DX200
S123

**DX200
S123**

CONTENTS

1. Foreword

Thank you for purchasing the DX200. This user's manual contains additional specifications for DX200 listed below. Please refer to DX200 standard user's manual (IM04L02A01-01E).

- Expandable input channel
- Daylight Saving Time
- Gradual Time Correction
- Time synchronization(SNTP)
- Addition of TC/RTD input types
- Message expansion
- Automatic monitor window recovery
- Simultaneous use of log input and Math options
- Scale display and display rate switching
- Green band and alarm mark display
- Media FIFO
- Internal switch
- Addition of Waveform Colors
- Increased Number of Characters Used in Arithmetic Expressions

2. Expandable input channel

2.1. Basic Specifications of Expandable input channel

a) This Expandable input channel is a channel specially designed for the communication input.
- The data can be taken from other devices using the Modbus master function.
- The data can be set up using the communication input command.

b) Up to 170 Expandable input channels can be used.

c) The Expandable input channel numbers are 101 to 270.

d) The number of effective bits of the Expandable input channel is 16.
- The data range is -30,000 to 30,000.

e) It is possible to set the alarm hysteresis for the alarm of the Expandable input channel in the same manner as described for the measurement channel.
- The On/Off setup of the alarm hysteresis is common to the measurement channel.
- The alarm hysteresis value is fixed at 0.5% of the span.
- The alarm hysteresis is not operated by the alarm of the mathematical alarm.

f) For alarms, only the upper/lower limit alarms and delay upper/lower limit alarms can be used.

g) The channel number setup method is changed from the setup with the function key to direct input of 3-digit channel number numeric value.

h) It is possible to refer to the Expandable input channel using the mathematical channel.

i) Table 2.1 shows the comparison between the Expandable input channel and mathematical channel referring to the communication input data.

Table 2.1 Comparison between Expandable input channel and mathematical channel

Item	Mathematical channel (Communication input data is referred to.)	Expandable input channel
Number of channels	30ch	170ch
Channel number	31 to 60 (C01 to C30)	101 to 270
Number of effective bits	32 bits	16 bits
Data range	-9,999,999 to 99,999,999	-30,000 to 30,000
Alarm hysteresis	Not provided.	Provided.
Data taking with Modbus master function	Possible	Possible
Data setup with communication command	Possible	Possible

2.1.1. Memory Save/Trend Display Setting of Expandable input channel

a) This section describes how to make the settings to save the data of the Expandable input channel into the internal memory and those to display the trend.

b) The data of the Expandable input channel you have set up is saved into the internal memory. You can save the data stored in the internal memory into external memory media.

c) The waveform of the data of the Expandable input channel you have set up is displayed on the trend display. Even though [Off] is set, the digital value, bar graph, and overview are displayed.

d) The main unit is set up using [#2 Memory, Memory and trend, Memory timeup] of [Setup mode].

e) When selecting the [#2] soft key, the screen shown in Fig. 2.1 will appear. Make the On/Off setting in the "Memory and trend" area.
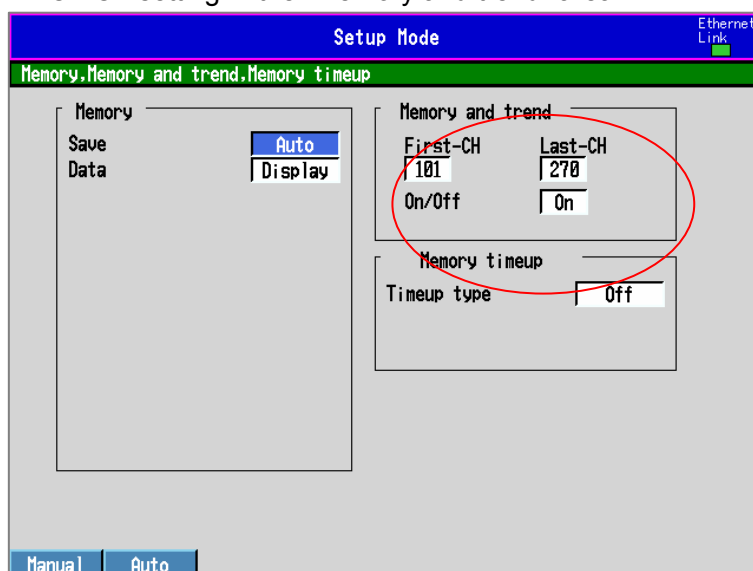
Fig. 2.1   Memory save/Trend display setup screen

<Setting on screen>

Table 2.2 Setting items of memory save/trend display setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	001 to 030 031 to 060 101 to 270	Specify an Expandable input channel number you want to set up.
2	On/Off	On, Off	Make the On/Off setting of the memory save/trend display.

<Communication command>

1. The communication command is common to the measurement channel/mathematical channel. (XS command)
2. The parameter of the channel number is specified using a 3-digit numeric value. (Continuous channels cannot be specified.)

2.1.2.   Span/alarm Setting of Expandable input channel

a)   This section describes how to make the settings related to the span and alarm of the Expandable input channel.

b)   The settings on the screen are made using [#8 Ext.ch set1] and [#9 Ext.ch set2] of [Set mode]. (Red circle portion in Fig. 2.2)
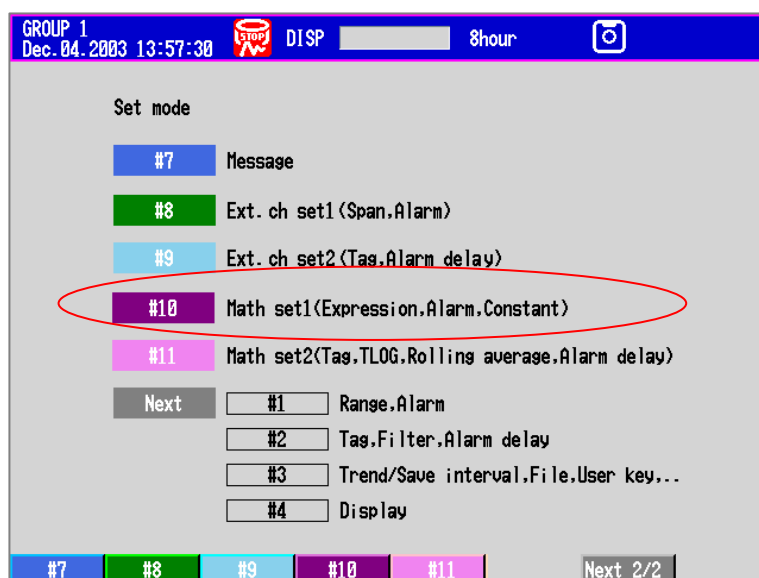
Fig. 2.2   Expandable input channel setting item selection screen

2.1.2.1.   Span setting of Expandable input channel

<Settings on screen>

Select [#8 Ext.ch set1] to set up the span of the Expandable input channel.

Table 2.3 Setting items of Expandable input channel span setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	101 to 270	Specify an Expandable input channel number you want to set up.
2	On/Off	On, Off	Make the Expandable input channel enabled or disabled.
3	Span lower limit	-30000 to 30000	Set a lower limit value of the span.
4	Span upper limit	-30000 to 30000	Set an upper limit value of the span.
5	Decimal point position	0 to 4	· Specify the decimal point position for the span upper limit value/lower limit value. · When making the setting on the screen, set the decimal point position during setting of the span lower limit value.
6	Unit	Up to 6 characters	Set a unit using up to 6 alphanumeric characters.

<Communication command>

The following special communication command is used to set up the span of the Expandable input channel.

> ER p1,p2,p3,p4,p5,p6
>
> p1: Channel number (101 to 270)
>
> p2: Expandable input channel On/Off (On, Off)
>
> p3: Span lower limit value (-30000 to 30000)
>
> p4: Span upper limit value (-30000 to 30000)
>
> p5: Decimal point position (0 to 4)
>
> p6: Unit (Up to 6 alphanumeric characters)

2.1.2.2. Alarm setting

<Settings on screen>

Select [#8 Ext.ch set1] to set up the alarm of the Expandable input channel.

Table 2.4 Setting items of alarm setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	101 to 270	Specify an Expandable input channel number you want to set up.
2	Alarm No.	1 to 4	Specify an alarm No. you want to set up.
3	On/Off	On, Off	Make the alarm enabled or disabled.
4	Alarm type	H, L, T, t	H: Upper limit, L: Lower limit T: Delay upper limit, t: Delay lower limit
5	Alarm value	-30000 to 30000	Set an alarm value within the span upper limit/lower limit value range.
6	Relay On/Off	On, Off	Make the relay output enabled or disabled.
7	Relay No.	I01 to I36	Set a relay No. for the relay output. I01 to I06, I11 to I16, I21 to I26, I31 to I36

<Communication command>

1. The communication command is common to the measurement channel/mathematical channel. (SA command)

2. The parameter of the channel number is specified using a 3-digit numeric value. (Continuous channels cannot be specified.)

2.1.2.3. Alarm Delay Time Setting

<Settings on screen>

Select [#9 Ext.ch set2] to set up the alarm delay time of the Expandable input channel.

Table 2.5 Setting items of alarm delay time setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	101 to 270	Specify an Expandable input channel number you want to set up.
2	Alarm delay time	1 to 3600 sec.	Set a period of the alarm delay time.

<Communication command>

1. The communication command is common to the measurement channel/mathematical channel. (BD command)

2. The parameter of the channel number is specified using a 3-digit numeric value. (Continuous channels cannot be specified.)

2.1.2.4. Tag Setting

<Settings on screen>

Select [#9 Ext.ch set2] to set up the tag of the Expandable input channel.

Table 2.6 Setting items of tag setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	101 to 270	Specify an Expandable input channel number you want to set up.
2	Tag name	Up to 16 characters	Set a tag name using up to 16 alphanumeric characters.

<Communication command>

1. The communication command is common to the measurement channel/mathematical channel. (ST command)

2. The parameter of the channel number is specified using a 3-digit numeric value. (Continuous channels cannot be specified.)

2.1.3. Display Setting of Expandable input channel

This section describes how to make the settings related to the display, such as Expandable input channel group setting.

1. To make the settings on the screen, select [#4 Display] of [Set mode].

2. When selecting the [#4 Display] soft key, the screen shown in Fig. 2.3 will appear. Select [#1 Group set,Trip line], [#5 Ext.ch (Color)], or [#6 Ext.ch (Zone, Graph)] to set up the display related setting items of the Expandable input channel.
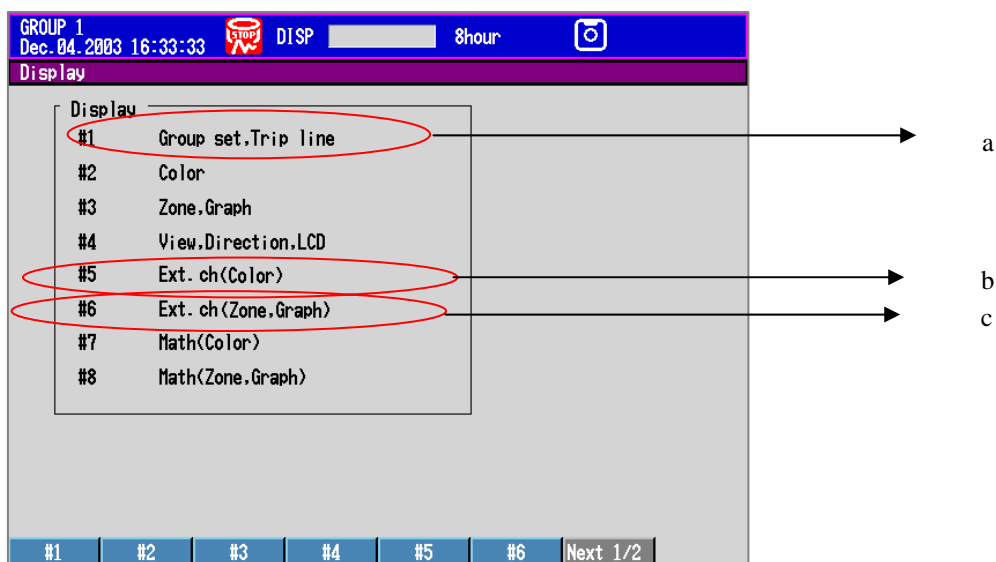
Fig. 2. 3   Display setting item selection screen

a. Assign the channel to the group.

b. Set up the display color of the Expandable input channel.

c. Set up the zone, the number of scale divisions, and the green band of the Expandable input channel.

2.1.3.1. Group Setting

<Settings on screen>

Select [#1 Group set,Trip line] to set up the group.

Table 2.7 Setting items of group setup

No.	Setting item	Setting range	Contents
1	Group No.	1 to 23	Specify a group No. you want to set up.
2	Group On/OFF	On, Off	Make the group enabled or disabled. The group you have set disabled cannot be changed on the operation screen.
3	Group name	Up to 16 characters	Set a group name using up to 16 characters.
4	Channel configuration	01 to 30 31 to 60 101 to 270	Set a channel number to be assigned to the group. Up to 10 channels can be assigned .

<Communication command>

1. The communication command is common to the measurement channel/mathematical channel. (SX command) However, "group On/Off" parameter is added.

    SX p1,p2,p3,p4

    p1: Group No. (01 to 23)

    p2: Group On/Off (On, Off)

    p3: Group name (Up to 16 alphanumeric characters)

    p4: Channel configuration (01 to 30, 31 to 60, 101 to 270)

2. The parameter of the channel number is specified using a 3-digit numeric value.

2.1.3.2.   Display Color Setting

\<Settings on screen\>

1. Select [#5 Ext.ch(Color)] to set up the display color of the Expandable input channel.

2. Select a function key assigned at intervals of 10 channels to set up the display color in units of 10 channels. (See also Fig. 2.4.)

Table 2.8 Setting items of display color setup

No.	Setting item	Setting range	Contents
1	Channel number	101 to 270	Specify a channel number you want to set up.
2	Display color	Select a desired color from those shown in the field on the right.	Set a display color for each channel. Red, Green, Blue, Blueviolet, Brown, Orange, Yellowgreen, Lightblue, Violet, Gray, Lime, Cyan, Darkblue, Yellow, ,Lightgray, Purple,Black

*   The colors you can select are common to the channel display, trip line, and green band.

\<Communication command\>

1. The communication command is common to the measurement channel/mathematical channel. (SC command)

2. The parameter of the channel number is specified using a 3-digit numeric value. (Continuous channels cannot be specified.)
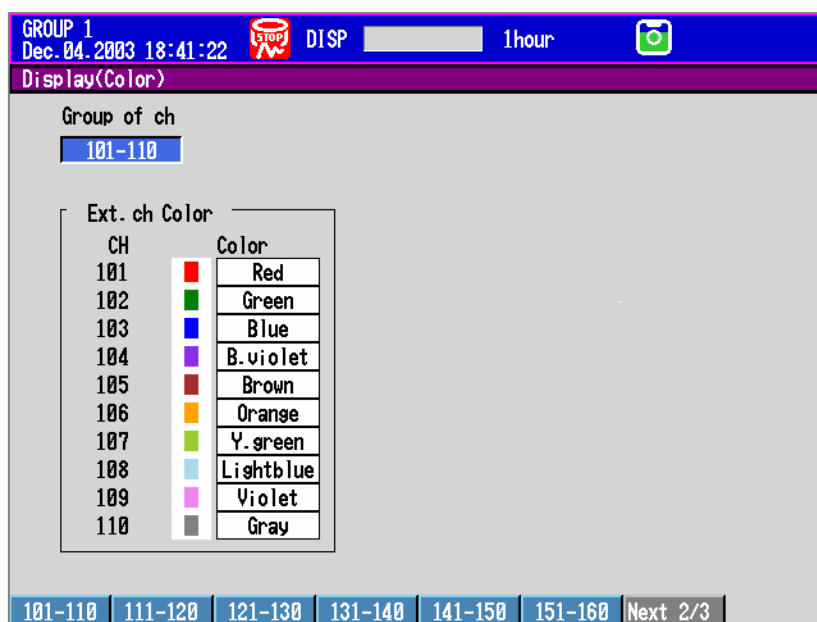
Fig. 2.4   Expandable input channel display color setting screen

2.1.3.3. Zone setting

<Settings on screen>

Select [#6 Ext.ch (Zone,Graph)] to set up the zone.

Table 2.9   Setting items of zone setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	101 to 270	Specify an Expandable input channel number you want to set up.
2	Zone lower limit position	0 to 95%	Set the zone lower limit position. Make the setting so that the zone upper limit is larger than the zone lower limit. The zone width cannot be set to a value, which is less than 5%.
3	Zone upper limit position	5 to 100%	Set the zone upper limit position.

<Communication command>

1. The communication command is common to the measurement channel/mathematical channel. (SZ command)

2. The parameter of the channel number is specified using a 3-digit numeric value. (Continuous channels cannot be specified.)

2.1.3.4.   Scale division, Bar Graph Display, and Scale Display Position Setting

<Settings on screen>

Select [#6 Ext.ch(Zone,Graph)] to set up the number of scale divisions, the bar graph display, and scale display position.

Table 2.10 Setting items of scale division, bar graph display, and scale display position setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	101 to 270	Specify an Expandable input channel number you want to set up.
2	Scale division	4 to 12, C10	Set the number of scale divisions.
3	Bar graph	NORMAL, CENTER	Set the reference position of the bar graph display.
4	Scale display position	Off, 1 to 10	Set the scale display position of the trend display.

<Communication command>

1. The communication command is common to the measurement channel/mathematical channel. (SB command)

2. The parameter of the channel number is specified using a 3-digit numeric value. (Continuous channels cannot be specified.)

2.1.3.5.   Alarm Mark Display and Green Band Setting

<Settings on screen>

Select [#6 Ext.ch(Zone,Graph)] to set up the alarm mark display and green band.

(See the red circle portion shown in Fig. 2.5.)

Table 2.11   Setting items of alarm mark display and green band setup

No.	Setting item	Setting range	Contents
1	First-CH/Last-CH	101 to 270	Specify an Expandable input channel number you want to set up.
2	Alarm mark On/Off	On, Off	Make the alarm mark on the scale enabled or disabled.
3	Green band area	Off, In, Out	Make the green band enabled or disabled. - [Off]: Green band is set disabled. - [In]: Green band is displayed inside. - [Out]: Green band is displayed outside.
4	Green band color	waveform colors selectable	Set a green band color.
5	Lower limit position of green band	0 to 99%	Set the lower limit position of the green band. Make the setting so that the green band upper limit is larger than the lower limit.
6	Upper limit position of green band	1 to 100%	Set the upper limit position of the green band.
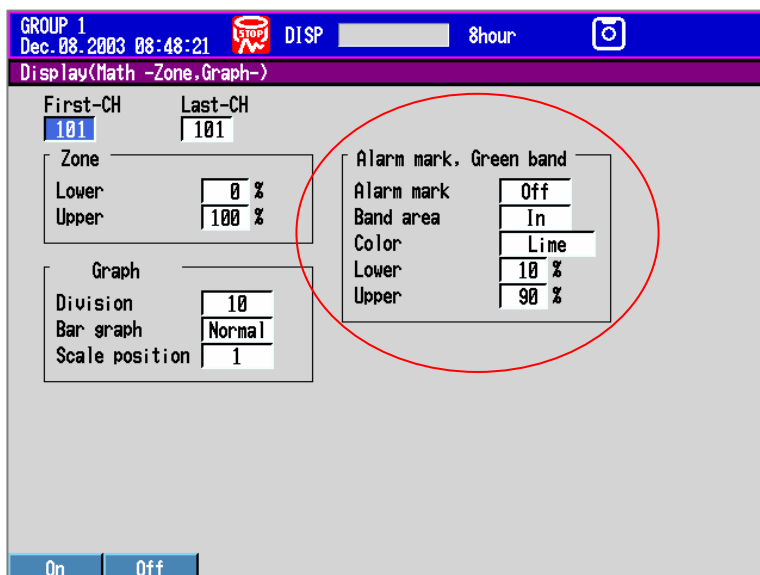
Fig. 2.5   Alarm mark display and green band setting screen

<Communication command>

The parameter of the channel number is specified using a 3-digit numeric value.
   (Continuous channels cannot be specified.)

   QH p1,p2,p3,p4,p5,p6

   p1:   Channel number (001 to 030, 031 to 060, 101 to 270)

   p2:   On/Off setting of alarm mark on scale (ON, OFF)

   p3:   Green band is enabled or disabled. (OFF, IN, OUT)

   p4:   Green band color

   p5:   Lower limit position of green band (0 to 99)

   p6:   Upper limit position of green band (1 to 100)

2.1.4. Communication Input of Expandable input channel

You can set up data for Expandable input channels using the command specially designed for the Expandable input channel.

CE p1,p2

    p1:   Expandable input channel number (101 to 270)

    p2:   Setting data (For details about data setting range, see Table 10.12)

Table 2.12 Expandable input channel and communication input data setting range

Input type	Channel number	Communication command	Set data setting range
Expandable input channel	101 to 270	CE	-30,000 to 30,000
Communication input data	C01 to C30	CM	-9.9999E+29 to -.0000E-30, 0, 1.0000E-30 to 9.9999E+29

2.1.5. Sending of E-mail about Expandable input channel Data

a) You can add the instantaneous value data of the Expandable input channel to the E-mail.

• The data of the Expandable input channel can be sent by making the setting to add the instantaneous value data enabled.

• The setting to add the instantaneous value data is common to the measurement/mathematical channel.

b) When the setting to send the alarm information is set enabled, the E-mail is sent every time the Expandable input channel alarm occurs or the alarm is reset.

2.1.6. Limitations on Expandable input channel

a) You cannot set up the Expandable input channel for the report function.

b) The data of the Expandable input channel cannot be output to the TLOG data or manual sample data.

2.2. Memory Specifications

With this special specification, the size of the internal memory used to store the display/event data is increased by about 4 times larger that that of the standard specification.

2.2.1. Number of display/event data and data write time

a) The size of the area, into which the display/event data is stored, is 5,000,000 bytes. (With the standard specification, this size is 1,200,000 bytes.)

b) The following describes the number of display/event data, which can be stored into the internal memory, as well as data write time.

2.2.1.1. Number of bytes per channel

a) For the display data, the minimum value and maximum value are stored at sampling intervals.

b) For the event data, the instantaneous value is stored at sampling intervals.

c) The time information (8 bytes) is added at sampling intervals.

d) Table 2.13 shows the number of data bytes per channel.

Table 2.13 Number of bytes per channel

Data type	Measurement channel	Mathematical channel	Expandable input channel
Display data	4 bytes/channel	8 bytes/channel	4 bytes/channel
Event data	2 bytes/channel	4 bytes/channel	2 bytes/channel

2.2.1.2. Maximum number of data points per channels

The number of sampling cycles you can save into the internal memory can be calculated from the type of data to be stored into the internal memory and the number of measurement, mathematical, and/or Expandable input channels.
The following Table shows how to calculate the maximum number of sampling cycles.

Table 2.14 Maximum number of data points per channels

Data type	Maximum number of data points per channels
Display data only	5,000,000 bytes/(Number of measurement channels *4 + Number of mathematical channels *8 + Number of Expandable input channels *4 + 8)
Event data only	5,000,000 bytes/(Number of measurement channels *2 + Number of mathematical channels *4 + Number of Expandable input channels *2 + 8)
Display and event data	Display data: 3,750,000 bytes/(Number of measurement channels *4 + Number of mathematical channels *8 + Number of Expandable input channels *4 + 8)
	Event data: 1,250,000 bytes/(Number of measurement channels *2 + Number of mathematical channels *4 + Number of Expandable input channels *2 + 8)

2.2.1.3. Maximum sampling length

The maximum time to save data into the internal memory is calculated from the following expression.

Maximum sampling length = Maximum number of data points * Sampling interval

2.2.1.4. Calculation example of maximum sampling length

<Display data only>

- Number of measurement channels: 30, Number of mathematical channels: 30, Number of Expandable input channels: 170
- Maximum number of data points = 5,000,000 / (30*4 + 30*8 + 170*4 + 8) = 4,770 data
- Maximum sampling length (Display refresh interval = 1 min./div. (Sampling interval is 2 sec.))

  4,770 data * 2 sec. = 9,540 sec. (2 hrs. and 39 min.)

<Event data only>

- Number of measurement channels: 30, Number of mathematical channels: 30, Number of Expandable input channels: 170
- Maximum number of data points = 5,000,000 / (30*2 + 30*4 + 170*2 + 8) = 9,469 data
- Maximum sampling length (Event data sampling interval is 1 sec.)

  9,469 data * 1 sec. = 9,469 sec. (2 hrs. and 37 min.)

2.2.2. Number of Alarm Data

The number of alarm data to be stored into the internal memory is 400 data.

Table 2.15 Number of alarm/message data to be stored into internal memory

Data type	Standard specification	Special specification
Alarm data	120	400
Message data	100	100

2.3. Modbus Specifications

2.3.1. Overview of Modbus Functions

2.3.1.1. Modbus slave

The following functions are provided on the master device.

a) Reading of measurement channel data

b) Reading of mathematical channel data

c) Reading/writing of communication input data

d) Reading/writing of Expandable input channel data

2.3.1.2. Modbus master

The following accesses can be made to the register of the slave device.

a) The data in the hold register is read to the communication input data periodically.

b) The data in the hold register is read to the Expandable input channel periodically.

c) The data in the input register is read to the communication input data periodically.

d) The data in the input register is read to the Expandable input channel periodically.

2.3.1.3. Mounted protocols

The following protocols are mounted.

a) Modbus/RTU master

b) Modbus/RTU slave

Note

- The Modbus/RTU master and Modbus/RTU slave cannot be used at the same time.
- The Modbus/TCP is not supported.

2.3.1.4. Applied models

To use the Modbus communication function, the following options are required.

a) Serial option

b) Mathematical option:The mathematical option is required for the following functions.

1. Slave: The data and alarm status of the mathematical channel are read.

2. Master: The data is input to the communication input channel.

2.3.1.5. Physical layer specifications

a) The Modbus/RTU uses the serial I/F as physical layer.

b) Table 2.16 shows the serial I/F specifications.

Table 2.16 Serial I/F specifications

Specifications	Contents
Transmission media	RS232 or RS422/485
Flow control	None (Fixed.)
Baud rate	Selected from 1200, 2400, 4800, 9600, 19200, or 38400.
Start bit	Fixed at "1 bit".
Stop bit	Fixed at "1 bit".
Parity	Selected from "none", "even", or "odd".
Data length	Fixed at "8 bits".

2.3.2. Modbus Slave Specifications

2.3.2.1. Modbus/RTU slave specifications

A slave address can be selected from 1 to 32.

2.3.2.2. Support functions of Modbus slave

Table 2.17 shows the function codes of Modbus slave functions supported by DX.

Table 2.17 Support functions of Modbus slave

Function code	Function	Contents
3	Reading the hold register (4xxxx)	The master device reads the communication input data, which has been written using function code 6 or 16.
4	Reading the input register (3xxxx)	The master device reads the data of the measurement, computation, and Expandable input channels of DX.
6	Writing to the hold register (4xxxx)	The master device writes the data to the communication input data of DX.
8	Loopback test	The master device performs the loopback test of DX.
16	Writing to the hold register (4xxxx)	The master device writes the data to the communication input data of DX.

2.3.2.3. Register assignments of Modbus slave

Table 2.18 shows the register assignments of the Modbus slave.

Bolded portions show the functions added to the special Expandable input channel specifications.

Table 2.18 Register assignments of Modbus slave

Input register	Contents	Description
30001 to 30030	Measured data of 01ch to 30ch	Signed 16-bit integer value Decimal point and unit are not included.
31001 to 31030	Alarm status of 01ch to 30ch	1 register is used for 1 channel. Alarm status is stored in the order of alarm level, 2→1→4→3.
32001 to 32060	Computed data of 31ch to 60ch	Signed 32-bit integer value 2 registers are used for 1 channel. The data is stored in the order, from the upper level to the lower level.
33001 to 33030	Alarm status of computation channels 31ch to 60ch	1 register is used for 1 channel. Alarm status is stored in the order of alarm level, 2→1→4→3.
34001 to	Data of communication input data C01 to C30	Reserved for Expandable input channel.
35001 to 35170	Alarm status of Expandable input channels, 101ch to 270ch.	1 register is used for 1 channel. Alarm status is stored in the order of alarm level, 2→1→4→3.
39001 to 39008	Time stamp	Data is stored in the order of year, month, day, hr., min., sec., msec., and DST.

Hold register	Contents	Description
40001 to 40030	Data of communication input data C01 to C30	Signed 16-bit integer value (This value is handled as floating point value internally.) ·When reading, the value is read with it converted into a signed 16-bit integer value. ·When writing, only singed 16-bit integer can be written. The floating point value cannot be written.
41001 to 41170	Data of Expandable input channels, 101ch to 270ch	Signed 16-bit integer value The decimal point and unit are not included.

Note

Register numbers, 34001 to 34170 are measured data for expansion channels.

Use these register numbers for reading data.

Register numbers, 41001 to 41170 are for writing to expansion channels/ When reading

the register numbers, written data can be read.*

* : When value of range is over, errors are given.

Error code for data of +30000 or more: 7FFFH

Error code for data of -30000 or less: 8001H

2.3.3.   Modbus Master Specifications

2.3.3.1.   Basic specifications of Modbus master

a) The Modbus master sends the command to each slave device at set intervals.

b) Commands to be supported are read from the hold/input register.
     (See Table 2.19)

1. The hold/input register is a 16-bit register. The data type and contents may depend on each slave device.

2. The data is read from the register of the slave device by considering the data type, and then it is input to the communication input data as float-type data.

3. The data is read from the register of the slave device by considering the 16-bit and 32-bit integer type data, and then it is input to the Expandable input channel as 16-bit integer type data.

4. If data exceeding the 16-bit integer range is input to the Expandable input channel, it is handled as over-range data.

Up to 8 commands per measurement can be registered.

There are some limitations for number of registers to be read by a command.

When reading data is 16 bit, up to 125 registers can be read.

When reading data 1s 32 bit, up to 62 registers can be read.

Table 2.19   Support functions of Modbus master

Function code	Function	Contents
3	Reading the hold register (4xxxx, 4xxxxx)	DX reads the data in the hold register of the slave device to the communication input data (C01 to C30) or Expandable input channel (101 to 270).
4	Reading the input register (3xxxx, 3xxxxx)	DX reads the data in the input register of the slave device to the communication input data (C01 to C30) or Expandable input channel (101 to 270).

2.3.3.2. Example of Modbus master connection

Fig. 2.6 shows an example of connection with Modbus/RTU.

a) Signed 16-bit integer data allocated to the "30001" register of the device A having register slave address 7 is input to the communication input data C01.

b) Signed 32-bit integer data allocated to the "30001" and "30002" registers of the device B having slave address 9 is input to the communication input data C02.

c) Signed 16-bit integer data allocated to the "30001" and "30002" registers of the device C having slave address 10 is input to the Expandable input channels 101 and 102.

d) Signed 32-bit integer data allocated to the "30001" and "30002" registers of the device D having slave address 20 is input to the Expandable input channel 103.
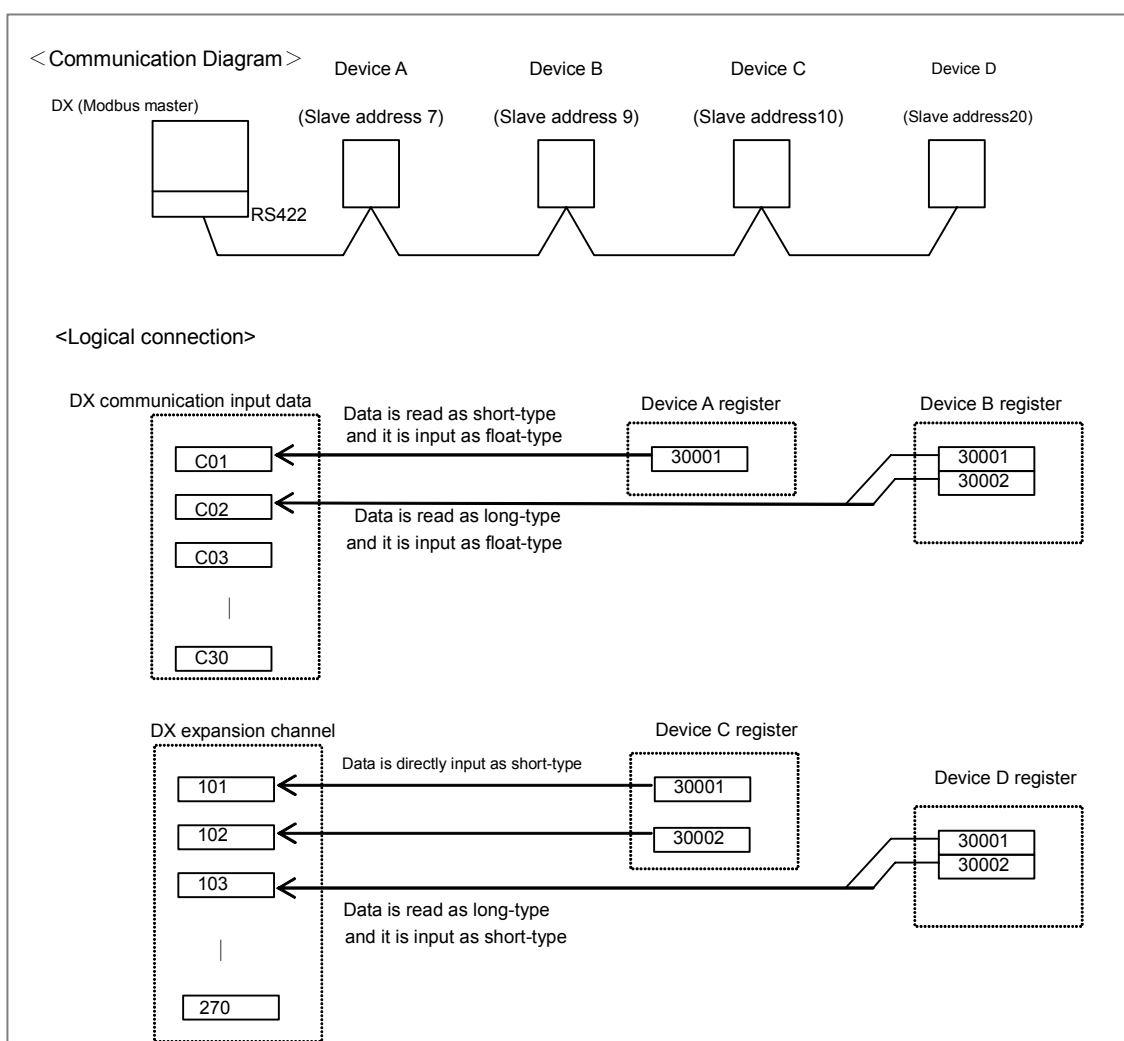
.

Fig. 2.6   Example of Modbus master connection

2.3.3.3. Data types of Modbus master

Table 2.20 shows the data types of the register of the slave device, which can be specified by the Modbus master.

Table 2.20   Data types of slave device specified by Modbus master

Data type	Description
INT16	Signed 16-bit integer type
UINT16	Unsigned 16-bit integer type
INT32_B	Signed 32-bit integer type using two registers, upper 16 bits and lower 16 bits, in that order
INT32_L	Signed 32-bit integer type using two registers, lower 16 bits and upper 16 bits, in that order
UINT32_B	Unsigned 32-bit integer type using two registers, upper 16 bits and lower 16 bits, in that order
UINT32_L	Unsigned 32-bit integer type using two registers, lower 16 bits and upper 16 bits, in that order
FLOAT_B	Signed 32-bit floating point type using two registers, upper 16 bits and lower 16 bits, in that order
FLOAT_L	Signed 32-bit floating point type using two registers, lower 16 bits and upper 16 bits, in that order

Table 2.21   Data types of slave device, which can be set by Modbus master

Channel of DX	Data types of slave device, which can be set by DX
Communication input data (C01 to C30) (32-bit floating point type)	INT16, UINT16, INT32_B, INT32_L UINT32_B, UINT32_L, FLOAT_B, FLOAT_L
Expandable input channel (101 to 270) (Signed 16-bit integer type)	INT16, UINT16,INT32_B, INT32_L UINT32_B, UINT32_L

2.3.3.4. Setting items

Table 2.22 shows the setting items of the Modbus/RTU master.

(The underlined values show the initial set values.)

Table 2.22 Setting items of Modbus/RTU master

Setting item	Modbus/RTU
Communication interval	125ms, 250ms, 500ms, 1s, 2s, 5s, 10s
Command time-out	125ms, 250ms, 500ms, 1s, 2s, 5s, 10s, 1min
Command retry	off, 1, 2, 3, 4, 5, 10, 20
Command wait time	NoWait, 15ms, 45ms, 100ms This setting is needed when communicating by two-wired system.
Auto recovery from communication stop	Off, On
Interval of auto recovery	1min, 2min, 5min, 10min, 20min, 30min, 1h

<Supplemental description>

a) Command wait time

- When communicating by two-wired system, the communication device switches between the master (DX) and each slave device through the half-duplex communication.

  Therefore, there are some cases that the signals of the drive devices collides with each other. If the communication through two RS485 lines does not function correctly, this setting must be adjusted.

- The communication through two RS485 lines is also improved by changing the baud rate.

2.3.3.5. Modbus master setting of Modbus/RTU

Fig. 2.7 shows an example of the Modbus master setup screen of the Modbus/RTU.
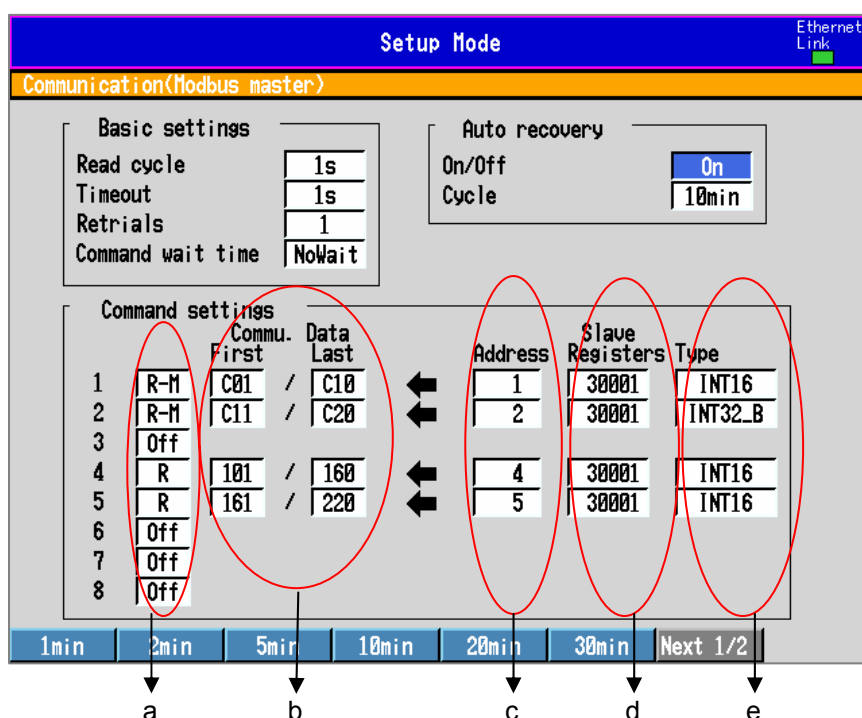
Fig. 2.7   Modbus master setting screen of Modbus/RTU

Table 2.23 Description of Modbus master setting of Modbus/RTU

Command (Fig. 7:a)	Input channel number (Fig. 7:b)	Slave address (Fig. 7:c)	Slave register (Fig. 7:d)	Data type (Fig. 7:e)

<Supplemental description>

a) Command

- To set up Expandable input channels, select the command [R].
- To set up the communication input data, select the command [R-M].
  ([R-M] can be selected only when the calculation option is added.)

b) Input channel number

- For the case of [INT16] or [UINT16] data type, up to 125 channels (registers) can be set.
- For the case of except [INT16] or [UINT16] data type, up to 62 channels (registers) can be set.

2.4. Auto Recovery Function of Modbus Master

2.4.1. Basic Specifications of Modbus Master Auto recovery

a) Auto recovery function, which functions if the communication is disconnected by communication fail or faulty slave device, is built-into the Modbus master function.

b) The Modbus master auto recovery is set up using the communication setup "Modbus master" in the setup mode. When using the auto recovery function, an auto recovery cycle is set at the same time.

c) The Modbus master auto recovery function is performed at intervals of cycles set in from the hour (zero minute position). The auto recovery is performed for all connected slave devices.

2.4.2. Auto Recovery Setting of Modbus Master
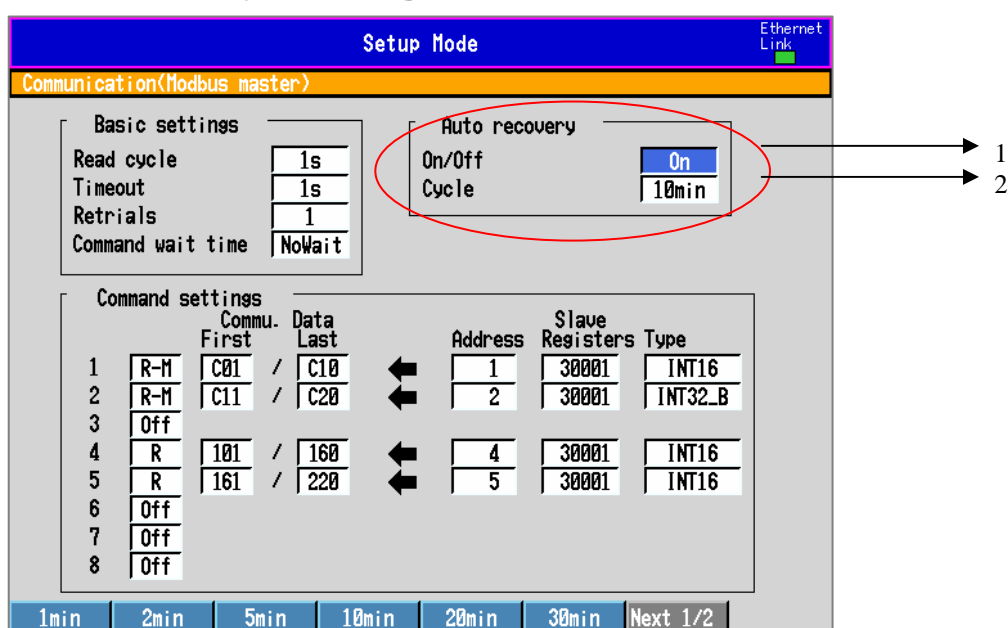
Fig. 2.8 Modbus master setup screen
Table 2.24 shows the setting items of the Modbus master auto recovery.

Table 2.24   Setting items of Modbus master auto recovery

No.	Setting item	Setting range	Contents
1	On, Off	On, Off	Set whether or not the auto recovery function is used. When selecting [On], items used to set the auto recovery cycle are displayed.
2	Cycle	1min, 2min, 5min, 10min, 20min, 30min, 1h	When using the auto recovery function, set an auto recovery cycle.

2.4.3. Communication Command of Modbus Master Auto Recovery

The following shows the communication command to set the Modbus master auto recovery.

MM p1,p2

p1:   Auto recovery function On/Off (On/Off)

p2:   Auto recovery cycle (1min/2min/5min/10min/20min/30min/1h)

2.5. Monitor Display

2.5.1. Number of Display Groups

a) The number of display groups to be used by the DX main unit is 23.

b) Up to 10 channels can be assigned to a group, the same as the standard specifications. You can select whether the group is enabled (On) or disabled (Off).

   When the setting to change the display group automatically is set enabled, groups, which are set disabled, are not displayed.

c) Up to 23 groups can be displayed on the following monitor screens.

1. Trend display
2. Digital value display
3. Bar graph display
4. Historical display

d) In operator mode of Web server function, up to 23 groups can be switched.

2.5.2. Overview Display

a) The list of measurement values and alarm statuses of all channels can be displayed.

b) The maximum number of channels to be displayed (total number of following channels) is 230ch.
1. Measurement channels, 30ch
2. Mathematical channels, 30ch
3. Expandable input channels, 170ch

c) Move the cursor to select a channel. The trend or bar graph of the group including the channel you have selected can be displayed.

d) The data display is updated at measurement interval (1 sec. or 2 sec.).

e) When the setting is made so that the tag name is displayed, the tag name is displayed.
1. The number of tag name characters, which can be displayed, may vary depending on the number of channels to be displayed.
2. To check and display all set tag names (up to 16 characters), press the [ESC] key. The tag name is scrolled by selecting the [ESC] key.

f) The data of the channel with the internal memory save setting at "Off", is also isplayed.

g) The data of the following channels is not displayed.

1. Measurement channel, which is set at "SKIP".

2. Mathematical channel, which is set at "Calculation Off".

3. Expandable input channel, which is set at "Off".

2.5.3. Historical Trend Display

a) There are four kinds of methods to display the historical trend of the display data or event data in the internal memory as described below.

1. Displayed from the alarm summery.

2. Displayed from the message summery.

3. Displayed from the memory summery.

4. Displayed from the screen menu.

b) The data type to be displayed when the historical trend is displayed from the alarm summery or message summery is determined by means of the method that writes the data into the internal memory.

1. "Display data only": Display data

2. "Event data only": Event data

3. "Display data and event data": Data type selected from the memory summery.

c) The data type, which is displayed when the historical trend is displayed from the memory summery, is the data of the data type selected from the memory summery.

d) The data type, which is displayed when the historical trend is displayed from the screen menu, is determined by means of the method to write the data into the internal memory.

1. "Display data only": Display data

2. "Event data only": Event data *

3. "Display data and event data": Display data

* This item is different from the standard DX specification.

2.5.4. Data Display on Web

a) Up to 230ch data can be displayed using the [All-channel] display function on Web.

b) The data of the following channels is not displayed.

1. Measurement channel, which is set at "SKIP".

2. Mathematical channel, which is set at "Calculation Off".

3. Expandable input channel, which is set at "Off".

3. Changing of DST (Daylight saving time) setting method

3.1. Overview

By setting the month, day of the week, week, and time, it becomes unnecessary to set the DST every time the system is started up.

3.2. DST Setting

The DST is set on the screen in the set mode.
When selecting the [DST] soft key, the DST setup screen (see Fig. 3.1) will appear.
On this screen, the specified DST can be set.
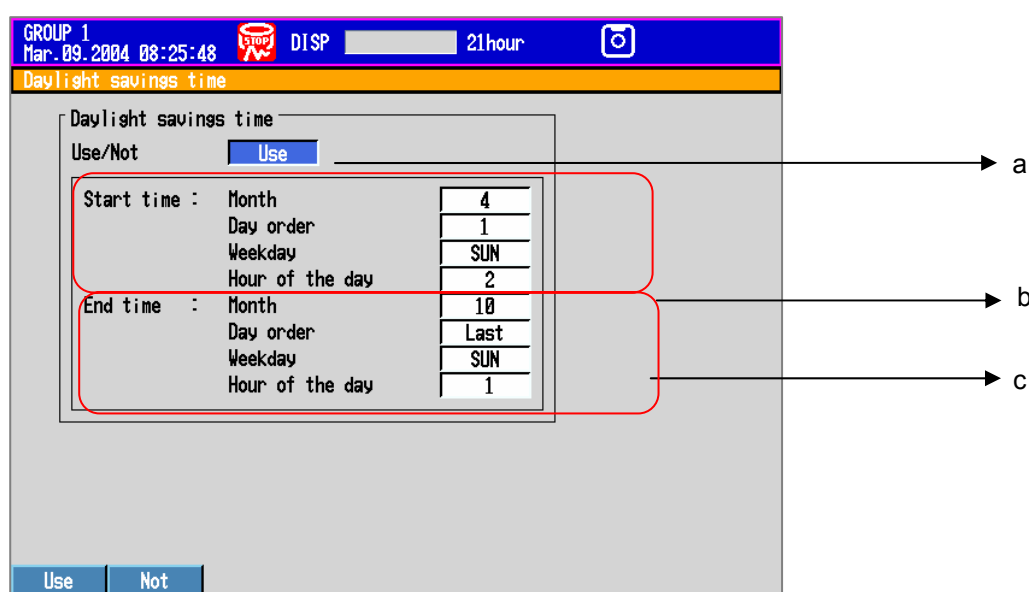
Fig. 3.1   DST setup

a) DST Use/Not setting
- To use the DST, select [Use].
- When selecting [Use], the summer time/winter time setting item screen will appear.

b)   DST setting (Start time)
1. [Month]:
   A month to change the time system to the DST is set. (1 to 12)
2. [Day order]:
   Where the day of the week to change the time system to the DST ranks in the month is set.
   ([1], [2], [3], [4], [Last])
3. [Weekday]:
   The day of the week to change the time system to the DST is set. (Sunday to Saturday)
4. [Hour of the day]:

An hour to change the time system to the DST is set. (0 to 23)

c) Winter time setting (End time)

1. [Month]:A month to change the time system to the winter time is set. (1 to 12)

2. [Day order]:

Where the day of the week to change the time system to the winter time ranks in the month is set. ([1], [2], [3], [4], [Last])

3. [Weekday]: The day of the week to change the time system to the winter time is set. (Sunday to Saturday)

4. [Hour of the day]:

An hour to change the time system to the winter time is set. (0 to 23)

3.3.   Communication Commands for DST Setting

a) DST enable/disable setting

RD p1

p1:   DST enable/disable (On/Off)

b) Summer/winter time setting

RT p1,p2,p3,p4,p5,p6,p7,p8

p1:   Month to change to the DST

p2:   Week No. to change to the DST (Where the day of the week to change to the DST ranks in the month.)

p3:   Day of the week to change to the DST

p4:   Hour to change to the DST

p5:   Month to change to the winter time

p6:   Week No. to change to the winter time (Where the day of the week to change to the winter time ranks in the month.)

p7:   Day of the week to change to the winter time

p8:   Hour to change to the winter time

4. Gradual Time Correction Function

4.1. Basic Specifications

a) A function is added that corrects the time gradually and completes the time change without effects on the measurement interval if it is required to change the time when operating the key during memory start.

b) This gradual time correction function applies to all time changes of DX during memory start.

1. Time change by key operation
2. Time change by communication command
3. Time change by remote time adjustment function
4. Time change by SNTP client function (For details about SNTP, see section 9, SNTP server/client functions.)

c) Before using the gradual time correction function, a critical value is set for the difference between the current time and the time to be adjusted.

1. When the difference between the time to be adjusted and the time set on DX exceeds the set critical value if any factor needing the time change arises, the time is not corrected gradually, but the time is corrected at once.
2. When [Off] is selected during setting of time deviation limit, the gradual time correction function does not function.

d) The gradual time correction function adjusts the time at a rate of 15.625 msec./sec.

e) The time on the status display screen is shown in yellow while the time is being corrected gradually.

f) The gradual time correction function functions only when the following two conditions are satisfied. In other case, the time is not corrected gradually, but the time is changed at once.

1. Operation must be in the memory start status
2. The difference between the time to be adjusted and the time set on DX must be within time deviation limit if any factor needing the time change occurs.

4.2. Gradual Time Correction Function Setting

4.2.1. Settings on Screen

a) To set up the gradual time correction function, select [Date & Time, Time zone] in the setup mode.

b) When selecting [Date & Time, Time zone], the screen shown in Fig. 4.1 will appear.

c) Set a critical value for the difference between the time to be adjusted and time set on DX in the [Time deviation limit] setting item.

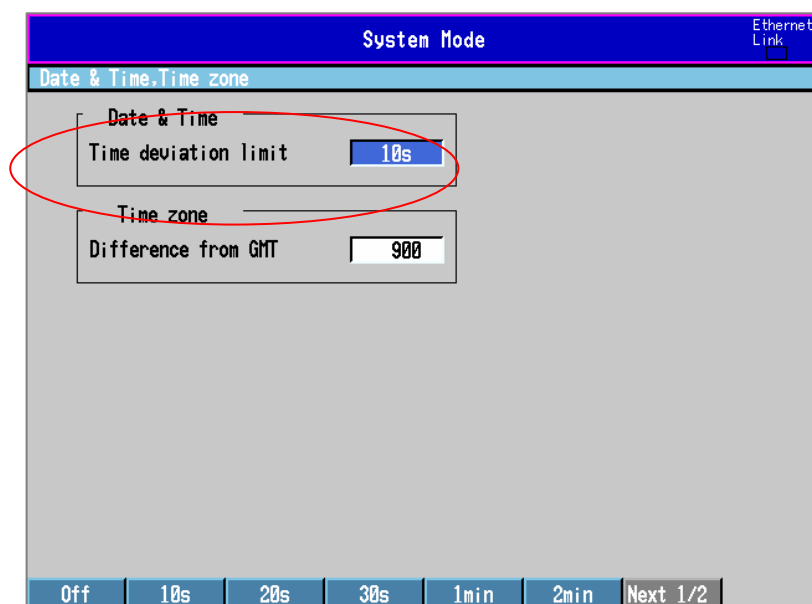d) Select a desired setting from the following.

Fig. 4.1   Gradual time correction function setup screen

4.2.2. Communication Command

The gradual time correction function is set using the "RG" command.

RG p1

    p1:   Critical value for difference between time to be adjusted and current time

5. SNTP Server/Client Functions

5.1. Overview of SNTP Server Function

a) DX is operated as SNTP server.

b) When operated as SNTP server, the time resolution becomes 15.625 msec.

c) When operated as SNTP server, the port number is fixed at "123".

5.2. Overview of SNTP Client Function

a) When using the SNTP client function, the time of DX is adjusted to the time of the SNTP server.

b) There are three kinds of methods to access the time of the SNTP server as described below.

1. Periodic access
- The access interval may vary depending on the setting.
2. Access when executing the memory start
- This operation may vary depending on the On/Off setting.
3. Access by manual operation

c) The time correction operation may vary depending on the memory sample status of DX.

1. During memory start: When the gradual time correction function is set enabled, the ime is corrected gradually. (For details, see section 8, Gradual time correction function.)
2. During memory stop: The time is adjusted at once as the time adjustment is requested.

d) The access log from the SNTP client to the SNTP server is recorded in "SNTP log". The "SNTP log" can be checked through the screen of DX or by outputting the log using the communication command.

e) An error of 125 msec. or less is not corrected.

f) If the time cannot be corrected by the SNTP client function, relevant error is given. The following shows error occurrence conditions.

1. Access to the SNTP server is failed due to response time-out.
2. The contents of the response from the SNTP server are illegal.
3. If the time difference between DX and the SNTP server exceeds ±10 min. during periodic access, the time is not corrected.

5.3. SNTP Function Setting

a) To set up the SNTP function on the screen, select the [SNTP] soft key in the setup mode.

b) When selecting the [SNTP] soft key, two selection items related to SNTP are shown as described below.

1. [#1 Basic settings]
- Make the settings related to the basic operation of the SNTP server/client.
2. [#2 SNTP synched to start]
- Set the time access On or Off when executing the memory start.

5.3.1. SNTP Basic Setting

When selecting [#1 Basic settings], the screen shown in Fig. 5.1 will appear.

Fig. 5.1 SNTP basic setup screen

a) SNTP server function setting
- This setting is used to set up whether or not DX is operated as SNTP server.
- Select [Use] or [Not].

b) SNTP client function setting
1. SNTP client function enabled/disabled
- Select [Use] or [Not].
- When [Not] is selected, the following setting items cannot be set.
  [Server name, port number, access interval, access reference time, time-out]
2. Server name
- Set a SNTP server name using the host name or IP address.
3. Port number
- Set a port number of the SNTP server.
- The initial value is "123".

4. Access interval
- Set a time interval to access the time of the SNTP server.
- When [Off] is selected, the periodic access to the SNTP server is not performed.

5. Access reference time
- The access to the SNTP server is performed at intervals based on the set reference time.
- Set a hour and minute.
- When the access interval is set at [Off], this setting becomes invalid.

6. Time-out
- Set a period of time to wait for response from the SNTP server.
- Select a time-out from [10s], [30s], and [90s].

5.3.2. Communication Commands for SNTP Basic Setting

a) The SNTP server function is set using the [WA] command.

WA p1

    p1:   SNTP server function enabled/disabled. (Use, Not)

b) The SNTP client function is set using the [WB] command.

WB p1, p2, p3, p4, p5, p6

    p1:   SNTP client function enabled/disabled. (Use, Not)

    p2:   SNTP server name (Up to 64 alphanumeric characters)

    p3:   Port number of SNTP server (0 to 65535)

    p4:   Access interval (Off, 1h, 8h, 12h, 24h)

    p5:   Access reference time (00:00 to 23:59)

    p6:   Time-out (10s, 30s, 90s)

5.3.3. SNTP Operation Setting at Memory Start

a) When selecting [#2 SNTP synched to start], the screen shown in Fig. 5.2 will appear.

b) This setting is used to correct the time using the SNTP client when executing the memory start.

c) Select [On] or [Off].

d) The memory start is executed regardless of the time adjustment by SNTP.

e) This setting is valid even in the memory start by the remote or communication command.
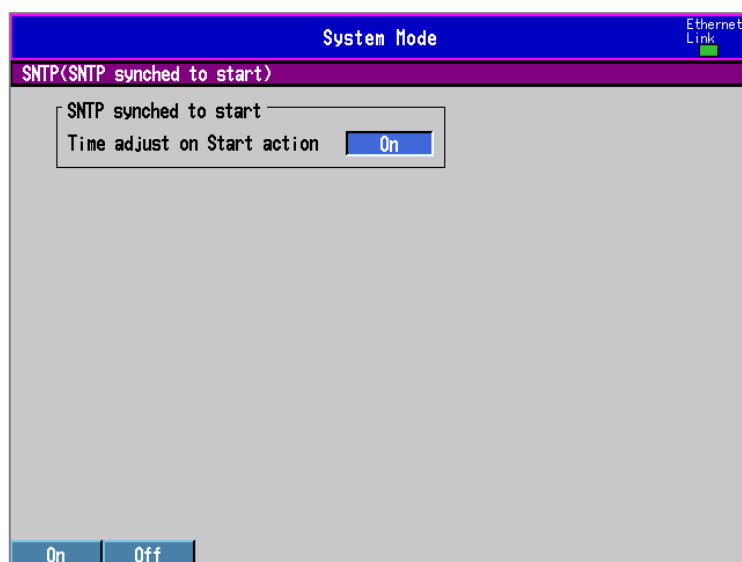
Fig. 5.2   Screen for SNTP setup at memory start

5.3.4. Communication Command for SNTP Operation Setting at Memory Start

The SNTP operation at memory start is set using the [WC] command.

WC p1

p1:   SNTP time adjustment On/Off at memory start (On, Off)

5.4. SNTP Operation at Memory Start

a) The access to the SNTP is performed at memory start. However, if any response is not received from the SNTP server within 2 sec. after that, the memory start is executed regardless of access to the SNTP server.

b) If the access to the SNTP server is succeeded after memory start, the same operation as the time setting during memory start is performed.

c) The communication response of the memory start (PS0) by the communication command shows whether or not the memory start is succeeded.

Whether or not the SNTP access is succeeded at memory start is checked using "status information 2" of the status byte.

Table 5.1 Status information 2 of SNTP operation at memory start

Bit	Name	Description
4	SNTP operation at start	This bit becomes "1" if the time is not adjusted by SNTP.

5.5. SNTP Operation with Manual Operation

a) From the menu screen that appears by selecting the FUNC key, select [SNTP] to execute the SNTP operation.

• [SNTP] can be selected only when the SNTP client function is set at [Use].
• The SNTP operation can be executed regardless of the memory start/memory stop status.

b) If any response is not returned from the SNTP server or if the contents of the response are illegal, relevant error is given.

c) Communication command
• The SNTP operation is performed using the "CL" command.

CL p1

p1:   Time adjustment with manual operation (0: Run)

5.6. SNTP Log

a) The operation log of the SNTP (SNTP log) can be checked on the screen of DX.

- From the menu screen that appears by selecting the FUNC key, select [LOG] and [SNTP] in that order. The SNTP log appears on the screen.

- Fig. 5.3 shows an example of the SNTP log screen.
- Table 5.2 shows the list of detailed codes shown on the SNTP log screen.
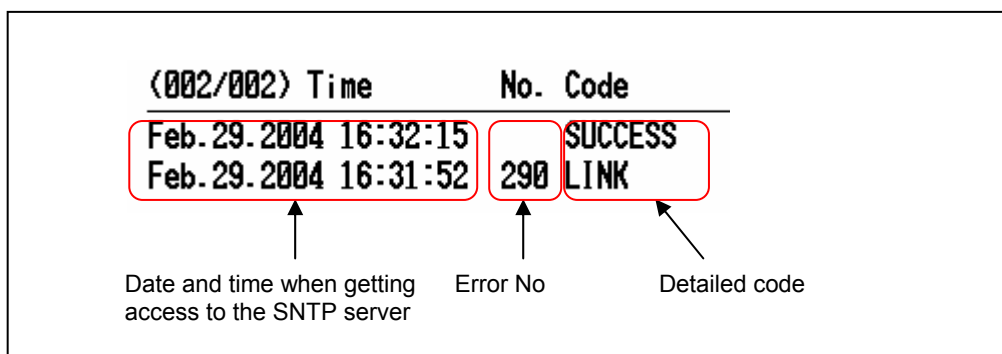
Fig. 5.3 Example of SNTP log screen

Table 5.2 List of SNTP log error codes

Detailed code	Contents
SUCCESS	Succeeded.
OVER	Value exceeds the correction critical value.
DORMANT	Internal process error
HOSTNAME	It is failed to match the host name.
TCPIP	Internal process error
SEND	It is failed to send the request.
TIMEOUT	Response time-out occurs.
BROKEN	Packet is corrupted.
LINK	Data link is broken.

b) The SNTP log is output through the communication using the [FL] command.

1. Communication command

   FL p1,p2

   p1:   Type of log (SNTP)

   p2:   Maximum read-out length of log (1 to 50)

2. Output format

   yy Year (00 to 99)

   mo Month (01 to 12)

   dd Day (01 to 31)

   hh Hour (00 to 23)

   mi Minute (00 to 59)

   ss Second (00 to 59)

   nnn   Error code (blank or __1 to 999)

   xxxxxxxxx Detailed code (9 characters)

6.   Addition of TC and RTD Input Types

6.1. Additional TC Inputs (Thermo-coupler)

- Table 6.1 shows added TC inputs.

Table 6.1   TC Inputs to be added

Range	Range name	Measurement range	Measurement accuracy	Max. resolution
Kp vs Au7Fe	Kp	0.0 to 300.0 K	0 to 20K Within ± 4.5K 20 to 300K Within ± 2.5K	0.1K
PLATINEL	PLATI	0.0 to 1400.0°C 32 to 2552°F	±(0.25% of rdg + 2.3°C)	0.1°C 1°F

PR40 - 20	PR	0.0 to 1900.0°C
		32 to 3452°F
			0 to 450 °C
			             Accuracy not guaranteed
			450 to 750°C
			             ±(0.9% of rdg + 16.0°C)
			750 to 1100°C
			             ±(0.9% of rdg + 6.0°C)
			1100 to 1900°C
			             ±(0.9% of rdg + 2.0°C)
				0.1°C
				1°F

NiNiMo	NiMo	0.0 to 1310.0°C 32 to 2390°F	±(0.25% of rdg + 0.7°C)	0.1°C 1°F
WRe3 - 25	WRe	0.0 to 2400.0°C 32 to 4352°F	±(0.3% of rdg + 2.8°C)	0.1°C 1°F
W/WRe26	W/WRe	0.0 to 2400.0°C 32 to 4352°F	Within 0 to 400 °C ± 15.0°C 400 to 2400°C ±(0.2% of rdg + 2.0°C)	0.1°C 1°F
TypeN (AWG14)	N2	0.0 to 1300.0°C 32 to 2372°F	±(0.2% of rdg + 1.3°C)	0.1°C 1°F

6.2. RTD Inputs (Resistance Temperature Detector)

- Table 6.2 shows added RTD inputs if the system.

Table 6.2   RTD Inputs added (Without /N1 option)

Range	Range name	Measurement range	Measurement accuracy	Max. resolution
JPt50	PT3	-200.0 to 550.0°C -328.0 to 1022.0°F	±(0.3% of rdg + 0.6°C)	0.1°C 0.1°F
Ni100 (SAMA)	Ni1	-200.0 to 250.0°C -328.0 to 482.0°F	±(0.15% of rdg + 0.4°C)	0.1°C 0.1°F
Ni100 (DIN)	Ni2	-60.0 to 180.0°C -76.0 to 356.0°F	±(0.15% of rdg + 0.4°C)	0.1°C 0.1°F
Ni120	Ni3	-70.0 to 200.0°C -94.0 to 392.0°F	±(0.15% of rdg + 0.4°C)	0.1°C 0.1°F
J263∗B	J263	0.0 to 300.0 K	0 to 40K Within ±3.0K 40 to 300K Within ±1.0K	0.1K
Cu53	CU8	-50.0 to 150.0°C -58.0 to 302.0°F	±(0.15% of rdg + 0.8°C)	0.1°C 0.1°F
Cu100	CU9	-50.0 to 150.0°C -58.0 to 302.0°F	±(0.2% of rdg + 1.0°C)	0.1°C 0.1°F

- Table 6.3 shows added RTD inputs with /N1 option.

Table 6.3   RTD Inputs added (with /N1 option)

Range	Range name	Measurement range	Measurement accuracy	Max. resolution
JPt25	PT4	-200.0 to 550.0°C -328.0 to 1022.0°F	±(0.15% of rdg + 0.6°C)	0.1°C 0.1°F

7. Message Expansion

7.1. Basic Specifications

a) There are 7 groups of messages with 8 messages per group.

- Any message can be written using keypad and communication commands.
- A message can be assigned to a remote inputs and USER key for activation.
- Assign a group name for message groups.

b) There are eight types of free messages.

   Free messages can be written using keys, communication commands and via Web. *

   *: Only free messages can be written via web. Message character strings that have been defined on DX will remain unchanged if a message is written.

Table 7.1   Message types and writing enable/disable

Message type	Key operation	Communication command	Remote input	USER key	Web
Message Groups 1 to 6	✓	✓			
Message Group 7	✓	✓	✓	✓	
Free message	✓	✓			✓

c) With Yokogawa's Viewer software such as DAQSTANDARD, groups numbers. and message numbers are displayed in the tens digit and ones digit, respectively.

   <Example> A message of Group No. 1 and Message No. 3 shall be displayed as "13".

d) System messages (power failure message, display rate change message) are displayed as messages of Group No. 0 and Message No. 9.

7.2. Procedure

7.2.1. Setting Message

1. Press the "MENU" key to enter the Set mode.
2. Press the "Next" soft key until "Message " appears.
3. Press the soft key corresponding to "Message".
4. Select the group No. of the message you want to set, and then specify the desired group name and enter message contents (up to 16 characters).

Fig. 7.1   Message setting window

7.2.2. Writing Pre-determined Messages

1. Press "FUNC" key and press soft key corresponding to "Message".

2. A list of message group Nos. and group names will appear.
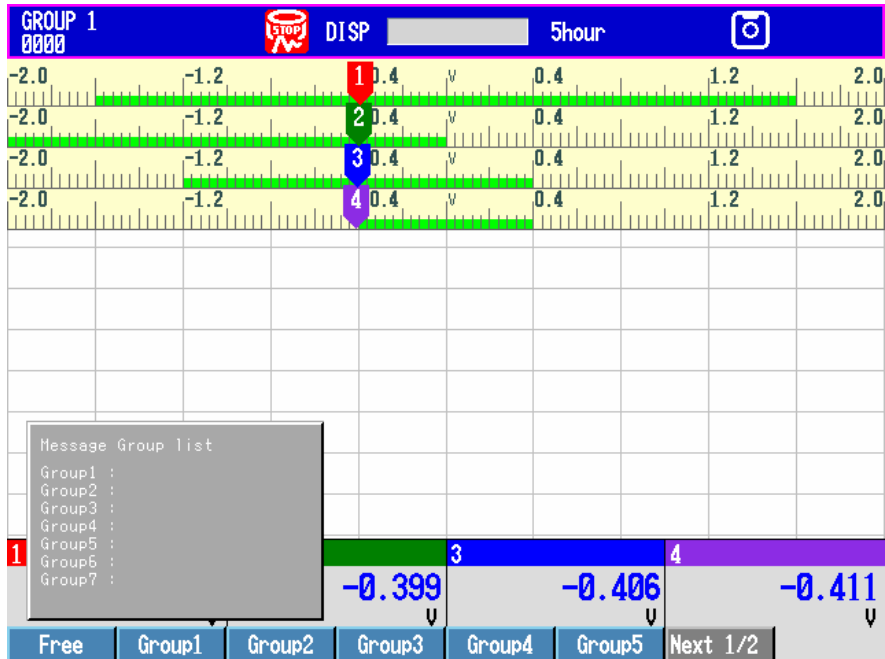
Fig. 7.2   Writing pre-determined messages -1

3. Select the group No. of the message you want to write.
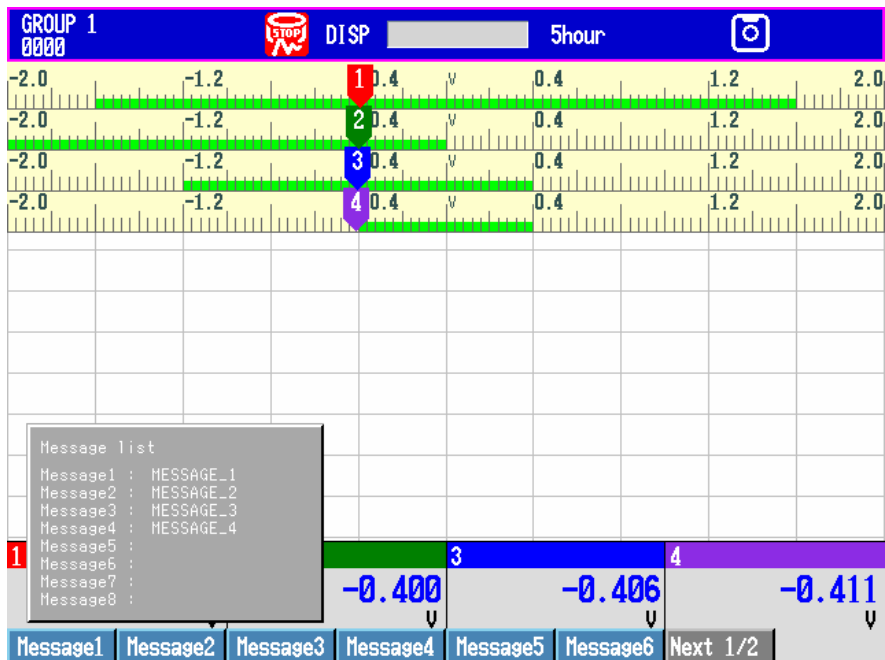
Fig. 7.3   Writing pre-determined messages -2

4. Click the soft key corresponding to the message you want to write. The message will be written.

7.2.3. Writing Free Messages

1. Press "FUNC" key, press soft key corresponding to "Message".

2. A list of message group Nos. and group names will appear.

3. Press the soft key corresponding to "Free".

4. Select the desired message No.*

   *: Each message No. has its own color mark.
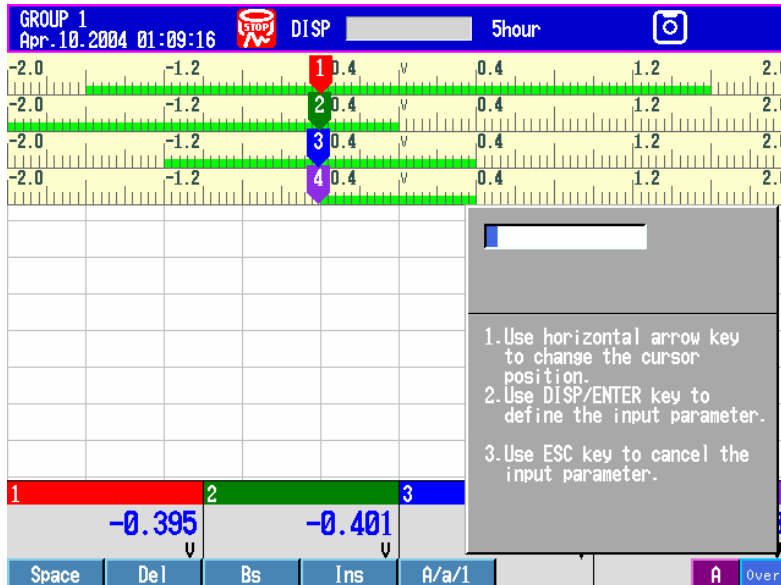
Fig. 7.4   Entering contents of free message

5. A window allowing you to enter message contents will appear. Enter the desired characters and press the "DISP/ENTER" key. The message will be written.

7.3. Communication Command

A command for automatic monitor window recovery added.

a) Message character strings setting

   SG p1, p2, p3

   p1: Message group No. (1-7)

   p2: Message No. (1-8)

   p3: Message (16 alphanumeric characters)

b) Message Write

   MS p1, p2

   p1: Message group No. (1-7)

   p2: Message No. (1-8)

c) Message group name setting

   BG p1, p2

   p1: Message group No. (1-7)

   p2: Group name (16 alphanumeric characters)

d) Free message Write

   BJ p1, p2

   p1: Message group No. (1-7)

   p2: Group name (16 alphanumeric characters)

8. Automatic Monitor Window Recovery Function

8.1. Basic Specifications

a) This function causes the pre-registered monitor window to appear automatically in cases where no keys have been pressed for a certain period of time.

b) The time to be elapsed before the pre-registered monitor window appears after no keys have been pressed for a certain period of time is selected from the following.

1min, 2min, 5min, 10min, 20min, 30min, 1h

c) This function is effective for monitor window only.

8.2. Procedure

1. Press the "MENU" key to enter the Set mode.
2. Press the soft key corresponding to "Display".
3. Press the soft key corresponding to "View, direction, LCD".
4. Move the cursor to "Jump default display, time" and select "time".

Fig 8.1   Automatic monitor recovery function setting menu

8.3. Registering the Window to be Automatically Recovered

1. Display the desired monitor window .

2. Press the "FUNC" and press soft key corresponding to "Standard display".
   The monitor window type and group No. in effect when the soft key is pressed is registered as the monitor window to be recovered automatically.
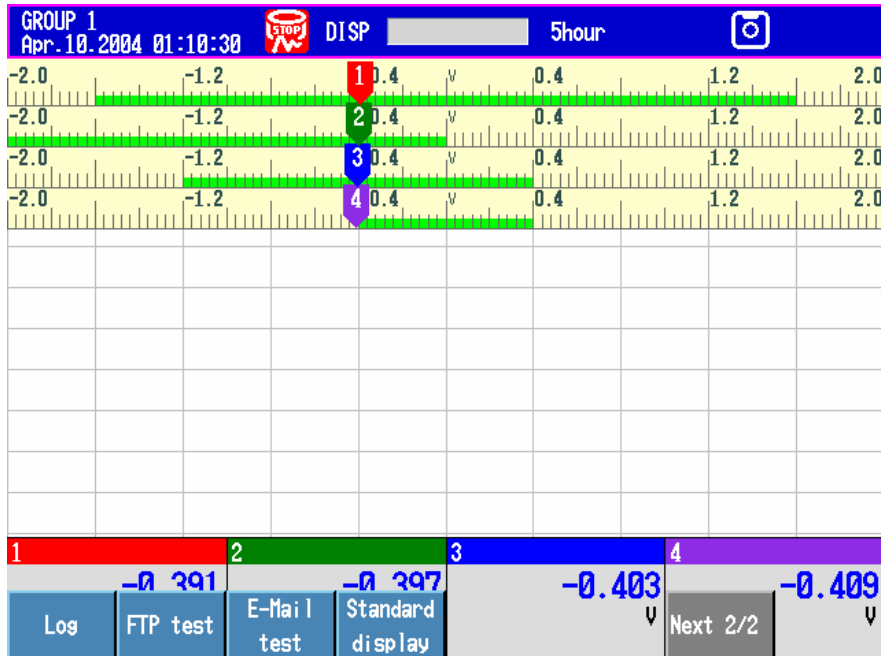
Fig. 8.2   Registering the monitor window to be recovered

8.4. Communication Command

A command for automatic monitor window recovery added.

QGp1   Allows you to set automatic monitor window recovery.

p1:   Time to be expired before the pre-registered monitor window is automatically displayed

            Off: Disables the automatic recovery function.

            1min, 2min, 5min, 10min, 20min, 30min, 1h

9. Log Display and Simulation Function

9.1. Specifications

a) Log display

Displays the measured data using a Log scale (common logarithm).

The equation is given by

$$Y=10^{(SU-SL)\times(X-VL)/(VU-VL)+SL}$$

where

Input voltage: X Lower limit of display span: VL   Upper limit of display span: VU

Lower limit of scaling: SL Upper limit of scaling: SU   Displayed value: Y

b) Simulation function

You can stop the updating of the display by applying a signal to the remote control terminal or by using a communication command.

The relationship between the signal that is applied to the remote control terminal and the updating of the display is as follows.
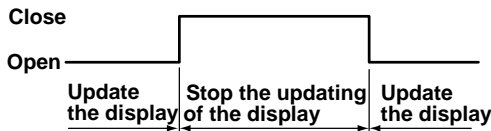
When the updating of the display is resumed, the current waveform is displayed from the stopped position.
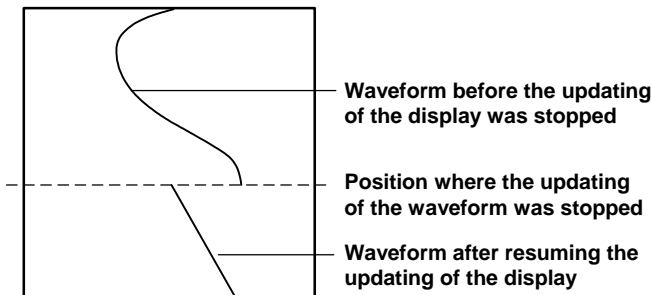
c) Clearing the internal memory/displayed waveform

You can clear the internal memory and the displayed trend by applying a signal to the remote control terminal.

Both the internal memory and the trend are cleared when the input signal to the remote control terminal changes from open to close.

d) Turning ON/OFF the time display

You can turn ON/OFF the time display.

e) The number of displayed digits for measured data

You can set the number of digits of the mantissa to two or three digits when displaying the digital value in exponential form.

Note

- Allows log input for models equipped with the math option.

- If the log input channel is included in arithmetic expressions, setting shall be allowed but an error will occur for math results.

- An error will appear for statistical computation if the log input channel is assigned to the report channel.

- In the Tlog file, an error will be set for measurement results for the log input channel.
  With Yokogawa's Viewer software such as DAQSTANDARD, "LACK"
  will be displayed.

9.2. Procedure

9.2.1 Log display

1. Press the "MENU" key to enter the Set mode.
2. Press the soft key corresponding to "Range, Alarm".
3. Set the channels for "First channel" and "Last channel".
4. Set the measurement range and span.
5. Set the exponent of the upper and lower limits of the scale.

Note

- You can set the scale value in the range from 1.0E-15 to 1.0E+15.
- The maximum exponential difference between the lower and upper limits of the scale is 15.
- The alarm hysteresis is fixed to 0%.
- The alarm value is set using a voltage value.
- Alarm type is H/L/T/t.

9.2.2. Setting remote control

In the procedure given in section 10.9 in the DX200 User's Manual, assign "Freeze" or "Memory clear" to the remote control action.

9.2.3 Turning ON/OFF the time display

1. Press the "MENU" key to enter the Set mode.
2. Press the "FUNC" key for three seconds to enter Setup mode.
3. Press the "Next" soft key numerous times until "AUX" appears.
4. Press the soft key corresponding to "AUX" to display the setting screen.
5. Move the cursor to "Time indicate" and set ON/OFF.
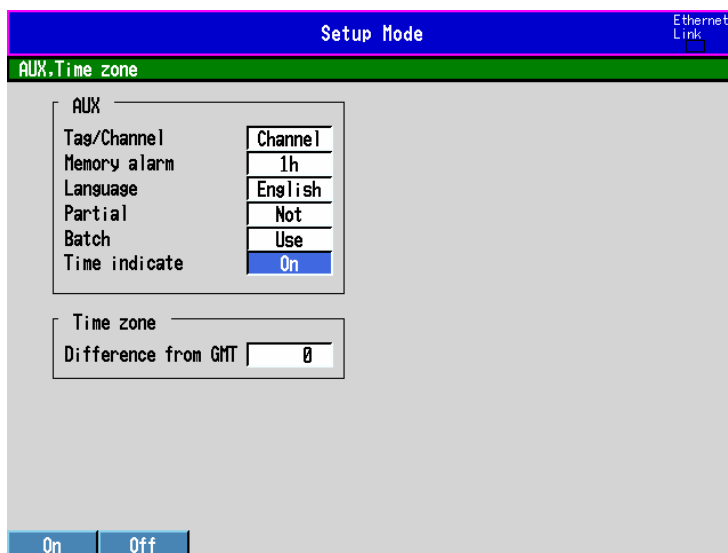
Fig. 9.1   Time indicate setting menu

9.2.4. Setting the number of displayed digits for measured data

1. Press the "MENU" key to enter the set mode.
2. Press the "FUNC" key for three seconds to enter Setup mode.
2. Press the "Next" soft key numerous times until "Alarm, A/D" appears.
3. Press the soft key corresponding to "Alarm, A/D" (DX200) to display the setting screen.
4. Move the cursor to "Display digits" and set 2 or 3.
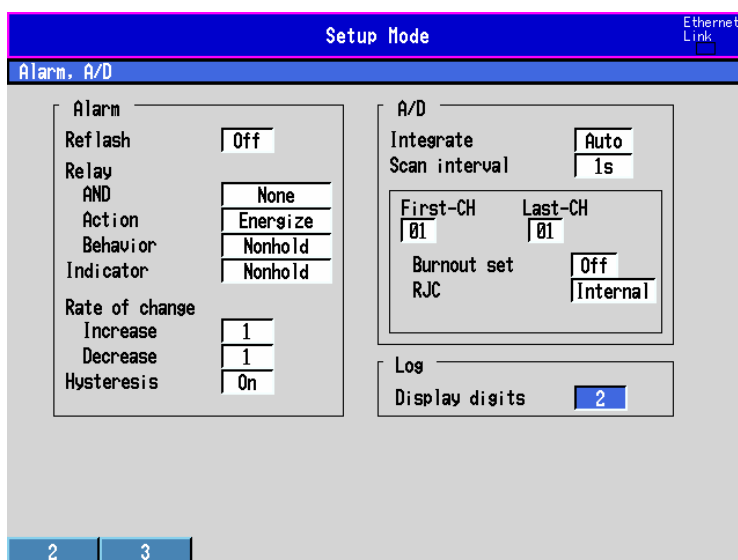
Fig. 9.2   Display digits setting menu

9.3. Communication Commands

SR   Sets the input range.

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

        p1   Channel number (DX200: 01 to 30)

        p2   Input type (Log)

        p3   Measurement range (20 mV, 60 mV, 200 mV, 2 V, 6 V, 20 V, 50 V)

        p4   Lower limit of span

        p5   Upper limit of span

        p6   Lower limit of exponent (-15 to 15)

        p7   Upper limit of exponent (-15 to 15)

        p8   Decimal position (fixed to 0)

        p9   Unit (up to 6 characters)

Query   SR?

Example   Set CH2 to log display, the measurement range to 6 V, the span to -6 V to 6 V, the upper limit of exponent to -5, upper limit of exponent to 6, the decimal position to 0, and the unit to abc.

        SR 02, Log, 6V, -6000, 6000, -5, 6, 0, abc

Description Make sure p7 - p6 does not exceed 15.
For details on the other parameters, see the Communication Interface User's Manual.

QA   Sets the number of displayed digits of the mantissa.

Syntax   QA p1<terminator>

        p1   Number of displayed digits

            2   Display using two digits

            3   Display using three digits

Query   QA?

Example   Set the number of displayed digits of the mantissa to two.

        QA 2

QB   Stops/Resumes the updating of the display and clears the internal memory and the trend.

Syntax   QB p1<terminator>

        p1   Operation

            0   Resume the updating of the display.

            1   Stop the updating of the display.

            2   Clear the internal memory and the trend.

Query   QB?

Example   Stop the updating of the display.

        QB 1

QC   Turns ON/OFF the time display.
Syntax   QC p1<terminator>
           p1   Turn On/Off the time display.
Query   QC?   On: Time indicate On
              Off: Time indicate Off
Example   Turn Off the time display.
           QC Off

10. Scale Display and Switching Display Rate

10.1. Specifications

a) Scale Display

You can display the current value instead of a mark for the trend display in the bargraph.

If several channels are assigned to a scale, only the first channel specified in the display group settings can be displayed for the current value of the scale in the bar graph.

Bar Graph Starting Point

When the direction of the trend display is vertical:

The starting point for the scale bar graph is the same as that when the measured value bar graph is horizontal.

When the measured value bar graph is vertical, the starting point for the scale bar graph also reverts to Standard.

When the display direction of the trend display is horizontal:

The starting point is the smallest numeric value on the height of the display from top to bottom.

b) Switch the Display Rate

When writing data to the internal memory by pressing START, the trend display update rate changes to the previously specified setting. If the display update rate is changed while data is being written to the internal memory, monitor data are created (separate from display data) to be used for displaying trend data.

- Monitor data cannot be saved to an external memory medium or output through communications.

- With historical trends, display data is displayed rather than monitor data.

- When loading trend displays by specifying an item in a summary list, display data is loaded.

- The position when the display update rate was changed is written to message 9.

Trend Display Data

DX200 models set to Horizontal trend display mode:

One scale, digital off, display trend screen is19.5 divisions of data

One scale, digital on, display trend screen is15 divisions of data

With combinations of total channels and maximum math computations configured for some DX200 models, past trend trace data may be less than the full screen 19.5 or 15 divisions as described above. The minimum trend trace data will always be at least 13 divisions of recent trend data once the unit has initially recorded the information. No data is lost in the archived data files. This may be noticed when switching screens or powering off and on the unit.

Number of Data

The number of TLOG, report, and manual sample data that can be saved to the internal memory is as follows:

	Main Unit	**Standard DX**
TLOG	30	400
Report	5	40
Manual Sample	5	50

When using Autosave, the above limits on the number of data do not apply since data is saved to the external memory medium at each "time up." When saving TLOG data using Autosave, a TLOG file is created every 30 data.

Note

If no external memory medium is installed, the number of data that can be saved to internal memory is reduced.

c) Message Display upon Restart after Power Failure

If a power failure occurs while saving data to the internal memory, once the power is resumed the time of resumption is displayed.

Message 9 appears in burgundy as follows: [Time/Date of Power Resumption Power Fail] (Ex.: May. 15 Power Fail). The time the message was written is displayed before the message.

Note

With the DX200's 4-screen display, no message is displayed.

With trend screen of DX200's 4-screen display, scale is displayed.

10.2. Procedure

10.2.1. Scale Display

1. Press DISP/ENTER to display the screen menu.
2. Press the right arrow key to display the submenu.
3. Choose SCALE BAR from the submenu. If the SCALE BAR does not appear, select the view display items then press DISP/ENTER one or two times. The display toggles between SCALE BAR, SCALE OFF, and SCALE ON.

10.2.2. Switching the Display Rate

1. Press MENU to enter set mode.
2. Press the #3 soft key to display the set screen.
3. Set the second display update rate. The available settings are the same as the standard display update rate settings.
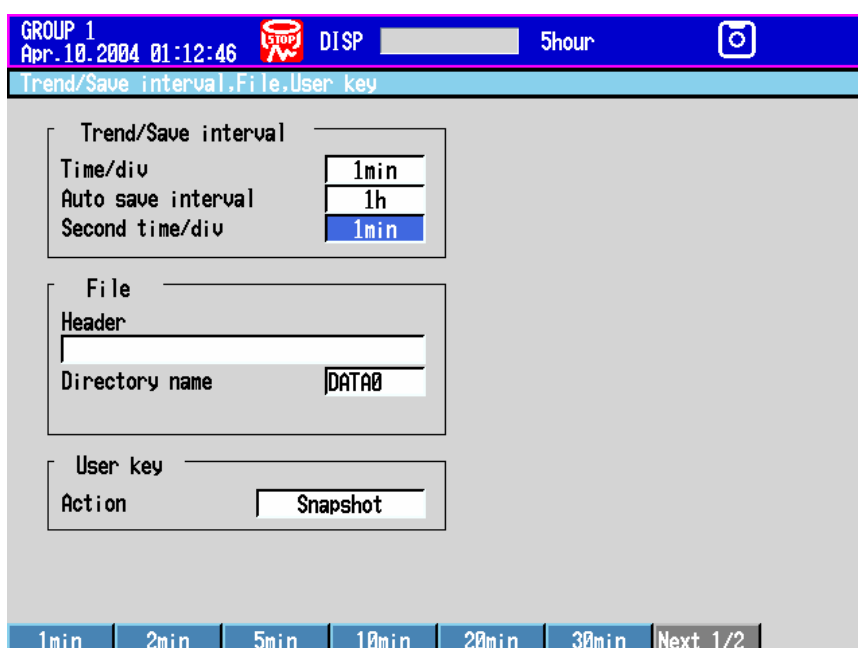
Fig. 10.1   Second time/div setting menu

Switching the Display Update Rate

There are four methods for switching the display update rate.

- Using the FUNC key (see section 3.4, "Run Mode" in the standard user's manual).
- Using the remote control function (with the /R1 option, see section 10.9, "Setting the Remote Control Functions (/R1 Option, Basic Setting Mode)" in the standard user's manual.
- Using communications commands (see page 18)

- Using internal switch function (see page 27)

10.3. Communication Commands

QE   Set the 2nd display update rate

Syntax   QE p1<terminator>

        p1   2nd display rate

           (15 s*, 30 s*, 1 min, 2 min, 5 min, 10 min, 20 min, 30 min, 1 h, 2 h, 4 h, 10 h)

            *:15 s and 30 s for the DX204, DX208 only

QF   Switching the display update rate

Syntax   QF p1<terminator>

        p1   Operation Type

           0 Changes to the 1st rate (standard rate)

           1 Changes to the 2nd rate

UD p1, p2, p3, p4, p5

Adds p4 to BAR

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

        p1   Switching the Display (4)

        p2   Enables/disables automatic monitor scroll (ON, OFF)

        p3   Switches all channel display and group display (ALL, GROUP)

        p4   Turns scale display on and off, and sets the type (ON, OFF, BAR)

           On Displays the scale display with a mark (same as standard unit)

           OFF   No scale display

           BAR   Displays scales in a bar graph

        p5   Turns the digital display ON/OFF (ON/OFF)
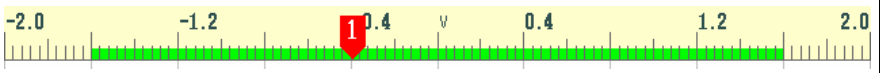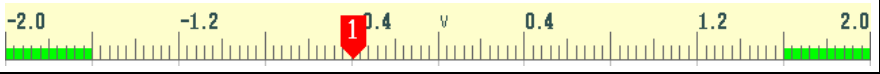
11. Green Band and Alarm Mark Display Functions

11.1. Green Band Display Function

11.1.1. Specifications

a) In the scale and bar graph views of the trend window, green bands are displayed in the specified color. (For display examples, refer to Figs. 11.1 and 11.2.)

b) The green band area can be set either inside or outside the specified positions.

Table 11.1   Green Band type

Selection	Display example
Inside	
Outside	

c) The top and bottom of the Green Band area are set within the range of 0 to 100%. Up to 1% width can be set.

11.1.2. Green Band Display Image

a) Trend Window
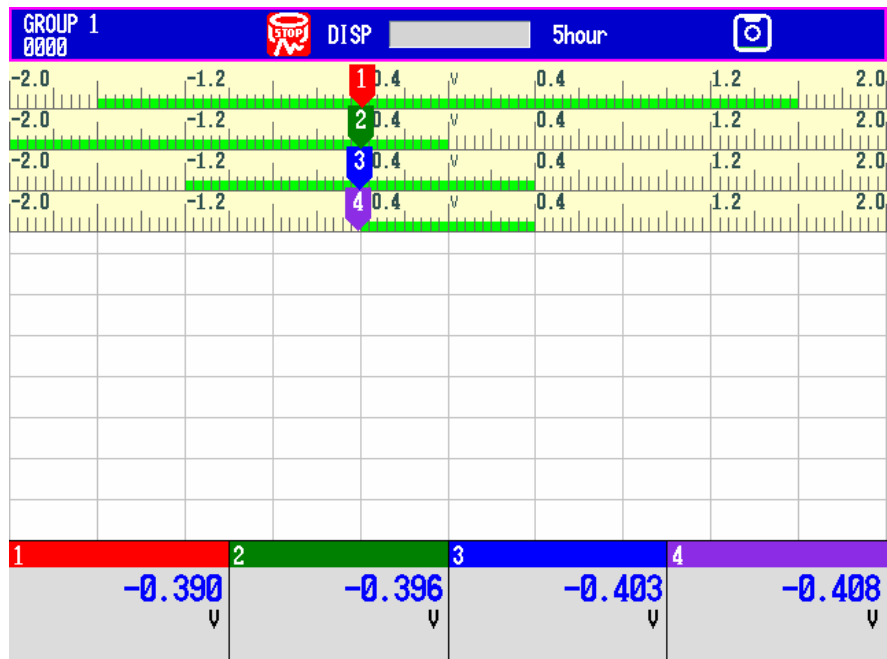
Fig. 11.1   Green Bands on scales

b) Bar Graph Window
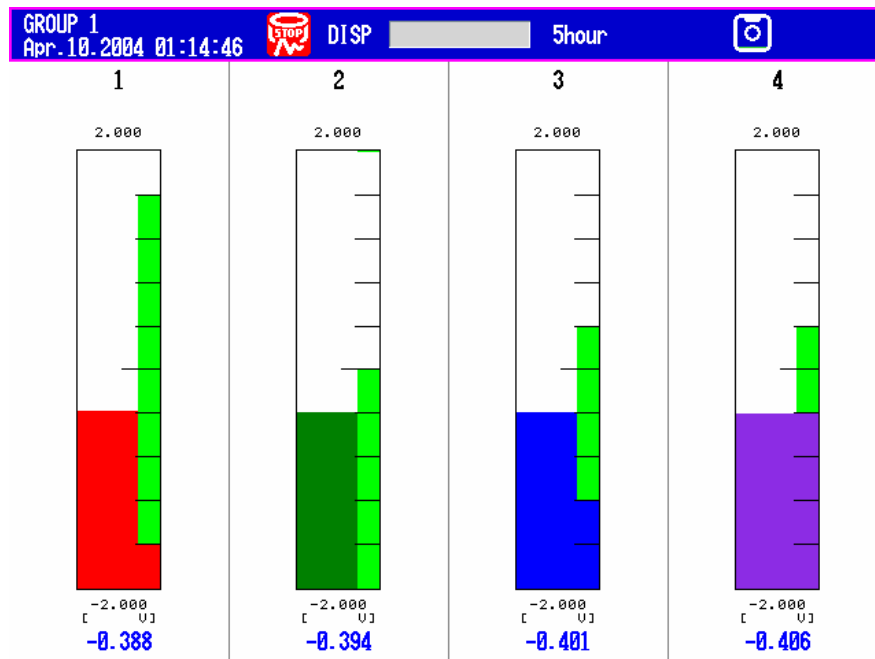
Fig. 11.2   Green Bands on bar graphs

11.2. Alarm Mark Display Function

11.2.1. Specifications

a) Displays alarm marks on the scales and bar graphs of the trend window.

b) Alarm marks are shown in the following colors.
The display colors will not change even if alarms occur.

Table 11.2   Alarm Mark display colors

Alarm level	Color
Level 1	Red
Level 2	Orange
Level 3	Orange
Level 4	Red

c) Alarm marks will be displayed only for the following alarm types.

• Upper-limit alarm (H)

• Lower-limit alarm (L)

• Delay upper-limit alarm (T)

• Delay lower-limit alarm (t)

d) If an alarm value is set beyond the scale upper or lower limit, an alarm mark will be
displayed at the corresponding edge of the scale.

11.2.2. Display Images

a) Trend Window
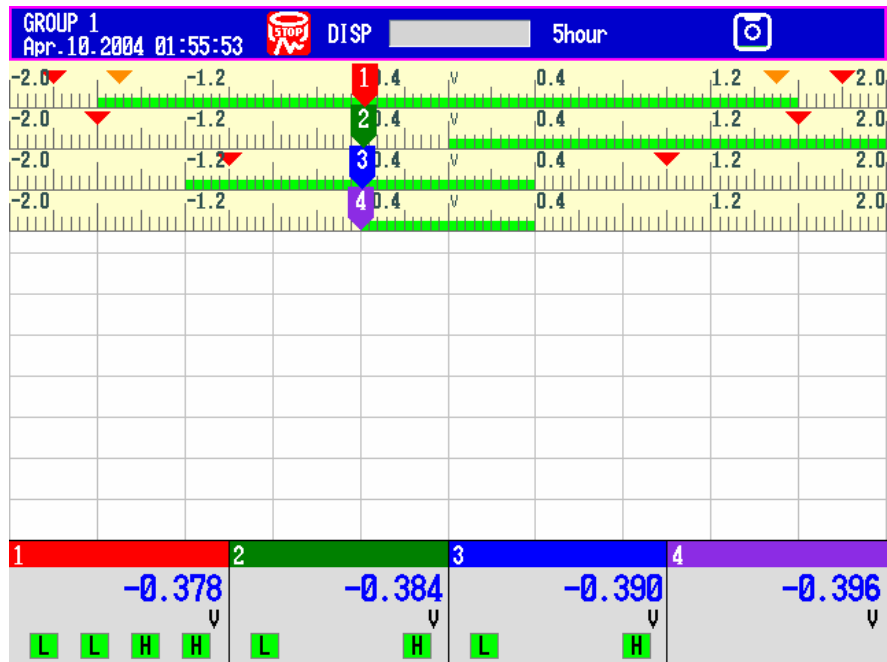
Fig. 11.3   Alarm Marks on scales

b) Bar Graph Window
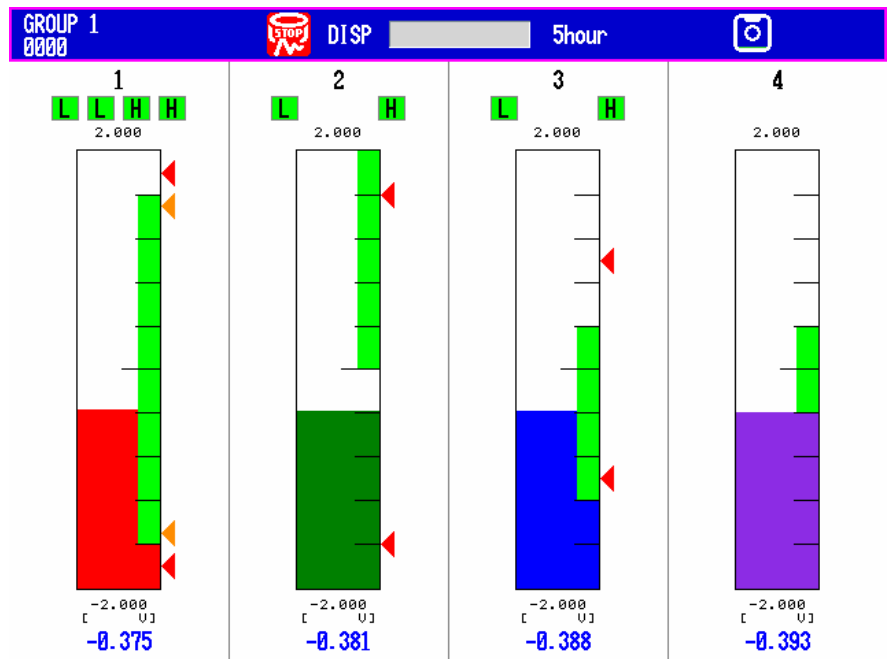
Fig. 11.4   Alarm Marks in bar graphs

11.3. Procedure

1. Press the "MENU" key to enter the Set mode.
2. Press the "Next" soft key until "Display" appears.
3. Press the soft key corresponding to "Display".
4. Press the soft key corresponding to "Zone, Graph".
5. Move the cursor to items shown in Table 11.3 and select items or input number.

Fig. 11.5 Green Band and Alarm Mark setting menu

Table 11.3 Items to be added

No.	Description	Item Name	Selection	Description
1	Presence/absence of alarm marks on scale	Alarm mark	On	Displayed
			Off	Not displayed *
2	Presence/absence of green bands	Band area	Off	Not displayed
			In	Displayed inside specified positions
			Out	Displayed outside specified positions
3	Green band color	Color	Selectable color for waveform	
4	Green band position (lower)	Lower	0 to 99	%
5	Green band position (upper)	Upper	1 to 100	%

*: If "None" is selected, alarm marks on bar graphs shall be the same as those provided on the standard model.

11.4. Communication Commands

- A new command to show or hide alarm marks and green bands shall be added.

  QHp1, p2, p3, p4, p5, p6   Display settings for alarm mark and green band

  p1:   Channel no. (01 to 60)

  p2:   Set whether to show or hide alarm marks on scale. (ON/OFF)

  p3:   Set whether to show or hide green bands on scale. (ON/IN/OUT)

  p4:   Green band color. (RED, GREEN, BLUE, BROWN, PURPLE, ORANGE, LIGHT BLUE, GRAY, VIOLET, YELLOW, DARK BLUE, CYAN, Y. GREEN, LIME, B. VIOLET, LIGHT GRAY, BLACK)

  p5:   Green band bottom position (0 to 99)

  p6:   Green band top position (1 to 100)

12. Media FIFO Function

12.1. Specifications

a) When media FIFO is selected, when the external media becomes full or the number of files in the folder reaches 1,000, the oldest file will be deleted and the latest data file will be saved.

b) All the files in the specified folder are subject to automatic deletion.

c) In the following cases, files will not be deleted even if they are old.
   * If the folder name is changed, data files in the previous folder name will not be deleted.
   * Read-only files, system files, hidden files

d) No warning will be given even if the remaining capacity on the external media reaches less than 10% of total capacity. The following will take place if an error occurs with the external media.
   * The media icon in the status display area switches to an error mark.
   * Memory full relay will be excited.
   * An E-mail will be sent.
   * Status information of communication interface will be shown.

e) ACK will be issued as shown below in case of media error.
   * After media error occurrence, media check is performed in case of the front door closed, and ACK will be issued if it is confirmed that the media is normal and if media format is done normally. However, ACK will not be issued if the front door is closed in the basic setting mode (setup mode).
   * After ACK is issued, the media icon will return to the original mark.

f) The following files will be re-created when they exceed 100 k bytes in file size. (The files will be divided into blocks.)
   * Manual sample, report data (weekly report, monthly report) *, TLOG data
     *: For hourly and daily reports, the file split function is provided as standard feature

g) The media FIFO function is effective only for those models equipped with ZIP or ATA card.

12.2. Procedure

1. Press the "MENU" key to enter the Set mode.
2. Press the "FUNC" key for three seconds to enter the Setup mode.
3. Press the "Next" soft key numerous times until "AUX" appears.
4. Press the soft key corresponding to "AUX" to display the setting screen.
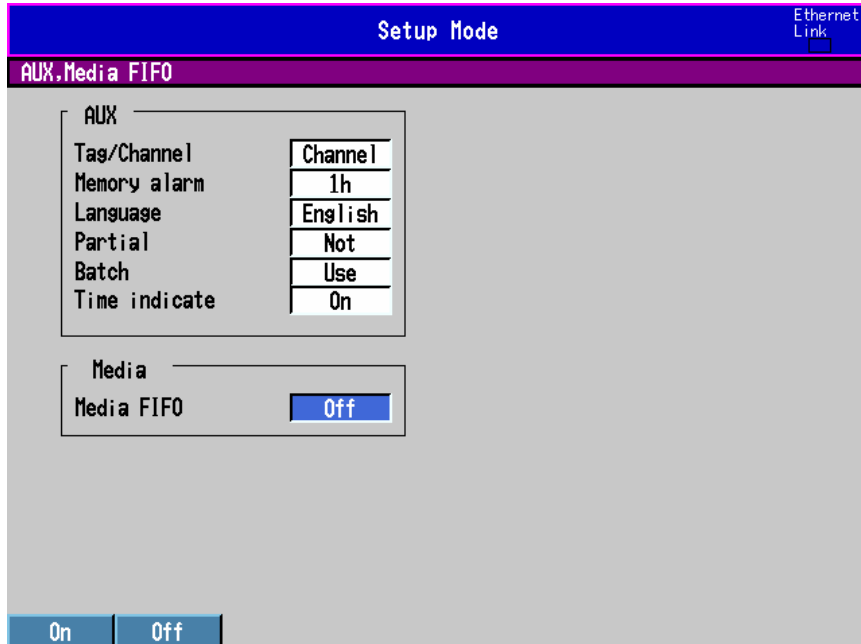5. Move the cursor to "Media FIFO" and select "On/Off".

Fig. 12.1   Enabling/Disabling media FIFO function

12.3. Communication Commands

- A command allowing you to enable or disable the media FIFO function added.

  QIp1

    p1:   Set whether to enable or disable the media FIFO function. (ON, OFF)
            With the floppy disk model, it is not possible to select "ON".

13. Internal Switch Function

13.1. Specifications

a) 30 internal switches (S01 to S30) added.

∗ Assignment to internal switches is made using alarm relay setting item.
In addition to I01 to I36, S01 to S30 can be selected.

b) Assignment of actions in the basic setting menu.

∗ Actions that can be assigned are given in the table below.

Table 13.1 Functions that can be assigned to Internal switches and their names

Function	English	
	Menu	**FUNC key**
Memory start/stop	MemoryStart/Stop	Memory (DX100) Start/Stop(DX200)
Event data trigger	Trigger	Trigger
Alarm ACK	AlarmACK	AlarmACK
Math start/stop	MathStart/Stop	Math
Math reset	MathReset	Math rst
Manual sample	ManualSample	M.sample
Snap shot	SnapShot	Snapshot
Message writing [1]	Message	Message
Screen refresh stop (Simulation)	Freeze	Freeze
Memory clear (Simulation)	Memory Clear	Clear
Display rate change	Rate Change	Change
No assignment	None	None

*1: Message group Nos. and message Nos. need to be set separately
*2: Used by the simulation function.
*3: To be added for this custom-made order.

13.2. Procedure

1. Press the "MENU" key to enter the Set mode.
2. Press the "FUNC" key for three seconds to enter the Setup mode.
3. Press the "Next" soft key numerous times until "Switch-Action settings" appears.
4. Press the soft key corresponding to "Switch-Action settings" to display the setting screen.
5. Move cursor to items that are shown in Table 13.2 and select one.

```
┌──────────────────────────────────────────────────────────┐  Ethernet
│                    Setup Mode                            │  Link
├──────────────────────────────────────────────────────────┤
│ Switch-Action Setting                                    │
│                                                          │
│  ┌ Switch-Action Setting ─────────┐                      │
│  │ Switch No.      │    S01    │                         │
│  │ Action          │  Message  │                         │
│  │ Message group   │     1     │                         │
│  │ Message No.     │     1     │                         │
│  └────────────────────────────────┘                      │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
│ │ S01 │ S02 │ S03 │ S04 │ S05 │ S06 │ Next 1/5 │         │
└──────────────────────────────────────────────────────────┘
```

Fig. 13.1   Setting Internal switches

Table 13.2   Items to be added

No.	Description	Item Name	Selection
1	Internal switch No.	Switch No.	S01 to S30
2	Action to be assigned to internal switch	Action	Refer to Table 10.1
3	Message group No.	Message group	1 to 7
4	Message No.	Message No.	1 to 8

13.3. Communication Commands

- Commands to assign actions to internal switches shall be added.

QJp1, p2, p3, p4

p1: Internal switch No. (S01 to S30)

p2: Action to be assigned

NONE	No action
ALARM ACK	Alarm ACK
MEMORY START/STOP	Memory start/stop
MANUAL SAMPLE	Manual sample
TRIGGER	External trigger input (event data)
MESSAGE	Message writing
MATH START/STOP	Math start/stop
MATH RESET	Math reset
SNAPSHOT	Snap shot
FREEZE	Screen refresh stop
MEMORYCLEAR	Memory clear
RATECHANGE	Display rate change

p3: Message group No.

Effective when p2 = MESSAGE

1 to 7

p4: Message No.

Effective when p2 = MESSAGE

1 to 8

14. Others

14.1. Addition of Waveform Colors

a) Black color added as waveform color.

b) The background of the historical trend window is changed to a color that allows recognition of the black color.

c) With Yokogawa's Viewer software such as DAQSTANDARD, black will be used.

14.2. Increased Number of Characters Used in Arithmetic Expressions

a) Up to 120 characters can be used in arithmetic expressions.

b) Stack (number of channels and constants used in arithmetic expressions) shall be extended to 35.

14.3. Changing Historical Window Switch Method

1. When the "DISP/ENTER" key is pressed on the trend window, the cursor is placed on the historical trend menu.

   * Pressing the "DISP/ENTER" key again causes historical trend to reappear.
   * If the "DISP/ENTER" key is pressed on a window other than the trend window, the cursor shall be placed on the menu that indicates the current window.

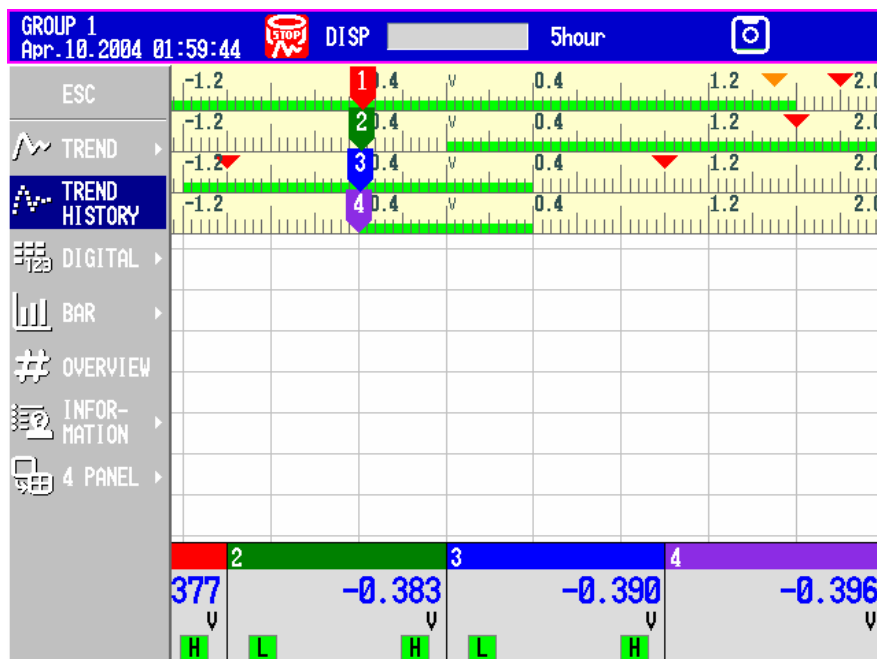2. The menu to switch to the historical window is located below the trend.

Fig. 14.1 Window switch menu

15. Limitations

15.1. Partial Expanded Display (Partial)

The partial expanded display cannot be used. The partial expanded display cannot be set enabled. ([Enable] selection item is not displayed.)

15.2. Limitations on Number of Data

15.2.1. Comparison with Standard Specification

To keep the monitor data area, the number of data to be saved into the internal memory is reduced.

Table 15.1   Number of data to be saved into internal memory

Data type	Standard model	S123 model
TLOG data iii	400	30
Report data	40	5
Manual sample data	50	5

15.2.2. Operation during Auto Save

a) When using the Auto save, the data can be written into external media periodically. Therefore, the number of data to be saved into the internal memory is not limited. However, if the media capacity becomes insufficient as the number of data to be saved into the internal memory is reduced or if the media is not inserted, the time until the data is missing becomes shorter than that of the standard unit. Great care shall be taken for this point.

b) Up to 30 data can be saved into one TLOG file. With the standard specification, a file is created at intervals of 400 data records. With this special specification, however, a file is created at intervals of 30 data records.

15.3. Communication Commands

Great care must be taken since the communication commands shown in Table 15.2 Have specific limitations.

Table 15.2   Limitations on communication commands

Command	Command type	Limitations
FE	Set data output	If multiple connections send the request at the same time in the setup data file output (parameter: 4) command, relevant error is given.
FF	FIFO data output	Even though the parameter (GETNEW) to output the latest value is specified, the data is not output. There are no limitations on other parameters.