0 %
Upper 100 %

Scale
Position 1
Division 10

Bar graph
Base position Normal
Division 10

Input

Settings

- **First-CH, Last-CH**
Select the target channels. The settings selected here will be applied to these channels.
- **Zone > Lower, Zone > Upper**
Set the zone where waveforms will be displayed. Set Lower and Upper as percentages of the maximum display width. Set Upper to a value greater than Lower, and set the zone width (Upper – Lower) to greater than or equal to 5%.
Lower: 0 to 95%
Upper: 5 to 100%

6.7 Displaying a Scale on the Trend Display

This section explains how to display a scale on the trend display.

► For an explanation of the trend display, see section 1.4.

Display

- Scale Division, Scale Division

MV1000

Press **MENU** and then select **Menu tab > Meas channel > Zone, Scale**.

MESSAGE SUMMARY
2008/01/23 02:56:52

First-CH: 1 Last-CH: 1

Zone
Lower 0 %
Upper 100 %

Scale
Position 1
Division 10

Off 1 2 3 Next 1/2

MV2000

Press **MENU** and then select **Menu tab > Meas channel > Zone, Scale, Bar graph**.

ALARM SUMMARY
2008/01/23 03:02:50

Meas channel > Zone, Scale, Bar graph

First-CH 001 Last-CH 001

Zone
Lower 0 %
Upper 100 %

Scale
Position 1
Division 10

Bar graph
Base position Normal
Division 10

Off 1 2 3 4 5 Next 1/2

- Scale Digit, Value Indicator

MV1000

Press **MENU** select **Menu tab > Display > Trend**.

MESSAGE SUMMARY
2008/01/23 02:58:06

Trend

Direction Wide
Trend clear On
Message direction Horizontal

Scale
Digit Normal
Value indicator Mark
Trend line 2 dot
Grid Auto div
Second interval 1min /div

Normal Fine

6.7 Displaying a Scale on the Trend Display

MV2000

Press **MENU** and then select **Menu tab > Display > Trend, Bar graph, LCD, Monitor.**

The screenshot shows the MV2000 menu interface. At the top, there is a status bar with 'ALARM SUMMARY', '2008/01/23 03:05:39', a 'VIEW' icon, 'EVENT', '1hour', and a 'G' icon. Below this is a breadcrumb trail: 'Display > Trend, Bar graph, LCD, Monitor'. The main menu is divided into three sections: 'Trend', 'LCD', and 'Monitor'. The 'Trend' section has options: Direction (Wide), Trend clear (On), Message direction (Horizontal), Scale (Normal), Digit (Normal), Value indicator (Mark), Trend line (2 dot), and Grid (Auto div). The 'LCD' section has options: Brightness (2), Backlight saver (Dimmer), Mode (1h), Saver time (Key+Aln), and Restore. The 'Monitor' section has options: Background (White), Display (Black), Historical trend (10s), Scroll time (Off), and Jump default display. At the bottom, there are two buttons: 'Normal' and 'Fine'.

- **Showing a Scale**

While in the trend display, press **DISP/ENTER** (to open the display selection menu) > **right arrow** key (to open the submenu), and select **SCALE ON** (see section 5.2 for details).

Settings

- **First-CH, Last-CH**

Select the target channels. The settings selected here will be applied to these channels.

- **Position**

Select the scale display position on the trend display from 1 to 6 with the MV1000 or from 1 to 10 with the MV2000. Select Off to not display a scale.

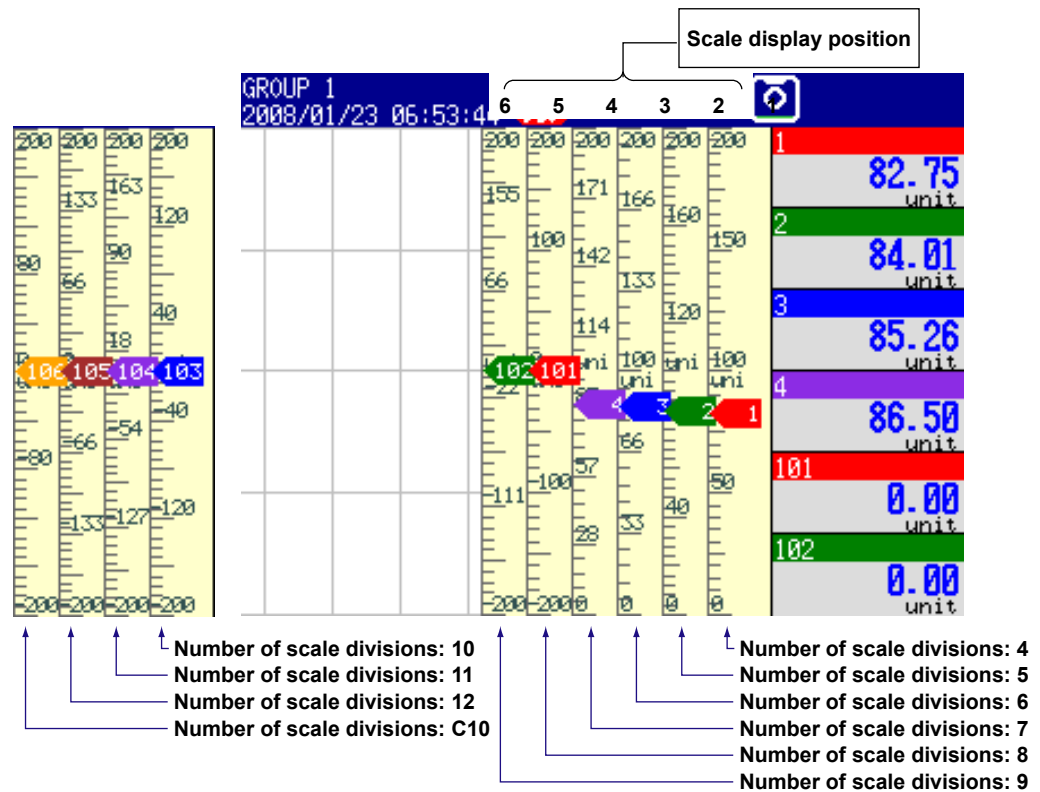
- **Scale > Division**

Select the number of main scale marks on the trend display from 4 to 12 and C10.

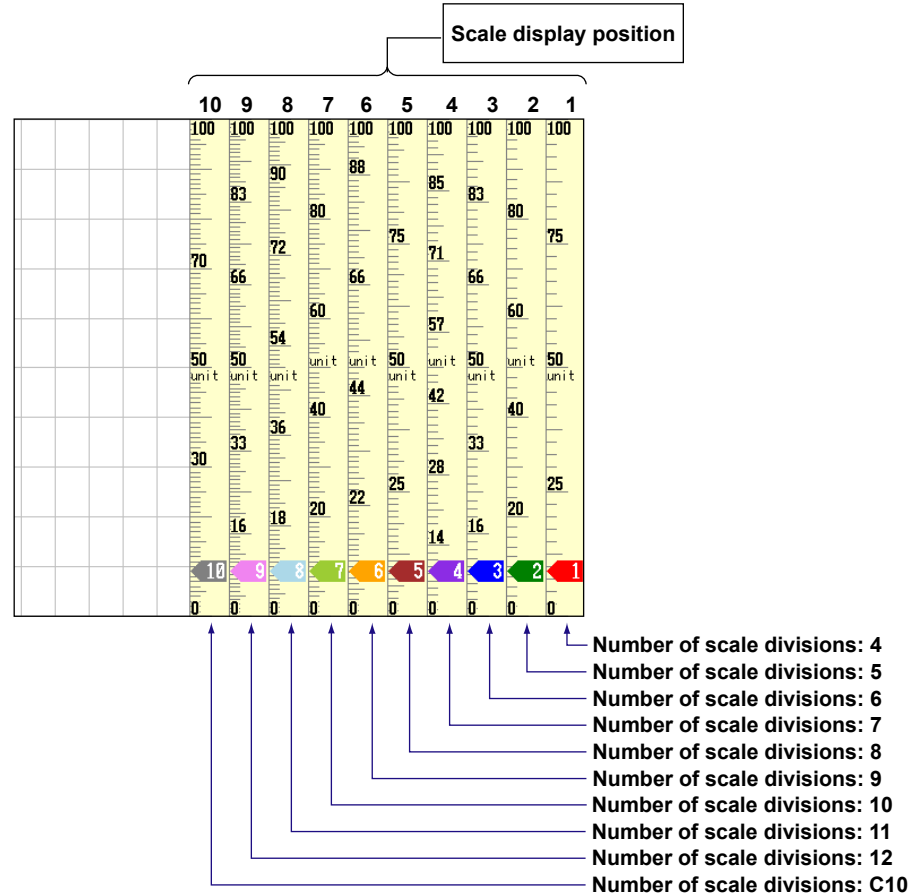
C10: The scale is equally divided into 10 sections by main scale marks, and scale values are indicated at 0, 30, 50, 70, and 100% positions on the trend display.

The next figure contains examples of scales for different numbers of divisions when the span is 0 to 100 and the unit is set to "unit."

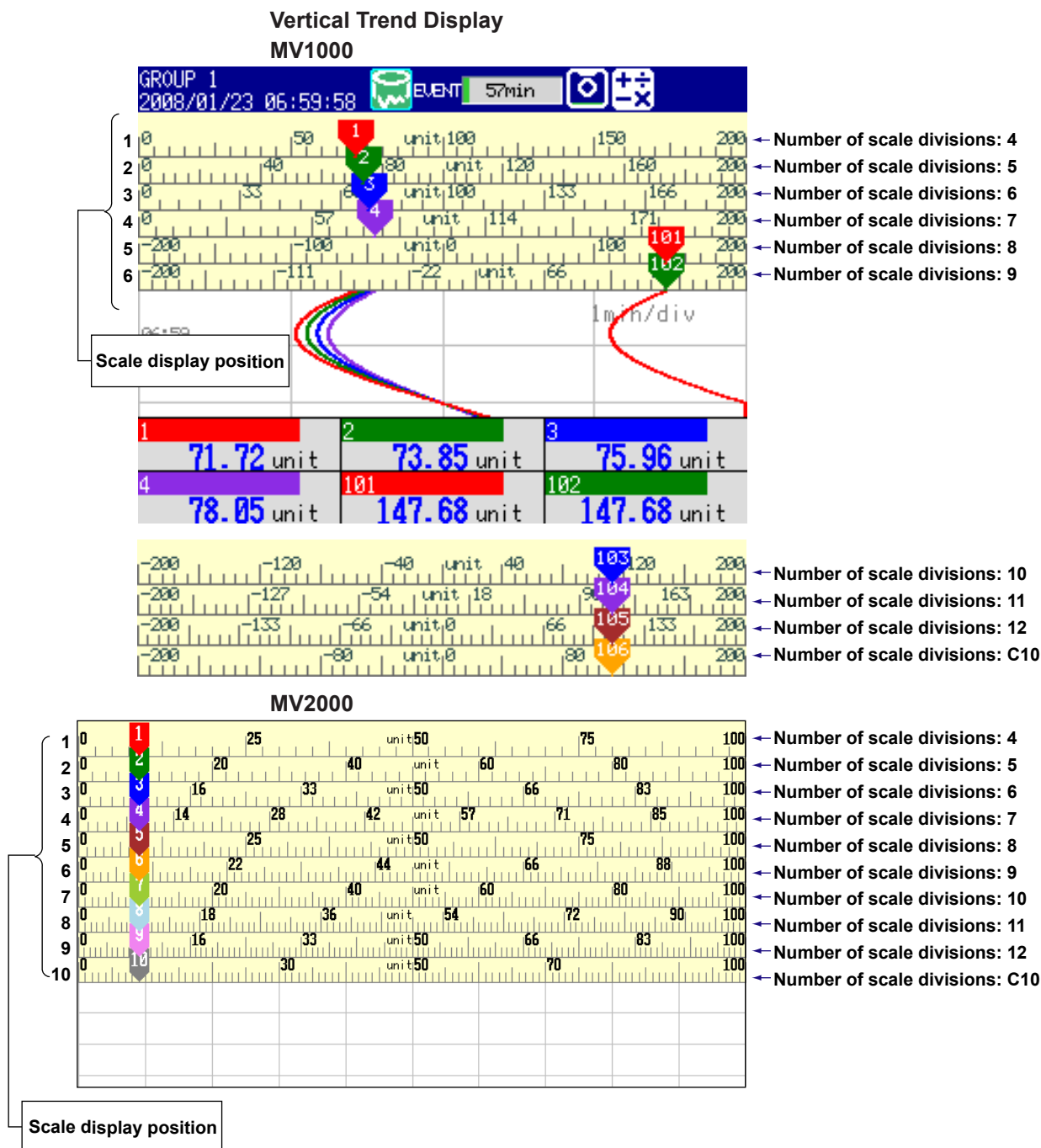
Horizontal Trend Display MV1000



MV2000



6.7 Displaying a Scale on the Trend Display



Note

- If the scales of multiple channels are set to the same position, the scale of the channel assigned to the group first is displayed.
Example: If the channel assignment order to a group is 003.002.001, and the scale display position is set to 1 for all channels, the scale of channel 3 is displayed at display position 1.
- Even if some of the scale display positions are skipped, the positions are shifted towards 1 so that there are no empty positions.
Example: Suppose the channel assignment to a group is 001.002.003, and the display positions of the scales are set to 1, 3, and 6, respectively. The scales will actually appear at positions 1, 2, and 3, respectively.

- The scale is divided into 4 to 12 sections by the main scale marks. The section between main scale marks is divided into 10 subsections by medium and small scale marks. Small scale marks are not displayed if:
 - The input range resolution is smaller than the total number of small scale marks.
 - Zone display is enabled.
 - Partially expanded display is enabled.
- The scale values are displayed according to the following rules.
 - If the number of scale divisions is 4 to 7 for the vertical trend display, values are displayed at all main scale marks. If the number of scale divisions is 8 to 12, the values are displayed at every other main scale mark.
 - Scale upper and lower limits are displayed at the ends of the scale.
 - Scale values are displayed up to three digits, ignoring the minus sign. However, if the integer parts of the values at the ends of the scale are both one digit or both is zero, two digits are displayed.

Example: If the scale is -0.05 to 0.50 , the lower limit will be -0.0 and the upper limit will be 0.5 .
 - If the integer part of either end of the scale is two or three digits, the fractional part is truncated.

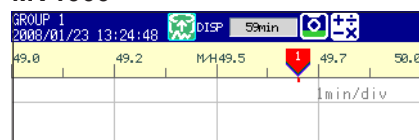
Example: If the scale is 0.1 to 100.0 , the lower limit will be 0 and the upper limit will be 100 .
 - If the integer part of either end of the scale is four or more digits, the value is displayed using a 3-digit mantissa and an exponent, " $\times 10$ " or " $\times 10^2$ " for example.

Example: If the scale is 10 to 2000 , the lower limit will be 1 and the upper limit will be 200×10 .
- The unit is displayed near the center of the scale. If partially expanded display is enabled, the display position will be offset from the center. For the vertical trend display, up to six characters can be displayed. For the horizontal trend display, up to four characters can be displayed.

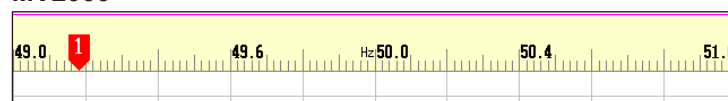
• Trend > Scale > Digit

Fine: If the scale value is displayed with two digits, it can be changed to three digits. For example, if the scale range is 49.0 to 51.0 , the scale values will be displayed with three digits as shown below.

MV1000

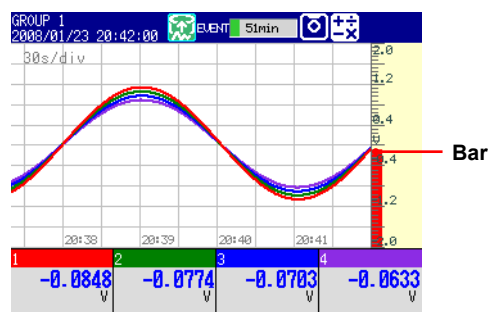


MV2000



• Trend > Scale > Value indicator

The current value is indicated with a mark or a bar.



6.8 Displaying Alarm Value Marks and Color Scale Bands

This section explains how to display alarm value marks on the scale and how to display a color band over a specified range.

► For an explanation of these functions, see section 1.4.

Display

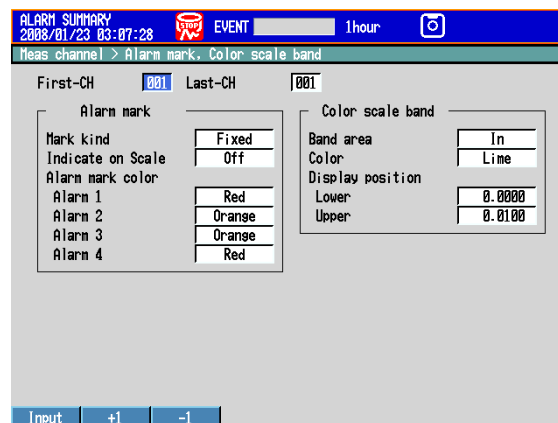
MV1000

Press **MENU** and then select **Menu tab > Meas channel > Alarm mark or Color scale band**.

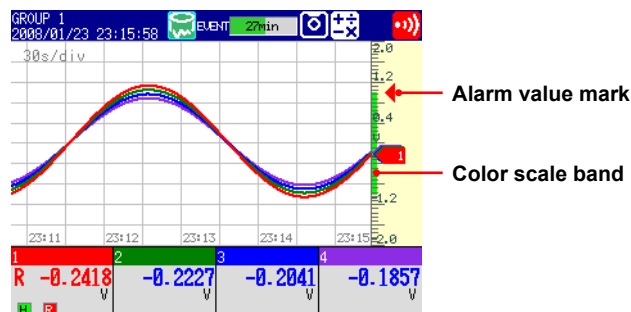


MV2000

Press **MENU** and then select **Menu tab > Meas channel > Alarm mark, Color scale band**.



Settings



- **First-CH, Last-CH**

Select the target channels. All of the other settings selected here will be applied to these channels.

- **Alarm mark**

Displays marks that indicate the values of the high and low limit alarms, delay high and low limit alarms, and difference high and low limit alarms. These settings are shared with the bar graph display.

- **Alarm mark > Mark kind**

Setting	Description	Mark
Alarm	Displays green marks under normal conditions and red marks when alarms are activated.	▲ or ▼
Fixed	Displays marks in fixed colors.	◀

- **Alarm mark > Indicate on Scale**

To display alarm value marks, select On.

- **Alarm mark > Alarm mark color > Alarm 1, Alarm 2, Alarm 3, and Alarm 4**

If Mark kind is set to Fixed, specify the alarm value mark colors.

- **Color scale band**

Displays a color band on the scale for a specified section of the measurement range. These settings are shared with the bar graph display.

- **Color scale band > Band area**

Setting	Description
In	Displays a color band for the area inside the range.
Out	Displays a color band for the area outside the range.
Off	Disables this function.

- **Color scale band > Color**

Set a color.

- **Color scale band > Display position > Lower, Upper**

Specify the display position. Specify a value within the span or scale range.

Lower: The lower limit of the area.

Upper: The upper limit of the area.

6.9 Partially Expanding a Waveform

This section explains how to expand a portion of a waveform (and shrink the other portion).

► For an explanation of this function, see section 1.4.

Display

- **Turning ON/OFF the Partially Expanded Display Function**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message.**

Basic Setting Mode		Ethernet Link
View		
Trend type	T-Y	
Partial	Off	
Trend rate switching	On	
Message		
Write group	Common	
Power-fail message	Off	
Change message	Off	
On		Off

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message, Input, Alarm.**

Basic Setting Mode		Ethernet Link
Environment > View, Message, Input, Alarm		
View		
Trend type	T-Y	
Partial	Off	
Trend rate switching	Off	
Input		
Value on over-range	Free	
Message		
Write group	Common	
Power-fail message	Off	
Change message	Off	
Alarm		
No logging	Off	
On		Off

- **Partially Expanded Display Settings**

Press **MENU** and then select **Menu tab > Meas channel > Partial.**

MESSAGE SUMMARY		EVENT 1hour	Speaker
First-CH: 1 Last-CH: 1			
Partial			
On/Off	On		
Expand	50 %		
Boundary	0.0000		
1 2 3 4		Next 1/3	

Settings

- **View > Partial**

If you select On, the Partial item appears in the Setting Mode menu.

- **First-CH, Last-CH**

Select the target channels.

- **Partial > On/Off**

To enable the partially expanded display function, select On.

- **Partial > Expand**

Set the position where the value specified by Boundary will be displayed as a percentage of the display span from within the range of 1 to 99.

- **Partial > Boundary**

Set the boundary value between the reduced section and the expanded section from within the range of “the minimum span value + the smallest number expressible given the decimal place” to “the maximum span value – the smallest number expressible given the decimal place.” For channels that are set to scaling, the selectable range is “the minimum scale value + the smallest number expressible given the decimal place” to “the maximum scale value – the smallest number expressible given the decimal place.”

Example: Input range: –6 V to 6V. Expand: 30. Boundary: 0

The –6 V to 0 V range is displayed in the 0% to 30% range, and the 0 V to 6 V range is displayed in the 30% to 100% range.

6.10 Changing the Display Layout, Clearing of the Waveform at Start, Message Display Direction, Waveform Line Width, and Grid

This section explains how to change the display layout, waveform line width, and grid. It also explains how to clear waveforms when memory sampling starts.

► For an explanation of these functions, see section 1.4.

Display

MV1000

Press **MENU** and then select **Menu tab > Display > Trend**.

MESSAGE SUMMARY
2008/01/23 03:05:18

Trend

Direction	Wide
Trend clear	On
Message direction	Horizontal
Scale	Normal
Digit	Mark
Value indicator	2 dot
Trend line	Auto div
Grid	1min /div
Second interval	

Horizon Vertical Wide Split

MV2000

Press **MENU** and then select **Menu tab > Display > Trend, Bar graph, LCD, Monitor**.

ALARM SUMMARY
2008/01/23 03:11:18

Display > Trend, Bar graph, LCD, Monitor

Trend

Direction	Wide
Trend clear	On
Message direction	Horizontal
Scale	Normal
Digit	Mark
Value indicator	2 dot
Trend line	Auto div
Grid	1min /div

Bar graph

Direction	Vertical
-----------	----------

LCD

Brightness	2
Backlight saver	Dimmer
Mode	1h
Restore	Key+Alm

Monitor

Background	White
Display	Black
Historical trend	10s
Scroll time	Off
Jump default display	Off

Horizon Vertical Wide Split

Settings

- **Trend > Direction**
Set the trend waveform display direction to Horizontal, Vertical, Wide, or Split.

- **Trend > Trend clear**

Setting	Description
On	Clears the displayed waveforms when memory sampling starts.
Off	Does not clear the displayed waveforms when memory sampling starts.

- **Trend > Message direction**

Sets the message display direction to Horizontal or Vertical. The message direction is fixed to Horizontal if Trend Direction is set to Vertical.

- **Trend > Trend line**

Sets the line width of trends in dots (1 to 3).

- **Trend > Grid**

Sets the number of grids that will be displayed in the trend waveform display area.

Setting	Description
4 to 12	Displays a grid that divides the display width into 4 to 12 sections.
Auto	Displays the same number of grids as the number of scale divisions of the first-assigned channel of a group.

- **Second interval**

► See section 6.3 for details.

6.11 Changing the Bar Graph Display Method

This section explains how to change the bar graph display method.

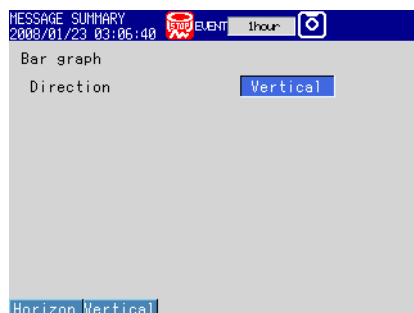
► For an explanation of the bar graph display, see section 1.4.

Display

- **Display Direction**

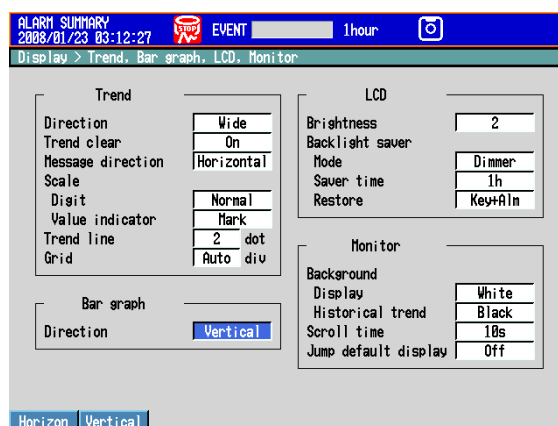
MV1000

Press **MENU** and then select **Menu tab > Display > Bar graph**.



MV2000

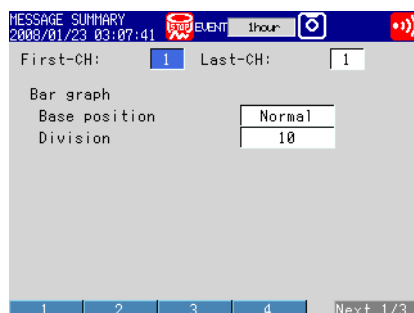
Press **MENU** and then select **Menu tab > Display > Trend, Bar graph, LCD, Monitor**.



- **Base Position and the Number of Scale Divisions**

MV1000

Press **MENU** and then select **Menu tab > Meas channel > Bar graph**.



MV2000

Press **MENU** and then select **Menu tab > Meas channel > Zone, Scale, Bar graph**.

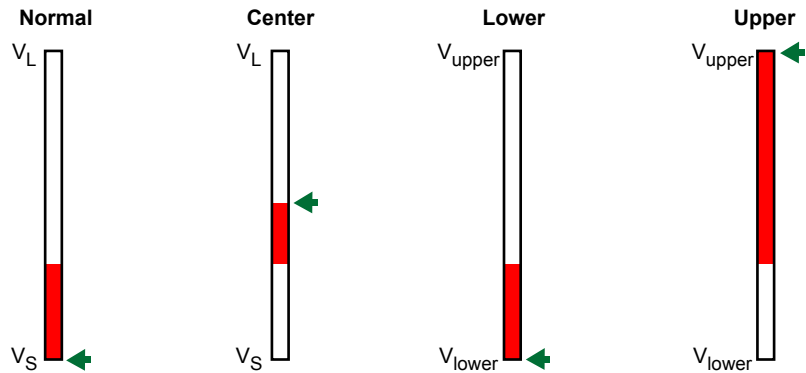
The screenshot shows the MV2000 menu interface. At the top, there is a status bar with 'ALARM SUMMARY', '2008/01/23 03:13:40', a red alarm icon, 'EVENT', and '1hour'. Below this is a breadcrumb trail: 'Meas channel > Zone, Scale, Bar graph'. The main menu area has three sections: 'First-CH' and 'Last-CH' both set to '001'; 'Zone' with 'Lower' at '0 %' and 'Upper' at '100 %'; 'Scale' with 'Position' at '1' and 'Division' at '10'; and 'Bar graph' with 'Base position' set to 'Normal' (highlighted in blue) and 'Division' at '10'. At the bottom, there are four buttons: 'Normal', 'Center', 'Lower', and 'Upper'.

Settings

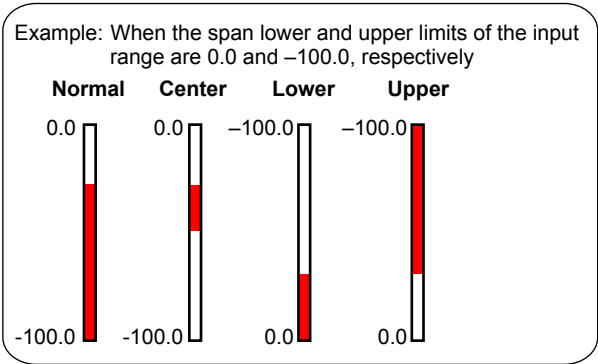
- **Bar graph > Direction**
Set the bar graph display direction to Horizontal or Vertical.
- **First-CH, Last-CH**
Select the target channels. All of the other settings selected here will be applied to these channels.
- **Bar graph > Base position**
Set the base position of bar graphs to Normal, Center, Lower, or Upper. A description of how the MV displays bar graphs depending on this setting is given on the following pages. This setting is applied to the bar graph display and to the bar that indicates the current value on the scale in the trend display.

When the Bar Graph Display Direction Is Set to Vertical

- Normal
The value at the bottom of the bar graph: The span lower limit or span upper limit (or scale lower limit or scale upper limit), whichever is less
The value at the top of the bar graph: The span lower limit or span upper limit (or scale lower limit or scale upper limit), whichever is greater
Starting point of the bar: Bottom edge
- Center
The value at the bottom of the bar graph: Same as with Normal.
The value at the top of the bar graph: Same as with Normal.
Starting point of the bar: Center
- Lower
The value at the bottom of the bar graph: Span lower limit (or scale lower limit)
The value at the top of the bar graph: Span upper limit (or scale upper limit)
Starting point of the bar: Bottom edge
- Upper
The value at the bottom of the bar graph: Same as with Lower.
The value at the top of the bar graph: Same as with Lower.
Starting point of the bar: Top edge



V_{upper} : Span upper limit (or scale upper limit)
 V_{lower} : Span lower limit (or scale lower limit)
 V_L : V_{lower} or V_{upper} , whichever is greater
 V_S : V_{lower} or V_{upper} , whichever is less
←: Starting point of the bar



When the Bar Graph Display Direction Is Set to Horizontal

The span lower limit (or scale lower limit) is set to the left edge of the bar graph, and the span upper limit (or scale upper limit) is set to the right edge of the bar graph.

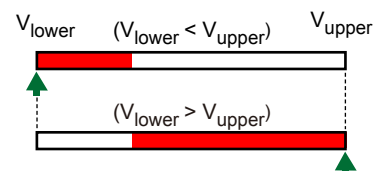
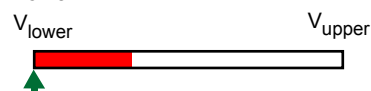
- Starting point of the bar

Normal: The left edge or right edge, whichever is less

Center: Center

Lower: Left edge

Upper: Right edge

Normal**Lower****Center****Upper**

V_{upper}: Span upper limit (or scale upper limit)

V_{lower}: Span lower limit (or scale lower limit)

↑: Starting point of the bar

Example: When the input range's span lower limit is 0.0, and the span upper limit is -100.0

Normal 0.0 -100.0



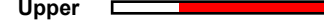
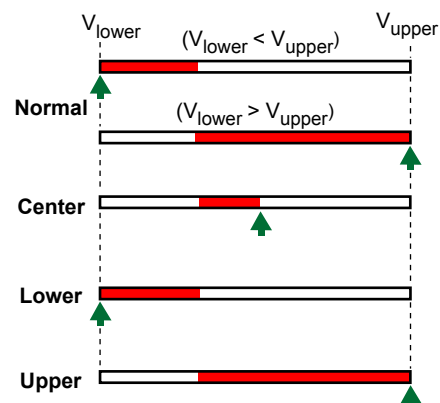
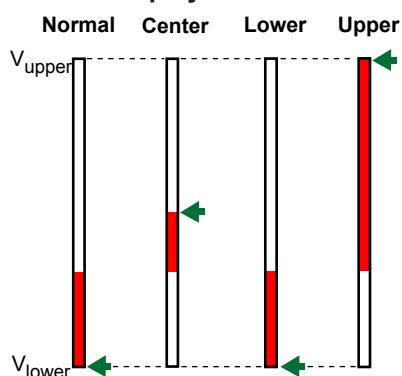
Center 0.0 -100.0



Lower 0.0 -100.0



Upper 0.0 -100.0

**When Displaying a Bar That Indicates the Current Value on the Scale in the Trend Display**

- Bar graph > Division**

Select the number of main scale marks from 4 to 12.

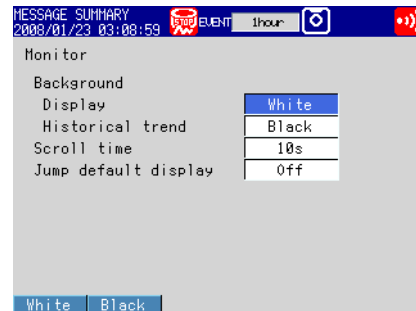
6.12 Changing the Display Background Color

This section explains how to change the display background color. This setting is applied to the operation screen.

Display

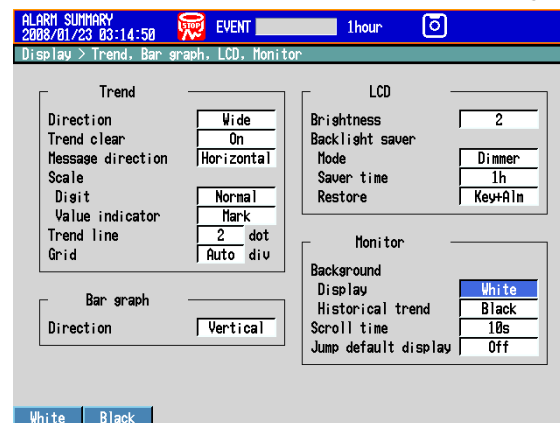
MV1000

Press **MENU** and then select **Menu tab > Display > Monitor**.



MV2000

Press **MENU** and then select **Menu tab > Display > Trend, Bar graph, LCD, Monitor**.



Settings

- **Monitor > Background > Display**
Set the background color of the operation screen to White (default setting) or Black.
- **Monitor > Background > Historical trend**
Select the background color of the historical trend display from the following:
Settings: White, Black (default setting), Cream, and Lightgray

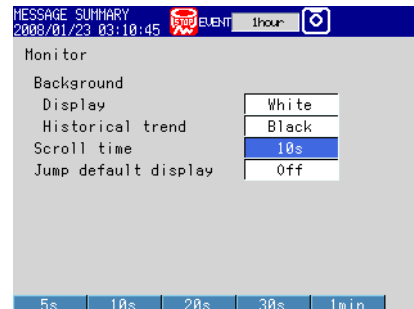
6.13 Automatically Switching Display Groups

This section explains how to enable the automatic switching of the displayed group at specified intervals.

Display

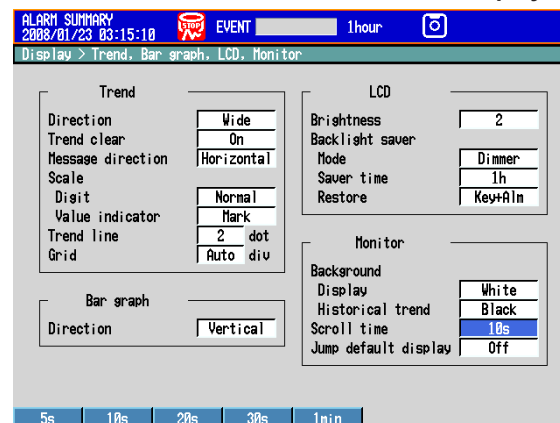
MV1000

Press **MENU** and then select **Menu tab > Display > Monitor**.



MV2000

Press **MENU** and then select **Menu tab > Display > Trend, Bar graph, LCD, Monitor**.



Settings

- **Monitor > Scroll time**
Select a switching interval from 5 s to 1 min from the available choices. The displayed group switches in ascending order.
Use the display selection menu to select whether or not to automatically switch the display.
▶ See section 5.2 for details.

6.14 Automatically Returning to a Specified Display

This section explains how to configure the MV to automatically switch back to a specified display if there is no user activity within a set time period.

Display

MV1000

Press **MENU** and then select **Menu** tab > **Display** > **Monitor**.

MESSAGE SUMMARY
2008/01/23 03:10:55 FUNC EVENT 1hour

Monitor

Background
Display White
Historical trend Black
Scroll time 10s
Jump default display Off

Off 1min 2min 5min Next 1/2

MV2000

Press **MENU** and then select **Menu** tab > **Display** > **Trend, Bar graph, LCD, Monitor**.

ALARM SUMMARY
2008/01/23 03:15:21 FUNC EVENT 1hour

Display > Trend, Bar graph, LCD, Monitor

Trend
Direction Wide
Trend clear On
Message direction Horizontal
Scale Normal
Digit Mark
Value indicator 2 dot
Trend line Auto div
Grid Vertical

Bar graph
Direction Vertical

LCD
Brightness 2
Backlight saver Dimmer
Mode 1h
Saver time Key+Alm
Restore Key+Alm

Monitor
Background
Display White
Historical trend Black
Scroll time 10s
Jump default display Off

Off 1min 2min 5min 10min 20min Next 1/2

Settings

• Monitor > Jump default display

The MV will return to a specified display if there is no key operation within a set time period.

Setting	Description
1min to 1h	The time interval for switching the display.
Off	Disables this function.

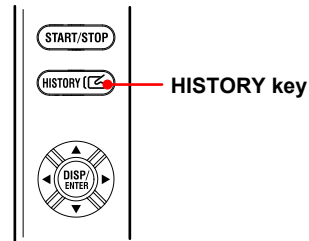
Procedure

• Specifying the Display

1. Switch to the operation screen that you want to register.
2. In Operation Mode, press **FUNC**.
The function menu appears.
3. Press the **Standard display** soft key.
The display is registered.

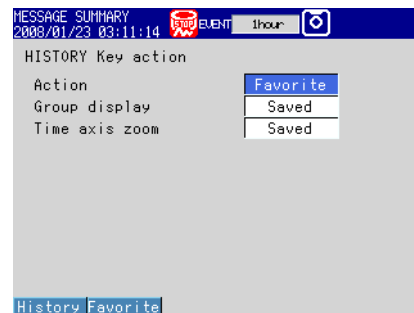
6.15 Registering Favorite Displays

This section explains how to register often-used displays to the HISTORY key for easy access.



Display

Press **MENU** and select **Menu tab > Display > HISTORY Key action**.



Settings

- HISTORY key action > Action**

Setting	Description
History	Switches to the historical trend display when the key is pressed.
Favorite	Switches to the favorite display that you registered when the key is pressed.

Select Favorite if you want to register favorite displays and switch to them.

- HISTORY key action > Group display**

Setting	Description
Current	Displays a favorite display in the current group.
Saved	Displays a favorite display in the group that was selected when you registered the favorite display.

- HISTORY key action > Time axis zoom**

Setting	Description
Current	Displays a favorite display at the current time axis zoom rate.
Saved	Displays a favorite display at the time axis zoom rate that was selected when you registered the favorite display.

Procedure

- Registering Displays**

You can register up to eight displays.

1. Switch to the display that you want to register in Operation Mode.
2. Press **FUNC**.
The function menu appears.

6.15 Registering Favorite Displays

3. Press the **Favorite regist** soft key. Then, press a registration number soft key.
 4. Press the **Regist** soft key.
A window opens for you to enter the display name.
* To delete a registration, press the **Delete** soft key.
 5. Enter the display name (up to 16 characters, **Aa#1**).
 6. Press **DISP/ENTER**.
The display is registered.
- **Switching the Display**
Press the HISTORY key to switch the displays in the order of their registration.
Pressing the history key after switching to the last registered display will switch the display back to the original display.

6.16 Writing a Message When the MV Recovers from a Power Failure

This section explains how to configure the MV to write a message to the trend display when the MV recovers from a power failure that occurs during memory sampling.

Display

- **Power Recovery Message**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message.**

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > View, Message, Input, Alarm.**

Settings

- **Message > Power-fail message**

Setting	Description
On	Automatically writes a message when the MV recovers from a power failure that occurs during memory sampling. Display example: 15:12 Power Off 2008/01/23 15:12:57
Off	Disables this function.

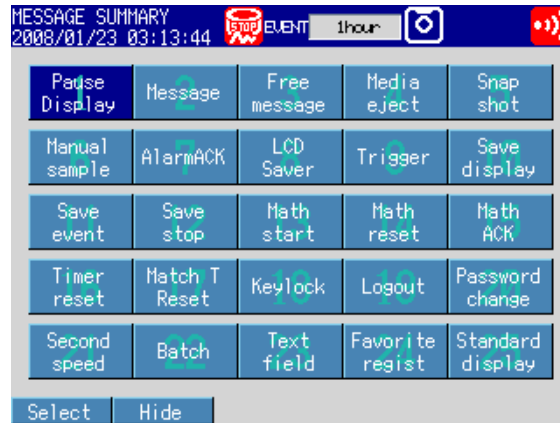
6.17 Changing the Function Menu and the Display Selection Menu

This section explains how to change the contents of the function menu, which is displayed when you press the FUNC key, and the display selection menu, which is displayed when you press the DISP/ENTER key.

Display

- **Function Menu**

Press **MENU** and then select **Menu tab > Menu customize > Function menu**.



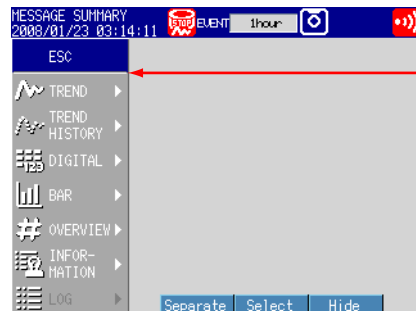
Number indicating the display order

Message

Menu name
White Used
Gray: Not used

- **Display Selection Menu**

Press **MENU** and select **Menu tab > Menu customize > Display menu**.



Separator

Settings

- **Enabling/Disabling the Function Menu Items**

Menu items that are in white are shown.

1. Press the **arrow** keys to select a menu item.
2. Press the **Hide** or **Select** soft key.
If you press the Hide soft key, the menu item will be displayed in gray and will not appear in the function menu.

































- **Changing the Displayed Order of Function Menu Items**

Menu items are displayed in numeric order. Menu items appear when the corresponding function can be used.

1. Press the **arrow** keys to select a menu item.
2. Press the **Select** soft key.
The menu item is enclosed in a red frame.
3. Press the **arrow** keys to select the destination.
4. Press the **Transfer** soft key.
The menu item moves to the selected number position.

- **Description of the Function Menu Items**

For a description of each item, see the respective section.

				
► Sec. 5.1	Sec. 6.4	Sec. 6.4	Sec. 4.4 Sec. 4.10	Sec. 4.6
				
► Sec. 4.5	Sec. 3.8	Sec. 9.8	Sec. 4.4	Sec. 4.4
				
► Sec. 4.4	Sec. 5.9	Sec. 10.4	Sec. 10.4	Sec. 10.4
				
► Sec. 7.2	Sec. 7.3	Sec. 8.1	Sec. 8.3	Sec. 8.3
				
► Sec. 6.3	Sec. 4.3	Sec. 4.3	Sec. 6.15	Sec. 5.11
				
► Sec. 9.3	Sec. 9.3	Comm.*	Comm.*	Comm.*
				
► Comm.*	► Sec 5.11 (only with the MV2000)			

* MV1000/MV2000 Communication Interface User's Manual

- **Enabling/Disabling the Display Selection Menu and Submenu**

Menu items that are in white are shown.

1. Press the **arrow** keys to select a menu item.
2. Press the **Hide** or **Select** soft key.
If you press the Hide soft key, the menu item will be displayed in gray and will not appear in the display selection menu.

6.17 Changing the Function Menu and the Display Selection Menu

- **Changing the Display Selection Menu/Submenu Positions**

1. Press the **arrow** keys to select a menu item.
2. Press the **Select** soft key.
The menu item is enclosed in a red frame.
3. Press the **arrow** keys to select the destination.
4. Press the **Transfer** soft key.
The menu item moves to the selected position.

- **Showing/Hiding Separators**

1. Press the **arrow** keys to select a menu item.
2. Press the **Separate** soft key.
A separator (line) is displayed between the current item and the next lower item.
If the separator is already showing, pressing the key hides it.
You can set up to three separators in the display selection menu and each sub-menu.

- **Description of the Display Selection Menu and Submenu Items**

Items with an asterisk are set to Hide by default.

Display Selection Menu	Submenu	Reference Section
Trend	GROUP 1 to GROUP 10 ¹ /GROUP 36 ²	Section 5.2/6.12
	ALL CHANNEL/GROUP CHANNEL	Section 5.2/6.13
	AUTO ZONE ON/OFF	Section 5.2
	SCALE ON/OFF	Section 5.2/6.12
	FINE GRID ON/OFF	Section 5.2
	DIGITAL ON/OFF	Section 5.2/6.12
	MESSAGE DISP 1/2	Section 5.2
	* TREND SPACE ON/OFF	Sections 5.2 and 6.12
	AUTO SCROLL ON/OFF	Sections 5.2 and 6.12
	EXPAND ²	Section 5.11
TREND HISTORY	GROUP 1 to GROUP 10 ¹ /GROUP 36 ²	Section 5.3
DIGITAL	GROUP 1 to GROUP 10 ¹ /GROUP 36 ²	Section 5.2
	AUTO SCROLL ON/OFF	Section 5.2
	EXPAND ²	Section 5.11
BAR	GROUP 1 to GROUP 10 ¹ /GROUP 36 ²	Section 5.2
	AUTO SCROLL ON/OFF	Section 5.2
	EXPAND ²	Section 5.11
OVERVIEW	CURSOR ON/OFF	Section 5.4
	JUMP TO ALM SUM	Section 5.4
	JUMP TO TREND	Section 5.4
	* JUMP TO DIGITAL	Section 5.4
	* JUMP TO BAR	Section 5.4
	EXPAND ²	Section 5.11

6.17 Changing the Function Menu and the Display Selection Menu

Display Selection Menu	Submenu	Reference Section
INFORMATION	ALARM SUMMARY	Section 5.5
	MESSAGE SUMMARY	Section 5.5
	MEMORY SUMMARY	Section 5.5
	* MODBUS CLIENT	Section 5.5
	* MODBUS MASTER	Section 5.5
	* RELAY	Section 5.5
	REPORT DATA	Section 5.5
	COLUMN BAR	Section 5.6
	TO HISTORY	Section 5.7/5.8/5.9
	TO HISTORY(DISP)	Section 5.7/5.8/5.9
	TO HISTORY(EV)	Section 5.7/5.8/5.9
	TO OVERVIEW	Section 5.7
	CHANGE SORT KEY	Section 5.7/5.8
	ASCENDING/DSCENDING ORDER	Section 5.7/5.8
	DATA SAVE MODE	Section 5.9
	* SELECT SAVE	Section 5.9
	* M.SAMPLE SAVE	Section 5.9
	* REPORT SAVE	Section 5.9
	* ALL SAVE	Section 5.9
	CHANGE DISP ITEM	Section 5.8
	CHANGE DATA KIND	Section 5.9
	FILENAME/TIME DISPLAY	Section 5.9
	CHANGE REPORT CH	Section 5.5
	DUAL/SINGLE GRAPH	Section 5.6
	SELECT COLUMN	Section 5.6
	REPORT GROUP1 to REPORT GROUP4 ¹ /REPORT GROUP6 ²	Section 5.6
	EXPAND ²	Section 5.11
* LOG	LOGIN	Section 5.10
	ERROR	Section 5.10
	COMMUNICATION	Section 5.10
	FTP	Section 5.10
	MAIL	Section 5.10
	WEB	Section 5.10
	SNTP	Section 5.10
	DHCP	Section 5.10
	MODBUS	Section 5.10
4 PANEL ²	MIX	Section 5.11
	ALL TREND	Section 5.11
	ALL DIGITAL	Section 5.11
	ALL BAR	Section 5.11
* EXPAND ²		Section 5.11

1 MV1000 only

2 MV2000 onl

7.1 Configuring the Event Action Function

This section explains how to configure the MV to execute a specified action when a given event occurs. This function is called *event action*. This section also explains how to configure the remote control function (/R1 option) and the USER key.

- ▶ For an explanation of these functions, see section 1.7.
- ▶ For event action configuration examples, see appendix 2.

Display

Press **MENU** and then select **Menu tab > Timer, Event action > Event action**.

Settings

- **Logic box number**

You can set up to 40 event actions.

- **Event**

An event is a condition for executing an action.

Setting	Description
None	—
Remote	Select a remote control input terminal number.
Relay	Select an alarm output relay number.
Switch	Select an internal switch number.
Timer	Select a timer number.
Match T	A match time timer.
	Select a match timer number.
Alarm	—
UserKey	—

- **Action**

An action that is executed when an event occurs.

Setting		Description
MV1000	MV2000	
Memory	Memory	Memory start/stop
Start	Start	Memory start
Stop	Stop	Memory stop
Trigger	Trigger	An event trigger.
		You can specify this when the MV is configured to record event data.
AlarmACK	AlarmACK	You cannot specify this when the event is set to Relay, Switch, or Alarm.
Math	Math	Computation start/stop. You can specify this on models with the /M1 or /PM1 option.
MathStart	MathStart	You can specify this on models with the /M1 or /PM1 option.
MathStop	MathStop	You can specify this on models with the /M1 or /PM1 option.
MathReset	MathReset	You can specify this on models with the /M1 or /PM1 option.

7.1 Configuring the Event Action Function

Setting		Description
MV1000	MV2000	
SaveDisp	SaveDisplay	You can specify this when the MV is configured to record display data.
SaveEvent	SaveEvent	You can specify this when the MV is configured to record event data.
Message	Message	Set the message number and destination. Set the message destination to all groups (All) or to a specific group number.
Snapshot	Snapshot	—
Rate1/2	DisplayRate1/2	A display rate switch. You can specify this when trend interval switching is enabled.
ManualSample	ManualSample	—
TimerReset	TimerReset	A relative time timer reset. You cannot specify this when the event is set to Timer.
Group	DisplayGroupChange	A display group switch. Specify the number of the group you want to display.
Flag	Flag	A /M1 or /PM1 option.
PanelLoad	PanelLoad	You can only specify this when the event is set to Remote.
TimeAdjust	TimeAdjust	Time adjustment. You can specify this only when the event is set to Remote.

7.2 Setting Timers

You can set timers on the events of the event action function. Timers are also used in TLOG computation.

► For an explanation of the event action function, see section 7.1.

Display

Press **MENU** and then select **Menu tab > Timer, Event action > Timer**.

- When relative time is selected

GROUP 1
2008/01/23 12:34:56 DISP 1hour

Timer No.	1
Mode	Relative
Interval	01:00
Reset at Math Start	On

1 2 3 4

- When absolute time is selected

GROUP 1
2008/01/23 12:34:56 DISP 1hour

Timer No.	1
Mode	Absolute
Interval	1h
Ref. time	0 :00

1 2 3 4

Settings

You cannot change these settings during memory sampling or computation.

- **Timer No.**
You can set four timers (1 to 4).

When Using a Relative Timer

- **Mode**
Select **Relative**.
- **Interval**
Set the interval in the range of 00:01 (1 minute) to 24:00 (24 hours).
- **Reset at Math Start**
On: Resets the timer when computation is started. The resetting of the timer is not considered a timeout. Even if the timer is used as an event, the action is not executed.

When Using an Absolute Timer

- **Mode**
Select **Absolute**.
- **Interval**
Set the interval from within the range of available settings (1min to 24h).
- **Ref. time**
Set the time in the range of hour 0 to hour 23.

Procedure

- **Resetting a Relative Timer**
 1. In Operation Mode, press **FUNC**.
The function menu appears.
 2. Press the **Timer reset** soft key.
 3. Press the timer soft key that you want to reset. Select **All** to reset all timers.
The relative timer is reset.

Explanation

- **Resetting a Relative Timer**

Restart the timer.

 - The resetting of the timer is considered a timeout. (If the timer is used as an event, the action is executed.)
 - If the timer is used in TLOG computation (/M1 and /PM1 options) and MathReset is specified, the computed result is reset.

7.3 Setting the Match Time Timer

You can set the time match condition that is used for the event action function. These timers are also used in TLOG computation.

► For an explanation of the event action function, see section 7.1.

Display

Press **MENU** and then select **Menu tab > Timer, Event action > MatchTimeTimer**.

Settings

You cannot change these settings during memory sampling or computation.

- **Timer number**

You can set four match time conditions (1 to 4).

- **Kind**

Setting	Description
Day	Sets the time match condition for a day.
Week	Sets the time match condition for a week.
Month	Sets the time match condition for a month.
Year	Sets the time match condition for a year.

Set the items with check marks in the following table according to the Kind setting.

Settings	Kind			
	Day	Week	Month	Year
Month				✓
Day			✓	✓
Day of the week		✓		
Hour:Minute	✓	✓	✓	✓

- **Month**

Set the month.

- **Day**

Set the day.

- **Day of the week**

Set the day of the week.

- **Hour:Minute**

Set the time in the range of 00:00 to 23:59.

- **Timer action**

Setting	Description
Single	Executes the action once when the condition is met. You can reset a timer by pressing FUNC after the timer expires.
Repeat	Executes the action each time the condition is met.

Procedure

- **Resetting a Match Time Timer**
 1. In Operation Mode, press **FUNC**.
The function menu appears.
 2. Press the **Match T Reset** soft key.
 3. Press the match time timer soft key that you want to reset.
The match time timer is reset.

Explanation

- **Resetting a Match Time Timer**

A match time timer becomes inactive after it times out. You can reset an inactive match time timer to activate it again.

 - The resetting of the timer is not considered a timeout.
 - Resetting of a timer affects a match time timer whose time action is set to **Single**.
 - If the timer is used in TLOG computation (/M1 and /PM1 options) and MathReset is specified, the computed result is reset.

7.4 Using the Remote Control Function (/R1 option) and the USER Key

You can use the event action function to set remote control and USER key inputs as events that will trigger actions.

For event action configuration instructions, see section 7.1.

For a configuration example, see appendix 2.

7.5 Using an Alarm, Output Relay, or Internal Switch

You can use the event action function to set alarms, output relays, or internal switches as events that will trigger actions.

For event action configuration instructions, see section 7.1.

For a configuration example, see appendix 2.

8.1 Disabling the Keys (key lock function)

This section explains how to disable the keys.

► For an explanation of this function, see section 1.8.

Display

• Selecting the Key Lock Function

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Security, Media save.**

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Security, Media save, Batch.**

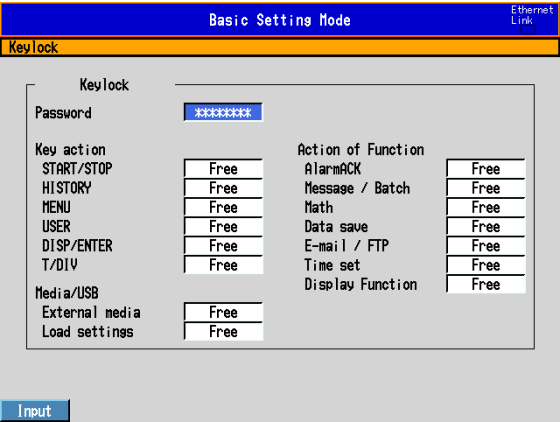
• Disabling Keys

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Keylock > Password, Key action, Media or Action of Function.**

8.1 Disabling the Keys (key lock function)

MV2000
Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Keylock**.



Settings

• **Security > Key**

Select **Keylock**.

Setting	Description
Keylock	Enables the key lock function. The Keylock item appears in the Basic Setting Mode menu.
Login	Enables the login function. See section 8.2 for details.

• **Password**

The password used to release the key lock (Up to eight characters, **Aa#11**)
The MV displays “*****” for the password.

• **Key action, External Media, and Action of Function**

Select whether or not to lock each item.

Setting	Description
Free	Does not lock the item.
Lock	Locks the item.

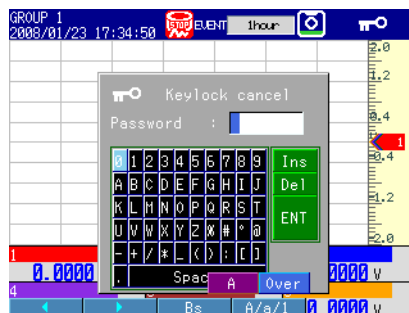
Procedure

• Locking the Keys

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Keylock** soft key.
The key lock function is enabled. The key lock icon appears in the status display section.

• Releasing the Key Lock Function

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Keylock** soft key.
A window prompting for the password opens.



3. Enter the password, and press **DISP/ENTER**.
The key lock is released. The key lock icon disappears from the status display section.

8.2 Allowing Only Registered Users to Operate the MV (login function)

This section explains how to configure the MV so that only registered users can operate the MV.

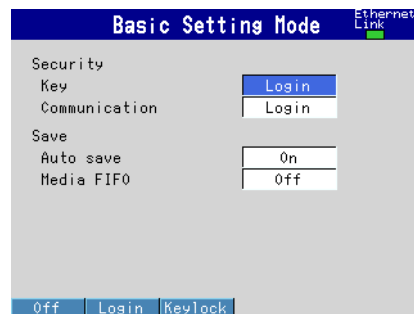
► For an explanation of this function, see section 1.8.

Display

- **Login Function**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Security, Media save.**



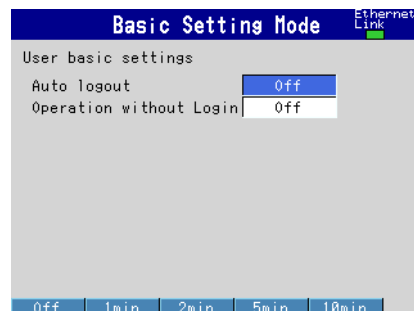
MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Security, Media save, Batch.**



- **Logout Method**

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Login > Basic settings.**



- **Registering an Administrator**

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Login > Admin settings**.

Basic Setting Mode		Ethernet Link
Admin number	1	
Mode	Key	
User name	Admin1	
Password	*****	
<div>1 2 3 4 5</div>		

- **Registering a User (user-level user)**

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Login > User settings**.

Basic Setting Mode		Ethernet Link
User number	1	
Mode	Key	
User name	User1	
Password	*****	
Authority of user	Off	
<div>1 2 3 4 Next 1/8</div>		

- **User Privileges**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Login > Authority of user > Key action, Media or Action of Function**.

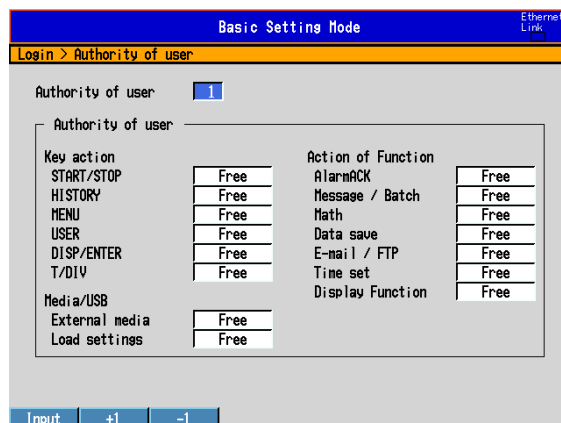
Basic Setting Mode		Ethernet Link
Authority of user	1	
Key action		
START/STOP	Free	
HISTORY	Free	
MENU	Free	
USER	Free	
DISP/ENTER	Free	
T/DIV	Free	
Media/USB		
External media	Free	
Load settings	Free	
<div>1 2 3 4 Next 1/3</div>		

Basic Setting Mode		Ethernet Link
Authority of user	1	
Action of Function		
AlarmACK	Free	
Message / Batch	Free	
Math	Free	
Data save	Free	
E-mail / FTP	Free	
Time set	Free	
Display Function	Free	
<div>1 2 3 4 Next 1/3</div>		

8.2 Allowing Only Registered Users to Operate the MV (login function)

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Login > Authority of user**.



Settings

You can specify different login settings for logins through keys and logins through communications.

- **Security > Key**
Select **Login**.

Setting	Description
Login	Allows only registered users to operate the MV by using keys. The Login item appears in the Basic Setting Mode menu.
Keylock	Enables the key lock function. See section 8.1 for details.
Off	Disables security features.

- **Security > Communication**

Setting	Description
Login	Only allows registered users to operate the MV via a communication interface. The Login item appears in the Basic Setting Mode menu.
Off	Disables security features.

- **User basic settings > Auto logout**

Setting	Description
Off	Does not log out until you manually log out.
1min to 10min	Automatically logs out when there is no key operation for a specified time.

- **User basic settings > Operation without login**

Sets the operations that a user can carry out when logged out.

Setting	Description
Off	Only allows a user to log in.
Display	Allows a user to log in or switch the operation screen.

- **Admin number**

You can register up to five administrators. Be sure to register at least one administrator. You can only use the login function when there is at least one registered administrator.

- **Admin number > Mode**

The available settings vary depending on the Security setting.

Setting	Description
Off	No registration.
Key	Allows login through keys.
Comm	Allows login through a communication interface.
Web	Allows login to the MV operator page and monitor page from a Web browser.
Key+Comm	Allows login through keys and through a communication interface.

- **Admin number > User name**

Set the user name (up to 20 characters, **[Aa#1]**).

- You cannot register a user name that is already registered.
- You cannot register “quit” or a user name containing only spaces.

- **Admin number > Password**

Set the password (up to eight characters, **[Aa#1]**).

The default password is a string of question marks (???????). When you set a password, the MV displays a string of asterisks (*****).

- You cannot register “quit” or a password containing only spaces.

- **User number**

You can register up to 30 users.

- **User number > Mode**

The available settings vary depending on the **Security** setting.

Setting	Description
Off	No registration.
Key	Allows login through keys.
Comm	Allows login through a communication interface.
Web	Allows login to the MV monitor page from a Web browser.
Key+Comm	Allows login through keys and through a communication interface.

- **User number > User name and Password**

See the explanation for the administrator user name and password.

- **User number > Authority of user**

Setting	Description
Off	Does not limit operations.
1 to 10	An operation limitation registration number.

- **Authority of user, Key action, Media/USB, and Action of Function**

Select the “authority of user” preset number from 1 to 10.

- ▶ See section 8.1 for details.

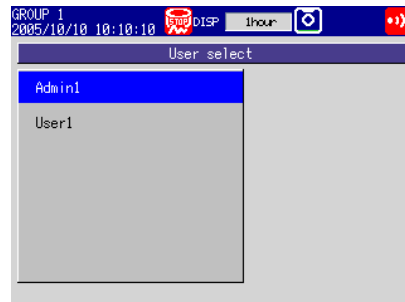
8.3 Logging in and Logging Out

This section explains how to log into the MV by using keys. For instructions on how to operate the MV via a communication interface, see the *Communication Interface User's Manual (IM MV1000-17E)*.

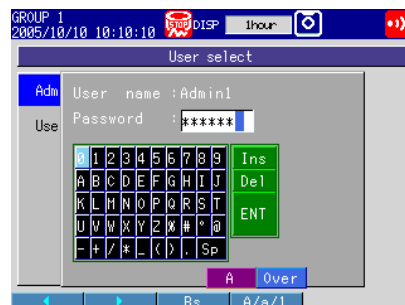
Procedure

• Logging In

1. In Operation Mode, press **FUNC**.
A list of registered user names appears.



2. Press the **arrow keys** to select a user name, and press **DISP/ENTER**.
A window opens for you to enter the password.



3. Enter the password,*, and press **DISP/ENTER**.
The MV is ready for key operation. The status display section shows the logged-in user name.
* The password that you enter appears as a string of asterisks (*****).

• Logging Out

Logging Out Using Keys

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Logout** soft key.
The MV logs you out. The user name disappears from the status display section.

Auto Logout

If auto logout is enabled, the MV will automatically log you out if you do not operate the keys for a specified time.

- **Changing the Password**

Procedure Using Keys

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Password change** soft key.
A window prompting for the current password opens.
3. Enter the current password, and press **DISP/ENTER**.
A window prompting for a new password opens.
4. Enter a new password, and press **DISP/ENTER**.
A window opens for re-entering the new password.
5. Enter the new password, and press **DISP/ENTER**.
The window closes, and the new password is activated.

9.1 Setting the Date and Time

This section explains how to set the date and time. If you are using the MV in a region that uses DST, specify the date and time for switching between DST and standard time.

Setting the Date and Time

Display

- **Date and Time**

Press **MENU** and then select **Menu tab > Date/Time**.



Settings

- **Time set**

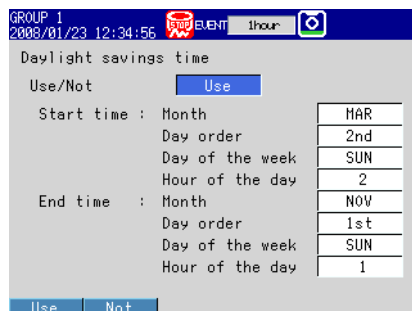
Enter the date and time, and press **DISP/ENTER**.

Configuring Daylight Saving Time

Display

- **DST**

Press **MENU** and then select **Menu tab > Date/Time > Daylight Saving Time**.



Settings

- **Use/Not**

To enable the DST function, select **Use**.

- **Start time**

Specify the date/time to switch from standard time to DST. Set the month, the nth week, the day of the week, and the time.

- **End time**

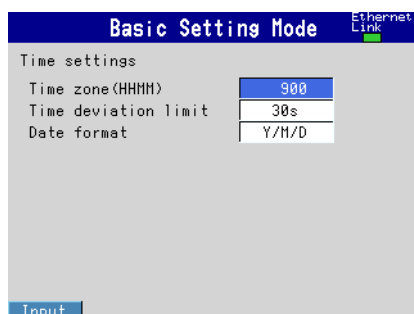
Specify the date/time to switch from DST to standard time. Set the month, the nth week, the day of the week, and the time.

Other Time Settings

Set the time zone of the region where the MV will be used, the time correction operation during memory sampling, and the date format. Be sure to set the time zone if you are using Ethernet network functions.

Display

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Time settings**.



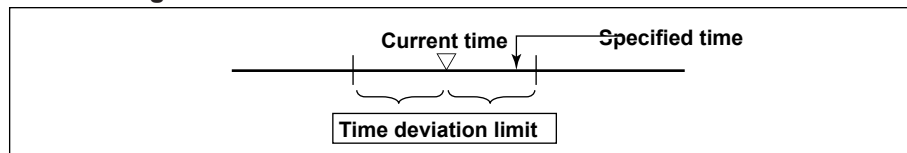
Settings

- **Time settings > Time zone (HHMM)**

Set the time zone of the region where the MV will be used in terms of the time difference from GMT. Specify a value in the range of –1300 to 1300 (where the first two digits denote the hour and the last two digits denote the minute). A negative value indicates that the local time is behind GMT.

Example: The standard time in Japan is ahead of GMT by 9 hours. In this case, enter 900.

- **Time settings > Time deviation limit**



When the time deviation between the time on the MV and the specified time is within \pm (the value specified here), the time on the MV is gradually corrected. Otherwise, the time is corrected immediately.

Setting	Description
10s to 5min	The time deviation limit.
Off	Disables gradual time correction.

Example: If Time deviation limit is set to 10s and the time on the MV is 10 hours 21 minutes 15 seconds, the time is gradually corrected if the specified time is between 10 hours 21 minutes 5 seconds and 10 hours 21 minutes 25 seconds.

- **Time settings > Date format**

Setting	Example for Jan. 23, 2008	Time displayed at the grid position of the trend display (if the time is 7:00 on Jan. 23)*
Y/M/D	2008/01/23	01/23 07
M/D/Y	01/23/2008	01/23 07
D/M/Y	23/01/2008	23/01 07
D.M.Y	23.01.2008	23.01 07

* Only when the trend interval is set to a value greater than or equal to 1h/div.

Where the Date Format Setting Applies

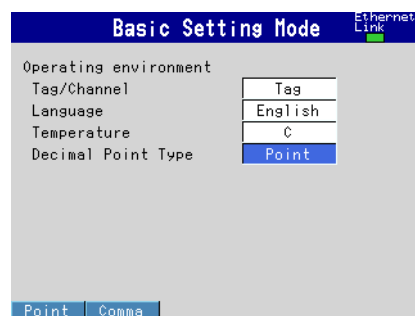
The date format is applied to the date shown on the display. It does not affect the date format on the date/time configuration screen, the date in the output data transmitted via a communication interface, the date information saved along with data, or the date used in data file names.

9.2 Setting the Temperature Unit and Decimal Point Type

This section explains how to set the temperature unit and how to set the type of decimal point that is used on the display and in data files saved to text format.

Display

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Operating environment**.



Settings

- **Temperature**

Select the temperature unit. This setting affects all temperature measurement channels.

Setting	Description
C	For Celsius
F	For Fahrenheit

- **Decimal Point Type**

Setting	Display Example
Point	1234.56
Comma	1234,56

9.3 Viewing MV Information

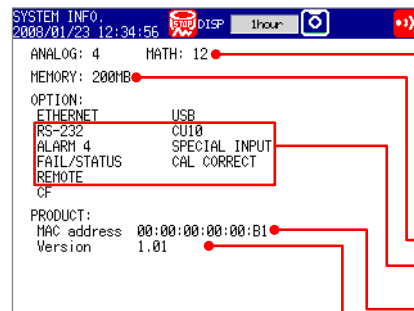
This section explains how to display the MV system information and network information.

Procedure

- **Displaying System Information**
 1. In Operation Mode, press **FUNC**.
The function menu appears.
 2. Press the **System info** soft key.
The system information is displayed.
- **Displaying Network Information**
 1. In Operation Mode, press **FUNC**.
The function menu appears.
 2. Press the **Network info** soft key.
The network information is displayed.

Explanation

- **System Information Screen**

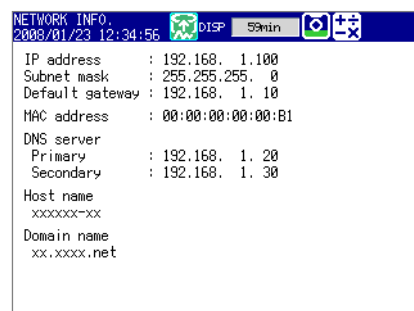


- ANALOG:** Number of measurement channels (C) denotes the clamped input terminals (/H2 option).
- MATH:** Number of math channels (/M1 and /PM1 options)
- EXTCH:** Number of external input channels (/MC1 option)
- MEMORY:** Internal memory size
- OPTIONS**
- MAC address**
- Version:** Firmware version

- **Network Information Screen**

The screen displays the following MV settings.

IP address, MAC address, DNS server, host name, and domain name

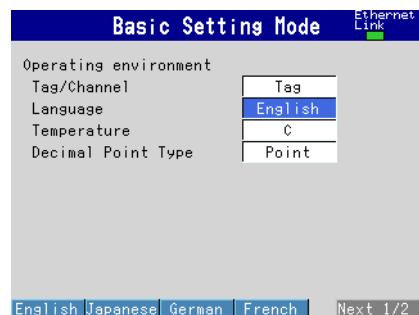


9.4 Changing the Displayed Language

This section explains how to select the displayed language.

Display

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Operating environment**.



Settings

- **Operating environment > Language**
Set the language to **English**, **Japanese**, **German**, **French**, **Chinese**, or **Korean**.

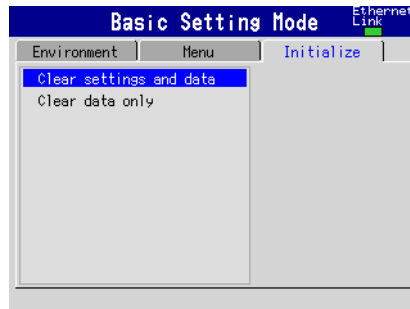
9.5 Initializing the MV

This section explains how to initialize the MV and how to clear the internal memory.

- For a list of default settings, see the *First Step Guide (IM MV1000-02E/IM MV2000-02E)*.

Display

Press **MENU** and then select **Menu tab > Basic setting mode > Initialize tab > Clear settings and data or Clear data only**.



Settings

• Initialization Method

Menu Item	Description
Clear settings and data	Initializes the settings in Basic Setting Mode and Setting Mode to their default values and clears the data in the internal memory.
Clear data only	Clears the data in the internal memory.

Data in the Internal Memory That Is Cleared

Display data, event data, manually sampled data, report data (/M1 and /PM1 options), and log information.

Procedure

1. Select **Clear settings and data** or **Clear data only**.
2. Press **DISP/ENTER**.
A confirmation window opens.
3. Select **Yes**, and then press **DISP/ENTER**.
The specified operation is executed, and the MV returns to Operation Mode.
If you do not want to initialize, select No, and press DISP/ENTER.

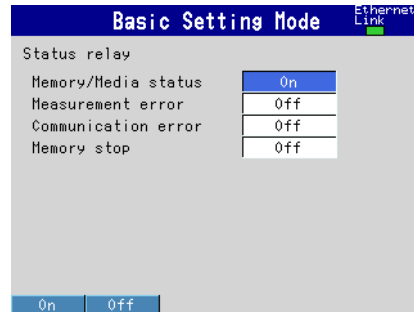
9.6 Transmitting the MV Status via Relay Contact (/F1 option)

This section explains how to configure the MV to transmit a relay contact signal when an error occurs in the MV CPU. It also explains how to configure the MV to transmit a signal to another relay when a specific condition occurs.

► For an explanation of these functions, see section 1.10.

Display

Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Status relay**.



Settings

- **Memory/Media status**
On: Transmits the internal memory and CF card statuses to a relay.
- **Measurement error**
On: Transmits a relay signal when a measurement error occurs.
- **Communication error**
On: Transmits a relay signal when a communication error occurs.
- **Memory stop**
On: Outputs a relay signal when memory sampling is stopped.

Procedure

- **FAIL Output**
No settings or operations are required. The MV transmits a relay contact signal if it detects a CPU error. The MV also transmits a relay contact signal when the MV is turned OFF.
- **Status relay**
The MV transmits a relay contact signal when a specified condition occurs.

9.7 Controlling the MV by Using a Keyboard

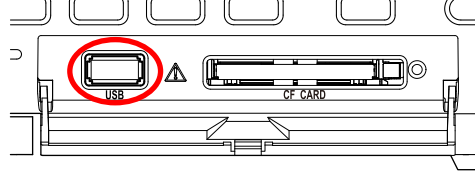
Connecting/Removing a Keyboard

- **Connecting a Keyboard**

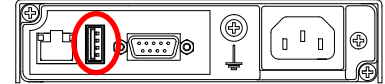
Connect the keyboard connector to the MV USB port.

The message “USB device has been connected” appears on the screen, and the keyboard is ready for use.

Front panel USB port



Rear panel USB port



- **Removing the Keyboard**

Remove the keyboard connector from the MV USB port.

Note

- You can connect or remove a keyboard regardless of the MV condition (power ON/OFF or displayed screen).
- You can connect one keyboard to the MV.
- Use a keyboard appropriate for the MV language setting.
- The CapsLock and NumLock key states are retained even if you disconnect the USB keyboard.

Operating from a Keyboard

You can carry out the same operations that you carry out from the MV front panel.

Example: Switch to Setting Mode

While the MV is in Operation Mode, press Ctrl+M.

The MV switches to Setting Mode, and the corresponding menu appears.

Mapping of the MV Keys to the Keyboard Keys

Keyboard Keys	MV Keys
Enter	DISP/ENTER
←	Left arrow key
↑	Up arrow key
↓	Down arrow key
→	Right arrow key
Num Enter	DISP/ENTER
Esc	ESC
F1 to F7	Soft keys 1 through 7
F9	FUNC
F12	Hold down FUNC for 3 seconds
Left-Windows	MENU
Right-Windows	MENU
Application	HISTORY
Ctrl+S	START/STOP
Ctrl+T	T/DIV
Ctrl+U	USER
Ctrl+M	MENU
Ctrl+H	HISTORY
Tab, Shift+Tab	Arrow keys*

* Press Tab to move the cursor to the next item or Shift+Tab to move to the previous item.
This does not work in the following screens:
Operation screens, the Setting mode and Basic setting mode menus, screens for entering values and characters, the “Menu customize” and “Save/Load” screens in Setting mode, and the “Load setting, Initialize” screen in Basic setting mode

Entering Alphabetical Characters, Numbers, and Symbols

When alphabetical characters, numbers, and symbols can be entered, you can enter them from the keyboard. The operation is the same as with normal keys.

Symbols You Can Enter from a Keyboard

You can enter the symbols below. However, only the symbols that are valid on the MV can be used. For example, you cannot use the following characters for the data save destination directory name: & * / ?

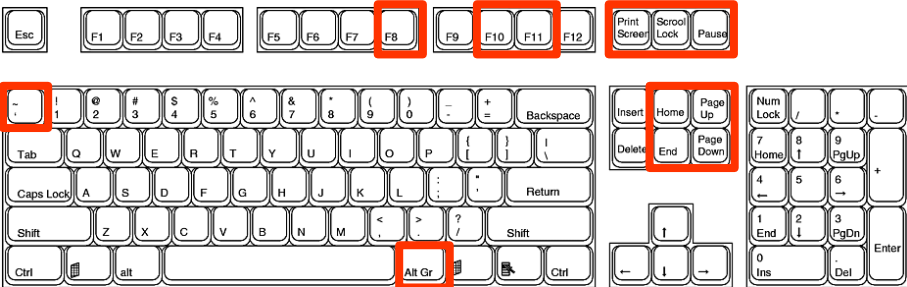
#	%	&	()	*	+	-	.	/	:	?	@	[]	^	_
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

* Press ^ on the keyboard to enter the degree symbol.

Invalid Keys

Keys enclosed in a frame are invalid.

PC104 keyboard (US)



9.8 Setting the LCD Brightness and Backlight Saver

This section explains how to change the LCD brightness. It also explains how to set the backlight saver function to prolong the service life of the LCD backlight.

Display

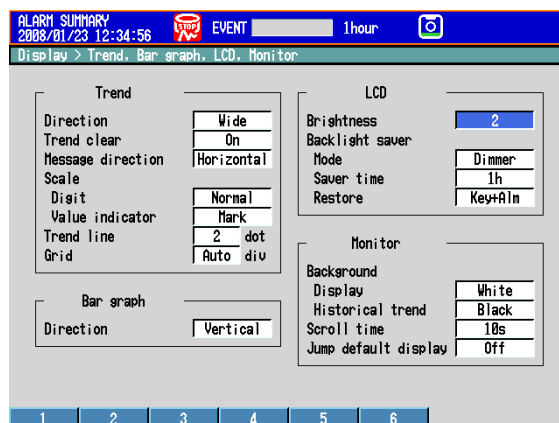
MV1000

Press **MENU** and then select **Menu tab > Display > LCD**.



MV2000

Press **MENU** and select **Menu tab > Display > Trend, Bar graph, LCD, Monitor**.



Settings

- **Brightness**

The larger the value, the brighter the display becomes.

Setting	Model
1 to 8	MV1000
1 to 6	MV2000

- **Backlight saver > Mode**

Setting	Description
Off	Disables the backlight saver.
Dimmer	Dims the display if there is no operation for a given time.
Timeoff	Turns the backlight OFF if there is no operation for a given time.

9.8 Setting the LCD Brightness and Backlight Saver

- **Backlight saver > Saver time**

Select a value from 1min to 1h. If the specified time elapses without any key operation or alarm occurrence, the LCD backlight switches to the specified mode.

- **Backlight saver > Restore**

Setting	Description
Key	The backlight returns to the original brightness when a key is pressed.
Key+Alm	The backlight returns to the original brightness when a key is pressed or when an alarm occurs.

Note

- If the backlight is dimmed or turned OFF by the backlight saver function, pressing any key on the MV will cause the backlight to return to the original brightness. In this instance, the key does not perform its intended function.
 - A higher brightness level tends to lead to faster screen discoloration (yellowing) and brightness degradation. Avoid extended use at an unnecessarily high setting. We also recommend that you use the backlight saver function.
-

Procedure

If you set the mode to Dimmer or Timeoff, you can execute the specified operation at any time by pressing **FUNC** and selecting **LCD saver**.

10.1 Configuring Computation Channels

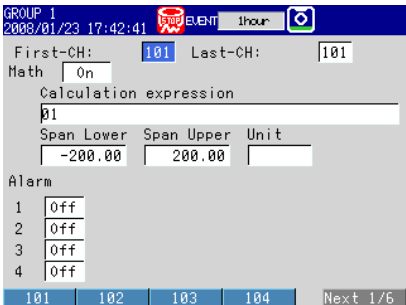
This section explains how to set a computation channel's expression, measurement range, tag, alarm, and recording On/Off. You cannot set expressions or constants during memory sampling or computation.

► For an explanation of these functions, see section 1.9.

Display

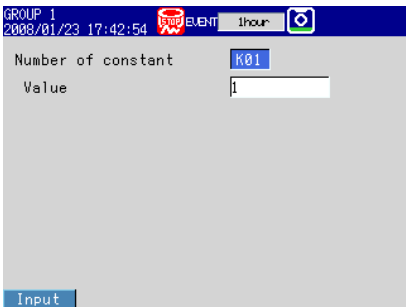
- **Expressions and Alarms**

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



- **Constants Used in Expressions**

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

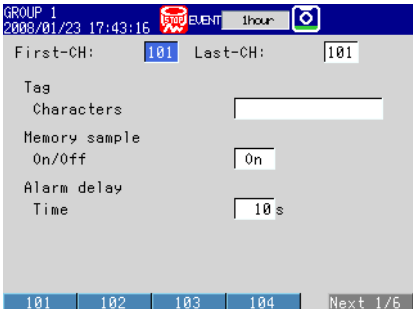


- **Computation Channel Tag, Memory Sampling On/Off, Alarm Delay**
MV1000

Press **MENU** and then select **Menu tab > Math channel > Tag, Memory, Delay.**

MV2000

Press **MENU** and then select **Menu tab > Math channel > Tag, Memory sample, Alarm delay.**



10.1 Configuring Computation Channels

- **TLOG Computation Conditions, Rolling Average**

Press **MENU** and then select **Menu tab > Math channel > TLOG, Rolling average**.

GROUP 1
2008/01/23 17:43:38 EVENT 1hour

First-CH: 101 Last-CH: 101

TLOG	
Timer type	Timer
Timer No.	1
Sum scale	Off
Reset	Off
Rolling average	
On/Off	On
Interval	10s
Number of samples	1

101 102 103 104 Next 1/6

- **Computation Error Display, Overflow Data Handling in Statistical Computation**
MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Math**.

Basic Setting Mode Ethernet Link

Math	
Value on Error	+Over
Value on Overflow	
SUM, AVE	Skip
MAX, MIN, P-P	Over

+Over -Over

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Math, Report**.

Basic Setting Mode Ethernet Link

Environment > Math, Report

Math	
Value on Error	+Over
Value on Overflow	
SUM, AVE	Skip
MAX, MIN, P-P	Over
Report	
Report select	
1	Ave
2	Max
3	Min
4	Sum
File type	Separate

+Over -Over

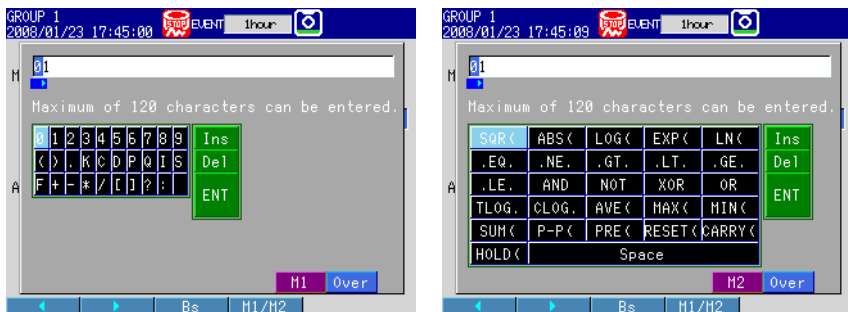
Settings

- **First-CH, Last-CH**
Select the target channels.
- **Calculation expression, span**
 - **Math On/Off**
Select **On** for channels that you want to use.
 - **Calculation expression**
Set the expression by using up to 120 characters.
 - For instructions on how to write expressions, see section 10.2.

MV1000

Press the **Input** soft key to open a window for entering an expression.

Press the **M1/M2** soft key to switch between a screen used to enter values and characters and a screen used to enter operators and functions. Use soft keys, arrow keys, and DISP/ENTER to enter an expression.



MV2000

Press the **Input** soft key to open a window used to enter an expression.



Note

You cannot simultaneously use a USB keyboard and the keys on the MV to enter an expression. If you press an MV soft key while entering an expression from a USB keyboard, the expression will be cleared.

- **Span Lower, Span Upper**

Set the measurement range.

Selectable range of values: -9999999 to 99999999

Selectable decimal places: X.XXXXX, XX.XXX, XXX.XX, XXXX.X

- **Unit**

Set the unit for the computed values (up to six characters, **Aa#1**).

- **Alarm**

The available alarm types are high limit alarm, low limit alarm, delay high limit alarm, and delay low limit alarm.

The range of alarm values is as follows:

Type	Alarm Values
H, L, T, t	-9999999 to 99999999 ignoring the decimal point

► For alarm configuration instructions, see section 3.7.

- * If you change the On/Off or expression setting of a computation channel, the alarm on that channel will be set to **Off**.

- **Alarm delay > Time**

Set the alarm delay using an integer in the range of 1 s to 3600 s.

- **Tag > Characters**

Set the tag name (up to 16 characters, **Aa#1**).

- **Constant**

- **Number of constant**

Select the constant (K01 to K60) you want to set.

- **Value**

The selectable range is as follows:

-9.9999E+29 to -1.0000E-30, 0, 1.0000E-30 to 9.9999E+29

The number of significant digits for constants is five. If you are setting a constant in exponential notation, use up to five digits for the mantissa and up to two digits for the exponent.

- **TLOG**

- **Timer type**

Set the timer type to **Timer** or **MatchTimeTimer**.

- **Timer No.**

Select the timer number that you want to use.

► For timer configuration instructions, see section 7.2.

► For instructions on how to set the match time timer, see section 7.3.

- **Sum scale**

Select the sum scale from **/s** to **/h** to match the time unit of the measured value.

Example: If the unit of the measured value is m³/min, select **/min**.

Off: Directly sums the measured data for each scan interval.

- **Reset**

To reset the TLOG computed value after each interval, select **On**.

- **Rolling Average**

- **On/Off**

To calculate the rolling average of the computed results, select **On**.

- **Interval**

Select the sampling interval for the rolling average from the available settings. The sampling interval takes on a value that is an integral multiple of the scan interval.

For example, if the sampling interval is set to 5 s when the scan interval is 2 s, the actual sampling interval is 6 s.

- **Number of samples**

Set the number of samples to use for the rolling average using an integer between 1 and 1500.

The rolling average time is equal to the sampling interval × the number of data samples.

Note

- If the number of data points to be averaged has not reached the specified number of samples immediately after computation starts, the average of the available data is calculated.
- Computation error data is excluded from the rolling average computation.
- If the computed data exceeds the upper or lower limit, the data is clipped at the upper or lower limit, and the rolling average is computed. The upper and lower limits are ± 100000000 ignoring the decimal point. The decimal place is the same as that of the span lower limit.

- **Memory sample > On/Off**

Select **On** to record the computed data of the target channels.

- **Math**

- **Value on Error**

Specify whether to display a computation error as **+Over** or **-Over**.

- **Value on Overflow > SUM, AVE**

Specify how to handle overflow data when it is detected in a SUM or AVE computation of TLOG or CLOG. This setting is also applied to report generation.

Setting	Description
Error	The computed result is a computation error indication.
Skip	Discards the overflow data and continues the computation.
Limit	Uses a limit value in place of the overflow data and continues the computation.

- **Value on Overflow > MAX, MIN, P-P**

Specify how to handle overflow data when it is detected in a MAX, MIN, or P-P computation of TLOG or CLOG. This setting is also applied to report generation.

Setting	Description
Over	Uses the overflow data as-is.
Skip	Discards the overflow data and continues the computation.

10.2 Writing Expressions

This section defines expressions and explains how to write them.

Common Items

Follow the rules below when writing expressions.

- Use up to 120 characters to write expressions.
- Use parentheses to indicate the order of mathematical functions.
- Specify channels in an expression using channel numbers.
Examples: 1, 12, 101, and 201
- You can write the one digit numbers of constants (K), communication input data (C), remote input terminal statuses (D), pulse inputs (P, Q), internal switch statuses (S), alarm output relay statuses (I), and flags (F) in an expression using two digits or one digit. For example: 01 or 1.
Examples: K01, K1, C01, C1, D01, D1, P01, P1, Q01, Q1, S01, S1, I01, I1, F01, and F1
- Be aware that the data of the previous scan is used for the computation channel's value and for the values of channels with numbers that are greater than the computation channel's number.
- Write special computations (HOLD, RESET, and CARRY) and conditional expressions at the beginning of an expression.

Order of Precedence for Computations

The order of precedence for computations in an expression is as follows:

Type	Operators and Functions
	(High order of precedence)
Functions	ABS(), SQR(), LOG(), LN(), EXP(), TLOG.MAX(), TLOG.MIN(), TLOG.AVE(), TLOG.SUM(), TLOG.P-P(), CLOG.MAX(), CLOG.MIN(), CLOG.AVE(), CLOG.SUM(), CLOG.P-P()
Special computations and conditional expressions	
	PRE, HOLD, RESET, CARRY, [a?b:c]
Power	**
Logical negation	NOT
Multiplication and division	*, /
Addition and subtraction	+, -
Greater than and less than	.GT., .LT., GE., LE.
Equal and not equal	.EQ., .NE.
Logical product	AND
Logical sum and exclusive logical sum	OR, XOR
	(Low order of precedence)

Limitations

Expressions have these limitations.

Expression	Limitations
TLOG computation	An operator or function cannot be written inside the parentheses. An expression can contain only one TLOG function.
CLOG computation	The maximum number of channels that can be written in the parentheses is 30. An operator or function cannot be written inside the parentheses. An expression can contain only one CLOG function.
PRE	An operator or function cannot be written inside the parentheses.
HOLD(a):b	Can only be written at the beginning of an expression. An expression can contain only one HOLD function.
RESET(a):b	Can only be written at the beginning of an expression. An expression can contain only one RESET function.
CARRY(a):b	Can only be written at the beginning of an expression. An expression can contain only one CARRY function. Only TLOG.SUM can be specified for b.
Conditional expressions [a?b:c]	RESET, CARRY, and HOLD cannot be specified for a, b, and c. Conditional expressions cannot be combined with other operators or functions ([a?b:c]+001 for example). However, a conditional expression can be specified for a, b, and c.

Basic Arithmetic

Expression Example

- Addition 001+002
(Determines the sum of the measured values of channel 1 and channel 2)
- Subtraction 001-002
(Determines the difference between the measured values of channel 1 and channel 2)
- Multiplication 001*K03
(Multiplies the measured value of channel 1 by constant K03)
- Division 001/K02
(Divides the measured value of channel 1 by constant K02)

Power and Other Operations

Expression Example

- Power 001**002
(Determines the measured value of channel 1 to the power of the measured value of channel 2)
- Square root SQR(002)
(Determines the square root of the measured value of channel 2)
- Absolute value ABS(002)
(Determines the absolute value of the measured value of channel 2)
- Common logarithm LOG(001)
(Determines the common logarithm (\log_{10}) of the measured value of channel 1)
- Natural logarithm LN(001)
(Determines the natural logarithm of the measured value of channel 1)
- Exponent EXP(001)
(Determines e to the power of the measured value of channel 1)

Relational Computation

Expression Example

002.LT.003

If the measured value of channel 2 is less than the measured value of channel 3, the computed result is 1. Otherwise, the result is zero.

002.GT.003

If the measured value of channel 2 is greater than the measured value of channel 3, the computed result is 1. Otherwise, the result is zero.

002.EQ.003

If the measured value of channel 2 is equal to the measured value of channel 3, the computed result is 1. Otherwise, the result is zero.

002.NE.003

If the measured value of channel 2 is not equal to the measured value of channel 3, the computed result is 1. Otherwise, the result is zero.

002.GE.003

If the measured value of channel 2 is greater than or equal to the measured value of channel 3, the computed result is 1. Otherwise, the result is zero.

002.LE.003

If the measured value of channel 2 is less than or equal to the measured value of channel 3, the computed result is 1. Otherwise, the result is zero.

Logical Computation

Checks whether the two data values, e1 and e2 (e1 only for NOT), are zero or nonzero, and computes according to each condition.

AND

Logical product

(Syntax) e1ANDe2

(Condition) If the two data values e1 and e2 are both nonzero, the computed result is 1. Otherwise, it is zero.

(Explanation)	e1 = 0, e2 = 0	→	e1ANDe2 = 0
	e1 ≠ 0, e2 = 0	→	e1ANDe2 = 0
	e1 = 0, e2 ≠ 0	→	e1ANDe2 = 0
	e1 ≠ 0, e2 ≠ 0	→	e1ANDe2 = 1

OR

Logical sum

(Syntax) e1ORe2

(Condition) If the two data values e1 and e2 are both zero, the computed result is zero. Otherwise, it is 1.

(Explanation)	e1 = 0, e2 = 0	→	e1ORe2 = 0
	e1 ≠ 0, e2 = 0	→	e1ORe2 = 1
	e1 = 0, e2 ≠ 0	→	e1ORe2 = 1
	e1 ≠ 0, e2 ≠ 0	→	e1ORe2 = 1

XOR

Exclusive OR

(Syntax) e1XORe2

(Condition) If the two data values e1 and e2 are zero and nonzero or nonzero and zero, the computed result is 1. Otherwise, it is zero.

(Explanation)	e1 = 0, e2 = 0	→	e1XORe2 = 0
	e1 ≠ 0, e2 = 0	→	e1XORe2 = 1
	e1 = 0, e2 ≠ 0	→	e1XORe2 = 1
	e1 ≠ 0, e2 ≠ 0	→	e1XORe2 = 0

NOT

Logical negation

(Syntax) NOTe1

(Condition) The result is the inverse of the status of data e1 (zero or nonzero).

(Explanation)	e1 = 0	→	NOTe1 = 1
	e1 ≠ 0	→	NOTe1 = 0

Expression Example

01-02OR03.GT.04

Determines the OR of the computed results of "01-02" and "03.GT.04".

TLOG Computation

In the explanation below, you cannot enter an expression that contains an operator or function, an internal switch (S), a relay (I), or a flag (F) for e1. Also, an expression can contain only one TLOG function.

TLOG.MAX()

Maximum value

(Syntax) TLOG.MAX(e1)

(Condition) Determines the maximum value of channel e1.

TLOG.MIN()

Minimum value

(Syntax) TLOG.MIN(e1)

(Condition) Determines the minimum value of channel e1.

TLOG.AVE()

Average value

(Syntax) TLOG.AVE(e1)

(Condition) Determines the average value of channel e1.

TLOG.SUM()

Sum value

(Syntax) TLOG.SUM(e1)

(Condition) Determines the sum of channel e1.

TLOG.P-P()

Maximum – minimum value

(Syntax) TLOG.P-P(e1)

(Condition) Determines the maximum – minimum value of channel e1.

Expression Example

TLOG.MAX(01)+K01*SQR(02)

Examples of Invalid Expressions

TLOG.AVE(01)+TLOG.AVE(02)

Reason: TLOG appears twice in one expression.

TLOG.AVE(ABS(01))

Reason: A function is used inside the parentheses.

CLOG Computation

Only data from measurement, computation, and external input channels can be used in a CLOG computation. Up to 30 channels can be written inside the parentheses.

In the explanation below, an operator or function cannot be placed inside the parentheses. Also, an expression can contain only one CLOG function.

CLOG.SUM()

Sum value

(Syntax) CLOG.SUM(e1.e2.e4-e6)

(Condition) Determines the sum of the data of channels e1, e2, e4, e5, and e6 that are measured at the same time.

CLOG.MAX()

Maximum value

(Syntax) CLOG.MAX(e1.e2.e4-e6)

(Condition) Returns the maximum measured data value at a given point in time from channels e1, e2, e4, e5, and e6.

CLOG.MIN()

Minimum value

(Syntax) CLOG.MIN(e1.e2.e5.e7)

(Condition) Returns the minimum measured data value at a given point in time from channels e1, e2, e5, and e7.

CLOG.AVE()

Average value

(Syntax) CLOG.AVE(e1-e6)

(Condition) Returns the average of the measured data values of channels e1 to e6 at a given point in time.

CLOG.P-P()

Maximum – minimum value

(Syntax) CLOG.P-P(e1.e2.e5.e7)

(Condition) Returns the difference between the maximum and minimum data values measured at a given point in time from channels e1, e2, e5, and e7.

Expression Example

CLOG.MAX(001.002.I04-I06)+K01*SQR(002)

Examples of Invalid Expressions

CLOG.AVE(001.003.005)+CLOG.AVE(002.004.006)

Reason: CLOG appears twice in one expression.

CLOG.AVE(001.ABS(001))

Reason: A function is used inside the parentheses.

Special Computation:**PRE()**

(Syntax)

PRE(e1)

(Condition)

Determines the previous value of e1.

HOLD(a):b

(Syntax)

HOLD(a):b

(Condition)

When a is zero, b is carried out to derive the computed value.
Otherwise, the previous computed value is held.

RESET(a):b

(Syntax)

RESET(a):b

(Condition)

When a is zero, b is carried out to derive the computed value.
Otherwise, the previous computed value of b is reset, and b is carried out to derive the computed value.

CARRY(a):b

(Syntax)

CARRY(a):b

(Condition)

Only TLOG.SUM can be specified for b. If the computed value X of b is less than a, the computed result is X. If X is greater than or equal to a, the computed result is the excess (X – a).

(Explanation)

When a value such as a flow rate is summed and the threshold value is reached or exceeded, the sum value is reset while carrying over the amount that exceeded the threshold value.

Expression Example

Expression that sums the values of channel 1 and resets the value when it reaches or exceeds 10000

K01=10000

CARRY(K01):TLOG.SUM(001)

Examples of Invalid Expressions

002+HOLD(K01):TLOG.SUM(001)

HOLD is not at the beginning of the expression.

RESET(101.GT.K01):TLOG.SUM(001)+RESET(101.GT.K01):002

Reason: RESET appears twice in one expression.

Conditional Expression**[a?b:c]**

(Syntax)

[001.GT.K01?002:003]

(Condition)

If the measured value of channel 1 is greater than constant K01, the computed result is the measured value of channel 2. Otherwise, the computed result is the measured value of channel 3.

Examples of Invalid Expressions

[001.GT.K01?002:003]*K02

Reason: Used in combination with another operator.

Nested Conditional Expressions

A conditional expression can be written in Expression₁, Expression₂, and Expression₃ in the equation [Expression₁?Expression₂:Expression₃]. For example, the following expression is allowed: [Equation₁?[Equation₂₋₁?Equation₂₋₂:Equation₂₋₃]:[Equation₃₋₁?Equation₃₋₂:Equation₃₋₃]]

Expressions can be nested as long as the number of characters does not exceed 120 characters.

10.3 Displaying Computation Channels

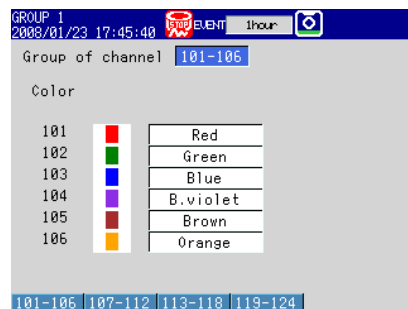
You can assign computation channels to groups and display them just like measurement channels.

► For an explanation of these functions, see section 1.9.

Display

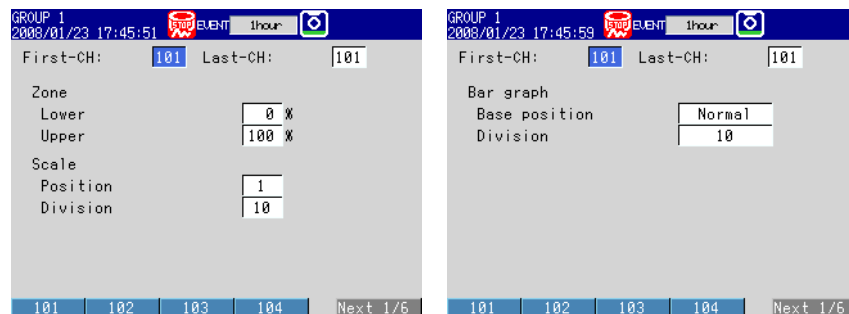
- **Color**

Press **MENU** and then select **Menu tab > Math channel > Color**.

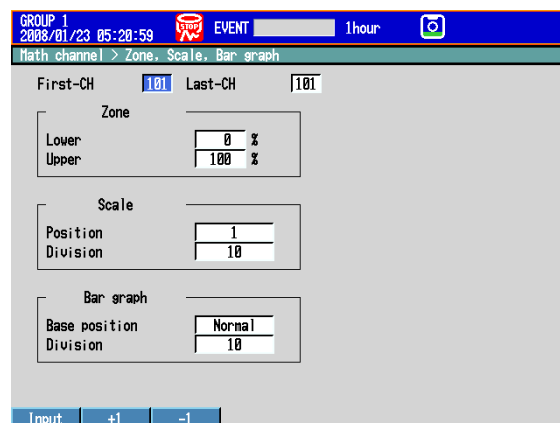


- **Showing the Zone Display, Scale Display, and Bar Graph display**
MV1000

Press **MENU** and then select **Menu tab > Math channel > Zone, Scale or Bar graph**.

**MV2000**

Press **MENU** and then select **Menu tab > Math channel > Zone, Scale, Bar graph**.



- **Partially Expanded Display**

Press **MENU** and then select **Menu tab > Math channel > Partial**.

* The Partial command appears in the menu if you set Partial to On in Basic Setting Mode.

► For configuration instructions, see section 6.9.

- **Alarm Mark and Color Scale Band**

MV1000

Press **MENU** and then select **Menu tab > Math channel > Alarm mark** or **Color scale band**.

MV2000

Press **MENU** and then select **Menu tab > Math channel > Alarm mark, Color scale band**.

Settings

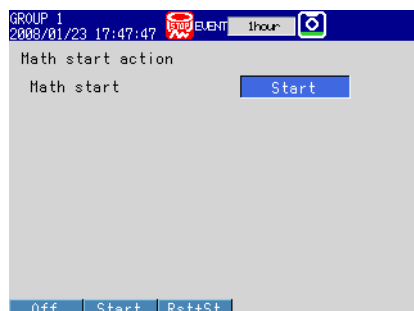
- **Group of channel, First-CH, and Last-CH**
Select the target channel range.
- **Color**
▶ See section 6.5 for details.
- **Zone**
▶ See section 6.6 for details.
- **Partial**
▶ See section 6.9 for details.
- **Bar graph**
▶ See section 6.11 for details.
- **Scale**
▶ See section 6.7 for details.
- **Alarm Mark and Color Scale Band**
▶ See section 6.8 for details.

10.4 Starting/Stopping Computation

Display

- **Action Performed When the START Key Is Pressed**

Press **MENU** and then select **Menu tab > Math channel > Math start action**.



Settings

- **Math start action > Math start**

Setting	Description
Off	Does not start computation even when the START/STOP key is pressed.
Start	Start computation when the START/STOP key is pressed.
Reset+Start	Starts computation when the START/STOP key is pressed and resets the computed result up to that point.

Procedure

- **Starting Computation**

- **Starting Computation and Memory Sampling at the Same Time**

Press **START/STOP**. Computation starts at the same time as memory sampling.
The computation icon appears in the status display section.

* Math start must be set to Start or Reset+Start.

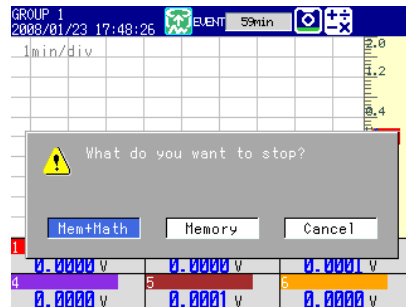
- **Starting Computation Only**

1. In Operation Mode, press **FUNC**.
The function menu appears.
2. Press the **Math start** soft key.
Computation starts, and the status display section shows the computation icon.

- **Stopping Computation**
 - **Stopping Computation and Memory Sampling at the Same Time**

1. Press START/STOP.

A confirmation dialog box opens.



2. Select Mem+Math, and then press DISP/ENTER.

Memory sampling and computation stop, and the computation icon in the status display section disappears.

- **Stopping Computation Only**

1. In Operation Mode, press FUNC.

The function menu appears.

2. Press the Math stop soft key.

Computation stops, and the computation icon in the status display section disappears.

Note

When computation is stopped, the computed data of the computation channel is held at the value that existed immediately before the computation was stopped. If memory sampling is in progress, the held value is recorded.

- **Resetting the Computed Results of All Computation Channels**

You can carry out this operation regardless of whether or not computation is in progress.

1. In Operation Mode, press FUNC.

The function menu appears.

2. Press the Math reset soft key.

The computed results of all computation channels are reset.

- **Releasing the Computation Data Dropout Display**

You can carry out this operation when a computation data dropout occurs. When a computation data dropout occurs, the computation icon turns yellow.

1. In Operation Mode, press FUNC.

The function menu appears.

2. Press the Math ACK soft key.

The computation icon returns to white.

* Math ACK appears in the function menu only when a computation data dropout occurs.

Note

A computation data dropout occurs when the MV cannot process computation within a scan interval. If computation data dropout occurs frequently, reduce the load on the CPU by reducing the number of computation channels or by setting a longer scan interval. If a computation data dropout occurs during memory sampling, the data immediately before the dropout is recorded as the computed data of the scan interval in which the dropout occurred.

10.5 Generating Reports

This section explains how to configure report generation.

► For an explanation of these functions, see section 1.9.

Display

- **Report Computation Type**

MV1000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Report**.

The screenshot shows the 'Basic Setting Mode' screen for the MV1000. At the top, there is a blue header bar with 'Basic Setting Mode' and 'Ethernet Link' status. Below the header, the 'Report' section is active. It contains a 'Report select' list with four options: 1 (Ave), 2 (Max), 3 (Min), and 4 (Sum). The 'Ave' option is currently selected. Below the list is a 'File type' dropdown menu set to 'Separate'. At the bottom of the screen, there is a navigation bar with buttons for 'Max', 'Min', 'Ave', 'Sum', and 'Inst'.

MV2000

Press **MENU** and then select **Menu tab > Basic setting mode > Environment tab > Math, Report**.

The screenshot shows the 'Basic Setting Mode' screen for the MV2000. The top header bar is blue with 'Basic Setting Mode' and 'Ethernet Link' status. Below the header, a yellow bar indicates the current path: 'Environment > Math, Report'. The 'Math' section has two dropdown menus: 'Value on Error' set to '+Over' and 'Value on Overflow' set to 'Skip'. Below these are two more options: 'SUM, AVE' and 'MAX, MIN, P-P'. The 'Report' section is active, showing a 'Report select' list with four options: 1 (Ave), 2 (Max), 3 (Min), and 4 (Sum). The 'Ave' option is selected. Below the list is a 'File type' dropdown menu set to 'Separate'. At the bottom of the screen, there is a navigation bar with buttons for 'Max', 'Min', 'Ave', 'Sum', and 'Inst'.

- **Report Type and Time of Generation**

Press **MENU** and select **Menu tab > Basic setting mode > Menu tab > Report > Basic settings**.

The screenshot shows the 'Basic Setting Mode' screen for the MV2000. The top header bar is blue with 'Basic Setting Mode' and 'Ethernet Link' status. Below the header, the 'Report set' section is active. It contains a 'Report kind' dropdown menu set to 'Hour+Day'. Below this are two input fields: 'Date' set to '1' and 'Time (hour)' set to '0 :00'. At the bottom of the screen, there is a navigation bar with buttons for 'Off', 'Hour', 'Day', 'H+D', and 'Next 1/2'.

- **Target Channels**

Press **MENU** and select **Menu tab > Basic setting mode > Menu tab > Report > Report settings**

The screenshot shows the 'Basic Setting Mode' interface. At the top right, 'Ethernet Link' is indicated with a green status. The main area displays settings for 'Report channel number' (R01), 'On/Off' (0n), 'Channel' (001), and 'Sum scale' (/s). At the bottom, there is a navigation bar with buttons for R01, R02, R03, R04, and 'Next 1/6'.

- **Overflow Data Handling**

See page 10-5.

Settings

- **Report > Report select > 1, 2, 3, 4**

Select the type of data to output as reports. The only data type that can be set more than once is Off. You cannot set 1 to Off.

Setting	Description
Off	Does not generate reports.
Ave	Outputs the average value.
Max	Outputs the maximum value.
Min	Outputs the minimum value.
Sum	Outputs the sum.
Inst	Outputs the instantaneous value.

- **Report > File type**

Set this item to generate two types of reports such as daily and monthly reports.

Setting	Description
Separate	Saves each type of report to a separate file.
Combine	Saves two types of report data to a single file.

- **Overflow Data Handling**

Overflow data is handled in the same way as it is in statistical computations (TLOG and CLOG).

► See section 10.1 for details.

- **Report set > Report kind**

Select the type of report to be generated.

Setting	Description
Hour	Generates hourly reports.
Day	Generates daily reports.
H+D	Generates hourly and daily reports.
Day+Week	Generates daily and weekly reports.
D+M	Generates daily and monthly reports.

- **Report set > Date/Day of the week, Time (hour)**

Set the date or day of the week and the time when the report will be generated. The specified date/time is when the report file is divided. Set the values in the range indicated below. Items with a dash are invalid.

Report Type	Date	Day of Week	Time
Hour	-	-	0 to 23
Day	1 to 28*	-	0 to 23
H+D	-	-	0 to 23
Day+Week	-	SUN to SAT	0 to 23
D+M	1 to 28*	-	0 to 23

* You cannot specify 29, 30, or 31.

Report Filing Time and Date/Time When a Report File Is Divided

Example: When the Date of a daily report is set to 1 and the Time (hour) is set to 18:00

A daily report is created every day at hour 18.

The file that the report is stored to is divided at 18:00 on day 1 of each month.

- **Report channel number**

Determines the order in which reports are output.

- **Report CH > On/Off**

Select **On** to use the report channels.

- **Report CH > Channel**

Set the channel to be assigned to the report channel. All channels can be assigned, but reports are not generated for channels set to Skip or Off even if they are assigned. In a stacked bar graph display (see section 5.6 for details), the MV shows report data for each group indicated below. However, the MV displays only channels with the same unit as the first channel in the group.

Report Group	MV1004, MV1008, MV2008	MV1006, MV1012, MV1024	MV2010, MV2020, MV2030, MV2040, MV2048
1	R001 to R006	R001 to R006	R001 to R010
2	R007 to R012	R007 to R012	R011 to R020
3	-	R013 to R018	R021 to R030
4	-	R019 to R024	R031 to R040
5	-	-	R041 to R050
6	-	-	R051 to R060

- **Report CH > Sum scale**

Select the sum scale from **/s** to **/day** to match the time unit of the measured value.

Example: If the unit of the measured value is m³/min, select **/min**.

Off: Directly sums the measured data for each scan interval.

Procedure

- **Start/Stop Report Generation**

Report generation starts when memory sampling starts. Report generation stops when memory sampling stops.

- **Displaying Reports**

► See sections 5.5 and 5.6 for details.

- **Saving Reports**

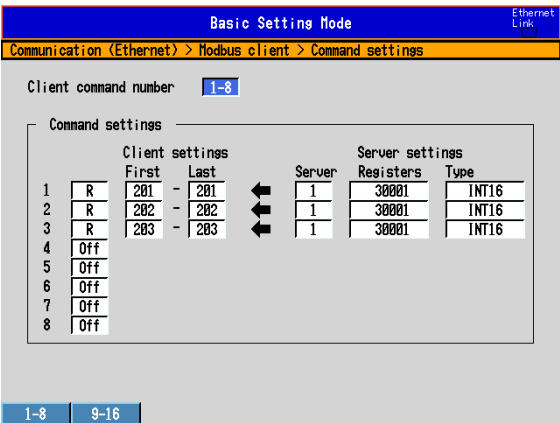
► See section 1.5 for details.

11.1 Configuring External Input Channels

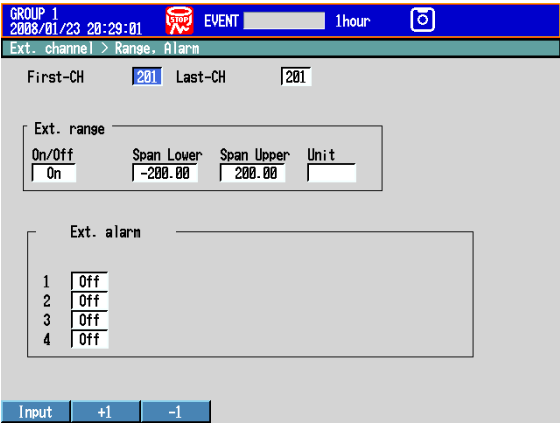
You can use external input channels on MV2000 medium-speed input models. With communication functions, you can load data from other devices and display and save the loaded data on the MV.

Display

- **Configuring the Input**
Press **MENU** and then select **Menu tab > Basic setting mode > Menu tab > Communication (Ethernet) or Communication (Serial) > Modbus client or Modbus master > Command settings**.



- **Input Range and Alarm**
Press **MENU** and then select **Menu tab > Ext. channel > Range, Alarm**.



11.1 Configuring External Input Channels

- **Tag, Memory sample, and Alarm delay**
Press **MENU** and then select **Menu tab > Ext. channel > Tag, Memory sample, Alarm delay**.

GROUP 1
2008/01/23 20:29:24 EVENT 1hour

Ext. channel > Tag, Memory sample, Alarm delay

First-CH 201 Last-CH 201

Tag
Characters

Memory sample
On/Off On

Alarm delay
Time 10 s

Input +1 -1

- **Channels to Be Manually Sampled**
► See section 4.5.

Settings

- **Configuring the Input**
The measured values of external devices are loaded into external input channels by using the Modbus client or Modbus master function.
► For configuration instructions, see the *Communication Interface User's Manual (IM MV1000-17E)*.
- **First-CH, Last-CH**
Select the target channels. Channel numbers are from 201 to 440.
- **Ext. range > On/Off**
Select **On** to use the channels.
- **Ext. range > Span Lower, Span Upper**
The measurement range.
Selectable range of values: -30000 to 30000
Decimal place: Up to four fractional digits
- **Ext. range > Unit**
Set the unit (up to six characters, **Aa#1**).
- **Ext. alarm**
The available alarm types are high limit alarm, low limit alarm, delay high limit alarm, and delay low limit alarm.
The range of alarm values is as follows:

Type	Alarm Values	Example of Alarm Values
H, L	In the range of -30000 to 30000 ignoring the decimal point	If the span is 0.0 to 100.0: -3000.0 to 3000.0
T, t	Same as H, L	Same as H, L

► For alarm configuration instructions, see section 3.7.
* If you change the On/Off or span settings of an external input channel, the alarm on that channel will be set to Off.

- **Alarm delay > Time**
 - ▶ For instructions on how to set the alarm delay, see section 3.7.
- **Tag**
 - ▶ For information on how to set the tag name, see section 6.2.
- **Memory sample > On/Off**
 - Select **On** for the target channels.

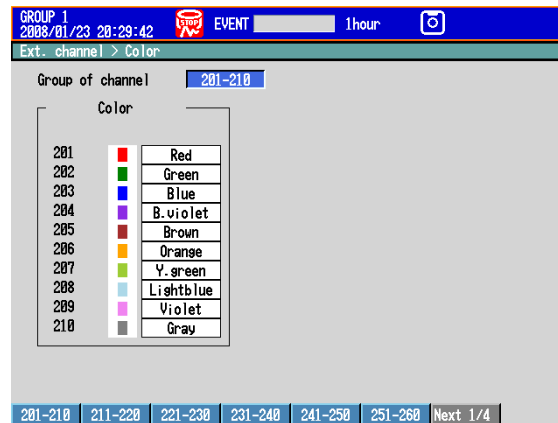
11.2 Displaying External Input Channels

You can assign external input channels to groups and display them just like measurement channels. See chapter 6 for details.

Display

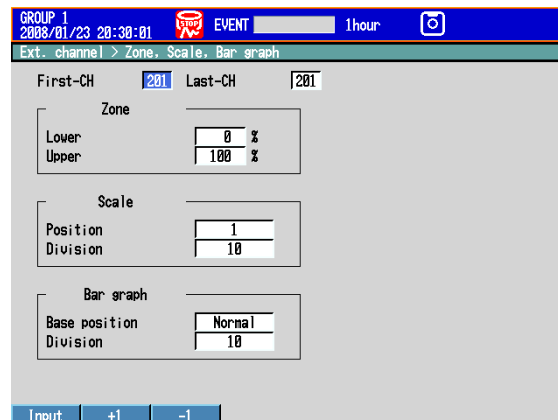
- **Channel Display Color**

Press **MENU** and then select **Menu tab > Ext. channel > Color**.



- **Showing the Zone Display, Scale Display, and Bar Graph display**

Press **MENU** and then select **Menu tab > Ext. channel > Zone, Scale, Bar graph**.



- **Partially Expanded Display**

Press **MENU** and then select **Menu tab > Ext. channel > Partial**.

* The Partial command appears in the menu if you set Partial to On in Basic Setting Mode.

► For configuration instructions, see section 6.9.

- **Alarm Mark and Color Scale Band**

Press **MENU** and then select **Menu tab > Ext. channel > Alarm mark, Color scale band**.

Settings

- **Group of channel, First-CH, Last-CH**
Select the target channels. Channel numbers are from 201 to 440.
- **Color**
▶ See section 6.5.
- **Zone**
▶ See section 6.6.
- **Partial**
▶ See section 6.9.
- **Bar Graph**
▶ See section 6.11.
- **Scale**
▶ See section 6.7.
- **Alarm Mark and Color Scale Band**
▶ See section 6.8.

12.1 List of Messages

There are cases in which error codes and messages are displayed on the screen during operation. A list of the possible error codes and messages are given in the table below. Communication error codes and messages are also listed.

Error responses to communication commands are output in English.

Errors Related to Parameter Settings

• Setting Errors

Code	Message	Explanation/Countermeasures/Ref. section
1	System error.	Contact your nearest YOKOGAWA dealer.
2	Incorrect date or time setting.	Enter a correct value.
3	A disabled channel is selected.	Specify a channel that is not set to Skip or Off. Specify a channel that is installed.
4	Incorrect function parameter.	See the <i>Communication Interface User's Manual</i> .
5	The input numerical value exceeds the set range.	Enter a proper value.
6	Incorrect input character string.	Enter a proper character string.
7	Too many characters.	Enter the correct number of characters.
8	Incorrect input mode.	Specify a correct mode. See section 3.3.
9	Incorrect input range code.	Specify a correct range code. See section 3.3.
11	Range settings are not same within the selected channels.	Specify channels with the same range setting. See section 3.9.
21	Cannot set an alarm for a skipped channel.	Cannot be specified on channels set to Skip. See section 3.7.
22	The upper and lower span limits are equal.	Cannot be set to the same value. See section 3.3.
23	The upper and lower scale limits are equal.	Cannot be set to the same value. See section 3.3.
24	The lower limit of the span band is greater than the upper limit.	Set the lower limit less than the upper limit. See section 3.3.
25	The lower limit of the scale band is greater than the upper limit.	Set the lower limit less than the upper limit. See section 3.3.
30	The partial boundary value exceeds the range of the span.	Set the boundary value in the range of "the minimum span value + 1 digit" to "the maximum span value – 1 digit." See section 6.9
31	Partial-expansion display is set ON for a SKIPPED channel.	Cannot be specified on channels set to Skip. See sections 3.3 and 6.9
35	The upper and lower limits of the display band are equal.	Set the upper limit greater than the lower limit + 5. See section 6.6
36	The lower limit of the display band is greater than the upper limit.	Set the upper limit greater than the lower limit + 5. See section 6.6
37	The display band is narrower than 4% of the entire display.	Set the upper limit greater than the lower limit + 5. See section 6.6
40	Incorrect group set character string.	Check the syntax. See section 6.1
41	There is no specified input channel.	Specify a channel that is installed. See sections 2.3 and 6.1
42	Exceeded the number of channels which can be set.	Up to 10 channels/group (MV2000). Up to 6 channels/group (MV1000). See section 6.1
43	A channel number cannot repeat in a group.	Check that a channel is not registered twice. See section 6.1
45	There is no character string saved in the clipboard.	Copy a character string to the clipboard. See section 6.1

12.1 List of Messages

Code	Message	Explanation/Countermeasures/Ref. section
46	The character string saved in the clipboard is too long.	Paste a character string with the specified number of characters. Check the character length limitation at the destination. "Settings and Values" in the <i>First Step Guide</i>
61	There is no channel specified by the MATH expression.	Check the channel number specified by the expression. See sections 1.9 and 10.1
62	MATH expression grammar is incorrect.	Check that the expression grammar is correct. See section 10.2
63	MATH expression sequence is incorrect.	Check that the operator used in the expression in relation to the applicable operands meets the grammar requirements. See section 10.2
64	MATH upper and lower span values are equal.	Set different values for the upper and lower limits of the computation span. See section 10.1
65	Too many operators for MATH expression.	The maximum number of operators in an expression has been exceeded. Reduce the number of operators, such as by splitting up the expression into multiple computation channels. See section 10.2
70	Nonexistent constant specified in MATH expression.	Check the constant number specified by the expression. See section 10.1
71	Set range of the MATH constant is exceeded.	Check the selectable range. See section 10.1
80	This username is already registered.	Register another user name. See section 8.2
81	All space or 'quit' string cannot be specified.	Change the character string. See section 8.2
84	The login password has not been set up.	Set a password. See section 8.2
85	The login password is incorrect.	Check the password. If you lost the password, ask your administrator to reset it. See sections 8.2 and 8.3
86	The key-lock release password is incorrect.	Check the password. If you lost the password, it must be reset. See section 8.1
87	This key is locked.	Release the key lock. See section 8.1
88	This function is locked.	Release the key lock. See section 8.1
89	Press [FUNC] key to login.	Log in. See section 8.3
90	No permission to enter to the SETUP mode.	The MV never generates this message.
91	Password is incorrect.	Enter the correct password. If you lost the password, it must be reset. Sections 8.2 and 8.3
92	Press [ESC] key to change to the operation mode.	Press ESC.
93	String including space or all space cannot be specified.	Spaces are not allowed in the Web browser user name and password. Section 2.4 in the communication manual
94	More than one address cannot be specified.	Only a single sender is allowed. Section 2.3 in the communication manual
95	Number entered exceeds channel number range. Use another command.	Check the syntax of the Modbus command. Sections 2.9 and 3.5 in the communication manual
100	IP address doesn't belong to class A, B, or C.	Check the IP address. Section 2.2 in the communication manual
101	The result of the masked IP address is all 0s or 1s.	Check the subnet mask. Section 2.2 in the communication manual

Code	Message	Explanation/Countermeasures/Ref. section
102	SUBNET mask is incorrect.	Check the subnet mask. Section 2.2 in the communication manual
103	The net part of default gateway is not equal to that of IP address.	Check the IP address. Section 2.2 in the communication manual
105	This port number is already in use. Please enter a different number.	Enter a different port number for each function. Section 7.1 in the communication manual
113	Password entered is incorrect.	Enter the correct password. See section 8.3
119	This user name is unable to use this mode.	A user-level user cannot enter the Basic Setting mode. See section 8.2
120	Measured value is incorrect. (in ascending order)	Set the calibration correction value to a value greater than the previous value. See section 3.9
122	Measured value exceeds the range setting.	Check the channel input or the channel range setting. See sections 3.3 and 3.9
125	Character entry cannot be performed.	The MV is not showing a display used to enter character strings. See section 9.7
126	You cannot use the same password.	Specify a different password. See section 8.3
127	Report kind overlaps and cannot be set up.	Change the overlapped report data type. See section 10.5
129	IP address is not set.	Set the MV IP address. Section 2.2 in the communication manual
131	You have exceeded the available channel capacity.	You cannot connect more than 240 channels. Section 2.9 in the communication manual
132	You have exceeded the available number of commands.	The maximum number of commands that can be sent is 16. The modules that can be set with a single command are consecutive modules that can be automatically set. Change the MW100 module configuration so that there are no empty slots. Section 2.9 in the communication manual
133	External I/O auto setting information is not available.	Below are the possible causes. Check them. <ul style="list-style-type: none"> • The MW100 is in calibration mode. Change to the setting mode or measurement mode. • The measurement module may not have been detected. Perform system reconfiguration. • There are no modules that can be automatically set. Check the modules. • An IP address has not been assigned to the MW100. Set the IP address. • The Modbus server of the MW100 is turned OFF. Turn the server ON. Section 2.9 in the communication manual
134	Auto setting has already been executed.	You cannot set an MW100 that has been automatically set. Section 2.9 in the communication manual
135	External I/O cannot be found.	Check the Ethernet connection. Section 2.2 in the communication manual
136	External I/O start cannot be executed.	The current MW100 settings do not allow the measurement to be started. Check the settings.
137	DNS for this device is not set.	Set the MV DNS parameter. Section 2.2 in the communication manual

12.1 List of Messages

• Execution Errors

Code	Message	Explanation/Countermeasures/Ref. section
150	This action is not possible because sampling is in progress.	Stop memory sampling and then execute. See section 4.4
151	This action is not possible during sampling or calculating.	Stop memory sampling or computation first. See sections 4.4 and 10.4
152	This action is not possible because saving is in progress.	Wait until the saving is complete.
153	This action is not possible because formatting is in progress.	Wait until the formatting is complete.
154	Message not accepted because message limit was reached.	The limit is 50 messages. See section 6.4
155	The message is not written while sampling is stopped.	Start memory sampling and then execute. See section 4.4
156	There are no channels to be saved to the memory.	Set the channels to be saved. See sections 4.1 and 10.1
157	This function is not possible at this time.	If the data type to be recorded is set to E+D, you cannot change the trend interval by using the T/DIV key. See section 5.2
158	Exceeds time deviation setting.	When synchronizing the clock through remote control. See section 1.7
159	It is outside the postscript message write-in range.	Add message can be written to the past section of the data being memory sampled. See section 6.4

Operation Errors

• Errors Related to the External Storage Medium

Code	Message	Explanation/Countermeasures/Ref. section
200	Operation aborted because an error was found in media.	Use another storage medium or format it. See section 4.7
201	Not enough free space on media.	There is not enough free space on media or the number of directories exceeded the limit. Replace with another medium. See section 1.5
202	Media is read-only.	Make it writable.
210	Media has not been inserted.	Insert a storage medium into the drive.
211	Media is damaged or not formatted.	Remove the medium and set it again. If an error still occurs, replace or format the medium. See section 4.7
212	Format error.	Try formatting again. See section 4.7
213	The file is read-only.	Access another file or make the file writable.
214	There is no file or directory.	Specified a file in which data is being added. Tried to save a file which does not exist in the internal memory.
215	Exceeded the allowable number of directories or files.	Replace with another storage medium. Delete unneeded files and directories. See section 4.7
216	The file or directory name is incorrect.	Use alphanumeric characters. See section 4.2
217	Unknown file type.	Check the extension. See section 13.3
218	This directory or file now exists. Delete it or change the name.	See section 4.2
219	Invalid file or directory operation.	Tried to delete multiple directory levels. Or, tried to delete a directory containing files. Delete the files and directories in the directory first before executing the operation. See section 4.7
220	The file is already in use. Try again later.	Wait until the file is accessible.
221	This action is not possible because FTP transmission is in progress.	Execute after FTP data transfer is complete.
222	Media is not recognized.	Remove the medium and set it again.
230	There is no setting file.	Switch to a medium that contains a setup file (.pdl extension).
231	Abnormal setting exists in file.	Specify another file.

12.1 List of Messages

• Errors Related to the Historical Trend

232	There is no available data.	Appears when displaying historical trends. Specify another file.
233	The specified historical data do not exist.	Appears when switching to historical trend from information display. Sections 5.7, 5.8, and 5.9
234	The specified channel is not assigned to the display group.	Appears when switching to trend, digital, or bar graph from overview. See sections 5.4 and 6.1

• Errors Related to E-mail and Web Server

260	IP address is not set or ethernet function is not available.	The IP address is not specified. Check the IP address. Section 2.2 in the communication manual
261	SMTP server is not found.	Occurs when the SMTP server is specified by name. <ul style="list-style-type: none">• Check the DNS setting.• Check the SMTP server name. Sections 2.2 and 2.3 in the communication manual
262	Cannot initiate E-mail transmission.	<ul style="list-style-type: none">• The host name of the MV is not correct. Check the host name.• The port number of the SMTP server is not correct. Check the port name. Sections 2.2 and 2.3 in the communication manual
263	Sender's address rejected by the server.	Check the sender address. Section 2.3 in the communication manual
264	Some recipients' addresses are invalid.	Check the recipient addresses. Section 2.3 in the communication manual
265	SMTP protocol error.	May occur if a network failure (cable problems, duplicate addresses, network device failure, and so on) occurs in the middle of the e-mail transmission.
266	Ethernet cable is not connected.	Check the cable connection. Section 2.2 in the communication manual
267	Could not connect to SMTP server.	<ul style="list-style-type: none">• Check to see that the SMTP server is connected to the network.• If the SMTP server name is specified using an IP address, check to see that the IP address is correct. Section 2.3 in the communication manual
268	E-mail transmission request failed.	Contact your nearest YOKOGAWA dealer.
269	E-mail transfer error.	May occur if a network failure (cable problems, duplicate addresses, network device failure, and so on) occurs in the middle of the e-mail transmission.
270	Could not connect to the POP3 server.	Check whether or not the destination POP3 server is running. Check that the cables are connected properly and that the HUB is turned on. Section 2.3 in the communication manual
271	POP3 server authentication failed.	Check whether the user name and server name are permitted by the server. Section 2.3 in the communication manual
275	The current image cannot be output to the Web.	The setup display cannot be output to the Web browser. This message is displayed on the Web browser.
276	Image data currently being created. Unable to perform key operation.	Try again a little later. This message is displayed on the Web browser.
277	Could not output screen to Web.	Failed to create the image. This message is displayed on the Web browser.

• Errors Related to FTP Client

For a description of the FTP client function of the MV, see the *Communication Interface User's Manual (IM MV1000-17E)*. The detail code does not appear in the error message on the screen. You can view the code on the FTP log display of the MV or using the FTP log output via communications.

Code	Message
280	<p>IP address is not set or FTP function is not available.</p> <p>Further details are provided by the character string that appears after error code 280.</p> <p>Character String and Details</p> <p>HOSTADDR An IP address has not been assigned to the MV. Check the IP address.</p> <p>DORMANT Internal processing error.¹</p> <p>LINK Data link is disconnected. Check the cable connection.</p>
281	<p>FTP mail box operation error.</p> <p>Further details are provided by the character string that appears after error code 281.</p> <p>Character String and Details</p> <p>MAIL Internal processing error.¹</p> <p>STATUS Internal processing error.¹</p> <p>TIMEOUT Internal processing error.¹</p> <p>PRIORITY Internal processing error.¹</p> <p>NVRAM Internal processing error.¹</p>
282	<p>FTP control connection error.</p> <p>Further details are provided by the character string that appears after error code 282.</p> <p>Character String and Details</p> <p>HOSTNAME Failed the DNS lookup (search the IP address corresponding to the host name). Check the DNS setting and the destination host name.</p> <p>TCPIP Internal processing error.¹</p> <p>UNREACH Failed to connect to a control connection server. Check the address setting and that the server is running.</p> <p>OOBINLINE Internal processing error.¹</p> <p>NAME Internal processing error.¹</p> <p>CTRL The control connection does not exist. Check that the server does not drop the connection and that it responds within the proper time period.</p> <p>IAC Failed to respond in the TELNET sequence. Check that the server does not drop the connection and that it responds within the proper time period.</p> <p>ECHO Failed to transmit data on the control connection. Check that the server does not drop the connection and that it responds within the proper time period.</p> <p>REPLY Failed to receive data on the control connection. Check that the server does not drop the connection and that it responds within the proper time period.</p>

12.1 List of Messages

Character String and Details	
SERVER	
The server is not in a condition to provide the service. Check that the server is in a condition in which service can be provided.	
<hr/>	
Code	Message
283	FTP command was not accepted. Further details are provided by the character string that appears after error code 283.
Character String and Details	
USER	
Failed to verify the user name. Check the user name setting.	
PASS	
Failed to verify the password. Check the password setting.	
ACCT	
Failed to verify the account. Check the account setting.	
TYPE	
Failed to change the transfer type. Check that the server supports the binary transfer mode.	
CWD	
Failed to change the directory. Check the initial path setting.	
PORT	
Failed to set the transfer connection. Check that the security function is disabled.	
PASV	
Failed to set the transfer connection. Check that the server supports PASV commands.	
SCAN	
Failed to read the transfer connection settings. Check that proper response to the PASV command is received from the server.	
284	FTP transfer setting error. Further details are provided by the character string that appears after error code 284.
Character String and Details	
MODE	
Internal processing error. ¹	
LOCAL	
Internal processing error. ¹	
REMOTE	
The destination file name is not correct. Check that you have the authority to create or overwrite files.	
ABORT	
File transfer abort was requested by the server. Check the server for the reason for the abort request.	

Code	Message
285	<p>FTP data connection error.</p> <p>Further details are provided by the character string that appears after error code 285.</p> <p>Character String and Details</p> <p>SOCKET Failed to create a socket for the transfer connection.²</p> <p>BIND Failed the transfer connection command.²</p> <p>CONNECT Failed the transfer connection.²</p> <p>LISTEN Failed the transfer connection reception.²</p> <p>ACCEPT Failed to accept the transfer connection.²</p> <p>SOCKNAME Internal processing error.¹</p> <p>RECV Failed to receive data over the transfer connection.²</p> <p>SEND Failed to send data over the transfer connection.²</p>
286	FTP file transfer error.
290	<p>SNTP access failure.</p> <p>Further details are provided by the character string that appears after error code 290.</p> <p>Character String and Details</p> <p>DORMANT Internal processing error.¹</p> <p>LINK Data link is disconnected. Check the cable connection.</p>
291	<p>SNTP server does not respond.</p> <p>Further details are provided by the character string that appears after error code 291.</p> <p>Character String and Details</p> <p>TIMEOUT Check that the server is running.²</p>
292	<p>Incorrect SNTP server setting.</p> <p>Further details are provided by the character string that appears after error code 292.</p> <p>Character String and Details</p> <p>HOSTNAME Failed the DNS lookup (search the IP address corresponding to the host name). Check the DNS setting and the SNTP server name.</p> <p>TCPIP Internal processing error.¹</p>
293	<p>Invalid SNTP server reply.</p> <p>Further details are provided by the character string that appears after error code 293.</p> <p>Character String and Details</p> <p>SEND A correct IP address has not been assigned to the MV. Check the IP address.</p> <p>BROKEN There is a problem with the SNTP server. If this error occurs even after executing SNTP manually several times, check the SNTP server.</p>

12.1 List of Messages

Code	Message
294	No time correction because excess time deviation with SNTP server. Further details are provided by the character string that appears after error code 294. Character String and Details OVER This error occurs when periodic SNTP is executed by the auto setting of the clock and the clock is not adjusted because the time difference between the MV and the SNTP server is greater than or equal to 10 minutes. Check the time on the MV and the SNTP server.
295	IP address was released because DHCP setting is invalid. Further details are provided by the character string that appears after error code 295. Character String and Details REJECT Address obtained by DHCP is inappropriate.
296	DHCP access failure. Further details are provided by the character string that appears after error code 296. Character String and Details ESEND Failed to transmit to the DHCP. ESERVER DHCP server not found. ESERVFAIL No response from the DHCP server. ERENEWED Address renewal rejected. EEXTENDED Address lease extension rejected. EEXPIRED Address lease period expired.
297	Registration of the hostname to the DNS server failed. Further details are provided by the character string that appears after error code 297. Character String and Details INTERNAL Failed to register the host name (transmission error, reception timeout, etc.). FORMERR Failed to register the host name (format error: DNS message syntax error). SERVFAIL Failed to register the host name (server failure: DNS server processing error). NXDOMAIN Failed to register the host name (non existent domain). NOTIMP Failed to register the host name (not implemented). REFUSED Failed to register the host name (operation refused). YXDOMAIN Failed to register the host name (name exists). YXRRSET Failed to register the host name (RR set exists). NXRRSET Failed to register the host name (RR set does not exist). NOTAUTH Failed to register the host name (not authoritative for zone). NOTZONE Failed to register the host name (different from zone section). NONAME Host name not entered on the MV.

Code	Message
298	<div>Deletion of the hostname to the DNS server failed.</div> <div>Further details are provided by the character string that appears after error code 298.</div> <div>Character String and Details</div> <div>INTERNAL</div> <div>Failed to delete the host name (transmission error, reception timeout, etc.).</div> <div>FORMERR</div> <div>Failed to delete the host name (format error: DNS message syntax error).</div> <div>SERVFAIL</div> <div>Failed to delete the host name (server failure: DNS server processing error).</div> <div>NXDOMAIN</div> <div>Failed to delete the host name (non existent domain).</div> <div>NOTIMP</div> <div>Failed to delete the host name (not implemented).</div> <div>REFUSED</div> <div>Failed to delete the host name (operation refused).</div> <div>YXDOMAIN</div> <div>Failed to delete the host name (name exists).</div> <div>YXRRSET</div> <div>Failed to delete the host name (RR set exists).</div> <div>NXRRSET</div> <div>Failed to delete the host name (RR set does not exist).</div> <div>NOTAUTH</div> <div>Failed to delete the host name (not authoritative for zone).</div> <div>NOTZONE</div> <div>Failed to delete the host name (different from zone section).</div> <div>NOTLINKED</div> <div>4Physical layer was disconnected when removing the host name.</div>

- 1 Contact your nearest YOKOGAWA dealer.
- 2 These errors may occur if the network experiences trouble during the data transmission (bad cable connection, duplicate addresses, network equipment failure).

Note

- The FTP client function on the MV has a timer function that drops the connection if there is no data transfer for two minutes. If the server does not respond within this time period, the transfer fails.
- The FTP client function on the MV overwrites files without a warning if files with the same name exist at the transfer destination unless the server returns a negative response.

Communication Errors

For information regarding the communication function of the MV, see the *Communication Interface User's Manual (IM MV1000-17E)*.

- **Errors during Setting and Basic Setting Modes, Output Communication Command Execution, and Setup Data Loading**

Code	Message
300	Command is too long.
301	Too many number of commands delimited with ';'.
302	This command has not been defined.
303	Data request command can not be enumerated with sub-delimiter.
350	Command is not permitted to the current user level.
351	This command cannot be specified in the current mode.
352	The option is not installed.
353	This command cannot be specified in the current setting.
354	This command is not available during sampling or calculating.

- **Memory Access Errors during Setting and Basic Setting Modes and Output Communication Command Execution**

An English error message is returned via the communication interface. It is not displayed on the screen.

Code	Message
362	There are no data to send 'NEXT' or 'RESEND'.
363	All data have already been transferred.

• **Maintenance and Test Communication Command Errors**

An English error message is returned via the communication interface. It is not displayed on the screen.

Code	Message
390	Command error.
391	Delimiter error.
392	Parameter error.
393	No permission.
394	No such connection.
395	Use 'quit' to close this connection.
396	Failed to disconnect.
397	No TCP control block.
398	Format error.

• **Other Communication Errors**

An English error message is returned via the communication interface. It is not displayed on the screen.

Code	Message
400	Input username.
401	Input password.
402	Select username from 'admin' or 'user'.
403	Login incorrect, try again!
404	No more login at the specified level is acceptable.
410	Login successful. (The special user level)
411	Login successful. (The general user level)
420	Connection has been lost.
421	The number of simultaneous connection has been exceeded.
422	Communication has timed-out.

12.1 List of Messages

Status Messages

Code	Message
500	Execution is complete.
501	Please wait a moment...
503	Data are being saved to media...
504	File is being loaded from media...
505	Formatting...
506	Memory save to media was interrupted.
508	There is no file or directory.
509	Press [DISP/ENTER] key to display file name.
510	Range cannot be changed during sampling or calculating.
511	MATH expression cannot be changed during sampling or calculating.
513	Post process in progress.
514	Now loading historical data.
515	Data save is completed.
516	Files are now being sorted.
520	Connecting to the line...
521	The data file is being transferred.
530	Media can be removed safely.
531	Media was removed compulsorily.
532	USB device has been connected.
533	USB device cannot be recognized.
534	There was no data which is not saved to media.
535	Media was recognized.
536	Media is not recognized.
542	Media read error.
543	Flash write error.
550	The A/D calibration is being executed...
551	FTP test is being executed...
552	E-mail test is being executed...
560	Now connecting to SNTP server...
561	Now adjusting the time.

Code	Message
562	<p>Ethernet cable is disconnected.</p> <p>Further details are provided by the character string that appears after error code 562.</p> <p>Character String and Details</p> <p>ON</p> <p>Detected that an Ethernet cable was connected.</p> <p>OFF</p> <p>Detected that an Ethernet cable was disconnected.</p>
563	<p>The command is sent to DHCP.</p> <p>Further details are provided by the character string that appears after error code 563.</p> <p>Character String and Details</p> <p>RENEW</p> <p>Requesting address renewal to the DHCP server.</p>
564	<p>The response was received from DHCP.</p> <p>Further details are provided by the character string that appears after error code 564.</p> <p>Character String and Details</p> <p>RENEWED</p> <p>Address renewal complete.</p> <p>EXTENDED</p> <p>Address release extension request complete.</p> <p>RELEASED</p> <p>Address release complete.</p>
565	<p>IP address was set.</p> <p>Further details are provided by the character string that appears after error code 565.</p> <p>Character String and Details</p> <p>IPCONFIG</p> <p>Assigned the IP address.</p>
566	<p>It is a setting that doesn't register hostname to the DNS server.</p> <p>Further details are provided by the character string that appears after error code 566.</p> <p>Character String and Details</p> <p>NOREQUEST</p> <p>Configured not to register the host name.</p>
567	<p>The hostname was registered to DNS server.</p> <p>Further details are provided by the character string that appears after error code 567.</p> <p>Character String and Details</p> <p>UPDATE</p> <p>Registered the host name to the DNS server.</p>
568	<p>The hostname was deleted from DNS server.</p> <p>Further details are provided by the character string that appears after error code 568.</p> <p>Character String and Details</p> <p>REMOVE</p> <p>Assigned the IP address.</p> <p>OFF</p> <p>Removed the host name from the DNS server.</p>

12.1 List of Messages

Warning Messages

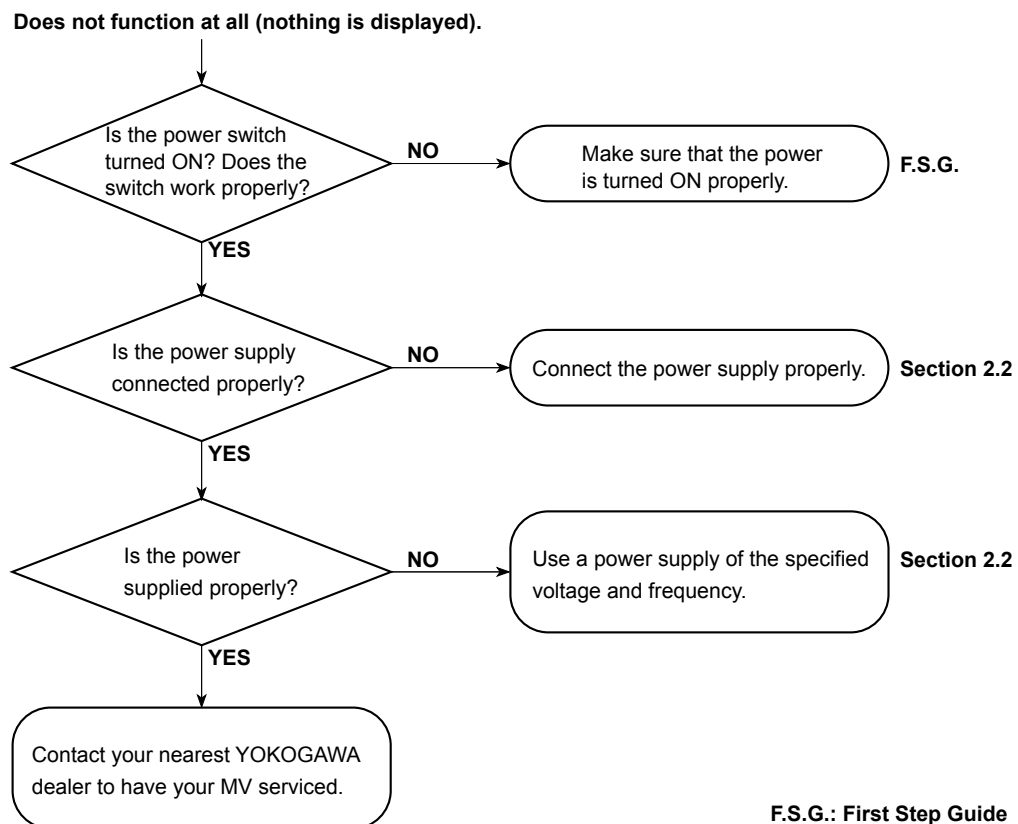
Code	Message	Ref. Section
600	Measured data and Settings have been initialized.	—
601	Measured data have been initialized.	—
610	This username is already registered.	See section 8.2.
614	Calibration settings are reset because of range setting change.	See section 3.9
615	Noise may influence measurement in test mode.	See section 3.1

System Errors

Servicing is required when a system error occurs. If this happens, contact your nearest YOKOGAWA dealer for repairs.

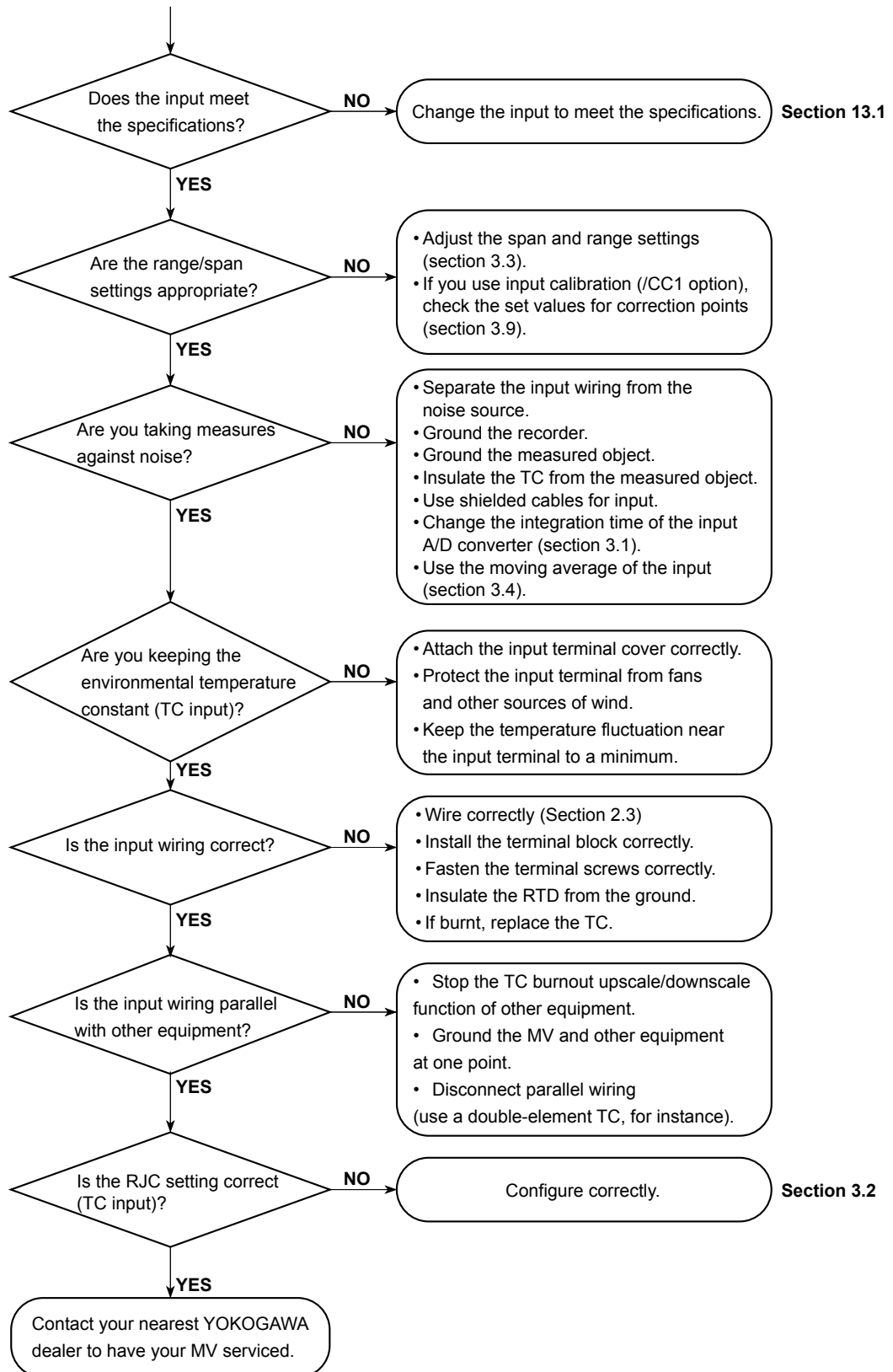
Code	Message
901	ROM failure.
902	RAM failure.
910	A/D memory failure for all input channels.
911	Channel 1 A/D memory failure.
912	Channel 2 A/D memory failure.
913	Channel 3 A/D memory failure.
914	Channel 4 A/D memory failure.
921	Channel 1 A/D calibration value error.
922	Channel 2 A/D calibration value error.
923	Channel 3 A/D calibration value error.
924	Channel 4 A/D calibration value error.
930	Memory acquisition failure.
940	The Ethernet module is down.

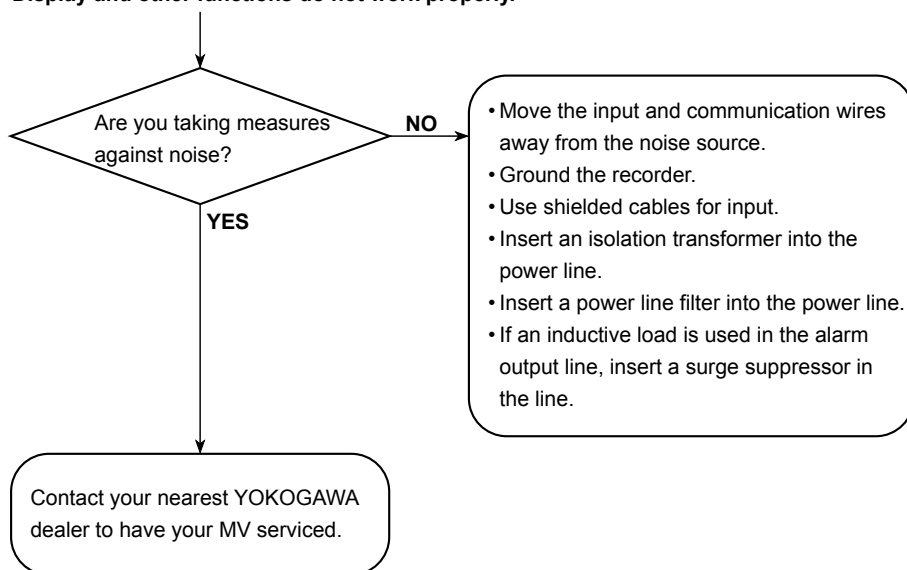
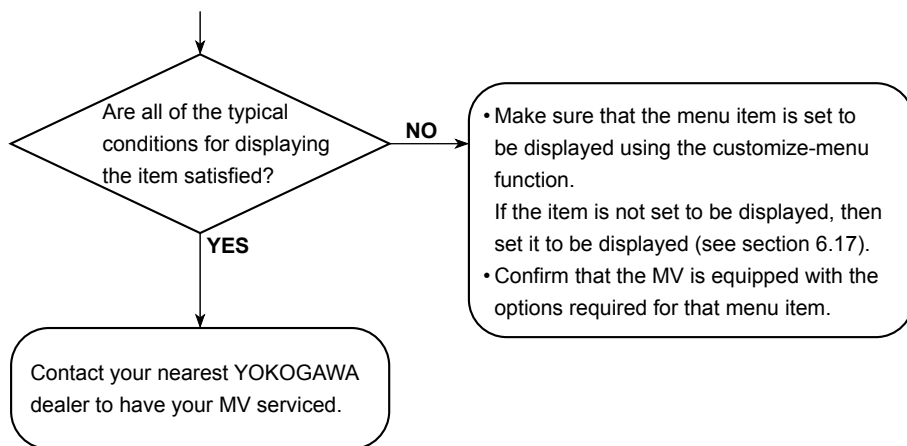
12.2 Troubleshooting



12.2 Troubleshooting

- Large measurement errors.
- Trend or digital wave value fluctuation.
- Trend going off the scale beyond either 0% or 100%.



Display and other functions do not work properly.**Items on the display selection menu or function menu are not displayed.**

12.3 Periodic Inspection

Check the operation periodically to keep the MV in good working order.

Perform the following checks and replace worn parts as needed.

- Is the display and storage functioning properly?
If not, see section 12.2, "Troubleshooting."
- Has the brightness of the LCD backlight deteriorated?
If replacement is necessary, see section 12.5, "Recommended Replacement Periods for Worn Parts."

12.4 Calibrating the MV

It is recommended that the MV be calibrated once a year to assure its measurement accuracy.
Calibration service is also provided by YOKOGAWA dealers.
For details, contact your nearest YOKOGAWA dealer.

Required Instruments

Calibration instruments with the following resolution are required for calibrating the MV.

Recommended Instruments

- DC voltage standard: 9100 by FLUKE or equivalent
Main specifications
Output accuracy: $\pm(0.005\% + 1 \mu\text{V})$
- Decade resistance box: Yokogawa Meters & Instruments Model 2793-01 or equivalent
Main specifications
Accuracy of output range 0.1 to 500 Ω : $\pm(0.01\% + 2 \text{ m}\Omega)$
Resolution: 0.001 Ω
- 0°C standard temperature device: ZC-114/ZA-10 by Coper Electronics or equivalent
Main specifications
Standard temperature stability accuracy: $\pm 0.05^\circ\text{C}$

For information on purchasing the calibration instruments, contact your nearest YOKOGAWA dealer.

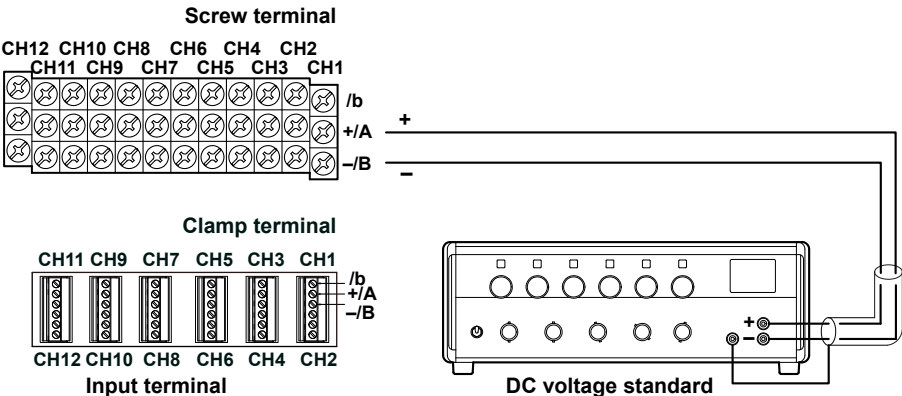
Calibration Procedure

1. Wire the MV and the calibration instrument as shown in the following figure, and adequately warm up the instruments (the warm-up time of the MV is at least 30 minutes).
2. Check that the operating environment such as ambient temperature and humidity is within the standard operating conditions (see section 13.6).
3. Apply appropriate input signals corresponding to 0, 50, and 100% of the input range and calculate the errors from the readings.
If the error does not fall within the accuracy range of the specifications, contact your nearest YOKOGAWA dealer.

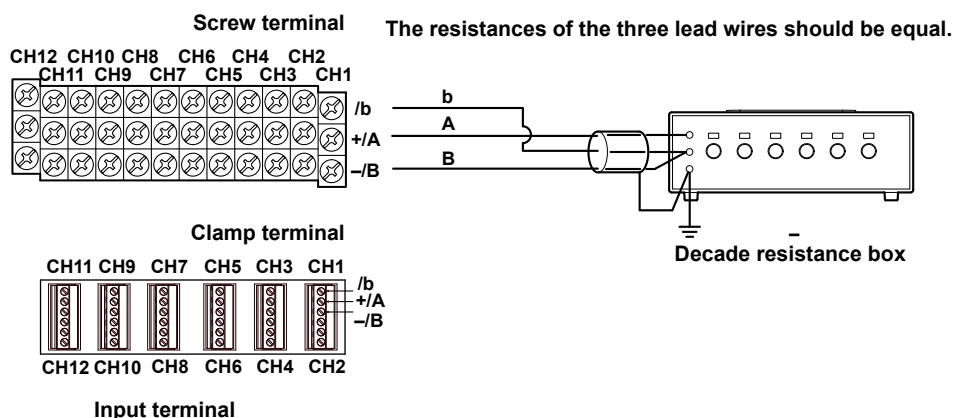
Note

For thermocouple inputs, you must measure the temperature of the input terminal and apply a voltage taking into account the reference junction temperature.

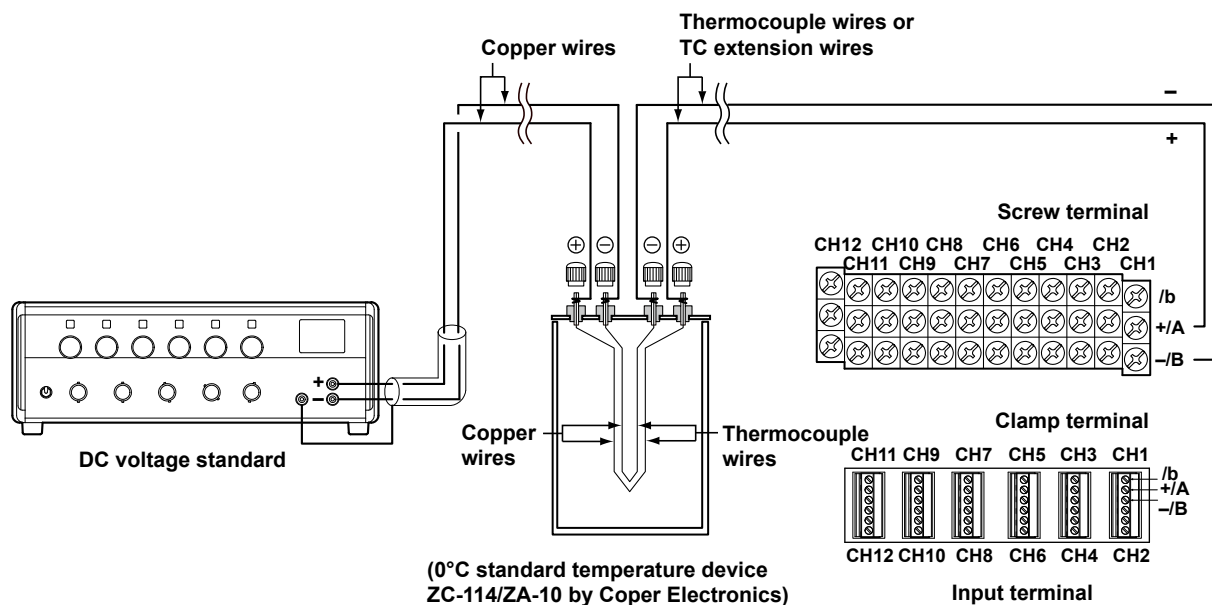
DC Voltage Measurement (Example for the MV1012)



Temperature Measurement When Using an RTD (Example for the MV1012)



Temperature Measurement When Using a Thermocouple (Example for the MV1012)



RJC of TC Input

As the measurement terminal of the MV is generally at room temperature, the actual output of the thermocouple is different from the values given on the thermoelectromotive force table based on 0°C. The MV performs compensation by measuring the temperature at the input terminal and adding the corresponding thermoelectromotive force to the actual output of the thermocouple. Therefore, when the measurement terminal is shorted (equivalent to the case when the detector tip is 0°C), the measured value indicates the temperature of the input terminal.

When calibrating the MV, this compensation voltage (thermoelectromotive force of 0°C reference corresponding to the input terminal temperature) must be subtracted from the output of the standard generator before application. As shown in the figure, by using the 0°C standard temperature device to compensate the reference junction at 0°C, you can input the thermoelectromotive force of 0°C reference from the DC voltage standard and perform the calibration.

12.5 Recommended Replacement Periods for Worn Parts

To maintain the reliability of the MV and to use the MV in a good condition for an extended time, we recommend that parts be replaced periodically. The replacement parts may change to accommodate preventive maintenance over extended time. Be sure to check with your nearest YOKOGAWA dealer.

The following table shows the recommended replacement period for expendable parts. The replacement period shown here applies when the MV is used under standard operating conditions. For the actual replacement period, consider the actual conditions of use. Replacement of parts will be carried out by a YOKOGAWA engineer or a YOKOGAWA-certified engineer. Contact your nearest YOKOGAWA dealer when such replacement is necessary.

MV1000

Item	Replacement Period	Name	Quantity Used	Notes
LCD	5 years	Bezel Assembly	1	
Battery	10 years	Battery Assembly	1	
Aluminum electrolytic capacitor	5 years	Power Supply Assembly*	1	
	5 years	AD Assembly*	Depends on the model	

* Replacement period when used at the upper limit of the normal operating temperature (40°C).

The replacement period varies depending on the operating temperature and the MV specifications. If the operating temperature is 30°C, it may be possible to use the part for more than 10 years.

MV2000

Item	Replacement Period	Name	Quantity Used	Notes
LCD	5 years	Bezel Assembly	1	
Battery	10 years	Battery Assembly	1	
Aluminum electrolytic capacitor	5 years	Power Supply Assembly*	1	
	5 years	AD Assembly*	Depends on the model	

* Replacement period when used at the upper limit of the normal operating temperature (40°C).

The replacement period varies depending on the operating temperature and the MV specifications. If the operating temperature is 30°C, it may be possible to use the part for more than 10 years.

Note

- The LCD replacement period indicates the half life of the brightness when the brightness is set to the factory default setting. The half life is shortened as the brightness is set higher. The deterioration of brightness varies depending on the condition of use, and its determination is subjective. Consider these points when determining the actual replacement period.
- The LCD color may turn yellowish over time. The discoloration tends to progress faster as the brightness is set higher.

13.1 Signal Input and Alarm

Signal Input

Item	Specifications				
Number of inputs, scan interval, and A/D integration time					
	Model	Number of Inputs:	Scan Interval		
			Normal mode		Fast sampling mode*
	MV1004	4	125 ms, 250 ms	<div></div>	25 ms
	MV1008	8			
	MV1006	6			
	MV1012	12	1 s, 2 s, 5 s	2 s, 5 s	125 ms
	MV1024	24			
	MV2008	8	125 ms, 250 ms	<div></div>	25 ms
	MV2010	10	1 s, 2 s, 5 s	2 s, 5 s	125 ms
	MV2020	20			
	MV2030	30			
	MV2040	40			
	MV2048	48			
	A/D Converter Integration Time		60 Hz/50 Hz	100 ms	600 Hz (fixed)

* Not available on models equipped with external input channels (/MC1 option).

Input types DC voltage, 1-5V, thermocouple (TC), resistance temperature detector (RTD), ON/OFF input (DI), and DC current (by adding an external shunt resistor)

Input format Floating unbalanced input

Measurement range and measurable range

Input Type	Range	Measurable Range	
DC voltage	20 mV	-20.000 to 20.000 mV	
	60 mV	-60.00 to 60.00 mV	
	200 mV	-200.00 to 200.00 mV	
	2 V	-2.0000 to 2.0000 V	
	6 V	-6.000 to 6.000 V	
	20 V	-20.000 to 20.000 V	
	50 V	-50.00 to 50.00 V	
1-5V	1-5 V ⁶	0.800 to 5.200 V	
Thermocouple	R ¹	0.0 to 1760.0°C	32 to 3200°F
	S ¹	0.0 to 1760.0°C	32 to 3200°F
	B ¹	0.0 to 1820.0°C	32 to 3308°F
	K ¹	-200.0 to 1370.0°C	-328 to 2498°F
	E ¹	-200.0 to 800.0°C	-328.0 to 1472.0°F
	J ¹	-200.0 to 1100.0°C	-328.0 to 2012.0°F
	T ¹	-200.0 to 400.0°C	-328.0 to 752.0°F
	N ¹	0.0 to 1300.0°C	32 to 2372°F
	W ²	0.0 to 2315.0°C	32 to 4199°F
	L ³	-200.0 to 900.0°C	-328.0 to 1652.0°F
	U ³	-200.0 to 400.0°C	-328.0 to 752.0°F
	WRe ⁴	0.0 to 2400.0°C	32 to 4352°F
RTD	Pt (Pt100) ⁵	-200.0 to 600.0°C	-328.0 to 1112.0°F
	JPt (JPt100) ⁵	-200.0 to 550.0°C	-328.0 to 1022.0°F
DI	Voltage	0: Less than 2.4 V. 1: 2.4 V or higher (judged at the 6 V range)	
	Contact ⁷	0: Open. 1: Closed (parallel capacitance of 0.01 µF or less)	

1: R, S, B, K, E, J, T, N: IEC584-1 (1995), DIN IEC584, JIS C1602-1995

2: W: W-5%Re/W-26%Re (Hoskins Mfg. Co.), ASTM E988

3: L: Fe-CuNi, DIN43710, U: Cu-CuNi, DIN43710

4: WRe: W-3%Re/W-25%Re (Hoskins Mfg. Co.)

5: Pt100: JIS C1604-1997, IEC751-1995, DIN IEC751-1996

JPt100: JIS C1604-1989, JIS C1606-1989

Measuring current: i = 1mA (Pt100, JPt100)

6: The range for linear scaling of 1-5V inputs. Burnout detection and low-cut functions are available.

7: The detected current value is approx. 10 µA.

13.1 Signal Input and Alarm

Item	Specifications
Thermocouple burnout*	Burnout upscale/downscale selectable (for each channel) Normal: 2 kΩ or less, burnout: 100 kΩ or more (parallel capacitance of 0.01 μF or less) Detection current: Approx. 10 μA
1-5 range burnout*	Burnout upscale/downscale selectable (for each channel) Burnout detection: Greater than the scale upper limit + 10% of scale width or less than the scale lower limit – 5% of scale width
TC reference junction compensation	
	Internal reference junction compensation or external reference junction compensation
Filter function	Takes the moving average of the input values (for each channel). Moving average data points: 2 to 400
Computation	
Difference computation	Computable range: DC voltage, TC, RTD, and DI
Linear scaling	Computable range: DC voltage, TC, RTD, and DI Scalable range: –30000 to 30000. The decimal place is anywhere that values will have less than four fractional digits. Unit: Up to six characters Range-out detection: You can configure the MV to indicate a range-out when a value falls outside ±5% of the scale range.
Square root computation	Takes the square root of the input and apply linear scaling Computable range: DC voltage Scalable range and unit: Same as linear scaling Low-cut: Set the low-cut point to a value in the 0.0% to 5.0% of the span Range-out detection: Same as linear scaling
1-5V	Computable range: 1-5 Scalable range and unit: Same as linear scaling Low-cut: The low-cut point is fixed to the span lower limit. Range-out detection: Same as linear scaling

* In fast sampling mode, the MV cannot detect burnouts on all measurement channels within a scan interval. The MV may not detect a burnout for the following number of measurements, if measurement is started in a burnout condition, or after a burnout condition occurs.

MV1004, MV1008, MV2008: a maximum of four measurements

MV1006, MV1012, MV1024, MV2010, MV2020, MV2030, MV2040, MV2048: a maximum of two measurements

Alarms

Item	Specifications
Number of alarms	Up to four alarms (levels) for each measurement channel
Alarm types	High limit, low limit, difference high limit, difference low limit, high limit on rate-of-change alarm, low limit on rate-of-change alarm, delay high limit, delay low limit
Alarm delay	1 to 3600 s (for each channel)
Rate-of-change calculation interval of rate-of-change alarms	1 to 32 times the scan interval (common to all channels)
Alarm output	Output to the internal switch Number of internal switches: 30 Internal switch operation: AND/OR operation selectable
Hysteresis	High and low limit alarms: 0.0 to 5.0% of the span (common to all channels) Difference high and low limit alarms: 0.0 to 5.0% of the span (common to all channels)
Display	Displays the status on the respective operation screen and an alarm icon on the status display section when an alarm occurs. Display operation: Hold or not hold the display until the alarm output release operation.
Alarm hide function (no alarm logging function)	Not display alarms nor record to the alarm summary (for each channel)
Alarm information	Displays a log of alarm occurrences on the alarm summary.

13.2 Display Functions

Display

Item	Specifications
Display*	MV1000: 5.5-inch TFT color LCD (320 × 240 dots) MV2000: 10.4-inch TFT color LCD (640 × 480 dots)
Brightness	MV1000: Eight levels. MV2000: Six levels.
Backlight saver function	Dim or turn off the LCD backlight if there is no key operation for a specified time. Dim or turn off the LCD backlight at any time by using the FUNC key

* The LCD monitor may contain few pixels that are always on or off. The brightness of the LCD may not be uniform due to the LCD characteristics. This is not a malfunction.

Screen

Item	Specifications
Display groups	Allows you to assign channels to groups on the trend display, digital display, and bar graph display for displaying
Number of groups	MV1000: 10. MV2000: 36.
Number of channels per group	MV1000: 6 max. MV2000: 10 max.
Display colors	Channel: Select from 24 colors Background: Select white or black
Trend display	
Waveform line width	Select 1, 2, or 3 dots
Display method	Displays with orthogonal time (T) and measured value (Y) axes
Layout:	Vertical, horizontal, wide, or split
Trend interval:	MV1004, MV1008, MV2008: Select from 5 s, 10 s, 15 s, 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 h, 2 h, 4 h, 10 h/div MV1006, MV1012, MV1024, MV2010, MV2020, MV2030, MV2040, MV2048: Select from 15 s (only for fast sampling mode), 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 h, 2 h, 4 h, 10 h/div
Scale	Switchable to the secondary trend interval Displays a scale for each channel
Miscellaneous	Current value bar graph, color scale band, and alarm value marks can be displayed on the scale. Grid (divisions: 4 to 12), trip line (line width: 1, 2, or 3 dots), message, zone display, partially expanded display, auto zone display
Digital display	Displays measured values numerically
Update rate	1 s (or the scan interval if the scan interval is greater than 1 s)
Bar graph display	Displays measured values on a bar graph
Direction	Vertical or horizontal
Base position	End or center
Update rate	1 s (or the scan interval if the scan interval is greater than 1 s)
Scale	Displays a scale for each channel Color scale band and alarm value marks can be displayed on the scale.
Historical trend display	
Display format	Shows the display data or event data in the internal memory or external storage medium. All screen or half screen (only when the display data is being redisplayed) Foreground display (TOP CHANNEL): Displays a specified channel's waveform in foreground Auto span display: Displays a waveform by automatically adjusting the display span of a specified channel Auto zone display: Displays waveforms in separated display zones for each channel
Time axis operations	Reduction/expansion, continuous data display, absolute/relative time display
Added message	Adds messages
Background colors	White, cream, black, and light gray
Overview display	Displays measured values of all channels and alarm statuses (measured values not displayed if there are 261 or more channels on the MV2000)

13.2 Display Functions

Item	Specifications
Information display	
Alarm summary display	Displays a log of up to 1000 alarms You can specify an alarm by using the cursor and jump to the corresponding section on the trend display.
Message summary display	Time and content of up to 450 messages (including 50 added messages) You can specify a message by using the cursor and jump to the corresponding section on the trend display.
Memory summary display	Displays information about the internal memory data You can specify a file by using the cursor and jump to the corresponding section on the trend display. You can save data in the internal memory to an external storage medium by using keys.
Report (/M1, /PM1)	Displays report data in the internal memory
Stacked bar graph (/M1, /PM1)	Displays stacked bar graphs of report data for each report group Display type: Hourly+daily (uses hourly report data for displaying), hourly+weekly (uses daily report data for displaying), daily+monthly (uses daily report data for displaying) Report groups: Every 6 channels (MV1000) or every 10 channels (MV2000) are assigned in order to groups 1, 2, 3, and so on, starting with the first report channel (R001). Channel assignment is fixed. Scale/grid: Fixed to four sections Update rate: 1 s Stacks report data of channels in the specified group and displays the result on a bar graph. Displays only channels with the same unit as the first channel in the group.
Status display	Relay status display: Displays the ON/OFF status of alarm output relays and internal switches Modbus client status: Displays the communication status of the Modbus client Modbus master status: Displays the communication status of the Modbus master
Log display	Displays the login log, error log, communication log, FTP log, Web log, e-mail log, SNTP log, DHCP log, and Modbus status log
4-panel display (only with the MV2000)	Divides the display into quadrants and shows four different display formats Four display combinations can be registered.
Display pause	You can pause the display using keys.

Other Displayed Information

Item	Specifications
Tag display	Up to 16 alphanumeric characters
Messages	You can write messages to the trend display.
Number of messages	100
Characters	Up to 32 alphanumeric characters
Write method	Enter a preset message or write a message on the spot
Write destination	You can specify to write only to the display group or to all groups.
Auto message	Writes a message when the MV recovers from a power failure while memory sampling is in progress. Writes a message when the trend interval is switched while memory sampling is in progress.
Added messages	Writes messages to past data positions
Number of messages	50
Status display section	Displays the MV status at the upper section of the display
Displayed information	(1) Year, month, day, time, (2) displayed group name/display name, (3) user name (when using the login function), (4) batch name (when using the batch function), (5) internal memory status, (6) external storage medium status, (7) alarm status, and (8) function usage status (key lock, computation function, and e-mail)
Auto switching of displayed groups	Switches the display group at given intervals. Interval: Select from the available settings between 5 s and 1 min.
Auto recovery display	Specify the display that will appear automatically when keys are not operated. Time until the display switches: Select from the available settings between 1 min and 1 h.
Favorite display	You can register an often-used display to the HISTORY key and use the key to switch to the display quickly Up to eight displays can be registered.

Item	Specifications
Available languages	English, Japanese, German, French, Chinese, or Korean
System information display	Displays the number of measurement, computation, and external input channels; available options; remote controller ID; MAC address; firmware version; and internal memory capacity.
Network information display	Displays the MV network configuration information.
Display selection menu customization	<p>You can show/hide and change the positions of each item in the display selection menu and submenus</p> <p>You can insert or delete separators.</p>
Function menu customization	You can show/hide and change the display positions of each item.

13.3 Storage Function

Configuration

Item	Specifications
Internal memory	Temporarily stores various types of data
Medium	Flash memory
External storage medium	
Medium	CF card (up to 2 GB)
Format	FAT32 or FAT16

Data Types

Data Type	Extension	Format	Display Method		
			MV	DAQSTANDARD	Application
Display data	DAD	Binary (undisclosed)	Yes	Yes	Yes ^{1, 2}
	TDD	Text	-	-	Yes
Event data	DAE	Binary (undisclosed)	Yes	Yes	Yes ^{1, 2}
	TDE	Text	-	-	Yes
Report data	DAR	Text	Yes	Yes	Yes
Manually sampled data	DAM	Text	-	-	Yes
Setup data	PDL	Binary (undisclosed)	Yes	Yes	-
Snapshot data	PNG	PNG (general format)	-	-	Yes

1 You can convert the data format on DAQSTANDARD and then open the data on a software application such as Microsoft Excel.

2 You can open on a software application, the data loaded from the MV through the communication function.

Display Data and Event Data

Item	Specifications
Internal memory	
File storage capacity	400 MB
Number of files	Up to 400
Operation	FIFO (First In First Out)
Display data	
Source	Measurement, computation, and external input channels (/MC1)
Sampling interval	Set by Trend/Storage interval MV1004, MV1008, MV2008: Select from 5 s, 10 s, 15 s, 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 h, 2 h, 4 h, 10 h/div MV1006, MV1012, MV1024, MV2010, MV2020, MV2030, MV2040, MV2048: Select from 15 s (only for fast sampling mode), 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 h, 2 h, 4 h, 10 h/div
Contents	The maximum and minimum values within the data update interval among the data values sampled at the scan interval
Data size	Measurement and external input channel (/MC1) data: 4 bytes/data value. Computation channel data: 8 bytes/data value.
Files size	Up to 8 MB
Data format	Binary or text
Recording	Records data at all times
Event data	
Source	Measurement, computation, and external input channels (/MC1)
Sampling interval	Set by Sample rate Select from 25ms, 125ms, 250ms, 500ms, 1s, 2s, 5s, 10s, 30s, 1min, 2min, 5min, and 10min However, you can only set rates that are slower than the scan interval.
Contents	Data for each sampling interval
Data size	Measurement and external input channel (/MC1) data: 2 bytes/data value. Computation channel data: 4 bytes/data value.
Files size	Up to 8 MB
Data format	Binary or text
Mode	Free: Records data at all times Triggered: Starts recording data when a certain event occurs and stops after a specified interval.
Saved data combinations	Display data only, event data only, or display data and event data.
File size	See appendix 1.

Manually Sampled Data

Item	Specifications
Contents	Values measured at user-specified times You can specify up to 120 channels when using external input channels (/MC1).
Data format	Text
Maximum number of data values that can be stored to the internal memory	400

Report Data (/M1, /PM1)

Item	Specifications
Contents	Report at each scheduled time of report
Data format	Text
Maximum number of reports that can be stored to the internal memory	100

Saving of Data to an External Storage Medium

Item	Specifications
Manual saving	Select the data in the internal memory and save to an external storage medium If auto saving is disabled, saves when you insert an external storage medium and operate the keys.
Auto saving	Automatically saves data in the internal memory to an external storage medium
Auto saving interval	Display data: Select from 10, 20, 30 min, 1, 2, 3, 4, 6, 8, 12 h, 1, 2, 3, 5, 7, 10, 14, and 31 days. Set by Save interval. Event data (Free mode): Set by Data length. Event data (triggered modes): Saves data at the end of a sampling operation at a specified time. Set by Data length.
Auto saving operation	Manually sampled data: When you execute manual sampling Report data: When reports are generated Select "save data only if there is sufficient free space on the CF card" or "constantly retain the most recent data files in the CF card (media FIFO)".
File name	Select from "serial number+user-assigned string+date," "sequence number+user-assigned string," and "sequence number+batch name."
Save destination	Auto saving: CF card. Manual saving: CF card or USB flash memory Directory name: Specify using up to 20 characters

Snapshot Data

Item	Specifications
Contents	Displayed screen image data
Data format	PNG
Output destination	CF card or communication output

Setup Data

Item	Specifications
Contents	MV setup data
Data format	Binary
File name	Specify using up to 32 characters
Output destination	CF card or USB flash memory
Loading	Loadable from a CF card or USB flash memory

Data File Loading

Item	Specifications
Function	You can load display data or event data from a CF card or USB flash memory and display the loaded data.

Miscellaneous

Item	Specifications
Header comment	You can add comments using up to 50 characters to display data, event data, manually sampled data, and report data files.

13.4 Other Standard Functions

Event Action Function

Item	Specifications
Event action	Executes a specified operation when a given event occurs.
Number of settings	40
Event	Remote control input, etc.
Timer	Number of timers: 4
Match time timer	Number of timers: 4
Action	You can specify memory start/stop, alarm ACK, etc. There are limitations on the combinations of events and actions.

Security Functions

Item	Specifications
Key lock function	Limitations on key operations, access to the external storage medium, and various operations
Login function	Allows registered users to operate the MV
Administrators	5 users
Users	30 users

Time Related Functions

Item	Specifications
Clock	With a calendar function
Accuracy	±10 ppm, excluding a delay (of 1 second, maximum) that results each time the power is turned ON.
Time setting	Using key operation, communication command, event action function, or SNTP client function
Time adjustment method	
While memory sampling	Corrects the time by 40 ms for each second. Limit by which the time is gradually adjusted: Select from the available settings between 10 s and 5 min. If the time is outside the limit, the time is immediately corrected. Cannot be used after hour 0 on January 1st, 2038.
While no memory sampling	Immediately changes the time
Time zone	You can set the time difference from GMT.
Date format	Select YYYY/MM/DD, MM/DD/YYYY, DD/MM/YYYY, or DD.MM.YYYY

Types of Characters That the MV Can Handle

Item	Specifications
Characters	Alphabet characters, numbers, and symbols (limitation exists)

Communication Functions

Item	Specifications
Electrical and mechanical	Conforms to IEEE 802.3 (Ethernet frames conform to the DIX specification)
Medium	Ethernet (10BASE-T)
Implemented protocols	TCP, IP, UDP, ICMP, ARP, DHCP, HTTP, FTP, SMTP, SNTP, Modbus, and MV-dedicated protocols
E-mail client	Automatically send e-mail when a specified event occurs such as an alarm POPbeforeSMTP authentication available
FTP client	Automatically transfer data files to the FTP server Applicable files: Display data, event data, screen image data, and report data
FTP server	Transfer files, delete files, manipulate directories, and output file lists from the MV
Web server	Shows the MV display on a Web browser.
SNTp client	Queries the SNTp server for the time and sets the MV. Cannot be used after hour 0 on January 1st, 2036.
SNTp server	Transmits the MV time. Time resolution: 5 ms Cannot be used after hour 0 on January 1st, 2036.
DHCP client	Automatically obtains the network address settings from the DHCP server
Modbus client	Reads data from another device and writes to the registers.
Modbus server	Transmits MV data
Setting/measurement server	Operate, set, and transmit data from the MV using a dedicated protocol
Maintenance/test server	Transmits connection information and network information
Instrument information server	Transmits the connected MV information (serial number, model name, etc.).

Batch Function

Item	Specifications
Function	Data management using batch names. You can enter text fields and batch comments in the data file.
Batch name	Added to the file name of the display data and event data.
Structure	Batch number (up to 32 characters) + lot number (up to 8 digits)
Text field	Adds text to the display data and event data.
Batch comment	Adds text to the display data and event data.

USB Interface

Item	Specifications
USB port	Conforms to Rev 1.1, host function
Number of ports	2 (One on the front panel and another of the rear panel)
Supplied power	5 V \pm 10%, 500 mA(per port) If the total bus power of the two ports exceeds 500 mA, the devices cannot be used simultaneously.
Connectable devices	Only connect the devices listed below. Connecting other devices may damage the MV.
Keyboard	HID Class Ver1.1 compliant 104 keyboard (US) and 109 keyboard (Japanese) Maximum number of connections: 1
External media	USB flash memory (up to 2 GB) We do not guarantee the operation of all USB flash memory devices. External media such as hard disks, ZIP, MO, and optical disks cannot be used. Maximum number of connections: 1

13.5 Options

Alarm Output Relay (/A1, /A2, /A3, and /A4)

Item	Specifications
Action	Transmits relay contact signals from the terminals on the rear panel when alarms occur.
Number of outputs	2 outputs (/A1), 4 outputs (/A2), 6 outputs (/A3), and 12 outputs (/A4)
Relay contact rating	250 VAC (50/60 Hz)/3 A, 250 VDC/0.1 A (for resistance load)
Output format	NO-C-NC
Relay operation	Energized/de-energized, AND/OR, hold/non-hold, and reflash settings are selectable.

RS-232 Interface (/C2) and RS-422/485 Interface (/C3)

Item	Specifications
Medium	EIA RS-232(/C2) or EIA RS-422/485(/C3)
Protocol	Dedicated protocol or Modbus protocol
Synchronization	Start-stop synchronization
Transmission mode (RS-422/485)	Four-wire, half-duplex, multi-drop connection (1:N (N = 1 to 32))
Data rate	1200, 2400, 4800, 9600, 19200, or 38400 bps
Data length	7 or 8 bits
Stop bit	1 bit
Parity	Odd, even, or none
Handshaking	Off:Off, XON:XON, XON:RS, and CS:RS
Communication distance (RS-422/485)	1200 m
Modbus communication	Operation modes: Master or slave

FAIL/Status Output Relay (/F1)

Item	Specifications
FAIL output	Relay contact output on CPU error
Relay operation	Energized during normal operation and de-energized on system error.
Status output	Transmits a relay contact signal when a selected condition occurs
Relay operation	Energized when a condition occurs
Relay contact rating	250 VAC (50/60 Hz)/3 A, 250 VDC/0.1 A (for resistance load)

Computation Function (including the report function) (/M1)

Item	Specifications
Number of computation channels	MV1004, MV1008, MV2008: 12 channels (101 to 112) MV1006, MV1012, MV1024: 24 channels (101 to 124) MV2010, MV2020, MV2030, MV2040, MV2048: 60 channels (101 to 160)
Operation	General arithmetic operations: Basic arithmetic, square root, absolute, common logarithm, natural logarithm, exponential, and power Relational operations: <, ≤, >, ≥, =, ≠ Logic operations: AND, OR, NOT, XOR Statistical operations: TLOG, CLOG Special operations: PRE, HOLD, RESET, CARRY Conditional operation: [a?b:c]
Computation accuracy	Double-precision floating point
Usable data	
Channel data	Measurement, computation, and external input channels (/MC1)
Constants	60 constants
Communication input data	MV1000: 24, MV2000: 60
Remote control input status	0/1 (/R1)
Pulse input	Counts the number of pulses (/PM1)
Status input	Internal switch, alarm output relay (/A[]), and flags
Rolling average:	Performs moving average on the computed results.
Measure range	–9999999 to 99999999 Decimal place: Zero to four fractional digits
Alarms	High limit, low limit, delay high limit, and delay low limit Hysteresis: High and low limit alarm: 0.0% to 5.0% of the span.
Display	Same as the measurement channels
Data saving	Same as the measurement channels
Report function	Number of report channels: same as the number of computation channels Operations: Average, maximum, minimum, sum, instantaneous value Report types: Hourly, daily, hourly + daily, daily + weekly, daily + monthly

Cu10, Cu25 RTD Input/Three-Wire Isolated RTD Input (/N1)

Item	Specifications
Function	In addition to the standard input, the MV can also receive Cu10 and Cu25 input. On the MV1006, MV1012, MV1024, MV2010, MV2020, MV2030, MV2040, and MV2048, all the RTD input terminals (A, B, and b) are isolated on each channel.
Measurement/display accuracy	Under standard operating conditions

Input Type	Measurement Range	Accuracy Guaranteed Range	Measurement Accuracy		Max. Resolution
			A/D integration time: 16.7 ms or more	A/D integration time: 1.67 ms	
Cu10 (GE)	-200 to 300°C -328 to 572°F	-70 to 170°C	(0.4% of rdg + 1.0°C)	(0.8% of rdg + 5.0°C)	0.1°C
Cu10 (L&N)		-75 to 150°C			
Cu10 (WEED)		-200 to 260°C			
Cu10 (BAILEY)		-200 to 300°C			
Cu10: α = 0.00392 at 20°C					
Cu10: α = 0.00393 at 20°C					
Cu25: α = 0.00425 at 0°C					
		(0.3% of rdg + 0.8°C)	(0.5% of rdg + 2.0°C)		

* Measuring current i = 1 mA

Input source resistance	1 Ω or less per wire (The resistance of all three wires must be equal.)
Ambient temperature influence (applies when the A/D integration time is 16.67 ms or greater)	±(0.2% of range + 2 digits) or less
Signal source resistance	With a variation of 1 Ω per wire (same resistance for all three wires): ±(0.1% of rdg + 1 digit) or less With a maximum difference of 40 mΩ between wires: Approx. 1°C

13.5 Options

Three-Wire Isolated RTD Input (/N2)

Item	Specifications
Input terminal	Isolation on each channel Applies to MV1006, MV1012, MV1024, MV2010, MV2020, MV2030, MV2040, and MV2048

Extended Input (/N3)

Item	Specifications						
Measurement/display accuracy							
Under standard operating conditions							
Input Type		Measurement Range		Measurement Accuracy			Max. Resolution
				A/D integration time: 16.7 ms or more		A/D integration time: 1.67 ms	
TC	Kp vs Au7Fe	0.0 to 300.0 K		0 to 20 K	Within 4.5 K	Within 13.5 K	0.1 K
				20 to 300 K	Within 2.5 K	Within 7.5 K	
	PLATINEL	0.0 to 1400.0°C	32 to 2552°F	(0.25% of rdg + 2.3°C)		(0.25% of rdg + 8.0°C)	0.1°C
	PR40-20	0.0 to 1900.0°C	32 to 3452°F	0 to 450°C	Accuracy not guaranteed	Accuracy not guaranteed	
				450 to 750°C	(0.9% of rdg + 3.2°C)	(0.9% of rdg + 15.0°C)	
				750 to 1100°C	(0.9% of rdg + 1.3°C)	(0.9% of rdg + 6.0°C)	
				1100 to 1900°C	(0.9% of rdg + 0.4°C)	(0.9% of rdg + 3.0°C)	
	NiNiMo	0.0 to 1310.0°C	32 to 2390°F	(0.25% of rdg + 0.7°C)		(0.5% of rdg + 3.5°C)	
	W/WRe26	0.0 to 2400.0°C	32 to 4352°F	0 to 400°C	15.0°C	30.0°C	
				400 to 2400°C	(0.2% of rdg + 2.0°C)	(0.4% of rdg + 4.0°C)	
Type N (AWG14)	0.0 to 1300.0°C	32 to 2372°F	(0.2% of rdg + 1.3°C)		(0.5% of rdg + 7.0°C)		
RTD*	Pt50	-200.0 to 550.0°C	-328.0 to 1112.0°F	(0.3% of rdg + 0.6°C)		(0.6% of rdg + 3.0°C)	0.1 K
	Ni100 (SAMA)	-200.0 to 250.0°C	-328.0 to 482.0°F	(0.15% of rdg + 0.4°C)		(0.3% of rdg + 2.0°C)	
	Ni100 (DIN)	-60.0 to 180.0°C	-76.0 to 356.0°F	(0.15% of rdg + 0.4°C)		(0.3% of rdg + 2.0°C)	
	Ni120	-70.0 to 200.0°C	-94.0 to 392.0°F	(0.15% of rdg + 0.4°C)		(0.3% of rdg + 2.0°C)	
	J263*B	0.0 to 300.0 K		0 to 40 K	Within 3.0 K	Within 9.0 K	
				40 to 300 K	Within 1.0 K	Within 3.0 K	
	Cu53	-50.0 to 150.0°C	-58.0 to 302.0°F	(0.15% of rdg + 0.8°C)		(0.3% of rdg + 4.0°C)	0.1°C
	Cu100	-50.0 to 150.0°C	-58.0 to 302.0°F	(0.2% of rdg + 1.0°C)		(0.4% of rdg + 5.0°C)	
	Pt25	-200.0 to 550.0°C	-328.0 to 1022.0°F	(0.15% of rdg + 0.6°C)		(0.3% of rdg + 3.0°C)	

* Measuring current $i = 1$ mA

Input source resistance	Thermocouple input: 2 k Ω or less RTD input: 1 Ω or less per wire (The resistance of all three wires must be equal)
Ambient temperature influence (applies when the A/D integration time is 16.67 ms or greater)	
TC input	$\pm(0.1\%$ of rdg + 0.05% of range) or less, excluding the reference junction compensation error
RTD input	$\pm(0.2\%$ of range + 2 digits) or less
Signal source resistance	
TC input	With a variation of signal source resistance +1 k Ω : ± 10 μ V or less
RTD input	With a variation of 1 Ω per wire (same resistance for all three wires): $\pm(0.1\%$ of rdg + 1 digit) or less With a maximum difference of 100 m Ω between wires: Approx. 1°C

Remote Control (/R1)

Item	Specifications
Number of input terminals	8
Input type	Isolated from the main circuitry through a photocoupler, built-in isolated power supply for the input terminals, and shared common.
Input type and signal level	
Voltage-free contact	Contact closed at 200 Ω or less and contact open at 100 k Ω or greater.
Open collector	ON voltage: 0.5 V or less (sink current 30 mA or more), leakage current when OFF: 0.25 mA or less
Allowable input voltage	5 VDC
Signal type	Level or edge (250 ms or more)
Action	Executes a specified action by applying a given signal to the remote signal input terminal Action assignment: Set using the event action function

24 VDC Transmitter Power Supply (/TPS2 and /TPS4)

Item	Specifications
Number of loops	2 (/TPS2), 4 (/TPS4)
Output voltage	22.8 to 25.2 VDC (under rated load current)
Rated output current	4 to 20 mADC
Maximum output current	25 mADC (overcurrent protection operation current: approx. 68 mADC)
Allowable conductor resistance	$RL \leq (17.8 - \text{minimum transmitter operation voltage})/0.02 \text{ A}$ where 17.8 V is the result obtained by subtracting the maximum drop voltage of 5 V, when the load shunt resistance is 250 Ω , from the minimum output voltage of 22.8 V
Max. length of wiring	2 km (when using a CEV cable)
Insulation resistance	20 M Ω or more at 500 VDC between output terminal and ground
Dielectric strength	500 VAC (50/60 Hz, I = 10mA) for one minute between output terminal and ground 500 VAC (50/60 Hz, I = 10mA) for one minute between output terminals

Pulse Input (/PM1)

Item	Specifications
Pulse input	
Number of Inputs:	3 (8 when using the remote control input terminals)
Input type	Isolated from the main circuitry through a photocoupler and built-in isolated power supply for the input terminals. Shared common for pulse inputs
Input type and signal level	Voltage-free contact Contact closed at 200 Ω or less and contact open at 100 k Ω or greater. Open collector ON voltage: 0.5 V or less (sink current 30 mA or more), leakage current when OFF: 0.25 mA or less
Counting	Counts the rising edges of pulses. For voltage-free contact input: Contact open to contact close For open collector: The H terminal voltage level changing from high to low
Allowable input voltage	30 VDC
Max. sampling pulse period	100 Hz
Minimum detected pulse width	5 ms or more for both low (closed) and high (open)
Pulse detection period	Approx. 3.9 ms (256 Hz)
Pulse measuring accuracy	± 1 pulse
Pulse count interval	Scan interval or 1 s
Miscellaneous	Pulse input terminals can be used as remote control input terminals, isolated from remote control input terminals
Remote control	Number of inputs: 5. Other items are the same as with remote control (/R1) Remote control input terminals can be used as pulse input terminals.
Computation Function	Same as the computation function (/M1)

Calibration Correction (/CC1)

Item	Specifications
Calibration correction method	Corrects the measured value of each channel using segment linearizer approximation Number of segment points: 2 to 16 (including the start and end points)

External Input Channel Function (/MC1)

Item	Specifications
Function	Loads data from other instruments by using the Modbus client or Modbus master function and displays, records, and saves the data
Number of channels	240 channels (201 to 440)
Display	Same as the measurement channels
Data saving	Same as the measurement channels
Manual sampling	Specify up to 120 channels from measurement, computation, and external input channels.

13.6 General Specifications

Construction

Item	Specifications
Material	Case: Aluminum plate (MV2000), metal plate (MV1000) Bezel: Polycarbonate
Color	Case: Smoke blue (Munsell 4.1PB6.0/4.5 or equivalent) Bezel: Light gray (Munsell 5.2PB8.2/1.0 or equivalent)
External dimensions	MV1000: 189(W) × 177(H) × 253(D) mm, 189(W) × 177(H) × 259(D) mm ^{*1} , 189(W) × 186(H) × 259(D) mm ^{*2} MV2000: 307(W) × 273(H) × 254(D) mm, 307(W) × 273(H) × 260(D) mm ^{*1} ^{*1} With clamp terminals (input terminal suffix code is -1) or pulse inputs (/PM1 option) ^{*2} Rechargeable battery model (power supply suffix code is -3)
Weight	MV1004, MV1006, MV1012: Approx. 3.3 kg, Approx. 4.5 kg ^{*1} , MV1008, MV1024: Approx. 3.5 kg, Approx. 4.7 kg ^{*1} MV2008, MV2020: Approx. 5.3 kg, MV2010: Approx. 5.2 kg, MV2030: Approx. 5.5 kg, MV2040, MV2048: Approx. 5.6 kg excluding options ^{*1} Rechargeable battery model (power supply suffix code is -3)

Normal Operating Conditions

Item	Specifications
Supply voltage	90 to 132, 180 to 250 VAC
Power supply frequency	50 Hz ± 2%, 60 Hz ± 2%
Ambient temperature	0 to 40°C, 10 to 40°C (Rechargeable battery model (power supply suffix code is -3))
Ambient humidity	20 to 80%RH (at 5 to 40°C)
Vibration	10 to 60 Hz, 0.2 m/s ²
Shock	Not allowed
Magnetic field	400 A/m or less (DC and 50/60 Hz)
External noise	Normal mode (50/60 Hz)
DC voltage	The peak value including the signal must be less than 1.2 times the measuring range.
Thermocouple	The peak value including the signal must be less than 1.2 times the measuring thermal electromotive force.
RTD	50 mV or less
Common mode noise	250 VACrms or less for all ranges (50/60 Hz)
Maximum noise voltage between channels	250 VACrms (50/60 Hz) or less
Installation position	Horizontal You can tilt the MV by bringing the front legs out.
Warm-up time	At least 30 minutes after power-on
Installation location	Indoors
Operating altitude	2000 m or less

Input Terminal (input terminal suffix code -1)

Item	Specifications
Type	Clamp terminal Attachable and detachable for each channel Recommended wire size: 0.08 mm ² to 1.5 mm ² (AWG28 to 16)

Input Terminal (input terminal suffix code -2)

Item	Specifications
Type	M4 screw

Power Supply (Power supply suffix code -1)

Item	Specifications				
Rated supply voltage	100 to 240 VAC				
Supply voltage range	90 to 132, 180 to 264 VAC				
Rated power supply frequency	50 Hz or 60 Hz				
Power consumption	MV1000/MV2000	Supply voltage	LCD backlight off	Normal	Maximum
	MV1000	100 VAC	15 VA	30 VA	45 VA
		240 VAC	25 VA	40 VA	60 VA
	MV2000	100 VAC	28 VA	40 VA	65 VA
		240 VAC	38 VA	54 VA	90 VA
Allowable interruption time	Less than 1 cycle of the power supply frequency				

Power Supply (Power supply suffix code -2)

Item	Specifications				
Rated supply voltage	12 VDC/24 VDC				
Supply voltage range	10.0 to 28.8 VDC				
Power consumption	MV1000/MV2000	Supply voltage	LCD backlight off	Normal	Maximum
	MV1000	12 VDC	7 VA	14 VA	24 VA
		24 VDC	7 VA	14 VA	23 VA
	MV2000	12 VDC	9 VA	18 VA	35 VA
		24 VDC	9 VA	18 VA	33 VA
Miscellaneous	A/D converter integration time: Fixed to 20 ms (50 Hz) if set to Auto				
When using the AC adapter					
Rated supply voltage	100 to 240 VAC				
Supply voltage range	90 to 264 VAC				
Rated power supply frequency	50 Hz or 60 Hz				
Maximum input power consumption	MV1000: 60 VA, MV2000: 90 VA				
Rated power supply frequency	48 to 62 Hz				
Power consumption	MV1000/MV2000	Supply voltage	LCD backlight off	Normal	Maximum
	MV1000	100 VAC	15 VA	30 VA	45 VA
		240 VAC	25 VA	40 VA	60 VA
	MV2000	100 VAC	28 VA	40 VA	65 VA
		240 VAC	38 VA	54 VA	90 VA
Dielectric strength	1500 VAC (50/60 Hz) for one minute between the AC adapter power supply terminal and earth				
Miscellaneous	A/D converter integration time: Fixed to 20 ms (50 Hz) if set to Auto				

Power Supply (Power supply suffix code -3)

Item	Specifications
Battery drive mode	
When the AC adapter and the battery are used in combination, the AC adapter is the primary power supply.	
Charging function	Charge mode by connecting the AC adapter, whether the power switch is ON or OFF.
Charge time	Approx. 2.5 hours
Number of times chargeable	Approx. 300 times (depends on operating conditions)
LED display	ALARM LED : Lights when the battery voltage drops
	CHARGE LED : Lights while charging, blinks when fully charged.
When using the AC adapter	
Rated supply voltage	100 to 240 VAC
Supply voltage range	90 to 264 VAC
Rated power supply frequency	50 Hz or 60 Hz
Power supply frequency	48 to 62 Hz
Rated AC adapter output voltage	19.5 V (18.0 to 20.0 V)
Maximum AC adapter output current	4.7 A

13.6 General Specifications

Item	Specifications			
Maximum input power consumption	125 VA			
Power consumption	Supply voltage	Minimum	Normal	Maximum
	100 VAC	105 VA	105 VA	115 VA
	240 VAC	105 VA	115 VA	125 VA
Dielectric strength	The operating conditions of the MV1000 and MV2000 are as follows:			
	Minimum: No USB connection, no optional terminal, back light saver ON, Auto save ON			
	Normal: No USB connection, no optional terminal, LCD brightness 2, Auto save ON			
	Maximum: No USB connection, with optional terminals, LCD brightness 8, Auto save ON			
Miscellaneous	1500 VAC (50/60 Hz) for one minute between the AC adapter power supply line and earth			
	A/D converter integration time: Fixed to 20 ms (50 Hz) if set to Auto			

Isolation

Item	Specifications
Insulation resistance	Between the Ethernet, RS-422/485, and insulation terminals and earth: 20 MΩ or greater at 500 VDC
Dielectric strength	<p>Between the power terminal and earth: 2300 VAC at 50/60 Hz for one minute</p> <p>Between the contact output terminal and earth: 1600 VAC at 50/60 Hz for one minute</p> <p>Between the signal input terminal and earth: 1500 VAC at 50/60 Hz for one minute</p> <p>Between signal input terminals: 1000 VAC (50/60 Hz) for one minute (excluding the "b" input terminal of MV1006, MV1012, MV1024, MV2010, MV2020, MV2030, MV2040, MV2048)</p> <p>Between the remote input terminal and earth: 1000 VDC for one minute</p> <p>Between the pulse input terminal and earth: 1000 VDC for one minute</p>
Ground	Grounding resistance: 100 Ω or less

Transporting and Storage Conditions

Item	Specifications
Ambient temperature	−25 to 60°C
Ambient humidity	5 to 95%RH (no condensation)
Vibration	10 to 60 Hz, 4.9 m/s ² or less
Shock	392m/s ² or less (in packaged condition)

Compliant Standards

Item	Specifications
CSA	CSA22.2 No.61010-1, installation category II, ¹ pollution degree 2, ² and measurement category II
UL	UL61010-1 (CSA NRTL/C)
CE	
EMC directive	EN61326 compliant (Emission: Class A, Immunity: Annex A) EN61000-3-2 compliant EN61000-3-3 compliant EN55011
Low voltage directive	EN61010-1, installation category II, measurement category II, ³ pollution degree 2
C-Tick	AS/NZS CISPR11 compliant, Class A Group 1

- 1 Installation category (overvoltage category) II: Describes a number which defines a transient overvoltage condition. Implies the regulation for impulse withstand voltage. "II" applies to electrical equipment which is supplied from the fixed installation like a distribution board.
- 2 Pollution degree 2: Describes the degree to which a solid, liquid, or gas which deteriorates dielectric strength or surface resistivity is adhering. "2" applies to normal indoor atmosphere. Normally, only non-conductive pollution occurs.
- 3 Measurement category II: Applies to measuring circuits connected to low voltage installation, and electrical instruments supplied with power from fixed equipment such as electric switchboards.

Standard Performance

Item	Specifications			
Measurement/display accuracy				
Standard operating conditions:				
Temperature:		23 ± 2°C		
Humidity:		55% ± 10%RH		
Power supply voltage:		90 to 132 or 180 to 250 VAC		
Power supply frequency:		50/60 Hz ± 1%		
Warm-up time:		At least 30 minutes.		
Other ambient conditions such as vibration should not adversely affect the operation.				
Input Type	Range	Measurement Accuracy (Digital Display)		Max. Resolution of Digital Display
		A/D integration time: 16.7 ms or more	A/D integration time: 1.67 ms	
DC voltage	20 mV	(0.05% of rdg + 12 digits)	(0.1% of rdg + 40 digits)	1 μV
	60 mV	(0.05% of rdg + 3 digits)	(0.1% of rdg + 15 digits)	10 μV
	200 mV			10 μV
	2 V	(0.05% of rdg + 12 digits)	(0.1% of rdg + 40 digits)	100 μV
	1-5 V	(0.05% of rdg + 3 digits)	(0.1% of rdg + 15 digits)	1 mV
	6 V			1 mV
	20 V			1 mV
	50 V			10 mV
Thermocouple • Not including the accuracy of reference junction compensation • With burnout detection function OFF	R	(0.15% of rdg + 1°C) R, S 0 to 100°C: 3.7°C, 100 to 300°C: 1.5°C B 400 to 600°C: 2°C, Accuracy not guaranteed for values less than 400°C	(0.2% of rdg + 4°C) R, S 0 to 100°C: 10°C, 100 to 300°C: 5°C B 400 to 600°C: 7°C, Accuracy not guaranteed for values less than 400°C	0.1°C
	S			
	B			
	K	(0.15% of rdg + 0.7°C) –200 to –100°C: (0.15% of rdg + 1°C)	(0.2% of rdg + 3.5°C) –200 to –100°C: (0.15% of rdg + 6°C)	
	E	(0.15% of rdg + 0.5°C)	(0.2% of rdg + 2.5°C)	
	J	–200 to –100°C: (0.15% of rdg + 0.7°C)	–200 to –100°C: (0.2% of rdg + 5°C)	
	T			
	N	(0.15% of rdg + 0.7°C)	(0.3% of rdg + 3.5°C)	
	W	(0.15% of rdg + 1°C)	(0.3% of rdg + 7°C)	
	L	(0.15% of rdg + 0.5°C)	(0.2% of rdg + 2.5°C)	
	U	–200 to –100°C: (0.15% of rdg + 0.7°C)	–200 to –100°C: (0.2% of rdg + 5°C)	
	WRe	(0.2% of rdg + 2.5°C) 0 to 200°C: 4.0°C	(0.3% of rdg + 10°C) 0 to 200°C: 18.0°C	
RTD	Pt100	(0.15% of rdg + 0.3°C)	(0.3% of rdg + 1.5°C)	
	JPt100			
DI	Voltage	Threshold level (Vth=2.4 V) accuracy ± 0.1 V		
	Contact	1 kΩ or less: 1 (ON), 100 kΩ or more: 0 (OFF) (parallel capacitance of 0.01 μF or less)		

13.6 General Specifications

Item	Specifications
Measurement accuracy when scaling	<p>Accuracy during scaling (digits) = measurement accuracy (digits) × multiplier + 2 digits (rounded up) * Fractions rounded up where the multiplier = scaling span (digits)/measuring span (digits).</p> <p>Example For 1-5 V range (A/D integration time is 16.7 ms or more), measurement span of 1.000 to 5.000 V, and scaling span of 0.000 to 2.000 The measuring accuracy for 5 V input is as follows: Measuring accuracy (1-5V range) = $\pm(0.05\% \times 5 \text{ V} + 3 \text{ digits}) = \pm(0.0025 \text{ V [3 digits]} + 3 \text{ digits}) = \pm 6 \text{ digits}$ Multiplier = {2000 digits (0.000 to 2.000)}/4000 digits (1.000 to 5.000) = 0.5 Thus, accuracy during scaling = $\pm(6 \times 0.5 + 2) \text{ digits} = 5 \text{ digits}$ (fractions rounded up)</p>
Reference junction compensation accuracy	<p>When measuring temperature greater than or equal to 0°C and when input terminal temperature is balanced Type R, S, W, WRe: $\pm 1^\circ\text{C}$ Type K, J, E, T, N, L, and U: $\pm 0.5^\circ\text{C}$ Type B: Internal reference compensation is fixed to 0°C</p>
Maximum input voltage	$\pm 60 \text{ VDC}$ (continuous)
Input resistance	<p>200 mV range or less and TC: 10 MΩ or more 2 V range or higher: Approx. 1 MΩ</p>
Input source resistance	
Volt, TC	2 k Ω or less
RTD input (Pt100)	10 Ω or less per wire (The resistance of all three wires must be equal.)
Bias current	10 nA or less (except when burnout detection function is enabled)
Maximum common mode noise voltage	250 VACrms (50 Hz/60 Hz)
Maximum noise voltage between channels	250 VACrms (50 Hz/60 Hz)
Inter-channel interference	120 dB (when the input source resistance is 500 Ω and the input to other channels is 60 VDC)
Common mode rejection ratio	
When the A/D integration time is 20 ms	120 dB (50 Hz $\pm 0.1\%$, 500 Ω unbalanced, between the minus terminal and ground)
When the A/D integration time is 16.7 ms	120 dB (60 Hz $\pm 0.1\%$, 500 Ω unbalanced, between the minus terminal and ground)
When the A/D integration time is 1.67 ms	80 dB (50/60 Hz $\pm 0.1\%$, 500 Ω unbalanced, between the minus terminal and ground)
Normal mode rejection ratio	
When the A/D integration time is 20 ms	40 dB or more (50Hz $\pm 0.1\%$)
When the A/D integration time is 16.7 ms	40 dB or more (60 Hz $\pm 0.1\%$)
When the A/D integration time is 1.67 ms	Not reject 50/60 Hz

Effects from Operating Conditions

Item	Specifications
Ambient temperature (applies when the A/D integration time is 16.7 ms or greater)	
DC voltage, TC range	With temperature variation of 10°C: $\pm(0.1\% \text{ of rdg} + 0.05\% \text{ of range})$ or less * Excluding the reference junction compensation error
RTD range	$\pm(0.1\% \text{ of rdg} + 2 \text{ digits})$ or less
Power supply fluctuation	With a fluctuation within 90 to 132 V and 180 to 250 VAC (50/60 Hz): Accuracy specifications are met. With a fluctuation of ± 2 Hz of the rated power frequency (supply voltage 100 VAC): Accuracy specifications are met.
Magnetic field	AC (50/60 Hz) and 400 ADC/m fields: $\pm(0.1\% \text{ of rdg} + 10 \text{ digits})$ or less
Signal source resistance	
DC voltage range	With a variation of source signal resistance + 1 k Ω : 200 mV range or less: $\pm 10 \mu\text{V}$ or less 2 V range or higher: $\pm 0.15\%$ of rdg or less
TC range	With a variation of signal source resistance + 1 k Ω : $\pm 10 \mu\text{V}$ or less
RTD range (Pt100)	With a variation of 10 Ω per wire (same resistance for all three wires): $\pm(0.1\% \text{ of rdg} + 1 \text{ digit})$ or less With a maximum difference of 40 m Ω between wires: Approx. 0.1°C
Effects of vibration	Effects from a sinusoidal vibration along all three axes at a frequency between 10 to 60 Hz and an acceleration of 0.2 m/s ² : $\pm(0.1\% \text{ of rdg} + 1 \text{ digit})$ or less

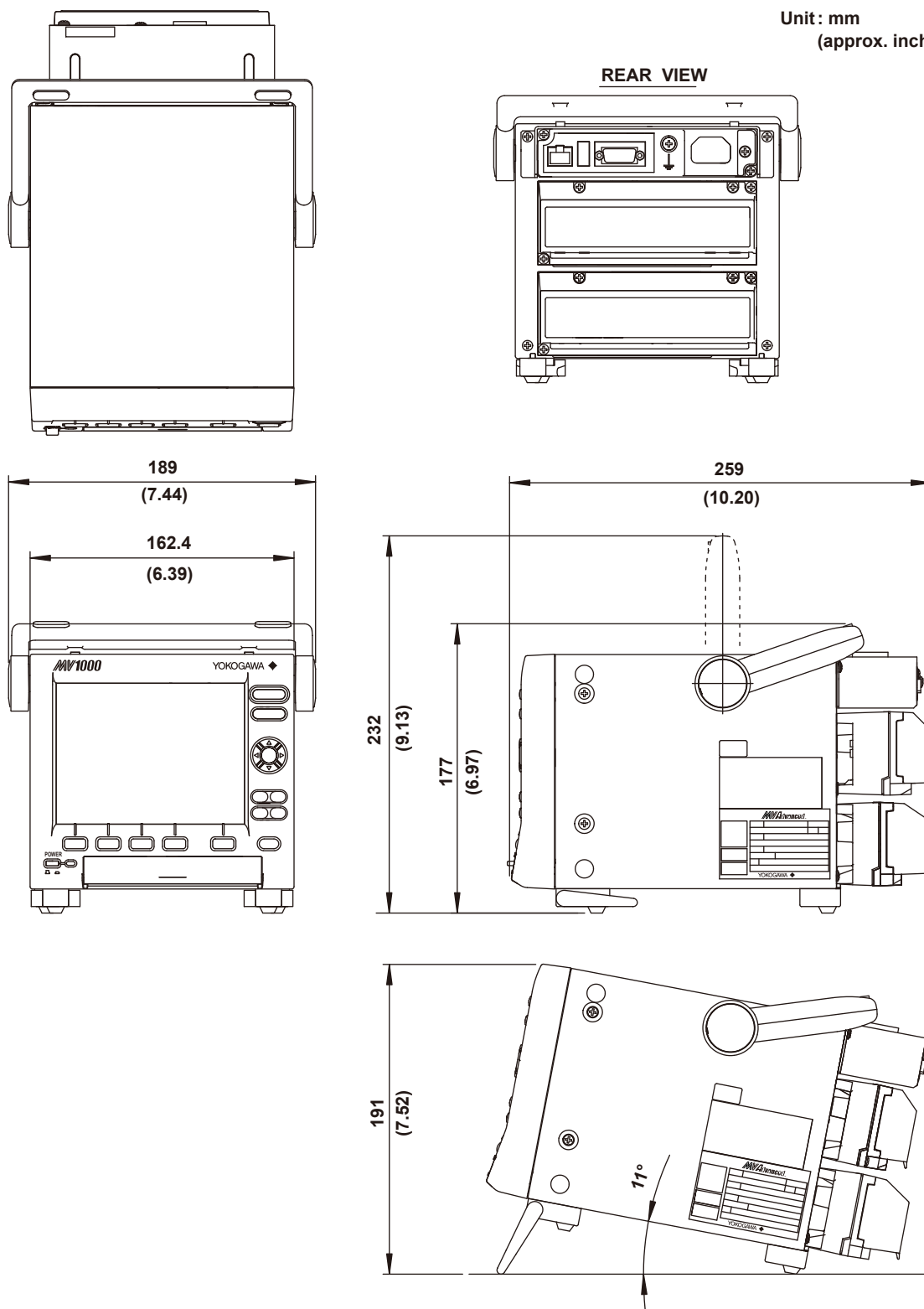
Miscellaneous

Item	Specifications
Memory backup	A built-in lithium battery backs up the settings and runs the clock Battery life: Approximately 10 years (at room temperature)
Clock	With a calendar function Time can be synchronized by using an external contact (remote control function, option). Clock accuracy: ± 10 ppm, excluding the delay at power-on (1 s or less)

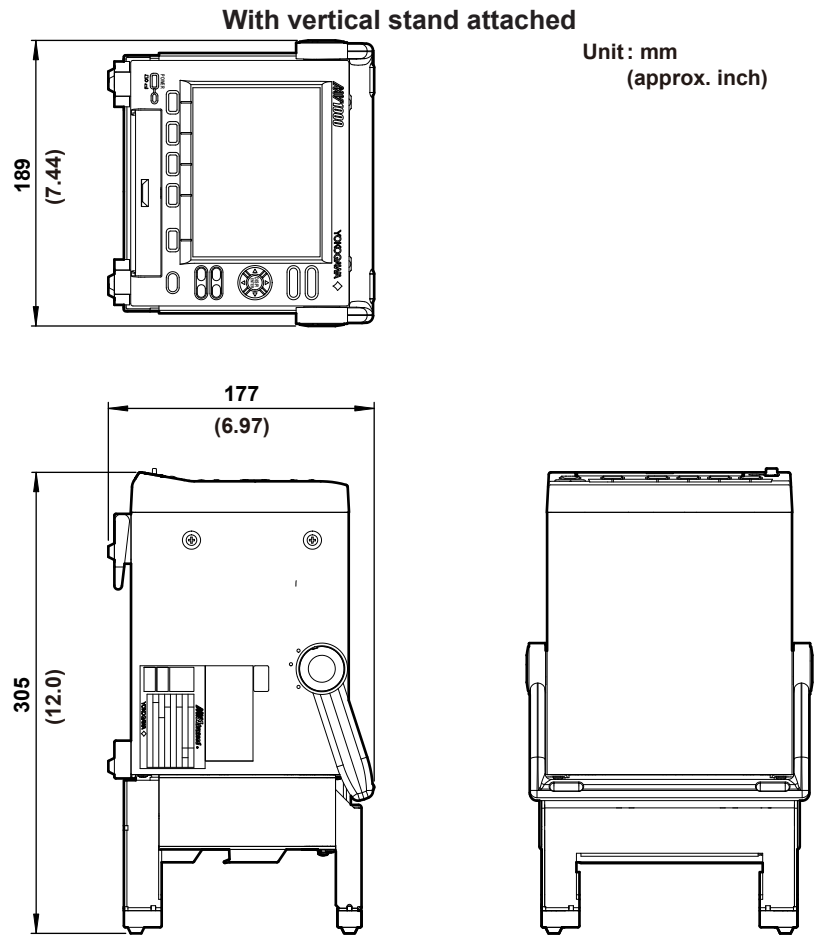
13.7 External Dimensions

MV1000

Unit: mm
(approx. inch)



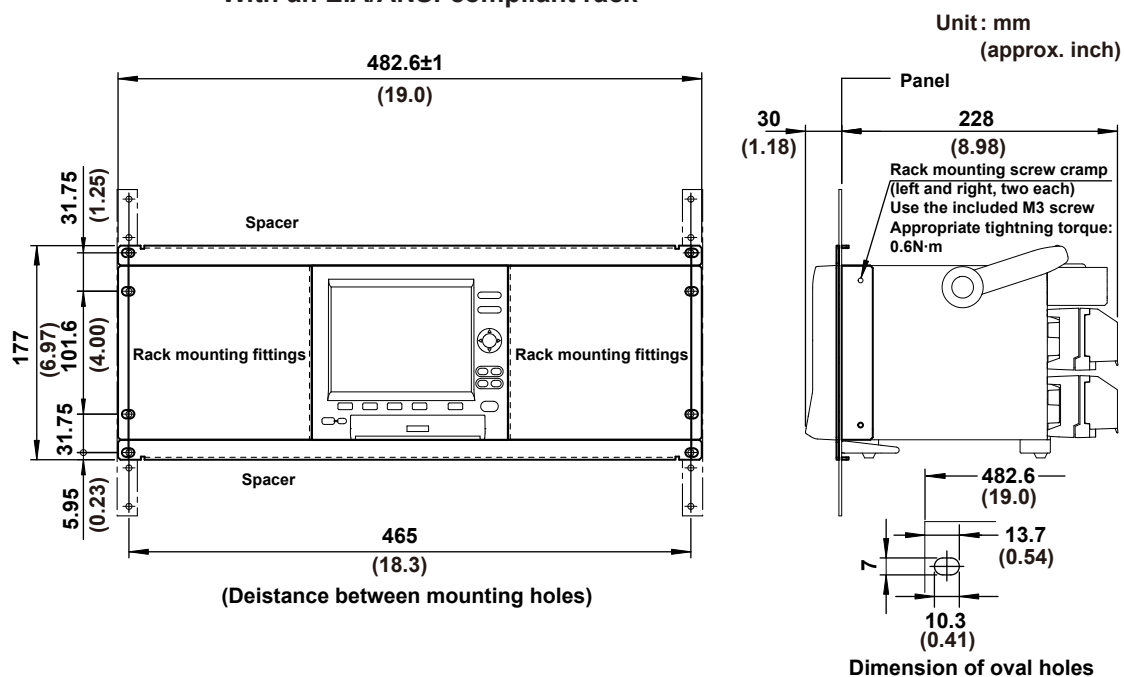
If not specified, the tolerance is $\pm 3\%$. However, in cases of less than 10 mm, the tolerance is ± 0.3 mm.



If not specified, the tolerance is $\pm 3\%$. However, in cases of less than 10 mm, the tolerance is ± 0.3 mm.

13.7 External Dimensions

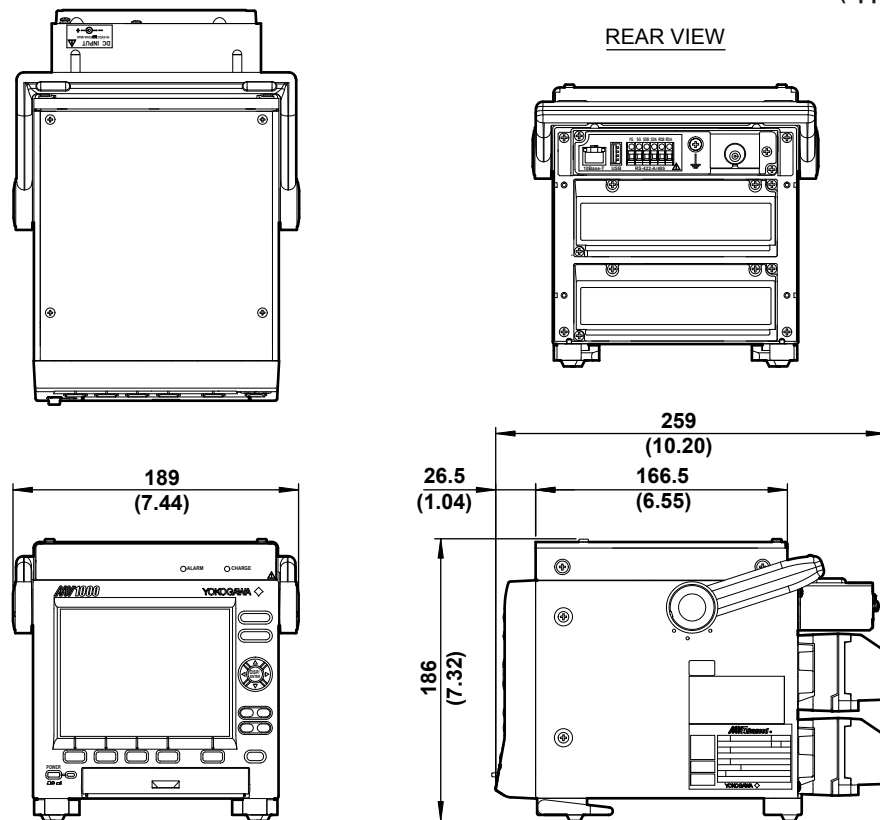
With an EIA/ANSI-compliant rack



If not specified, the tolerance is $\pm 3\%$. However, in cases of less than 10 mm, the tolerance is ± 0.3 mm.

Rechargeable Battery Model (Power supply suffix code is -3)

Unit: mm
(approx. inch)

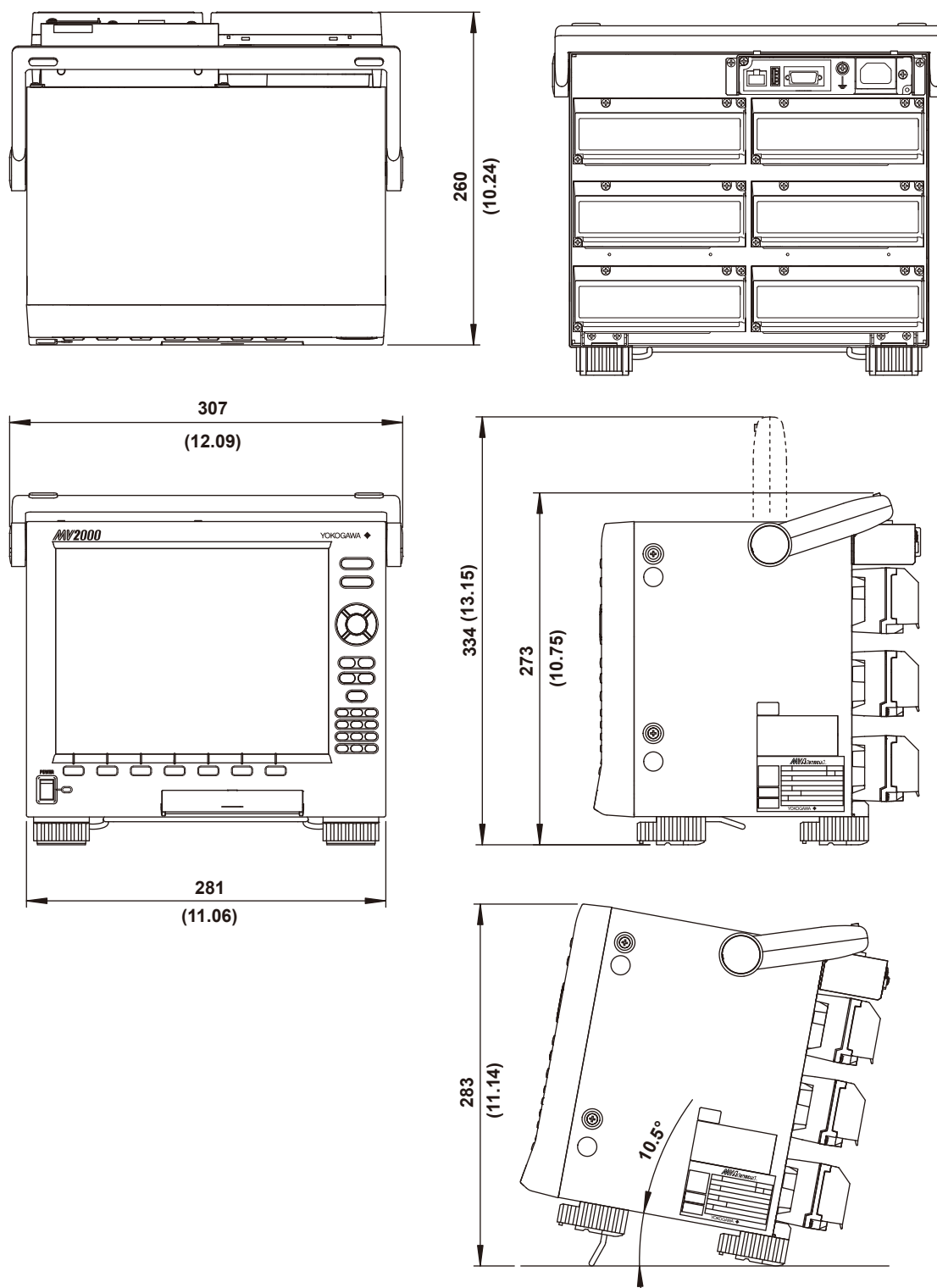


If not specified, the tolerance is $\pm 3\%$. However, in cases of less than 10 mm, the tolerance is ± 0.3 mm.

MV2000

Unit: mm
(approx. inch)

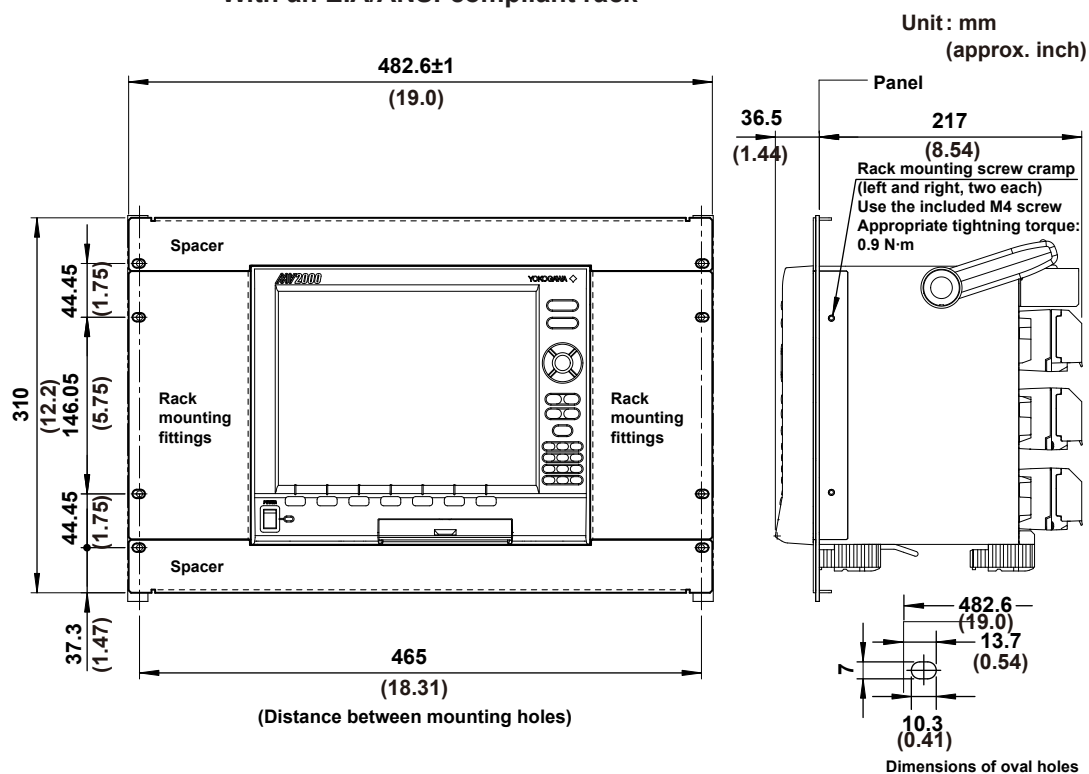
REAR VIEW



If not specified, the tolerance is $\pm 3\%$. However, in cases of less than 10 mm, the tolerance is ± 0.3 mm.

13.7 External Dimensions

With an EIA/ANSI-compliant rack



If not specified, the tolerance is $\pm 3\%$. However, in cases of less than 10 mm, the tolerance is ± 0.3 mm.

Appendix 1 Data File Size

This section explains how to calculate the file sizes of display data files and event data files. The calculation examples are for when the MV is set to record only display data or only event data. If you are recording both display and event data, calculate the data size of each and add them together.

Use the calculated file size as a rough estimate.

File Size

A file consists of the following:

sampled-data related information + sampled data

The maximum size of a single display data file or event data file is 8 MB.

Sampled-Data Related Information Size

Item	Size in Bytes
File header	216
Channel information	$88 \times N + 32$
Group information	$96 \times 10 + 32 = 992$ (MV1000) $96 \times 36 + 32 = 3,488$ (MV2000)
Message information	$104 \times 50 + 32$ (an add message area is reserved by default)
Batch information	832
Sampled data header	$80 + 32 + N \times 8 + 16 + 2$
Alarm information header	$24 + 8$ (add the size of this item even if there is no alarm)
Message information	Up to 104×1050 (varies depending on the number of messages)
Alarm information	Up to 32×5000 (varies depending on the number of alarms)

N is the number of channels (measurement channels + external input channels + computation channels).

Example 1: When recording measured data of 30 measurement channels, 240 external input channels, and 10 computation channels with no messages or alarms.

$$216 + (88 \times 280 + 32) + 3,488 + (104 \times 50 + 32) + 832 + (80 + 32 + 280 \times 8 + 16 + 2) + (24 + 8) = 36,842 \text{ bytes}$$

Sampled Data Size

• Data Sizes of Display Data and Event Data

Channel	Display Data	Event Data
Measurement channel	4 bytes/channel	2 bytes/channel
External input channel	4 bytes/channel	2 bytes/channel
Computation channel	8 bytes/channel	4 bytes/channel

Time data is added to all channels at each sampling.

Time data	8 bytes/sample
-----------	----------------

• Data Size per Sample

Display Data

(Number of measurement channels \times 4 bytes) + (number of external input channels \times 4 bytes) + (number of computation channels \times 8 bytes) + 8 bytes (time data)

Event Data

(Number of measurement channels \times 2 bytes) + (number of external input channels \times 2 bytes) + (number of computation channels \times 4 bytes) + 8 bytes (time data)

- **Sampled Data Size per File**

Display Data

Data size per sample × file save interval / sampling interval

The sampling interval is determined by dividing the Trend/Storage interval (s/div) by 30.

Example 2: When recording the display data of 30 measurement channels, 240 external input channels, and 10 computation channels with the Trend/Storage interval set to 30 min/div (display data sampling interval is 60 s) and the file save interval set to 1 day (24 h)

$$\begin{aligned} & (30 \times 4 \text{ bytes} + 240 \times 4 \text{ bytes} + 10 \times 8 \text{ bytes} + 8 \text{ bytes}) \times 24 \text{ h} \times 60 \times 60 / 60 \text{ s} \\ &= 1,168 \text{ bytes} \times 24 \text{ h} \times 60 \times 60 / 60 \text{ s} \\ &= 1,681,920 \text{ bytes} \end{aligned}$$

Event Data

Data size per sample × data length / sample rate

Example 3: When recording the event data of 30 measurement channels, 240 external input channels, and 10 computation channels with the sample rate set to 1 s and the data length set to 2 h.

$$\begin{aligned} & (30 \times 2 \text{ bytes} + 240 \times 2 \text{ bytes} + 10 \times 4 \text{ bytes} + 8 \text{ bytes}) \times 2 \text{ h} \times 60 \times 60 / 1 \text{ s} \\ &= 588 \text{ bytes} \times 2 \text{ h} \times 60 \times 60 / 1 \text{ s} \\ &= 4,233,600 \text{ bytes} \end{aligned}$$

Size of a File

The size of a file is the sum of the sampled-data related information size and the sampled data size.

Display Data

Example 4: When recording under the conditions given in examples 1 and 2

From examples 1 and 2, the size of a file is $36,842 + 1,681,920 = 1,718,762 \text{ bytes} \approx 1.639 \text{ MB}$.

Event Data

Example 5: When recording under the conditions in examples 1 and 3

From examples 1 and 3, the size of a file is $36,842 + 4,233,600 = 4,270,442 \text{ bytes} \approx 4.073 \text{ MB}$.

CF Card Recording Length

Here we will estimate how long the MV can record to a CF card when automatically saving measured data.

Display Data

CF card recording length (estimate) = (CF card size/file size)×file save interval

Example 6: We will estimate the CF card recording length under the conditions given in examples 1 and 2. We assume the CF card size to be 256 MB.

256 MB/1.639 MB×24 h
 ≈ 3,748 h
 ≈ 156 days

Event Data

CF card recording length (estimate) = (CF card size/file size)×data length

Example 7: We will estimate how often we will need to replace the CF card under the conditions given in examples 1 and 3. We assume the CF card size to be 256 MB.

256 MB/4.073 MB×2 h
 ≈ 125 h
 ≈ 5.2 days

Note

If you format a 256-MB CF card, you will be able to use approximately 246 MB.

Internal Memory Recording Length

If you are manually saving measured data to the internal memory, old data will be overwritten when the internal memory becomes full. You must save the measured data to a CF card before the data is overwritten.

Display Data

Internal memory recording length (estimate) = (Internal memory size/file size)×file save interval

Example 8: We will estimate the internal memory recording length under the conditions given in examples 1 and 2. An internal memory size is 400 MB.

400 MB/1.639 MB×24 h
 ≈ 5,857 h
 ≈ 244 days

Event Data

Internal memory recording length (estimate) = (Internal memory size/file size)×data length

Example 9: We will estimate the internal memory recording length under the conditions given in examples 1 and 3. An internal memory size is 400 MB.

400 MB/4.073 MB×2 h
 ≈ 196 h
 ≈ 8.18 days

Appendix 2 Event Action Configuration Examples

Example 1: To Start/Stop Memory Sampling by Using the Remote Control Function (/R1 Option)

We will configure the MV so that it starts or stops memory sampling when a signal is applied to remote control input terminal 2. We will use event action number 1.

- **Display and Settings**

Press **MENU** and then select **Menu tab > Timer, Event action > Event action**.

Logic box number	1
Event	Remote
Remote number	2
Action	MemoryStart/Stop

<Operation>

If you turn ON the input to remote control input terminal 2, the MV will start memory sampling (if it isn't already). If you turn OFF the input, the MV will stop memory sampling.

Example 2: To Write a Message When an Alarm Occurs

We will configure the MV so that it will write the message "Channel 1 Alarm" to group 1 when an alarm occurs on channel 1. We will use event action number 2.

- **Display and Settings**

Press **MENU** and then select **Menu tab > Timer, Event action > Event action**.

Logic box number	2
Event	Switch
Switch No.	S03
Action	Message
Message No.	4
Write to	Select
Group number	1

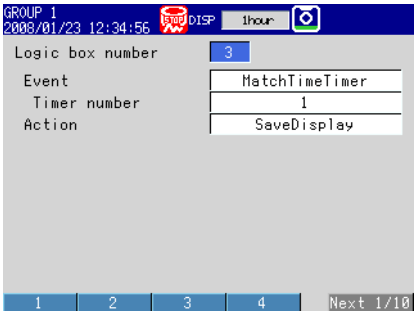
<Other Settings>

- Assign an alarm to channel 1, and configure the MV so that alarm events are sent to internal switch 3.
- Register "Channel 1 Alarm" to message number 4.
- ▶ For alarm configuration instructions, see section 3.7.
- ▶ For message registration instructions, see section 6.4.

Example 3: To Save Data Every Day at 17:00

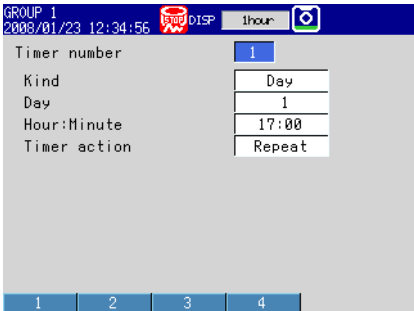
We will configure the MV so that it will store recorded data to a CF card every day at hour 17. We will use event action number 3. We will use timer number 1.

- **Display and Settings**
To set the Event Action
Press **MENU** and then select **Menu tab > Timer, Event action > Event action**.



To Configure Match Timer Number 1

Press **MENU** and then select **Menu tab > Timer, Event action > MatchTimeTimer**.



<Other Settings>

Configure the MV to automatically save display data, and set the file save interval to **1day** or longer. If you set the file save interval shorter than 1day, the MV also saves data at the file save interval.

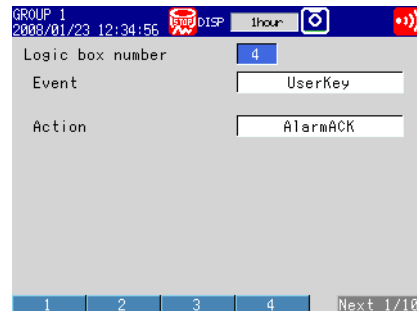
- For instructions on how to configure display data recording conditions, see section 4.1.

Example 4: To Release Alarm Output by Using the USER Key (AlarmACK Operation)

We will configure the MV so that the alarm output is released when the USER key is pressed. We will use event action number 4.

- **Display and Settings**

Press **MENU** and then select **Menu tab > Timer, Event action > Event action**.



<Operation>

Pressing USER releases an active alarm indication and relay output.

<Other Settings>

Set the alarm indication and alarm output relay operation to **Hold**.

- For instructions on how to configure the alarm indication and alarm output relay operation, see section 3.5.

Appendix 3 Text File Formats

This section explains the text file formats. The MV can generate the following text files: display data files, event data files, manually sampled data files, and report files. In the explanation below, CRLF represents a terminator.

Display Data

- If you set the display data file format to text, the MV generates a tab-separated text file that contains numeric values and text.
- The MV does not generate values for measurement channels set to Skip or for computation or external input channels set to Off.

Format

```
YRECCRLF
Measure Data      Version 1.00.00CRLF
Model             MV1000CRLF
Language Code     Shift_JISCRLF
Serial No.        III•••ICRLF
File Header       HHH•••HCRLF
File ID           N1          N2CRLF
Time Correction   TTTTCRLF
Start Info        FFF•••F   SSS•••S   JJJ•••JCRLF
End Info          FFF•••F   SSS•••S   JJJ•••JCRLF
Extra Data        PPPP      KKKK      Q1Q1Q1•••Q1   Q2Q2Q2•••Q2   •••CRLF
.....
Sampling Interval SI          UNCRLF
Trigger Point     TPCRLF
Batch Info        BI          BBB•••BCRLF
Batch Comment     (Time)     RRR•••R   GGG•••GCRLF
.....
Text InfoCRLF
Text Field        YYY•••Y   EEE•••ECRLF
.....
Ch                ccccc   ccccc   •••          ccccc   MessageCRLF
Tag               ttt•••t   ttt•••t   •••          ttt•••t   CRLF
Unit              uuuuuuu   uuuuuuu   •••          uuuuuuu   CRLF
Type              PPPP      PPPP      •••          PPPP      MessageCRLF
Kind              KKKK      KKKK      •••          KKKK      CountCRLF
Sampling DataCRLF
(Time)            nnn•••n   nnn•••n   •••          nnn•••n   sssssCRLF
.....
Message DataCRLF
(Time)            WWW•••W   SSS•••S   RRR•••RCRLF
.....
```

Appendix 3 Text File Formats

III•••I	MV serial number (16 characters)
HHH•••H	File header (50 characters)
Nx	N1 Memory start number
	N2 File serial number up to memory stop
TTTT	Time adjustment
	Done Carried out
	None Not carried out
FFF•••F	Start and stop conditions
	Manual Manually (using key operations or communications)
	Auto Auto (auto save, etc.)
	Black Out On a power failure event
	Trigger On a trigger event
SSS•••S	Start and stop trigger source or message trigger source
	None
	Key START/STOP key input
	Communication Communication input
	Remote Remote input
	Event Event occurrence
JJJ•••J	Start/end user name (up to 20 characters)
PPPP	Data type
	Meas Measurement channel data
	Math Computation channel data
	Ext External input channel data
KKKK	Maximum/minimum value
	Max Maximum value
	Min Minimum value
	Inst Instantaneous value
Q1Q1Q1•••Q1	Error data handling
	PlusOver Positive range-out
	MinusOver Negative range-out
	BurnOutUp Positive range-out due to burnout
	BurnOutDown Negative range-out due to burnout
	Error Computation error
	NoData Undefined
Q2Q2Q2•••Q2	Error data value (5 digits including the sign (measurement and external input), 10 digits including the sign (computation))
SI	Trend/Storage interval
UN	Time unit
TP	Trigger point (0 and greater, displays the trigger point number)
BI	Lot number
BBB•••B	Batch number (up to 32 characters)
RRR•••R	User name (up to 20 characters)
GGG•••G	Comments (up to 50 characters)
YYY•••Y	Title (up to 20 characters)
EEE•••E	Text (up to 30 characters)

cccc	Channel number (five characters)
ttt...t	Tag name (up to 16 characters)
uuuuuu	Unit (up to six characters)
nnn...n	Measured value (up to 10 characters)
sssss	Number of messages (up to five characters)
WWW...W	Message string (up to 32 characters)

Time Format

yyyy/mo/dd hh:mi:ss_bbb Year, month, day, and time of sampling (23 characters)

yyyy	Year
mo	Month
dd	Day
hh	Hour
mi	Minute
ss	Second
bbb	Millisecond

Event Data

- If you set the event data file format to text, the MV generates a tab-separated text file that contains numeric values and text.
- The MV does not generate values for measurement channels set to Skip or for computation or external input channels set to Off.

Format

For the format and parameters, see “Display Data.”

Manually Sampled Data

- The MV generates manually sampled data to a tab-separated text file that contains numeric values and text.
- The MV does not generate values for measurement channels set to Skip or for computation or external input channels set to Off.
- Data is added to the file each time you carry out a manual sampling operation.

Format

YRECCRLF				
Manual Sample Data	Version 1.00.00CRLF			
Model	MV2000CRLF			
Language Code	shift-JISCRLF			
File Status	ffffffffCRLF			
Serial No.	III•••ICRLF			
File Header	HHH•••HCRLF			
Ch	cccc	cccc	•••	ccccCRLF
Tag	ttt•••t	ttt•••t	•••	ttt•••tCRLF
Unit	uuuuuu	uuuuuu	•••	uuuuuuCRLF
yyyy/mo/dd hh:mi:ss	nnn•••n	nnn•••n	•••	nnn•••nCRLF
			File status (eight characters)	
			Complete	Completed
			Progress	Data being added
			Decrease	Defective
III•••I			MV serial number (16 characters)	
HHH•••H			File header (50 characters)	
cccc			Channel number (five characters)	
ttt•••t			Tag name (16 characters)	
uuuuuu			Unit (six characters)	
yyyy/mo/dd hh:mi:ss			Year, month, day, and time of sampling (19 characters)	
nnn•••n			Measured value (13 characters)	

File Output Example

Below is an example of manually sampled data for channels 1, 2, 3, and 4.

```

YREC
Manual Sample Data  Version 1.00.00
Model                MV2000
Language Code        shift-JIS
File Status          Progress
Serial No.           S5E701600
File Header
Ch                   CH001      CH002      CH003      CH004
Tag                  TI-101      OUT-102     FI-103     VA-204
Unit                 °C          V          m3/h       %
2008/01/23 08:57:22  213.8      0.517      368.4      68.9
2008/01/23 08:57:28  208.6      0.494      363.0      68.1

```

Note

- The output when error data, range-out data, or computation range-out data is detected

Channel	Data	Output
Measurement channels and external input channels	Error	(Space)
	Positive range-out (includes burnout detection)	99999
	Negative range-out (includes burnout detection)	-99999
Computation channels	Error	999999999
	Positive computation range-out (when the value exceeds approx. $3.4E+38$)	999999999
	Negative computation range-out (when the value is less than approx. $-3.4E+38$)	-999999999

- The MV generates a new manually sampled data file in the following cases:
 - A measurement channel is changed to Skip from a range other than Skip.
 - A measurement channel is changed from Skip to a range other than Skip.
 - A computation or external input channel is changed from On to Off or Off to On.
 - The unit is changed.

Report File

- The MV generates hourly, daily, weekly, and monthly reports to a tab-separated text file that contains numeric values and text.
- The MV does not generate values for measurement channels set to Skip or for computation or external input channels set to Off.
- Data is added to the file each time a file is generated.

Format

YRECCRLF				
Report Data	Version 1.00.00CRLF			
Model	MV2000CRLF			
Language Code	shift-JISCRLF			
File Status	ffffffffCRLF			
Serial No.	III...ICRLF			
File Header	HHH...HCRLF			
Report Set	RRR...RCRLF			
File Data	rrr...rCRLF			
Math Set	MMM	MMM	MMM	MMMCRLF
Start Time	YYYY/MO/DD HH:MI:SSCRLF			
Ch	cccc	cccc	...	ccccCRLF
Tag	ttt...t	ttt...t	...	ttt...tCRLF
Unit	uuuuuu	uuuuuu	...	uuuuuuCRLF
Data Type	sss...sCRLF			
Time	yyyy/mo/dd hh:mi:ssCRLF			
Status	eeeeeeeeCRLF			
Ave	nnn...n	nnn...n	...	nnn...nCRLF
Max	nnn...n	nnn...n	...	nnn...nCRLF
Min	nnn...n	nnn...n	...	nnn...nCRLF
Sum	nnn...n	nnn...n	...	nnn...nCRLF

ffffffff	File status (eight characters)
	Complete Completed
	Progress Data being added
	Decrease Defective
III...I	MV serial number (16 characters)
HHH...H	File header (50 characters)
RRR...R	Report setting (setting on the MV) (13 characters)
	Hourly
	Daily
	Hourly+Daily
	Daily+Weekly
	Daily+Monthly
rrr...r	Report file contents (13 characters)
	Hourly
	Daily
	Hourly+Daily
	Daily+Weekly
	Daily+Monthly

Example: When the MV is set to **Hourly+Daily** and **Combine**,
Hourly+Daily is output.
When the MV is set to **Hourly+Daily** and **Separate**, the
hourly report is output as **Hourly**, and the daily report as
Daily.

MMMM	Report items. Up to four types. 16 characters (including tabs that are counted as one character each).
	Ave
	Max
	Min
	Sum
	Inst Instantaneous value
YYYY/MO/DD HH:MI:SS	Report start year, month, day, and time (19 characters)
CCCCC	Channel number (five characters)
ttt...t	Tag name (16 characters)
uuuuuu	Unit (six characters)
eeeeeeeeee	Status (the events that occurred while creating report data) (10 characters)
	Bo Burnout detected
	Er Error detected
	Ov Overflow detected
	Pw Power failure
	Cg Change (time changed)
SSS...S	Report type (seven characters)
	Hourly
	Daily
	Weekly
	Monthly
yyyy/mo/dd hh:mi:ss	Report year, month, day, and time (19 characters)
nnn...n	Average, maximum, minimum, sum, or instantaneous value (13 characters)

File Output Example

Below is an example of an hourly report for four channels (with the report type set to Hourly+Daily reports and the file type set to Separate).

```

YREC
Report Data      Version 1.00.00
Model            MV2000
Language Code    shift-JIS
File Status      Complete
Serial No.       S5E701600
File Header
Report Set       Hourly+Daily
File Data        Hourly
Math Set         Ave           Max           Min           Sum
Start Time      2008/01/23 08:10:56
Ch              CH001         CH002         CH003         CH004
Tag             TI-101         OUT-102       FI-103        VA-204
Unit            °C           V            m3/h          %
Data Type       Hourly
Time            2008/01/23 09:00:00
Status
Ave             91.5           -0.039       241.1         48.6
Max             259.8          0.726        416.5         76.6
Min             -59.9          -0.727       83.4          23.3
Sum             3.293636E+05   -1.392980E+02 8.680871E+05 1.748983E+05

```

Note

- When channel data is in a condition shown in the table below, the MV outputs E_r , O_v , or B_o to the report.

Data Condition	Status
Error	E_r
Measurement and external input channels	
Positive range-out	O_v
Negative range-out	O_v
Burnout detection	B_o
Computation channels	
Positive computation range-out (when the value exceeds approx. $3.4E+38$)	O_v
Negative computation range-out (when the value is less than approx. $-3.4E+38$)	O_v

- The report output value of Ave, Max, Min, Sum, and Inst varies depending on the channel data condition as shown in the table below.

Item	Data Condition of Measurement or External Input Channels	Report Output Value
Ave	When all of the data are errors or range-outs	(Space)
Max,	• When all of the data are errors	(Space)
Min,	• Positive range-out values (includes burnout detection)	999999
Inst	• Negative range-out values (includes burnout detection)	-999999
Sum	• When all of the data are errors or range-outs	(Space)
	• When the sum value exceeds approx. $3.4E+38$	$9.999999E+99$
	• When the sum value is less than approx. $-3.4E + 38$	$-9.999999E+99$

Item	Data Condition of Computation Channels	Report Output Value
Ave	When all of the data are errors or computation range-out	(Space)
Max,	• When all of the data are errors	(Space)
Min,	• When the maximum value or instantaneous value exceeds 999999999*	999999999
Inst	• When the minimum value or instantaneous value is less than -999999999*	-999999999
Sum	• When all of the data are errors or computation range-outs	(Space)
	• When the sum value exceeds approx. $3.4E+38$	$9.999999E+99$
	• When the sum value is less than approx. $-3.4E + 38$	$-9.999999E+99$

- * The decimal place for maximum, minimum, and instantaneous values is set to the decimal place that was specified for the span setting of the expression. For example, if the span setting of the expression is 200.0, the MV outputs 999999999 when the value exceeds 9999999.9 and -999999999 when the value is less than -999999.9.

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[a?b:c]	10-11

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