Technical Information

DAQSTATION
DX100/DX200

TI 04L01A01-02E

2nd Edition Feb. 2000

Contents

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Introduction

This Technical Information (TI) describes the overview and functions of the DAQSTATION DX100/DX200.
Please read this document to fully use the capabilities of the DX100/200.

Companies today face a growing number of challenges – reducing total cost of ownership (TCO), improving efficiency, and controlling quality. As these needs increase, companies must deal with a growing amount of information needed to make informed decisions.
Conventional industrial recorders have been used primarily to monitor and record data in the field. In order to quickly extract information that is valuable to a user from this sea of data, recorders need to be made intelligent. This means they need to have advanced information processing and communication capabilities.

The DX Series of DAQSTATION represents a leading-edge solution for 21st-century field data stations from YOKOGAWA, the worldwide leader in recorder technology.

1 Features

Network capability

Since Ethernet is supported as a standard, installation in an existing LAN/WAN environment is quick. FTP transfer of data files is possible with the FTP client/server functions. In addition, data files can be periodically and automatically transferred to an FTP server.
By connecting the DAQSTATION to a network, auto transfer of data, centralized management, and remote data monitoring can be carried out. Reliability is improved by the duplication of data files and cost reduction is achieved in terms of data collection.

A wide variety of display options

High visibility has been achieved by using 5.5-inch and 10.4-inch high-resolution color TFT monitors on the DX100 and DX200, respectively.
In addition to trend displays, there are various other display functions including bar graphs, numeric, and overview displays. You can select the optimal display for the conditions present.

Storage options for greater flexibility

The DAQSTATION lineup contains models that support external recording media other than 3.5" floppy disks such as flash ATA memory cards and Zip disks. Zip is best suited to long-term data storage while flash ATA memory card is best suited to harsh operating conditions.
In addition, only the necessary data can be stored, thanks to the abundant file formats and trigger functions.

Rugged construction for high reliability

"Reliability that exists even in the toughest conditions." YOKOGAWA takes pride in providing the most reliable products.
All measured data are stored to the flash memory, which does not require battery backup. In addition, measured data are periodically stored to the external recording medium and, at the same time, measurement data files are automatically transferred to an FTP server. In addition, the front section of the case conforms to the IP65 and the NEMA4 standard, which shuts out power dust and even jet streams. The DAQSTATION is reliable in all sorts of field conditions.

2 Overview of Functions

2.1 Construction

2.1.1 Operation Section

DX100 DX200

a. Navigation key
b. Soft key
c. [START] key
d. [STOP] key
e. [USER] key
f. [FUNC] key
g.[ESC] key
h [MENU]key
i. Keyboard display(DX100)
j. Key panel(DX200)

2.1.2 Run Mode

The DX Series has three types of modes depending on the level of operation.

Operation Mode

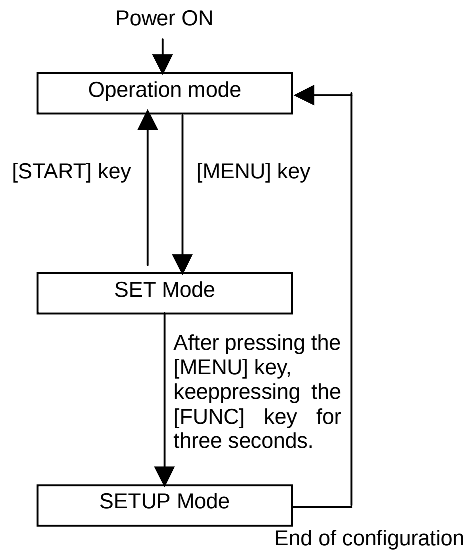
This mode is used during normal monitoring operation. Most operations such as switching the displayed group or display types are performed using the operation keys. Operations such as alarm acknowledgement, message entry, and screen snapshot are carried out by displaying a menu with the [FUNC] key and then using the soft keys.

SET Mode

This mode is used to change settings that are changed often such as the range and waveform update rate. The [MENU] key is used to display the setting parameters. Parameters that affect the data that are being recorded cannot be changed unless the recording is stopped. This prevents erroneous operation.

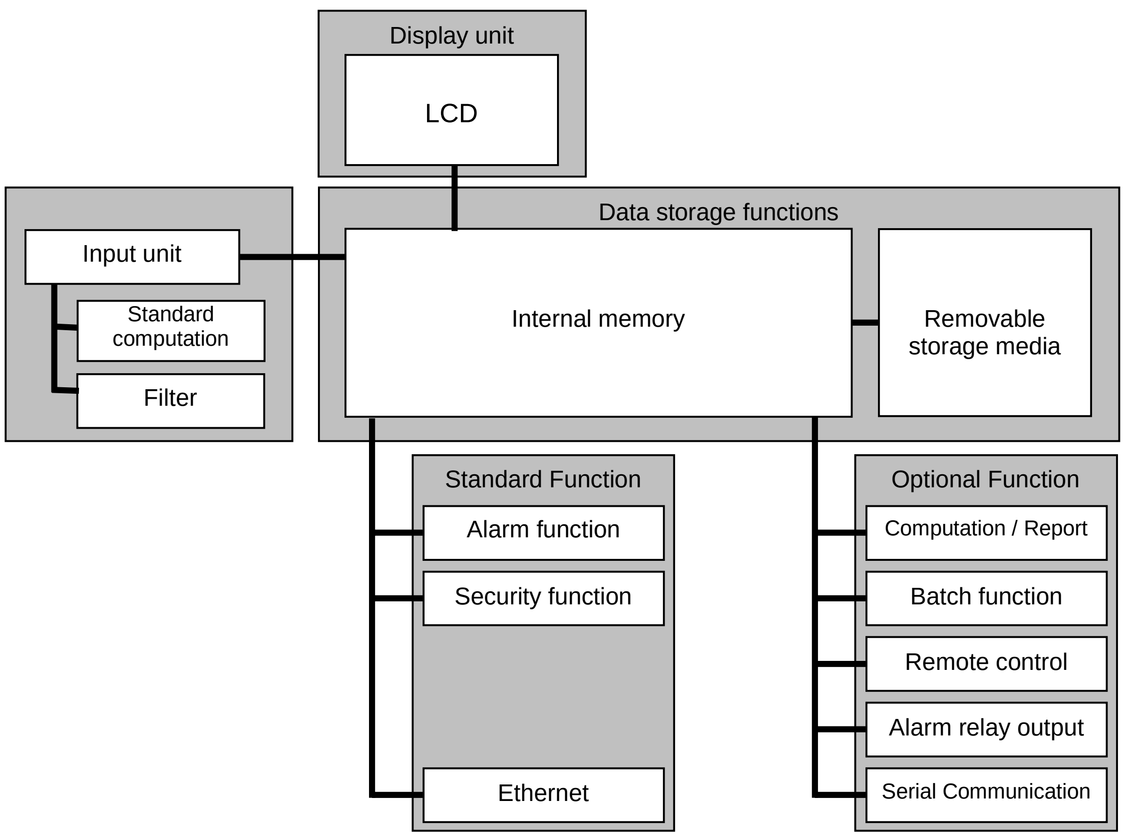
SETUP Mode

This mode is used to change the operating environment of the DX100/DX200 such as the input format or recording format.



2.1.3 Functional Construction

The DX100/200 is comprised of the following functions.



2.2 Input Unit

2.2.1 Input Specifications

Number of inputs and measurement interval

Model		Maximum number of inputs	Measurement Period
DX100	DX102	2	Select from 125 ms or 250 ms
	DX104	4	
	DX106	6	Select from 1 s or 2 s 2 s when the A/D integration time is set as any value other than 100 ms
	DX112	12	
DX200	DX204	4	Select from 125 ms or 250 ms
	DX208	8	
	DX210	10	Select from 1 s or 2 s 2 s when the A/D integration time is set as any value other than 100 ms
	DX220	20	
	DX230	30	

Input Types

DCV : DC voltage
TC : Thermocouple
RTD : Resistance temperature detector
DI : ON/OFF (contact) input
DCA : DC current (using an external shunt resistor. (10, 100, 250 ohm))

Measuring range

DCV : 20 mV, 60 mV, 200 mV, 2 V, 6 V, 20 V ranges
TC : R, S, B, K, E, J, T, N:IEC584-1 (1995), DIN IEC584,JIS C1602-1995
W : W-5% Rd/W-26% Rd (Hoskins Mfg. Co.), ASTM E988
L : Fe-CuNi,DIN43710
U : Cu-CuNi, DIN43710
RTD : Pt100: JIS C1604-1997, IEC 751-1995, DIN IEC751-1996
JPt100 : JIS C1604-1989, JIS C1606-1989
DI : For voltage input; detecting **off** when less than 2.4V, and **on** when 2.4V or greater
For contact input; on/off contact

A/D resolution : Equivalent to 14 bit

A/D integration time

Model		A/D integration time
DX100	DX102	20 ms (50 Hz), 16.7 ms (60 Hz), AUTO (automatically selected from 20 ms or 16.7 ms depending on the frequency of the power supply)
	DX104	
	DX106	20 ms (50 Hz), 16.7 ms (60 Hz), 100 ms (50/60 Hz), AUTO (automatically selected from 20 ms or 16.7 ms depending on the frequency of the power supply)
	DX112	
DX200	DX204	20 ms (50 Hz), 16.7 ms (60 Hz), AUTO (automatically selected from 20 ms or 16.7 ms depending on the frequency of the power supply)
	DX208	
	DX210	20 ms (50 Hz), 16.7 ms (60 Hz), 100 ms (50/60 Hz), AUTO (automatically selected from 20 ms or 16.7 ms depending on the frequency of the power supply)
	DX220	
	DX230	

Functions

TC Burnout : Forcibly clamps the measured value reading to zero or full scale when the thermocouple burns out.
Off, up, or down can be selected for each channel.

RJC : Select whether or not to use the internal compensation circuit to carry out reference junction compensation (Internal/External) for thermocouple(TC) inputs for each channel.

2.2.2 Standard Calculation Functions

Calculation types

Differential calculation: Calculates the difference between the measured values of two channels. The difference can also be found between two different range types. For example, the reference channel can be set to RTD, and the other channel set to TC.

Linear scaling : Scales the measured data to physical values that suit the application.

Square root : Scales the input data by taking the square root.

Standard Calculation Specifications

Differential calculation

Available ranges : DC voltage (DCV), thermocouple (TC), and RTD

Linear scaling

Available ranges : DC voltage (DCV), thermocouple (TC), and RTD
Scalable limits : -30000 to 30000
Decimal point : User selectable (should be specified when entering scale value)
Engineering unit : User selectable, up to six characters (alphanumeric and special characters)

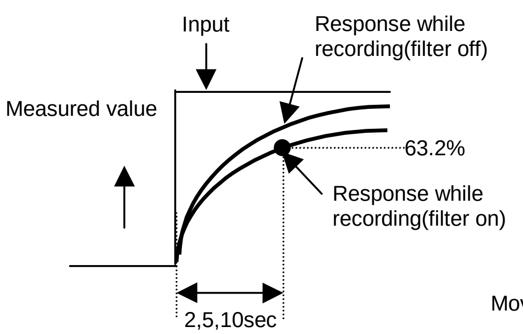
Square root

Available ranges : DC voltage (DCV)
Scalable limits : -30000 to 30000
Decimal point : User selectable (should be specified when entering scale value)
Engineering unit : User selectable (should be specified when entering scale value)

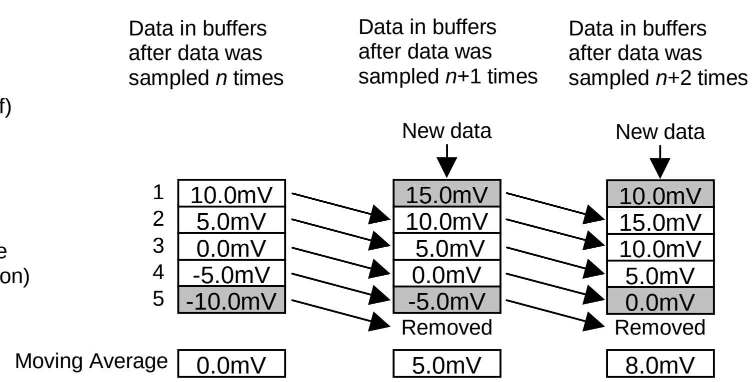
2.2.3 Input Filter

The filter types vary depending on the model. The filter can be set on each channel.

Model		Filter Type	Time Constant or Number of Moving Average
DX100	DX102	Low-pass filter	Select from off, 2 s, 5 s, and 10 s
	DX104		
	DX106	Moving average	Select from off or 2 to 16 times
	DX112		
DX200	DX204	Low-pass filter	Select from off, 2 s, 5 s, and 10 s
	DX208		
	DX210	Moving average	Select from off or 2 to 16 times
	DX220		
	DX230		



Low-pass filter



Moving Average Calculation Buffers When Calculating Average of 5 Most Recent Samples.

2.2.4 Tag Names

A tag name can be set for each channel.

Tag name : Up to 16 alphanumeric characters

2.3 Display Section

2.3.1 Display Specifications

Monitor	: 5.5-inch TFT color LCD (320×240 pixels) (DX100)
	: 10.4-inch TFT color LCD (640×480 pixels) (DX200)
Background	: Select either white or black.
Waveform display color	: Select from the following colors for each channel. The color setting applies both to trend and bar graph. Select from red, green, blue, blue-violet, brown, orange, yellow-green, light-blue, violet, gray, lime, cyan, dark-blue, yellow, light-gray, and purple (16 colors).
LCD saver	: The life span of the backlight can be prolonged by automatically lowering the LCD backlight when there are no key operations for a certain period of time (select from 1, 2, 5, 10, 30, 60 minutes) The LCD returns to the normal brightness when there is a key operation or an alarm.
Backlight brightness	: Select from eight levels (DX100) Select from four levels (DX200)

2.3.2 Display Group

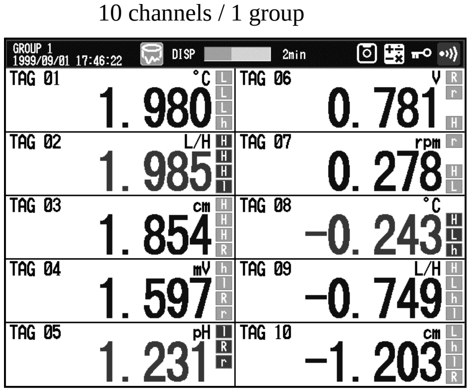
The display groups are initially configured using the SET mode. You can assign any measurement or computation channel in any order to each group.

Group name	: Up to 16 alphanumeric characters
Number of groups	: four groups (four screens)
Number of displayed channels	: Up to six channels per group (screen) (DX100) Up to 10 channels per group (screen) (DX200)
Auto monitor scroll	: In case of trend display, numeric display and bar display, display group can be automatically changed for every specified intervals. The scroll interval is 5,10,20,30sec and 1min.
Display optimization	: The display is optimized depending on the number of channels that are assigned to each group.

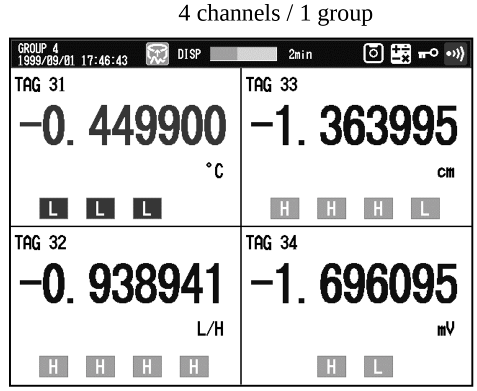
Model	Number of assigned channels	Number of displayed channels
DX100	1 or 2	2 channels
	3	4 channels
	4	
	5	6 channels
	6	
DX200	1 to 4	4 channels
	5	6 channels
	6	
	7	8 channels
	8	
	9	10 channels
	10	

Display example) Display Optimization on the DX200

10 channels / 1 group

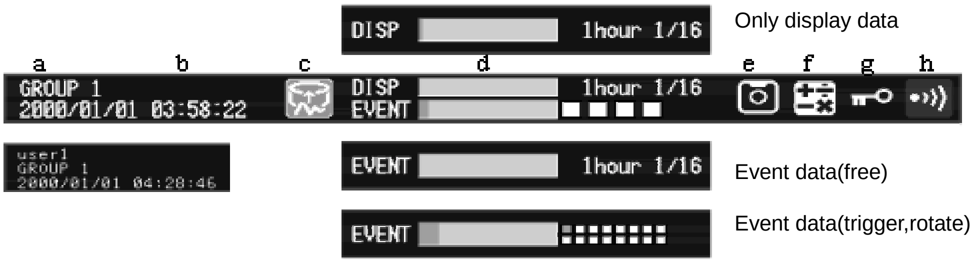


4 channels / 1 group



2.3.3 Status Display

The status display at the top section of the screen graphically displays the time, operating conditions, memory usage, alarm information, and other information at all times.



a. Display group name	: Displays the name of the group (screen) that is currently displayed. When mode is all, 'ALL'is displayed. In case of using log in function, user name is displayed when the status is log on.
b. Date and time	: Displays the current date and time.
c. Recording status indicator	: Displayed in green when recording is in progress, red when it is stopped.
d. Memory status indicator	: Displays the usage condition of the internal memory. Displays stored inner memory storage which has not been copied to external media. Displayed in orange when the event file is waiting for a trigger, green when collecting data.
e. Media status indicator	: Displays the usage condition of the removable storage medium and the open/closed condition of the front door.
f. Computation status indicator	: Turns on when computation is in progress.
g. Key lock indicator	: Turns on when the keys are locked.
h. Alarm indicator	: Turns on or blinks when an alarm occurs.

2.3.4 Display Types

You can select from the following display types on the DX Series.

Display Type		Display Function
Measurement data display	Trend	Displays the measured values using a waveform. This is useful when monitoring the trend of the measured values.
	Numeric	Displays the numeric measured values using large fonts. This is useful when monitoring the exact measured values.
	Bar graph	Displays the measured values on a bar graph. This is useful when monitoring the level of the measured values with respect to a specified value.
Overview		Displays the alarm conditions and numeric values of all the channels on one screen. You can use the cursor to specify a channel and jump to the trend or bar graph containing that channel.
Information display	Alarm information	Displays a list of the times of alarm occurrence and release, and the alarm type. You can select an alarm incident from the list and display the historical data containing the channel on which the alarm occurred.
	Message information	Displays a list of the times when messages were entered and the content of the messages. You can select a message from the list and display the historical data that existed when the message was entered.
	Memory information	Displays a list of files in the internal memory. You can select a display data file and display the historical data.
	Report data	Displays the result of the hourly, daily, weekly, or monthly report using numeric values.
Four screen display (DX200 only)		Simultaneously displays four types of screens. Each screen section can display any one of the measurement data displays, overview, and information displays. You can easily store and recall the screen configuration.
Historical data display		Displays the measured data(display data, event data) in the past that have been written to the internal memory. The data file stored in external media can be seen as a historical data. You can also display the historical waveform of the display data while displaying the current waveform.

Trend display

Displays the measured values using a waveform. This is useful when monitoring a trend in the measured values.

Number of displayed channels	Group display	: Up to six channels per group (screen) (DX100) Up to 10 channels per group (screen) (DX200)
	All channel trend display	: Displays waveforms of all channels. Measured values of a specified group are displayed in digital display part.
Number of group display screens		: four screens (four groups)

Analog waveform

Waveform span rate	: Select from 1, 2, 5, 10, 20, 30 min/div, 1, 2, and 4 hour/div
Direction of waveform display	: Vertical or horizontal (common to all groups)
Line width	: Select 1, 2, or 3 pixels (common to all groups)
Grid	: Select from 4 to 12 (common to all groups)
Scale value	: Indicates the recording span. DX100 can display maximum 6 scales, and DX200 can display maximum 10 scales. The number of divided scales is same as bar graph(4〜12). You can turn ON/OFF the scale using the operation keys.
Time information	: Displays the time on the grid.
Message display	: Displays the message that was entered using the keys or remotely.

Trip lines

Displays a line at a value to which you wish to pay special attention.

Number of lines	: Up to four levels (lines) can be set for each group.
Line width	: Select 1, 2, or 3 pixels (common to all groups)
Display color	: Select from red, green, blue, blue-violet, brown, orange, yellow-green, light-blue, violet, gray, lime, cyan, dark-blue, yellow, light-gray, and purple (16 colors). for each trip line.
Display position	: Enter the position in terms of a percentage (0 to 100%) of the display range.

Numeric display section

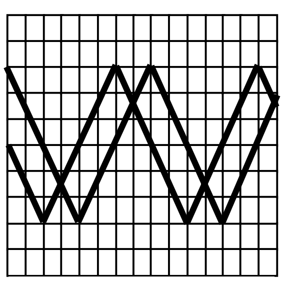
Displays the numeric measured values and the alarm conditions. The current value is displayed in red while an alarm is in effect. When displaying the all channel trend display, the numeric display shows the values of the selected display group.

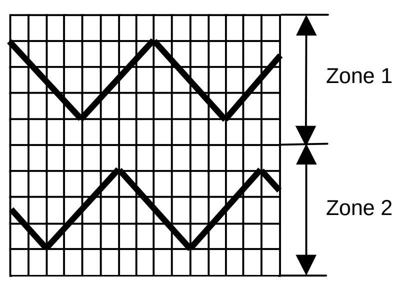
Display	:You can select ON/OFF of display using operation key.
Display update rate	: 1 s

Zone display

Each channel is displayed in its own separate display zone. Since the analog waveforms do not overlap each another, it is much easier to view.

Span bandwidth	: 5% or greater (display span of the waveform)
Resolution	: 1% (0 to 100%)


Normal display

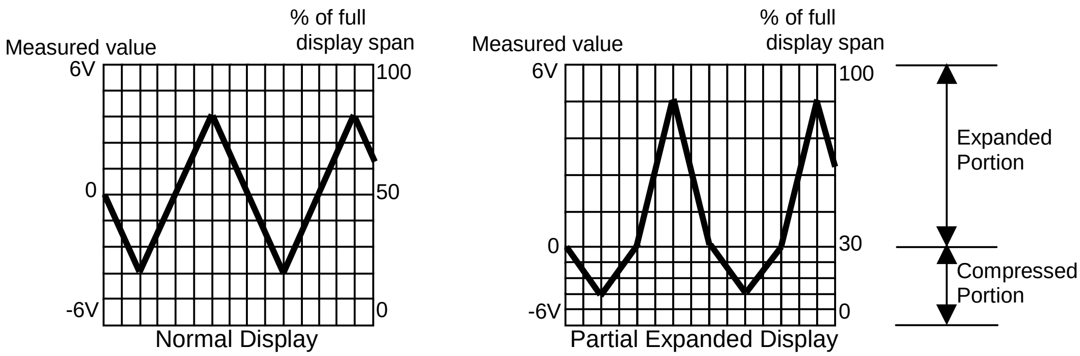


Zone display

Partial expanded display

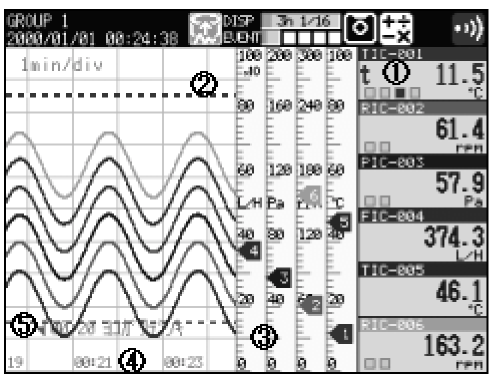
A section of the display is expanded in order to separate the sections of the analog waveform that you wish to view in detail from the other sections.

Boundary of portion to be expanded/compressed : 1 to 99%
Boundary value : within the display span

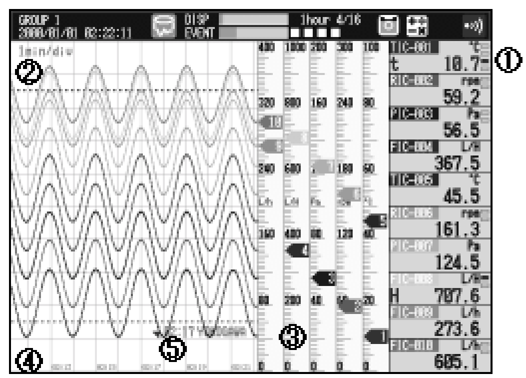


As can be seen from these figures, the lower side of the boundary (0V) shows at 30% of the full span of the screen the data in the range –6V to 0V. On the upper side of the boundary, the range 0V to 6V is shown at 70% of the full span of the screen. Thus the scales differ on the upper and low sides of the boundary.

Trend display screen



DX100

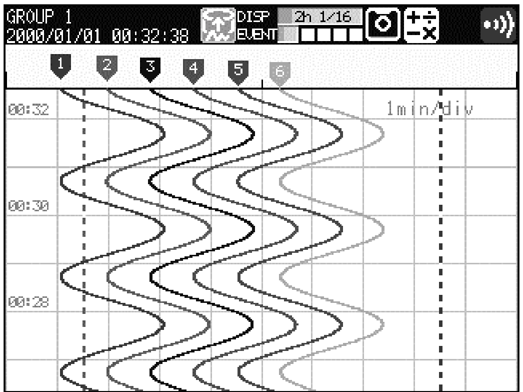


DX200

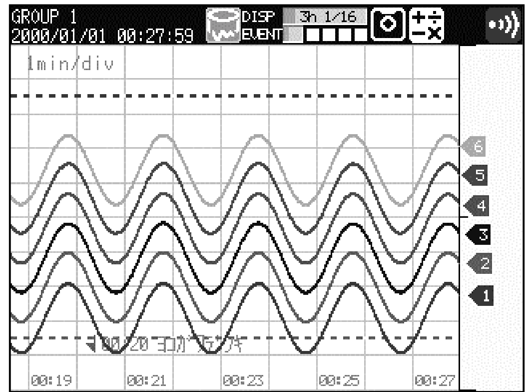
①Digital display part
②Trip line
③Scale display
④Time information
⑤Message

a. Numeric indications
b. Trip line
c. Current value pointer
d. Time information
e. Message

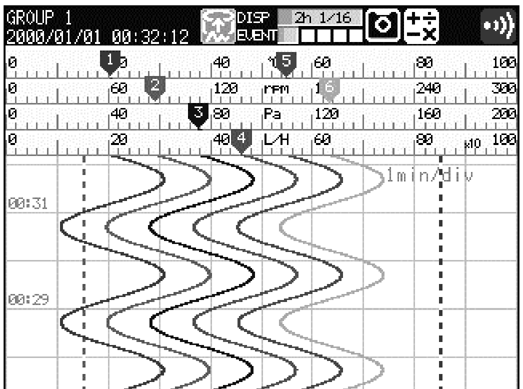
Samples of trend display(DX100)



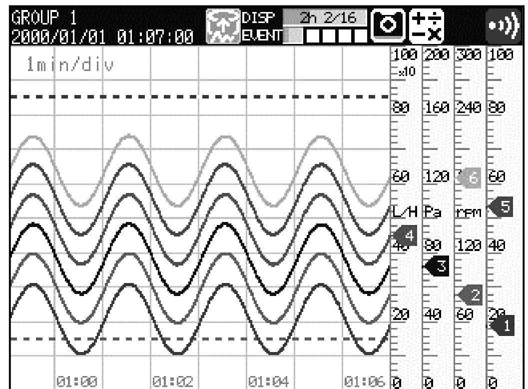
Scale：Off/Numeric display：Off



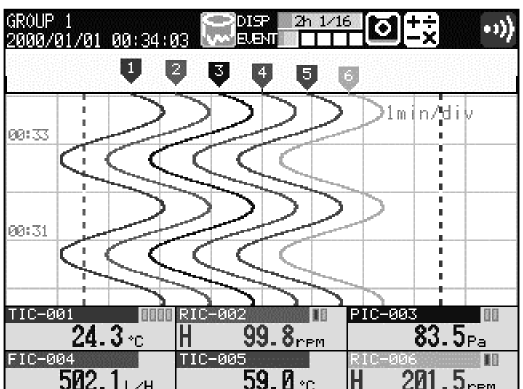
Scale：Off/Numeric display：Off



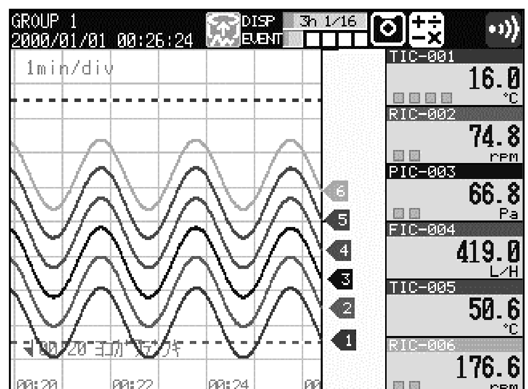
Scale：On/Numeric display：Off



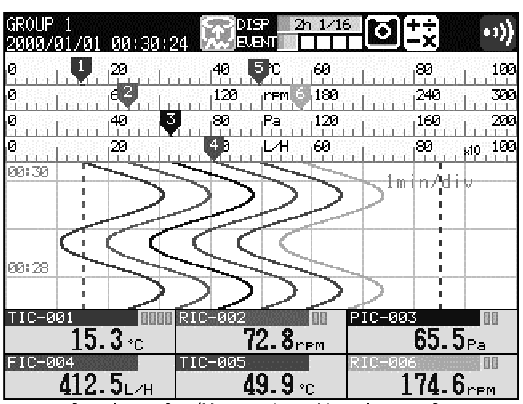
Scale：On/Numeric display：Off



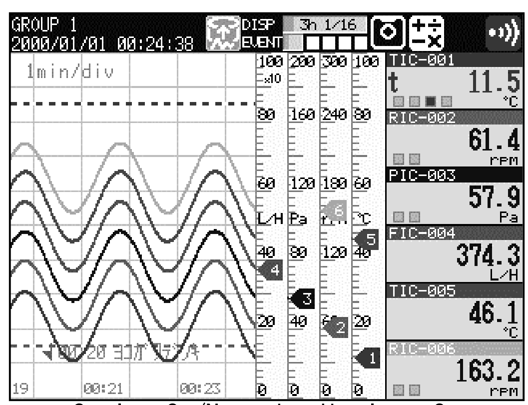
Scale：Off/Numeric display：On



Scale：Off/Numeric display：On

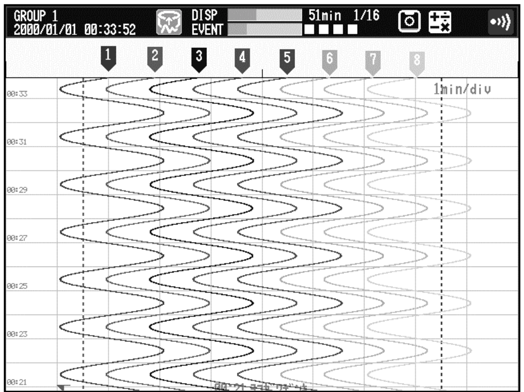


Scale：On/Numeric display：On

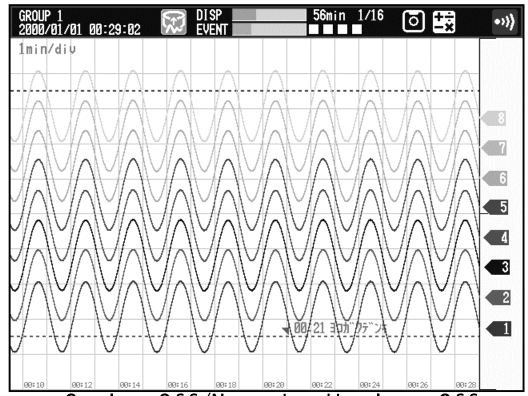


Scale：On/Numeric display：On

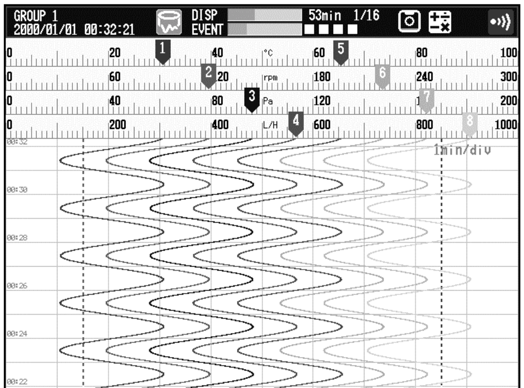
Samples of trend display（DX200）



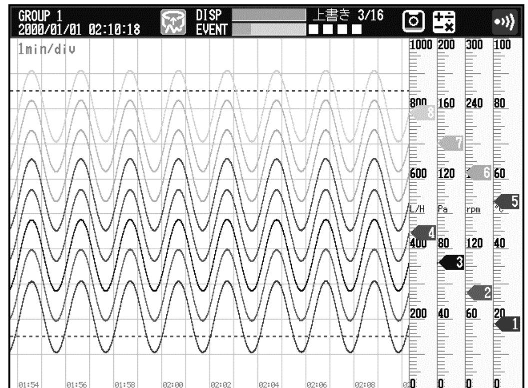
Scale : Off/Numeric display : Off



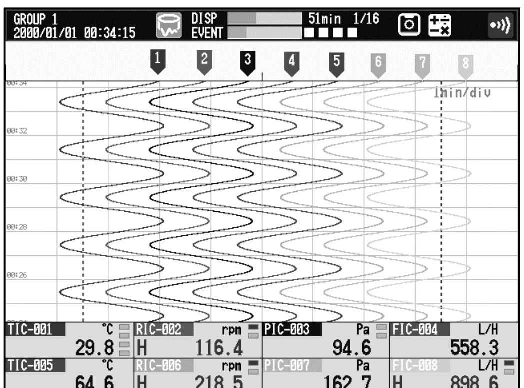
Scale : Off/Numeric display : Off



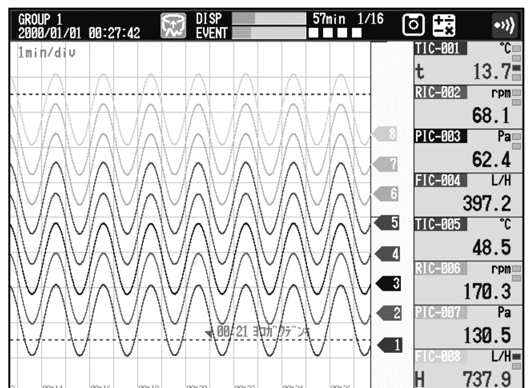
Scale : On/Numeric display : Off



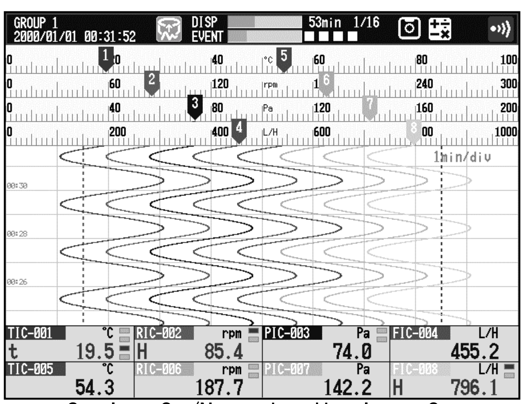
Scale : On/Numeric display : Off



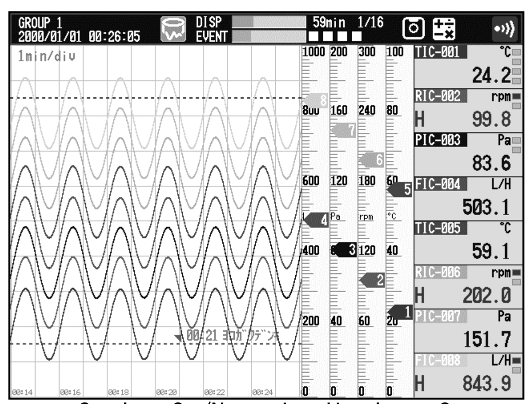
Scale : Off/Numeric display : On



Scale : Off/Numeric display : On



Scale : On/Numeric display : On



Scale : On/Numeric display : On

Scale specifications（DX100）

Scale display position

On the trend display, the scale display position for the channels that are assigned to groups can be displayed in 6 different positions.

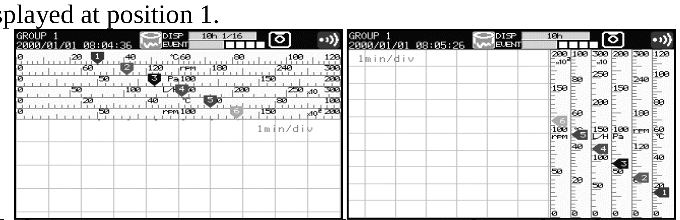
Trend vertical display：1,2,3,4,5,6 from the top.

Trend horizontal display：1,2,3,4,5,6 from the right

If the scale for two or more channels are specified to the same position, the scale for the channel that was assigned first to the group is displayed.

Example 1 Ifthechannelswereassignedtoagroupinthefollowingorder:[03.02.01.05]

If the scale display position for channels 3, 2, 1, and 5 are all set to [1], the scale for channel 3 is displayed at position 1.



Scale marks

The scale can be divided into 4 to 12 sections using the main scale marks. The area between the main scale marks is divided further into 10 sections using small and medium marks. When the main scale marks is divided into 6 to 12, the main scale marks is divided into 5 sections by small marks.

However, small marks are not displayed for the following cases:

・When the measurement/computation range resolution is smaller than the total number of sections created by small marks.

・When zone display is used.

・When partial expanded display is used.

Scale value

The scale values are displayed at all main scale marks when the scales divided into 4 to 7 sections using the main scale marks. When scale is divided into 8 to 12 sections, the scale values are displayed at every other main scale mark. In addition, the upper or lower limit of the scale is displayed at the end of the scale.

Rule 1 Up to 4 digits excluding the minus sign can be displayed at the end of the scale.

Rule 2 If the integer section of either value at the end of the scale is less than or equal to one digit, the value is displayed as □.□ or 0.□□.

Example 1 If the scale is set to -0.05 to 0.50, the scale display for the upper and lower limits is -0.0 to 0.5

Example 2 If the scale is set to -0.005 to 0.05, the scale display for the upper and lower limits are -0.0 to 0.0.

Rule 3 If the integer section of either value at the end of the scale is greater than or equal to tow digits and less than four digits, the value is displayed with the decimal fraction is discarded.

Example 3 If the scale is set to 0.1 to 100.0, the scale display for the upper and lower limits is 0 to 100.

Rule 4 If the integer section of either value at the end of the scale is greater than or equal to five digits, a four-digit mantissa and exponent are displayed($\times 10$ or $\times 10^2$)

Example 4 If the scale is set to 10 to 2000, the scale display for the upper and lower limits are 1 to 200$\times$10.

Rule 5 If the different in the number of digits between the upper and lower limits of the scale is larger than the number of digits that can be displayed, the smaller value is set to zero(0, 0.0).

Example 5 If the scale is set to -0.0005 to 0.5000, the upper and lower limits of the scale are displayed as 0.00 to 0.50

Scale specifications（DX200）

Scale display position

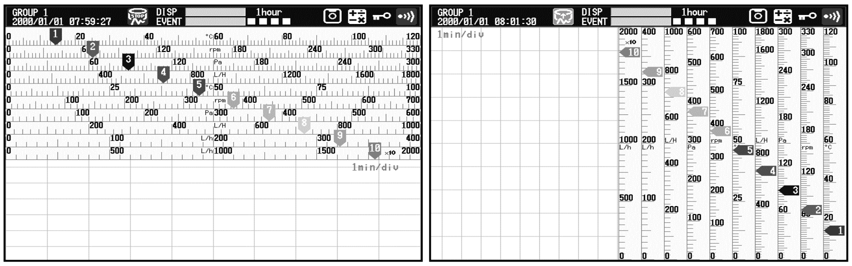
On the trend display, the scale display position for the channels that are assigned to groups can be displayed in 10 different positions.

Trend vertical display：1,2,3,4,5,6,7,8,9,10 from the top.

Trend horizontal display：1,2,3,4,5,6,7,8,9,10 from the right

If the scale for two or more channels are specified to the same position, the scale for the channel that was assigned first to the group is displayed.

Example 1 If the channels were assigned to a group in the following order: [03.02.01.05]
If the scale display position for channels 3, 2, 1, and 5 are all set to [1],
the scale for channel 3 is displayed at position 1.



Scale marks

The scale can be divided into 4 to 12 sections using the main scale marks. The area between the main scale marks is divided further into 10 sections using small and medium marks.

However, small marks are not displayed for the following cases:

・When the measurement/computation range resolution is smaller than the total number of sections created by small marks.

・When zone display is used.

・When partial expanded display is used.

Scale value

The scale values are displayed at all main scale marks when the scales divided into 4 to 7 sections using the main scale marks. When scale is divided into 8 to 12 sections, the scale values are displayed at every other main scale mark. In addition, the upper or lower limit of the scale is displayed at the end of the scale.

Rule 1 Up to 4 digits excluding the minus sign can be displayed at the end of the scale.

Rule 2 If the integer section of either value at the end of the scale is less than or equal to one digit, the value is displayed as □.□ or 0.□□.

Example 1 If the scale is set to -0.05 to 0.50, the scale display for the upper and lower limits is -0.05 to 0.50

Example 2 If the scale is set to -0.005 to 0.05, the scale display for the upper and lower limits are -0.00 to 0.05.

Rule 3 If the integer section of either value at the end of the scale is greater than or equal to tow digits and less than four digits, the value is displayed with the decimal fraction is discarded.

Example 3 If the scale is set to 0.1 to 1000.0, the scale display for the upper and lower limits is 0 to 1000.

Rule 4 If the integer section of either value at the end of the scale is greater than or equal to five digits, a four-digit mantissa and exponent are displayed(×10 or ×10^2)

Example 4 If the scale is set to 10 to 20000, the scale display for the upper and lower limits are 1 to 2000×10.

Rule 5 If the different in the number of digits between the upper and lower limits of the scale is larger than the number of digits that can be displayed, the smaller value is set to zero(0, 0.0, or 0.00).

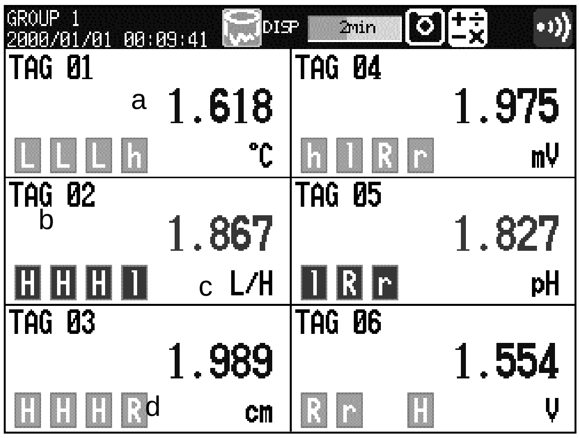
Example 5 If the scale is set to -0.0005 to 0.5000, the upper and lower limits of the scale are displayed as 0.00 to 0.50

Numeric display

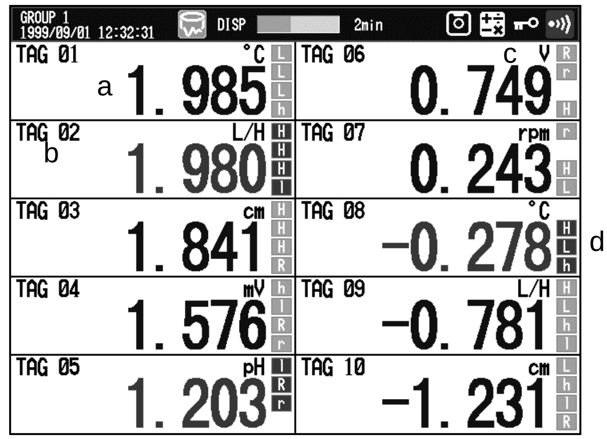
Displays the numeric measured values using large fonts. This is useful when monitoring the exact measured values. The current value of the measured data and alarm information can be observed easily.

Number of displayed channels	: Up to six channels per group (screen) (DX100) Up to 10 channels per group (screen) (DX200)
Number of screens	: four screens (four groups)
Display update rate	: 1 s

Numeric display (DX200)



DX100



DX200

a. Measured values	: Displayed in red while an alarm which is in effect.
b. Channel number	: Displays channel numbers or tags.
c. Unit	
d. Alarm status indicator	: Displays the alarm type and condition for each channel.

H	High limit alarm
L	Low limit alarm
R	Rate-of-change limit on increase
r	Rate-of-change limit on decrease
h	Difference high-limit alarm
l	Difference low-limit alarm
T	Delayed high limit alarm
t	Delayed low limit alarm

Green box	: Alarm released
Red box	: Alarm in effect

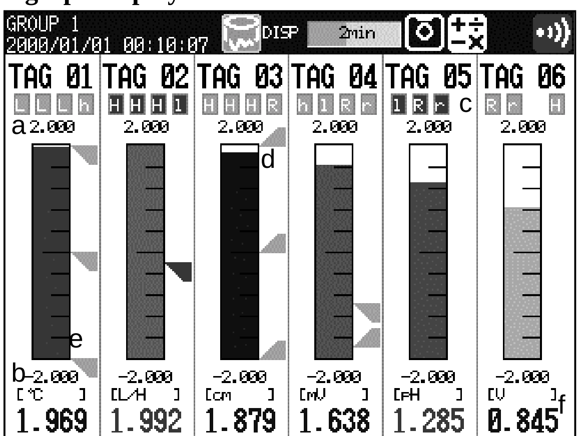
When Alarm Indication Hold is selected, it blinks until Alarm Ack is executed.

Bar graph display

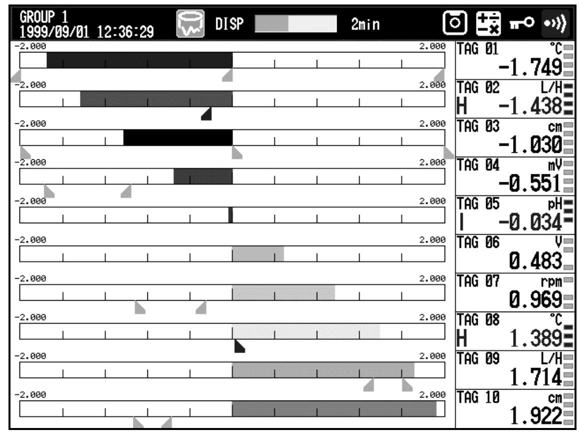
Displays the measured values on a bar graph. The current value of the measured data and alarm information can be observed easily for each channel.

Number of displayed channels	: Up to six channels per group (screen) (DX100) Up to 10 channels per group (screen) (DX200)
Number of screens	: four screens (four groups)
Scaling	: Select from 4 to 12 for each channel.
Bar graph display direction	: Vertical or horizontal (common to all groups)
Base position	: Vertical display ; standard (edge) Horizontal display ; standard (edge) or center (selectable for each channel)
Display update rate	: 1 s

Bar graph display



DX100



DX200(center bar graph)

a. Scale upper limit
b. Scale lower limit

c. Alarm status indicator : Displays the alarm type and condition for each channel.

H	High limit alarm
L	Low limit alarm
R	Rate-of-change limit on increase
r	Rate-of-change limit on decrease
h	Difference high-limit alarm
l	Difference low-limit alarm
T	Delayed high limit alarm
t	Delayed low limit alarm

Green box : Alarm released
Red box : Alarm in effect
When Alarm Indication Hold is selected, it blinks until Alarm Ack is executed.

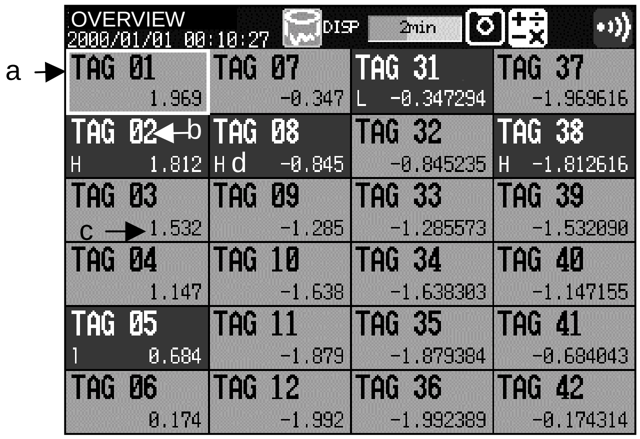
d. Upper limit alarm point : Displayed in green when the alarm is released, red when the alarm is in effect.
e. Lower limit alarm point : Displayed in green when the alarm is released, red when the alarm is in effect.
f. Measured value : Displayed in red when the alarm is in effect.

Overview display

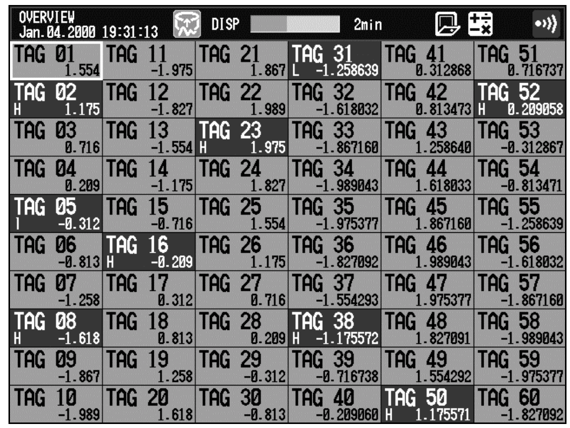
Displays the alarm conditions and numeric values of all the channels on one screen.

Number of displayed channels	: Up to 24 channels (DX100) Up to 60 channels (DX200)
Number of screens	: one screen
Display update rate	: 1 s
Displayed contents	: Displays the tag name and the current value in the display area for each channel.
Function	: When an alarm occurs, the display area of the channel turns from green to red. You can use the cursor to specify a channel and display the trend or bar graph containing that channel.

Overview display



DX100



DX200

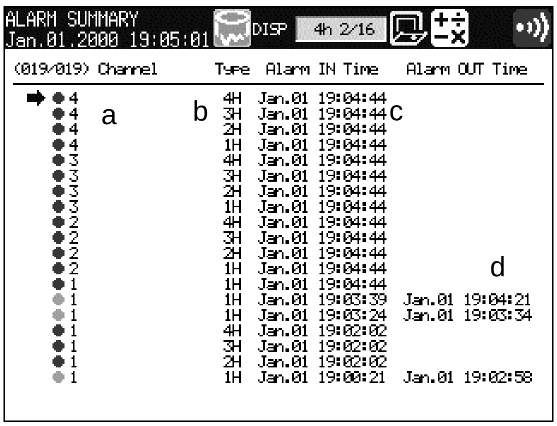
a. Cursor
b. Channel number or Tag name
c. Current value
d. Alarm type

Information display

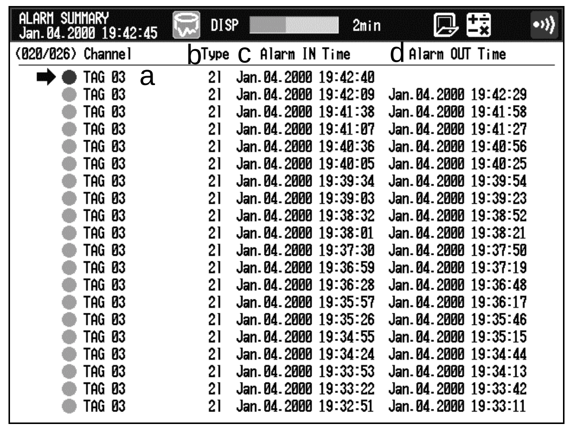
Displays various information such as an alarm that occurred in the past and the internal memory condition.

Alarm summary	: Displays a list of the times of the alarm occurrence and release, and the alarm type. You can select an alarm incident from the list and display the historical data containing the channel on which the alarm occurred.
Message summary	: Displays a list of the times when messages were entered and the content of the messages. You can select a message from the list and display the historical data that existed when the message was entered.
Memory summary	: Displays a list of files in the internal memory. You can select a display data file and display the historical data. When selected file includes report data(calculation option), report data can be displayed.
Report data	: Displays the result of the hourly, daily, weekly, or monthly report using numeric values.

Alarm summary display



DX100

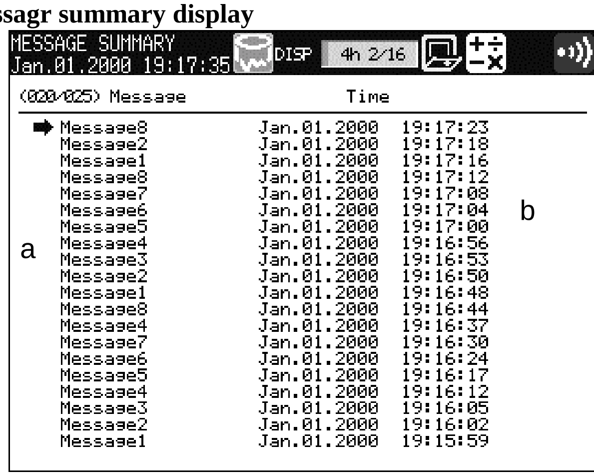


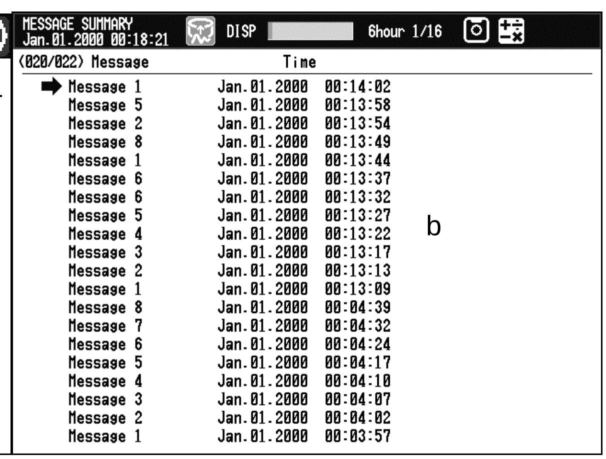
DX200

a. Channel or tag name
b. Alarm level and type
c. Time of alarm occurrence
d. Time of alarm release

Red	: Alarm in effect
Green	: Alarm released

Messagr summary display

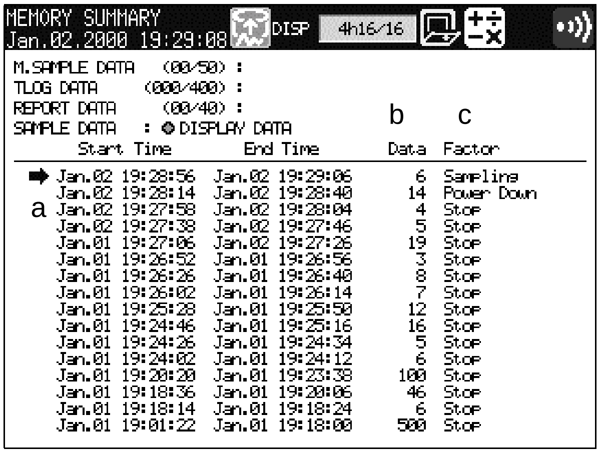




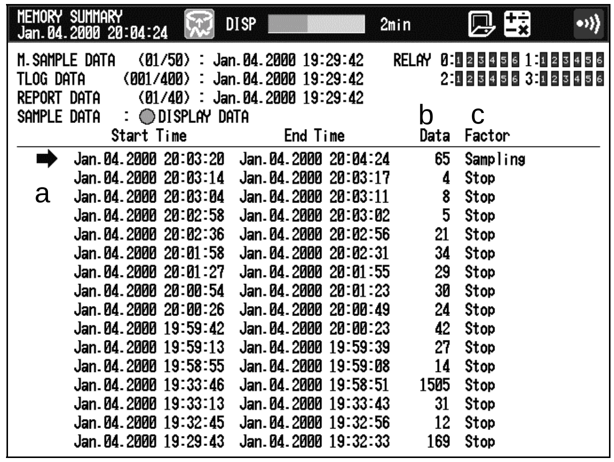
DX100 DX200

a Message
b. Date and time of message entry

Memory summary



DX100



DX200

a. Data saving start/stop time
b. Number of data
c. Factor : Indicates a factor of file generation.

Four screen display (DX200)

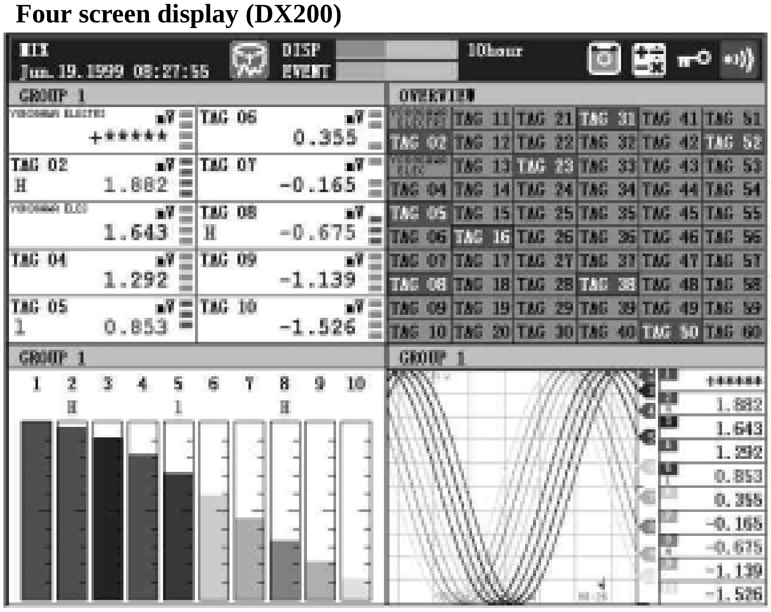
Divides the display into four areas and displays any one of the measurement data displays, overview, and information displays in each display area. You can also specify the display group and the type of display (vertical or horizontal trend, for example). You can also easily store and recall the screen configuration.

Display type You can assign the following displays to each display area.

	Measurement data display	Trend display
		Numeric display
		Bar graph display
	Overview display	
	Information display	Alarm information
		Message information
		Memory information
		Media information
		Report data

Screen configuration storage function		The screen configuration can be stored.
	Number of configurations	: Up to four
	Screen name	: Up to 16 alphanumeric characters
	Storage method	: Store using the soft keys in the operation mode
	Recall	: Select the desired configuration using the operation keys

Four screen display (DX200)



2.3.5 Waveform Reference Function (Historical Trend Display)

The past measured data stored in the internal memory can be viewed.
You can also display the historical data together with the current waveforms for easy comparison of the two.

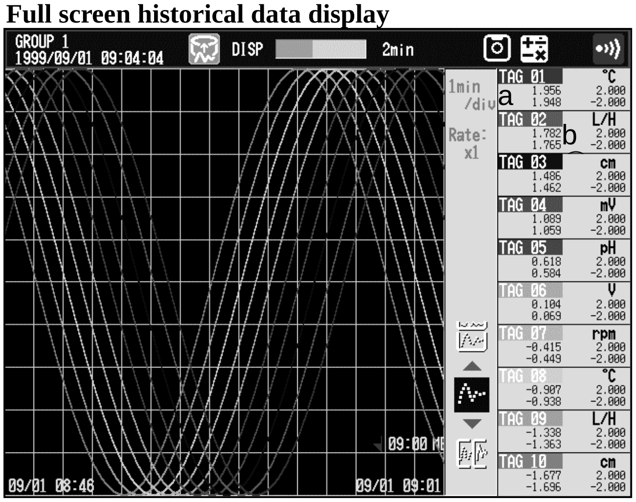
Display function

Display data : Display data file/event data file
Display : Display data file: Full screen for each display group of two screen display
Event data file: Full screen for each display group.
Scroll : You can scroll the waveform using the cursor keys.
Time axis zoom : Time axis expand: Up to a factor of two.
Time axis reduce ; Down to 1/60.

Memory overview

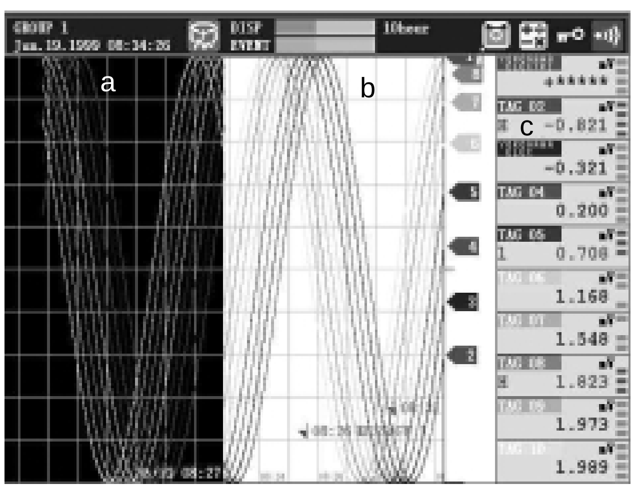
Displays in a compressed form the entire display data in the internal memory and removable storage media.
You can specify a position on the memory overview display with a cursor and display it on the full screen historical data display.

Full screen historical data display



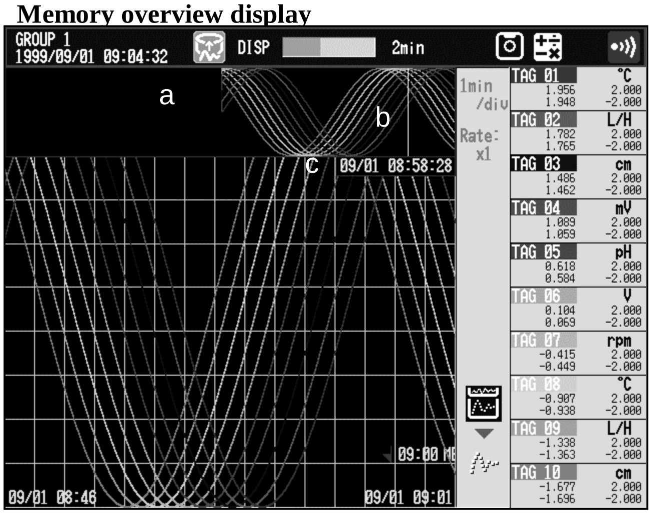
a. Max. and Min. values of right-end of the display.
b. Max. and Min. values of display range.

Two screen display(display data file)



a. Historical data
b. Current waveform
c. Numeric display section
The current value is displayed.

Memory overview display



a.Compressed display of a whole waveform reference display data file.
b.Cursor
c.Cursor position
Displayed in terms of time.

Displaying the historical data from the information display

You can display historical data from each of the information displays.

Alarm information : You can select an alarm incident from the list and display the historical data of the channel on which the alarm occurred.

Message information : You can select a message from the list and display the historical data that existed when the message was entered.

Memory information : You can select a display data file and display the historical data.

Historical trend display of display data file saved in removable storage media

Historical trend of Display data file, saved in media in set mode, can be displayed on DX.

2.4 Recording Section

Because the conventional chart paper has been replaced by electronic storage, various recording (file) formats and recording modes are available.

2.4.1 Removable storage media

You can select from the following removable storage media when you place the order.

3.5 inches floppy disk (1.44 MB: 2HD)
PCMCIA flash ATA memory card (Up to 160 MB)
Zip disk (100 MB)

2.4.2 File Types

File types

The following types of data can be stored on the removable storage meda.

File Type		Data description	Format
Measurement data file	Display data	The maximum and minimum values within the waveform update rate of the measured data that have been sampled	Binary
	Event data	Instantaneous value of the data sampled at the specified sampling rate	
Manual sampling Data file		Instantaneous value at the time of the key input or contact input.(It saves one set of instantaneous channel values to a ASCII file. Up to 50 sets of values can be saved in the file.)	ASCII
Statistical computation (TLOG) data file*1		Data at the time of TLOG time expiration	Binary
Report file*1		Hourly, Daily, Weekly, Monthly	ASCII
Setup file		Switching between SET mode and SETUP mode	ASCII
Information	Alarm/message	Saved within the measurement data file	Binary
	Setup information	Stored within the measurement data file	Binary
	Login user name	When the login function is turned ON, the user name of the person that executed the start/stop operation and entered messages is recorded within the measured data file.	Binary
	Batch information*2	Stores batch information within the measurement data file.	Binary

*1: When the computation option is installed.
*2: When the batch function option is installed.

The snapshot data file of the screen is output to the external recording medium or via communications.

File type	Data description	Output	Format
Snapshot file	Image obtained by screen shot	Output to removable storage meda or via communications	PNG

File name

The file name of the data is in the form [the time of the first sampled data + serial number.extension.
A folder can be created on the removable storage medium and the following data files can be stored.

Folder name : Up to eight alphanumeric characters
Display data file : Mddhhmma.DDS
Event file : Mddhhmma.DEV
Report file : Hourly: Mddhhmma.DHR
Daily: Mddhhmma.DDR
Weekly: Mddhhmma.DWR
Monthly: Mddhhmma.DMR
Manual sampling : Mddhhmma.DMN
TLOG file : Mddhhmma.DTG
M : Month (1 to 9,X,Y,Z) * X = Oct., Y = Nov., Z = Dec.
dd : Day
hh : Hour
mm : Minute
a : Serial number (0 to 9,A to Z)

Setup file name

The name of the setup file is specified using up to eight alphanumeric characters.

Setup file : xxxxxxxx.PNL (xxxxxxxx: eight or less alphanumeric characters)

2.4.3 Description of Files

Measurement data file

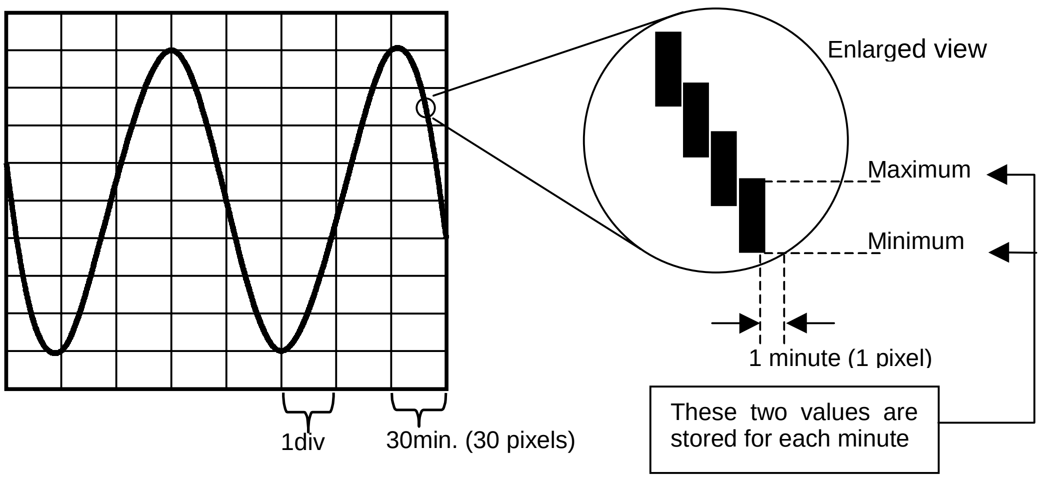
The following two types of files can be created simultaneously as measurement data files on the DX Series.

Display data file : Stores data at a sampling rate in sync with the display update rate
Event file : Stores data at a specified sampling interval.

Display data file (. DDS)

The display data file stores measured data that are used to display the waveform.

The maximum and minimum values of the data measured at a specified sampling rate over a time period corresponding to one dot on the time axis are stored as one waveform display data point (pixeles).
Since data can be stored over a long period at a comparatively slow sampling interval (2 s to 8 minutes), this file corresponds to the conventional chart paper.



Conceptual diagram of the display data file (When the waveform update rate is "30 min/div")

In the example above, the waveform display is updated at a rate of one dot per minute.
The DX102/104/204/208 measures at a maximum speed of 125 ms, thus it is actually making 480 measurements in one minute.
The DX106/112/210/220/230 measures at a maximum speed of 1 s, thus it is actually making 60 measurements in one minute.
The maximum and minimum values of the data measured over the waveform update interval of one minute are stored in the display data file.
In other words, even if an abrupt change occurs within one minute, the DX series will capture its peak value.

The relationship between the waveform span rate (the time corresponding to one div on the time axis), the data saving period is indicated below.

Waveform Span Rate	Data Saving Period	Waveform Display speed (Approx.)
1min/div	2sec	615.0mm/h
2min/div	4sec	307.5mm/h
5min/div	10sec	123.0mm/h
10min/div	20sec	61.5mm/h
20min/div	40sec	30.7mm/h
30min/div	1min	20.5mm/h
1hr/div	2min	10.2mm/h
2hr/div	4min	5.1mm/h
4hr/div	8min	2.5mm/h

Event file (. DEV)

The event data file stores data at a high sampling rate so that the data can be analyzed in detail using a PC. This file is used when storing data when trouble is occurring or when you wish to analyze the data.

Event file sampling interval

The DX series uses the following measurement interval at all times to acquire data into the A/D converter. The interval at which the data are stored to the memory is called the sampling interval.

If the sampling interval is set to the measurement interval, all data that are acquired by the A/D are stored in the memory. You can not specify a shorter sampling interval than the measurement interval.

Model		Measurement interval	Event file sampling interval
DX100	DX102	125ms or 250ms	Select from 125,250,500ms, 1,2,5,10,30,60,120s
	DX104		
	DX106	1sec or 2sec 2 s when the A/D integration time is 100 ms	Select from 1,2,5,10,30,60,120s
	DX112		
DX200	DX204	125ms or 250ms	Select from 125,250,500ms, 1,2,5,10,30,60,120s
	DX208		
	DX210	1sec or2sec 2 s when the A/D integration time is 100 ms	Select from 1,2,5,10,30,60,120s
	DX220		
	DX230		

Sampling mode

You can select the sampling mode of the event file from the following choices depending on whether or not the trigger is used.

Trigger free (FREE) : Acquires data in sync with the start operation.
Data are overwritten when the internal memory becomes full.
Trigger ON (TRIG) : Starts data acquisition when the trigger is activated.
Data acquisition stops when the internal memory becomes full.
Trigger rotate (ROTATE) : Starts data acquisition when the trigger is activated.
Data are overwritten when the internal memory becomes full.

Trigger condition

When the sampling mode is set to trigger ON or trigger rotate, the following triggers can be turned ON or OFF. When any one of the trigger conditions that is turned ON is satisfied, the trigger is activated.

Key trigger : Acquires data to the memory when a key is pressed.
External trigger : Acquires data to the memory when an external contact (remote input) is turned ON.
Alarm trigger : Acquires data to the memory when an alarm occurs.

Pretrigger

When the trigger occurs, you can have the data before the trigger is written to the memory.

Pretrigger : Select from 0, 5, 25, 50, 75, 95, and100%

File combination

On the DX Series, the display data file and event file can be combined in the following manner to suite the application.

1. Display data file + event file (ROTATE)
When you wish to analyze the long-term trend as well as the data around the point at which the external recording medium is inserted.

2. Display data file + event file (TRIG)
When you wish to analyze the long-term trend as well as the data around multiple trigger points that are set off by alarms and contacts.

3. Display data file only
When you wish to continuously record over a long period.

4. Event file only
When you do not need the long-term trend that is stored using a slow sampling interval. Instead, you want to store as much data as possible at a high sampling interval.

Trigger function	Event file only	: Select from TRIG, ROTATE, and FREE
	Display data + Event file	: Select TRIG or ROTATE
Number of memory partitions	Event file only(trigger, rotate)	: Select from 1, 2, 4, 8, and 16
	Display data + Event file	: Select from 1, 2, and 4
Data length	Specify the length of data to acquire in the divided block. The maximum data length depends on the number of channels, sampling interval, and the file combination.	

Number of Display files

The number of files that can be stored is as follows.
Internal memory : The newest 16 files (16 sets*)
Removable storage medium : Depends on the capacity of the external recording medium during auto mode.

*Number of sets : One sets consists of one **START** and one **STOP**. The storage range is either the maximum value of the number of data points or the maximum number of sets.

Manual sampling data file (.DMN)

Stores the date/time and the instantaneous value to the file in ASCII format when a key or a remote contact is input.

Every time a key or a remote contact is input, a data set is appended to the file.

Number of data sets : The number of data that can be stored is as follows.
Internal memory : Stores the newest 50 data sets.
Removable storage medium : Depends on the capacity of the removable storage media during auto mode.

Statistical operation (TLOG) data file (.DTG)(when the computation option is installed)

Stores the results of the statistical operation (TLOG) in binary format when the computation interval is passed.
A data set is appended to the file every time the computation interval is passed while the statistical operation (TLOG) function is enabled.

Maximum number of data sets : One statistical operation data file can hold up to 400 data sets.
Number of files : The number of files that can be stored is as follows.
Internal memory : The newest 16 files (16 sessions*)
Removable storage medium: Depends on the capacity of the external recording medium during auto mode.
*Number of sessions : The number of computing operations (START to STOP).

Report file (.DHR/.DDR/.DWR/.DMR) (when the computation option is installed)

Stores the result of the report in ASCII format when the report period expires.
A data set is appended to the file every time the report period expires while the report function is enabled,

Number of data sets : The number of files that can be stored is as follows.
Internal memory : The newest 40 data sets
Removable storage medium : Depends on the capacity of the external recording medium during auto mode.

Setup file (.PNL)

The SET mode and SETUP mode settings are stored to the medium.
The settings are stored using the keys in the SET mode screen.

2.4.4 Recording Operation

The measured data are storage to the internal memory in the DX100/DX200.

There are two methods of saving data to the removable storage media. One method is the **MANUAL Mode** in which data in the internal memory are automatically stored to the media when the media is inserted into the DX100/DX200. The other method is the **AUTO Mode** in which the media is inserted beforehand, and data are stored automatically at certain time intervals.

MANUAL Mode

The data in the internal memory is automatically stored in the removable storage media when the medium is inserted.

The recording operation in the manual mode is as follows.

File Type			Recording Operation	
			All	**Unsaved**
Measured data file	Display data file		Saves all data in the internal memory	Saves only the unsaved data
	Event file	Trigger free		
		Trigger enabled		
Manual sample file				
TLOG file				
Report file				

AUTO Mode

Automatically saves the data to a removable storage media that has been inserted beforehand.

The recording operation in the auto mode is as follows.

File Type			Recording Operation
Measured data file	Display data file		Automatically saves data to the removable storage media at auto save intervals or save execution using [FUNC] key when the operation is stopped.
	Event file	Trigger free	
		Trigger enabled	Automatically saves data to the removable storage media when the sampling is complete or when the operation is stopped.
Manual sample file			Data are appended to the file every time manual sample is executed.
TLOG file			A file is created at the first time up after the medium is inserted, and data are appended to the file at every time up.
Report file			

Auto save interval : Auto save interval can be selected within the range of maximum recording time.
3(only event file),5(only event file),10, 20, 30min, 1,2,3,4,6,8,12hours
1, 2, 3, 5, 7, 10, 14, 31days

Selectable Auto save intervals are varied by waveform update rate, file combination, or number of channels saved in internal memory. (Refer to 2.4.5 Sample time)

2.4.5 Sampling Time

The sampling time (maximum recording period) depends on the number of measurement and computation channels and the file combination.(Refer to the examples of the sampling time in the appendix)

Internal memory capacity

The capacity of the internal memory is defined according to the file combination as follows.
Display data only : Memory capacity = 1.2 Mbytes
Event file only : Memory capacity = 1.2 Mbytes
Display data file + Event file : Memory capacity = 900 Kbytes (display data file)
Memory capacity = 300 Kbytes (event file)

Data size

The data size of one sample per channel is as follows.

Display data	Measurement data = 4 bytes/channel
	Computation data = 8 bytes/channel
Event data	Measurement data = 2 bytes/channel
	Computation data = 4 bytes/channel

Data capacity

The data capacity of one sample is expressed by the following equation.
Display data capacity = Number of measurement channels × 4 bytes ＋number of computation channels × 8 bytes
Event data capacity = Number of measurement channels × 2 bytes ＋number of computation channels × 4 bytes

Maximum number of data points

The maximum number of data points that can be recorded in the internal memory is expressed by the following equation.
Maximum number of data points = Internal memory capacity/data capacity of one sample

Display data only

Display data :Maximum number of data points = 1.2 Mbytes / (number of measurement channels × 4 bytes＋ number of computation channels × 8 bytes) …1
However, 100,000 data points maximum.

Event file only

Event data :Maximum number of data points = 1.2 Mbytes / (number of measurement channels × 2 bytes＋ number of computation channels × 4 bytes) …2
However, 120,000 data points maximum.

Display data＋Event file

Display data :Maximum number of data points = 900 Kbyte / (number of measurement channels × 4 bytes＋ number of computation channels × 8 bytes) …3
However, 75,000 data points maximum.
Event data :Maximum number of data points = 300 Kbytes / (number of measurement channels × 2 bytes＋ number of computation channels × 4 bytes) …4
However, 30,000 data points maximum.

Sampling Time

Sampling period (maximum recording period) is determined from the following equation.
Sampling period = Maximum number of data points × sampling interval …5

Example

Display data file only

Measurement channel: 2 channels, computation channel: none

Display data — From equation *1*, we obtain 1.2 Mbytes/(2×4 bytes+0×8 bytes) = 150,000 data points.
However, because the maximum number of data points that can be recorded is 100,000 data points,
Maximum number of data points = 100,000 data points

When the waveform span rate is 30min/div (data storage interval of 60 s)
Sampling period = 100,000 data points×60 s = 6,000,000 s (approx. 69 days)

Measurement channel: 12 channels, computation channel: 6 channels

Display data — Maximum number of data points = 1.2 Mbytes/(12×4 bytes+6×8 bytes) = 12,500 data points

When the waveform span rate is 30min/div (data storage interval of 60 s)
Sampling period = 12,500 data points×60 s = 750,000 s (approx. 8 days)

Event file only

Measurement channel: 4 channels, computation channel: none

Event — From equation *2*, we obtain 1.2 Mbytes/(4×2 bytes+0×4 bytes) = 150,000 data points.
However, because the maximum number of data points that can be recorded is 120,000 data points,
Maximum number of data points = 120,000 data points

When event file sampling interval is 1 s
Sampling period = 120,000 data points ×1 s = 120,000 s (approx. 33 hours)

Measurement channel: 12 channels, computation channel: 6 channels

Event — Maximum number of data points = 1.2 Mbytes/(12×2 bytes+6×4 bytes) = 25,000 data points

When the event file sampling interval of 1 s
Sampling period = 25,000×1 s = 25,000 s (approx. 7 hours)

Display data file+Event file

Measurement channel: 2 channels, computation channel: none

Display data — From equation *3*, we obtain 900 Kbytes/(2×4 bytes+0×8 bytes) = 112,500 data points.
However, because the maximum number of data points that can be recorded is 75,000 data points,
Maximum number of data points = 75,000 data points

When the waveform span rate is 30min/div (data storage interval of 60 s)
Display data file sampling period = 75,000 data points×60 s = 4,500,000s (approx. 52 days)

Event — From equation *4*, we obtain 300 Kbytes/(2×2 bytes+0×4 bytes) = 75,000 data points.
However, because the maximum number of data points that can be recorded is 30,000 data points,
Maximum number of data points = 30,000 data points

When the event file sampling interval is 1 s
Event file sampling period = 30,000 data points×1 s = 30,000 s (approx. 8 hours)

Measurement channel: 12 channels, computation channel: 6 channels

Display data — Maximum number of data points = 900 Kbytes/(12×4 bytes+6×8 bytes) = 9,375 data points

When the waveform span rate is 30min/div (data storage interval of 60 s)
Display data file sampling period = 9,375 data points×60 s = 562,500 s (approx. 6.5 days)

Event — Maximum number of data points = 300 Kbytes/(12×2 bytes+6×4 bytes) = 6,250 data points

When the event file sampling interval is 1 s
Event file sampling period = 6,250 × 1 s = 6,250 s (approx. 1.7 hours)

3 Standard Functions

3.1 Functions in the Operation Mode

In the operation mode, you can do the following things in addition to displaying data and storing data to the removable storage medium.

3.1.1 Message Entry

You can display a message on the screen that has been registered beforehand, and write it into the data. When a message is entered, the message and the time it was entered are recorded to the data file.
You can display a list of written message information on the DX100/DX200 and display the waveform at the time a particular message was written. The message can be displayed along with the waveform using the software application included in the package.

Message	: Up to 16 alphanumeric characters
Number of messages that can be registered	: Up to eight types of messages can be registered beforehand.
Message entry	: Entered using keys or remotely.
Number of recorded messages	: The newest 100 messages on display. The header in data file includes newest 100 massages when AUTO mode is selected.

3.1.2 Snapshot

The displayed image can be copied as a image data file and output to the external recording medium or sent over the network.
The image data file is saved in PNG format. Thus, it can be copied or pasted into most of the popular document files.

3.1.3 Functions of the [FUNC] Key

The soft keys that appear when the [FUNC] key is pressed in the operation mode can be used to carry out the following operations.

Alarm ACK	: Resets the alarm relay. Resets the alarm indication when the alarm indication hold function is ON, Alarm acknowledgement when an alarm occurs.
Message	: Writes a message.
Manual sampling	: Stores the data/time and the instantaneous value when a key was pressed to the file.
Manual trigger	: Starts the data writing to the event file.
Key lock	: When the key lock function is enabled, it locks or releases the keys.
Computation	: Starts or stops computation.
Computation data reset	: Resets the computed data.
MATH ACK	: Resets the computation status indicator.
Login	: When the login function is enabled, it carries out login and logout operations.
Snapshot	: Outputs the displayed screen image to a medium or communications.
Log	: Display of Login/Logout information, Communication send/receive commands, ftp client communication, error message summary, and so on
FTP test	: Executes checking file transfer when operating as FTP client.
Batch	: Entry batch name and comment(Batch option).

3.1.4 Functions of the [USER] Key

You can assign one of the following functions to the [USER] key.

Trigger
Alarm ACK
Computation start/stop
Computation reset
Manual sampling
Messages 1 to 8
Snapshot

3.2 Alarm Function

Number of alarm levels : Up to four alarm levels for each channel.

Alarm Types

H High limit alarm : Generated when the measured value is higher than, or equal to, the alarm setting.

L Low limit alarm : Generated when the measured value is lower than, or equal to, the alarm setting.

R Rate-of-change limit on increase : Generated when the measured value variation in the ascending direction during a selected interval is greater than, or equal to, the alarm setting.

r Rate-of-change limit on decrease : Generated when the measured value variation in the descending direction during a selected interval is greater than, or equal to, the alarm setting.

h Difference upper limit alarm : Generated when the difference between two channels is equal to or greater than the alarm setting.

l Difference lower limit alarm : Generated when the difference between two channels is equal to or less than the alarm setting.

T Delayed high limit alarm : Generated when the measured value is higher than, or equal to the alarm setting and spend specified time.

t Delayed low limit alarm : Generated when the measured value is lower than, or equal to the alarm setting and spend specified time.

Hysteresis : On (0.5% of span, effective for high and low limit alarms) / off switchable, common for all channels.

Alarm indication

Status indicator section : Displayed in the status display area (upper section of the screen)

Trend display : Displayed in the numeric display section.

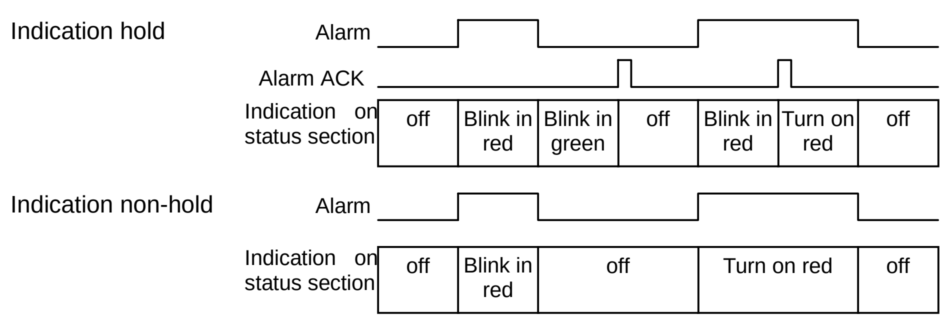
Numeric display : Displays the measured values of the channel on which the alarm is being generated in red.

Bar graph display : Displays the alarm condition of the channel on which the alarm is being generated. Also displays the alarm point marker. Displays the measured values In red.

Indication behavior

Indication hold : When alarm occurs, red box keeps blinking until Alarm Ack is executed. If Alarm Ack is executed during alarm in effect, red box changes from red blink to red light on.
When alarm is released before Alarm Ack is executed, green box blinks.

Indication non-hold : Red light turns on during alarm in effect.
Display does not change by Alarm Ack.

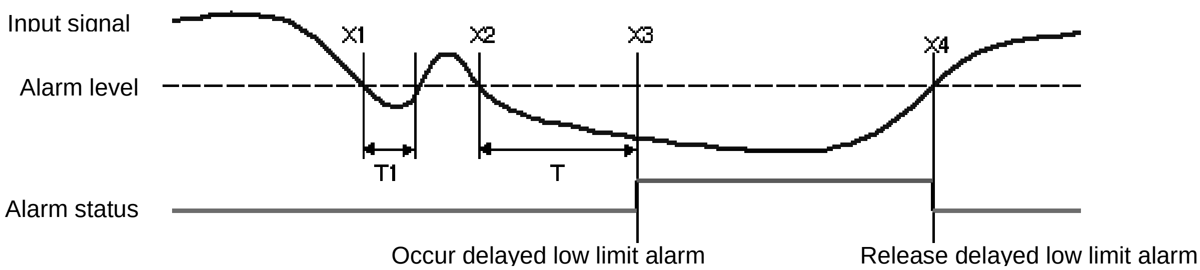


Output contacts : When the alarm output relay option is installed, the alarm can be output to the relay.

Applications examples using alarm functions

Observation of air pressure and alarm output in a clean room and an environmental testing room.

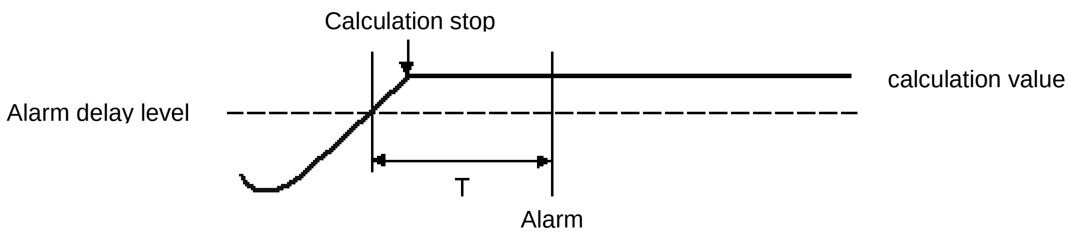
In a kind of clean room, inner pressure is higher than surroundings to avoid dust and trash, so generally observation of air pressure in a clean room is required.
In this case, if instant measured value of inner pressure is set as alarm value, alarm is frequently generated when operators enter and exit the room. Therefore, only when inner pressure is low during specified time, alarm generation is needed.
Using the delayed alarm function of DX series, you can set alarm value for specified time.



T	: Specified delay period
X1	: The input exceeds the alarm value, but the status does not last specified time(T). Therefore, alarm does not occur.
X2	: The input exceeds the alarm level and the status last specified delay period, so alarm occurs.
X4	: Alarm is released because the input is higher than the alarm level

Prohibition item for delayed alarm

Delay period	: In case of sampling interval is 2 seconds, if odd period is specified, DX works specified time + 1. Example） When delay period is 5 seconds, delay period is 6 seconds.
Alarm hysteresis	: Invalid
Power failure	: In case of power failure, alarm reset occurs. After recovery of power failure, when the specified delay period is lasted, alarm occur.
Calculation stop	: During alarm delay, if calculation is stoped, alarm occur after specified delay period is lasted



3.3 Security Function

3.3.1 Key Lock Function

The keys can be locked to prevent erroneous operation. It can prevent the recording operation from being stopped, the settings from being changed, and limit the operation.

The key lock function can be turned ON/OFF in the SETUP mode. The password used to clear the key lock is specified in the SETUP mode beforehand.

Enabling the key lock function (SETUP mode)

Key lock : Select ON or OFF. (The initial setting is OFF.)

Password : Specify the password used to clear the key lock.
Up to six alphanumeric characters

Target keys : The following keys can be locked individually when the key lock function is ON.
[START] key
[STOP] key
[MENU] key
[USER] key
DISP/ENTER key

Target soft keys : The following soft keys can be locked individually when the key lock function is ON.
Alarm ACK
Computation (start, stop, reset)
Memory writing (message entry, manual sampling, triger, save display data, save event data)

Medium : When the removable storage medium is a ZIP, the disk cannot be ejected while the key lock is effect.
It is not locked for floppy disks and flash memory cards.
When the data storage method is set to manual mode.
When a medium is inserted while the key lock is in effect, data are not stored.
Data are saved when the medium is reinserted after clearing the key lock.

Locking and releasing key lock (operation mode)

Key lock : Lock the keys by using the key lock soft key that is displayed by pressing the [FUNC] key.
When the keys are locked, the DX status display section displays the key lock indicator.

Release : Release the key lock using the soft key that is displayed by pressing the [FUNC] key. To release the key lock, you will enter a password that has been set beforehand. When the key lock is released, the key lock indicator in the DX status display section turns OFF.

3.3.2 Key Login Function

By using the login function, you can record the execution log of the start/stop operation and message entry, and display them on the DX100/200.
Since the name of the user that executed the start/stop operation and message entry is recorded in the measurement data file, it can be displayed via the DX standard software along with the measured data.
The login function is turned ON or OFF in the SETUP mode. The user ID, user name, and password for the login are specified in the SETUP mode beforehand.

Setting the key login function (SETUP mode)

Key login function : Select ON or OFF. (The initial setting is OFF.)
Auto logout : Automatically logs out when there is no operation for 10 minutes. Select ON or OFF.
User ID : Turns ON/OFF the user ID entry at login. When ON is selected, login user ID entry is required at login.

Set the following parameters for each login user. Up to seven login users can be registered.
User name : User name that is displayed at login. Up to 16 alphanumeric characters
User ID : User ID used to login. When the user ID setting is ON, this parameter is specified for each login user. Up to four alphanumeric characters
Password : Specifies the password used to login. Up to six alphanumeric characters
Setup : Specify whether or not to give access permission to the SETUP mode for each login user.

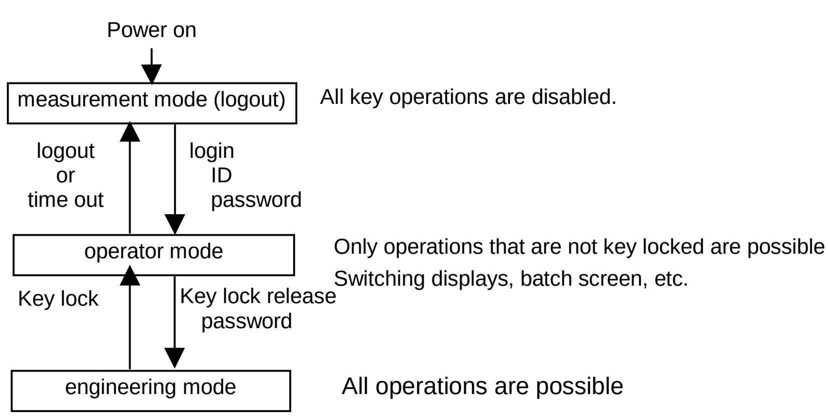
Key login (operation mode)

Login is carried out according to the following steps.

1. Press the [FUNC] key to display the user name.
2. Select the login user name from the displayed list of registered users.
3. Enter the user ID.
4. Enter the password.

Correlation with the key lock function

You can restrict the functions that are accessible for each operator by using the login and key lock functions. For example, you can assign security levels such as measurement mode, operator mode, and engineering mode.



3.4 Standard Communication Function (Ethernet)

Ethernet is included as standard on the DX Series.

Data that are being measured on the DX Series can be monitored via network. You can also transfer the data in the memory or on the removable storage medium via network by using the FTP client and server functions.

3.4.1 Standard Specifications

Basic Specifications

Electrical and mechanical specifications : Conforms to IEEE802.3
(DIX specification for Ethernet frames)
Transfer method : 10Base-T
Protocol : TCP, UDP, IP, ARP, and ICMP

Communication protocol

The DX Series is capable of using the TCP/IP protocol.

For upper layer protocols, it supports FTP for file transferring, and YOKOGAWA's proprietary protocol for monitoring.

<table>
<tr><th colspan="2">OSI 7 Layers</th><th colspan="5">DX Ethernet communications</th></tr>
<tr><td>7</td><td>Application layer</td><td>FTP client</td><td>FTP server</td><td>Common service</td><td>Maintenance and testing services</td><td rowspan="3">Device information service</td></tr>
<tr><td>6</td><td>Presentation layer</td><td colspan="2" rowspan="2">FTP</td><td colspan="2" rowspan="2">DX dedicated protocol</td></tr>
<tr><td>5</td><td>Session layer</td></tr>
<tr><td>4</td><td>Transport layer</td><td colspan="5">TCP</td></tr>
<tr><td>3</td><td>Network layer</td><td colspan="5">IP/ICMP</td></tr>
<tr><td>2</td><td>Data link layer</td><td colspan="5">CSMA/CD</td></tr>
<tr><td>1</td><td>Physical layer</td><td colspan="5">Baseband 10 Mbps</td></tr>
</table>

OSI : Open Systems Interconnection
FTP : File Transfer Protocol
TCP : Transmission Control Protocol
UDP : User Datagram Protocol
IP : Internet protocol
ICMP : Internet Control Message Protocol
CSMA/CD : Carrier Sense Multiple Access with Collision Detection

Security

There are two user levels: administrator and user level. You can restrict the number of connections to the services and the executable commands by specifying the levels.

Level	Maximum number of registrations	Rights
Administrator	1	All operations are allowed.
User	6	Restrictions on some operations such as configuration and control.

Communication resources

The ports used, the number of connections, and the number of connections permitted for various services are indicated in the table below.

The number of connections refers to "the number of connections that are allowed to connect to the service." The number of connections permitted refers to "the number of connections that are permitted to the user level."

Service	Port	Maximum number of simultaneous connections permitted		Maximum number of simultaneous connections
		Administrator	User	
Common	34260/tcp	1	2	3
Maintenance and testing	34261/tcp	1	1	1
FTP server	21/ftp	1	1	1
Device information	34264/udp	-	-	-

Common service : A service that is used to configure and control the DX Series.
It is also used for data collection and real-time monitoring.
Maintenance & testing service : A service that provides information that can be used to maintain and diagnose the Ethernet communications.
FTP service : A service use to transfer files.
Device information service : Service providing device information

3.4.2 Functions

FTP client function

The files in the internal memory of the DX100/200 can be automatically transferred.

Target files : Measurement data file (display data file, event file), Screen copy file

Setting the FTP destination

Destination : Primary and secondary servers can be specified.
Automatically transfers data to the secondary server when the primary server is down.

Server name : Specify the destination server name
Up to 64 characters

Port number : Select from 0 to 65535 (21 is default.)

Login name : Set the login name used to access the FTP server.
Up to 32 characters

Password : Set the password used to access the FTP server.
Up to 32 characters

Account : Set the account used to access the FTP server.
Up to 32 characters

PASV mode : Turn this ON when transferring data to a server that requires PASV.

Initial path : Specifies the file destination path.
Up to 64 characters

FTP server function

You can transfer the files manually, modify the directories of the external recording medium, and delete files from the host computer.

Target files : All files on the external recording medium.

User name : Registers the clients to allow access.
Up to 16 characters. You can not register identical names or the name *quit.

Password : Registers the password for the clients that will be allowed access.
Up to six characters

Configuration and measurement function

DX can be configured, and measured data can be seen as real time monitor via Ethernet.

Maintenance and Test Service Functions

You can connect to the DX Series by using an application such as Telnet and make the DX100/200 output statistical information, alarm information, and connection information regarding the Ethernet.

A list of maintenance service commands

Command	Administrator	User	Description
close	Permitted	Not permitted	Disconnect other connections
con	Permitted	Permitted	Output connection information
eth	Permitted	Permitted	Output statistic information on the Ethernet
help	Permitted	Permitted	Output help
net	Permitted	Permitted	Output statistic information on the network
quit	Permitted	Permitted	Disconnect this connection
wlog	Permitted	Permitted	Output an alarm log

Device information service Functions

In device information service, one UDP packet is interpreted as one command and one UDP packet responses to it.

Parameter	Information	Description
All	All information	Output all information.
Serial	Serial Number	Output serial number.
Model	Model name	Output vender, model, and version.
Host	Host name	Output host name.
Ip	IP address	Output IP address.

■FTP command list

Installed command list

command	explanation
ABOR	Interrupt executing order
APPE	Store a file
CDUP	Change current directory
CWD	Change current directory
DELE	Delete file and directory
HELP	Output Help
LIST	Output file list
MKD	Make directory
MODE	Specify transfer mode
NLST	Output file list
NOOP	No operation
PASS	Identify password
PASV	Notify data connection port
PORT	Notify data connection port
PWD	Output current directory
QUIT	Quit session and disconnect connection
REIN	Initialization during control connection
REST	Restart transfer
RETR	Get a file
RMD	Delete a directory
RNFR	Rename file name
RNTO	Rename file name
STOR	Store a file
STRU	Specify file structure
SYST	Output system type
TYPE	Specify data type
USER	Identify user name

■A example of file transfer by using FTP

A file stored in the external media of DX can be downloaded to PC by using PC's FTP client.
Execute FTP from DOS console, log in 'anonymous', change directory to 'data', display the file list, finaly the file '10400170.dev' is transfered to PC.

Environment

PC: DOS FTP client installed in Windows 95
DX: DX asigned IP address is 10.0.233.25

Procedure

1. Execute FTP（ftp）
2. Open FTP Connection（open, <user name>, <password>）
3. Change directory（cd）
4. Specify tarnsfer mode（binary）
5. Download a file（get）
6. Disconnect FTP connection（close）
7. Quit FTP（quit）

※ Commands in parenthesis correspond to the work.

A example of file transfer by FTP

Line	Input and output against console
1	C:\> **ftp**
2	ftp> **debug0**
3	Debugging On.
4	ftp> **open 10.0.233.25**
5	Connected to 10.0.233.25.
6	220 FTP server is ready.
7	User (10.0.233.25:(none)): **anonymous**
8	---> *USER anonymous*
9	331 Guest login ok, send ident as password.
10	Password: ******
11	---> *PASS* ******
12	230 Guest login ok, access restrictions apply.
13	ftp> **cd data**
14	---> *CWD data*
15	250 CWD command successful.
16	ftp> **dir**
17	---> *PORT 10,0,233,171,4,69*
18	200 PORT command successful.
19	150 Opening data connection.
20	---> *LIST*
21	total 1
22	-r—r--r-- 1 ftp ftp 652418 Jan 4 2000 10323170.dev
23	-r—r--r-- 1 ftp ftp 193958 Jan 4 2000 10400170.dev
24	226 Transfer complete.
25	145 bytes received in 2.03 seconds (0.07 Kbytes/sec)
26	ftp> **binary**
27	--->*TYPE I*
28	200 Type set to I.
29	ftp> **get 10400170.dev**
30	---> *PORT 10,0,233,171,4,70*
31	200 PORT command successful.
32	150 Opening data connection.
33	---> *RETR 10400170.dev*
34	226 Transfer complete.
35	193958 bytes received in 29.71 seconds (6.53 Kbytes/sec)
36	ftp> **close**
37	---> *QUIT*
38	221 Good bye.
39	ftp> **quit**
40	C:\>

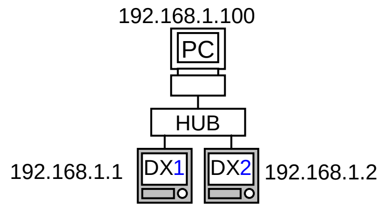
'C:\>' is DOS prompt, after execution of FTP, the prompt is changed to 'ftp>'. When FTP is specified 'debug' option, mode is changed to debug mode, and the line '--->' appear.

3.4.3 Network Configuration Example

Easy Network Configuration

When the system requires only a serial communication (one-to-one, multidrop), you can easily configure a small network even if there is none existing before.

The only items you will need are a 10BaseT network interface card (NIC) for the PC, a HUB, and cables capable of carrying 10BaseT (generally UTP).



Easy Network

Setting example

Setting example of PC

PC requires Ethernet card which has 10BASE-T port fitting the PC.

Network setting example at PC side

IP address	: 192.168.1.100
Subnet mask	: 255.255.255.0

Connection example of PC and DX series

Connection between PC and DX series is made via HUB.

Connect PC and HUB by straight 10BASE-T cable.

Connect DX series and HUB by straignt 10BASE-T cable.

Setting example of DX series

Set communication parameters in setup mode.

DX1 network setting example

IP address	: 192.168.1.1
Subnet mask	: 255.255.255.0
Default gateway	: 0.0.0.0
DNS On/Off	: Off

DX2 network setting example

IP address	: 192.168.1.2
Subnet mask	: 255.255.255.0
Default gateway	: 0.0.0.0
DNS On/Off	: Off

Setting example when DX series is used as FTP server

Use DX series FTP server function when transferring files saved in the media inserted in DX series from PC.

Setting example of DX series

Setting in SETUP mode

Setting of recording mode (SETUP mode/＃2 memory)

Save to media : Auto
Display data in internal memory is automatically saved in media as a file periodically.
Event data is automatically saved in media as a file at the end of event data gathering.

DX1 Network setting example (SETUP mode/#6 Communication/#1 Ethernet)

IP-Address : 192.168.1.1
Subnet mask : 255.255.255.0
Default gateway : 0.0.0.0
DNS On/Off : Off

FTP server function setting example (SETUP mode/#6 Communication/#3 Control)

Ethernet Login : Available
Level : Administrator
On/Off : On
User name : admin (Alphanumeric, Max 32 characters)
Password : xxxx (Alphanumeric, Max 32 characters)

Setting of SET mode

Setting Auto save ((SET mode/#3 Save period)

Auto save period : 1h
Display data in internal memory is saved as files in media every an hour automatically.

PC setting example

PC Network setting example

IP address : 192.168.1.100
Subnet mask : 255.255.255.0

FTP tool setting

To access media inserted in DX series, FTP tool should be installed in PC. There are various FTP tools like free software or shareware. Please install one which matches the PC.

FTP tool setting example

Host address : 192.168.1.1 (IP address of DX to be accessed)
User ID : admin (User name registered in DX)
Password : xxxx (Password of User admin registered in DX)

Depending on FTP tool installed, Since descriptions of host address or user ID are different depending on FTP tool installed, please confirm them before setting.

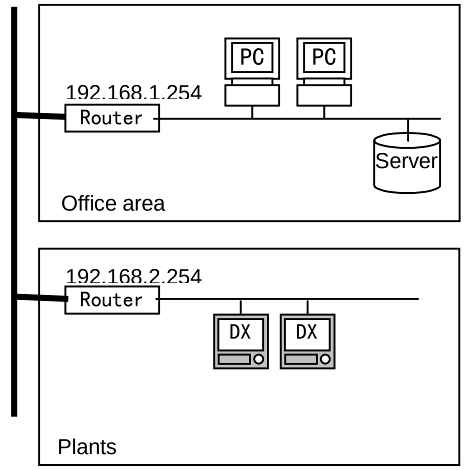
Configuration using the LAN

This example remotely connects between two floors or between two buildings on the same premises.

Remote connection is realized by using the preexisting network that is on the premises.

FDDI or Ethernet is used to connect between building. A router is used to connect between floors.

The IP address assignments are usually already determined on a preexisting network. Therefore, you only need to configure and connect the DX series to the network in order to carry out centralized data storage and monitoring.



Connection Example using the LAN

Setting example when you transfer measured data file and report data file from DX series installed in Factory to DX1 folder under ftp_root directory of FTP server in Office automatically.

Setting example of FTP server

FTP server network setting example

IP address : 192.168.1.100
Subnet mask : 255. 255. 255. 0

FTP server setting example

To make DX series transfer data to FTP server automatically, user registration of the DX should be done in advance.

Port : 21
User name : DX1 (DX name for user registration in server)
Password : xxxx(DX1 password for user registration)
Directory : ftp_root/DX1
Specify the directory where automatically transferred data are saved.

Setting example of DX series

Setting in SETUP mode

Setting of recording mode (SETUP mode/#2 memory)

Save in media : Auto
Display data in internal memory is automatically saved in media as a file periodically and transferred to the server automatically at the same time.
Event data is automatically saved in media as a file at the end of event data gathering and transferred to the server automatically at the same time.

DX1 network setting example (SETUP mode/#6 Communication/#1 Ethernet)

IP address : 192.168.2.1
Subnet mask : 255.255.255.0
Default gateway : 192.168.2.254
DNS On/Off : Off

FTP client function setting example (SETUP mode/#6 Communication/#2 FTP client)

FTP transfer file : Display & Event data ; On
Report ;On
FTP server name : 192.168.1.100
Port number : 21
Login : DX1(DX user name registered in server)
Password : xxxx (DX1 password registered in server)
Account : not necessary to specify usually
PASV mode : set as Off usually
Initial path : ftp_root/DX1

Setting in SET mode

Setting Auto save period (SET mode/#3 Save period)

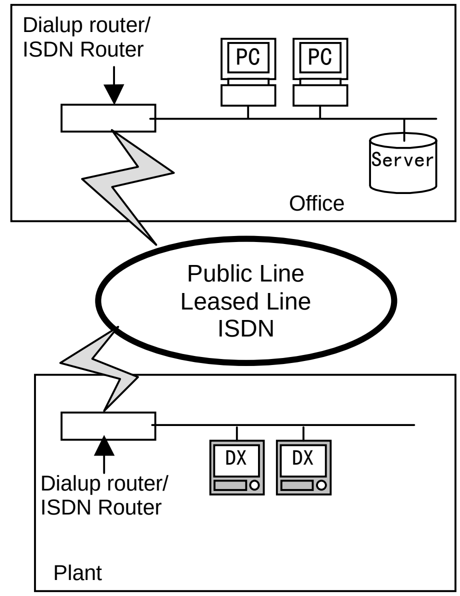
Auto save period : 1h
Display data in internal memory is saved as files in media every an hour automatically and transferred to the server automatically at the same time.

Configuration using public lines

This example uses telephone and leased lines to remotely connect the LANs.
Remote connection is achieved by connecting the bases using telephone and leased lines.

Digital lines are advantageous over analog lines as they can achieve faster data communications.
Whether to use pubic lines or leased lines depends on the cost factor. When using ISDN, one line can be used to simultaneously carry out data communication and telephone communication.
The ends of the line are presumed to be Ethernet. There are cheap routers that support ISDN.

In addition, for connecting to remote sites that do not have a network established, a dialup router can be used. When the remote DX100/200 or the PC accesses a network at the office, the dialup router will automatically dial up and connect to the public line. In this case, the dialup router must be configured, but you can construct a closed network using public lines.



Connection Example using public line

3.4.4 Points to be noted when configuring a network

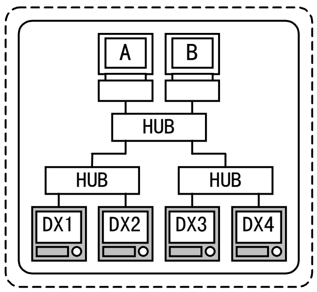
The point to note when configuring a network using Ethernet is designing the network by considering the collision domain and broadcast domain. By dividing the collision domain with a switch and the broadcast domain with the router, the network traffic can be reduced.

Collision domain

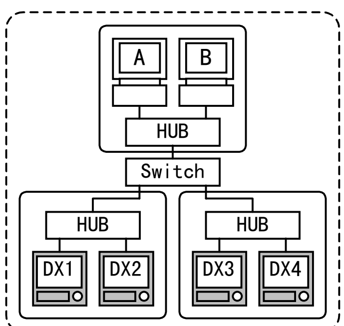
Because multiple terminals use one transmission line in an Ethernet communication, a collision of packets occurs when multiple terminals transmit data simultaneously.
Therefore, the terminal that wishes to transmit data determines whether or not other communication is taking place, and if the line is available, it starts sending data. If a collision occurs, the timing is altered for retransmission. The network unit in which other communications must be confirmed is called the collision domain unit.

Broadcast domain

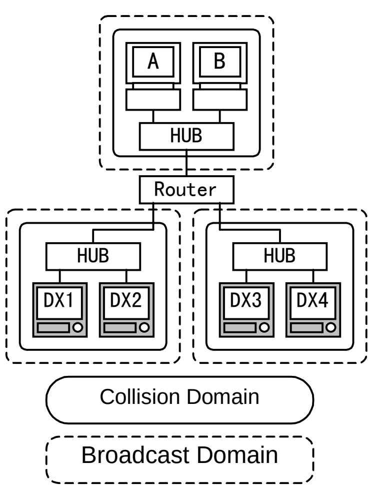
In a TCP/IP network, broadcast is used as a method to collect address information. The range over which the broadcast packet is able to reach is called the broadcast domain. This domain is equivalent to one network. When packets are to be passed over the broadcast domain, they must be relayed using a router.



The configuration which is the simplest is one with only a collision domain.
A packet that is transmitted from PC A to DX1 also reaches PC B, DX2, DX3, and DX4. PC B cannot transmit packets to any of the DXs during this period.



Because MAC address filtering is carried out by the switch, PC B is able to transmit packets to DX3 or DX4, while PC A is transmitting packets to DX1. (Since DX1 and DX2 are in the same collision domain, PC B cannot transmit packets to DX2.)



A router relays the packets (routing) according to the network address.

3.4.5 Network Terminology

LAN (local area network)
Network system which connects computers and peripherals in a limited area of space, such as inside a building or office, that allows sharing of resources such as files and printers.

WAN (wide area network)
Network that connects devices spread over a wide area. Telephone or leased lines are used to connect terminals located at far locations, and to connect multiple LANs.

Ethernet
Bus-type LAN (local area network). Jointly developed by XEROX, DEC, and Intel, and was commercialized in 1980. It is the most developed and widely used LAN. In general, a LAN that uses CSMA/CD (IEEE802.3) created by IEEE802 is called Ethernet.

10BaseT
LAN interface standardized by IEEE802.3.
Uses an unshielded twisted pair cable (UTP), and an 8-pin modular jack (RJ-45). The segment length is limited to 100 m. A hub is needed for connecting segments. However, because it is very flexible in terms of adding devices or altering the layout, it is the most common used type of LAN. The data transfer rate is 10 Mbps.

CSMA/CD (carrier sense multiple access with collision detection)
This is a type of LAN's MAC (Media Access Control) technology which allows multiple terminals to use the same transmission line. The station that wishes to transmit data determines whether or not other communication is taking place, and if the line is available, it starts sending data. Because, all stations have equal priority in sending data, it is called multiple access. If multiple stations transmit data at the same time causing a collision, the timing is altered for retransmission.

OSI (open systems interconnection)
Network architecture established by the ISO (International Organization for Standardization). The network architecture is comprised of various protocols in a model of seven layers of functions.

Protocol
A set of rules that is defined in order to carry out data communications. By complying with the set of rules, devices of different types can be mutually be connected.

IP (internet protocol)
This is the network layer protocol that is used on the Internet. It is the main protocol in the TCP/IP protocol suite and performs connectionless packet exchange.

TCP(Transmission Control Protocol)
Set connection for the target host in advance to send/receive data. It secures reliability of data sending/receiving.

UDP(User Datagram Protocol)
Protocol which does not set connection for the target host.

FTP (file transfer protocol)

FTP is a file transfer protocol that works above the TCP/IP protocol layer. It supports many types of files such as ASCII and binary files.
The DX Series uses FTP to automatically transfer data and report files to the data server.
The client PC can also use FTP to access the files on the recording medium of the DX Series.

Server

This computer provides management services like file storage, input/output, access, or services like printout or communication control. Server is for providing specified services such as File server to share files, Print server to share printers, or Database server to share database.

Client

This computer utilizes the services provided by Server. It indicates user side computer terminals or programs on the terminals.
For example, when there are two computers, one computer has database and the other requests to search data to the former computer, the former one is called Server and the latter one is called Client.

Hub

Hub is a node (station) placed in the center of Star-type network. Generally, it indicates a device with repeater or switching functions, which gathers twist-pair cables for 10BASE-T. Sometimes, it is a general term for LAN gathering device. There are various kinds such as SNMP (simple network management protocol), intelligent HUB with agent function, dumb HUB without agent function, stackable HUB and so on. When number of ports is insufficient, plural HUBs can be connected by cascade or stack connections.

Router

Router is a station to connect LANs or LAN and WAN (wide area network). It analyzes protocols of data (packet) flowing on one network, and transfers the data after selecting the best route. Since it has a function to set data transfer routes, it is a suitable device to connect different networks or WAN. It also has a filter function to stop transferring data to the sites not relevant for them.

ISDN(integrated services digital network)

Total service digital communication network. Digital communication network, which provides integrated service of telephone, fax, internet and so on.

4 Optional Functions

4.1 Computation Function (/M1)

The DX Series can be used in a wider area of applications by installing the computation function.

4.1.1 Specifications

Available Channels

The following computation channels (used only for computation) are available on the DX100/DX200 (/M1: computation option)

DX102/104	: Up to four channels can be specified. (31-34)
DX106/112	: Up to 12 channels can be specified. (31-42)
DX204/208	: Up to eight channels can be specified. (31-38)
DX210/220/230	: Up to 30 channels can be specified. (31-60)

Computation uses dedicated computation channels. You can not perform computation on the measurement channels.

Range of Computation

When the value in the middle of the computation exceeds the $\pm 1 \times 10 \pm 38$ range, the computation result becomes positive overflow (+ ****) or negative overflow(-****).

Constants

Number of constants	DX102/104/106/112	: Up to 12 constants can be specified (K1-K12)
	DX204/208/210/220/230	: Up to 30 constants can be specified (K1-K30)
	Constants always start with the letter K (K2 for example).	
Range of Constants	: 9.9999E+29 to 1.0000E-30	
	0	
	-1.0000E-30 to -9.9999E+29	
Number of significant digits	: five digits	

Communication digital input: Can be used in solving equations other than statistical operation.

Number of inputs	DX102/104/106/112	: Up to 12 values can be specified. (C1-C12)
	DX204/208/210/220/230	: Up to 30 values can be specified. (C1-C30)
	Communication digital inputs always start with the letter C (C2, for example).	
Input range	: 9.9999E+29 to 1.0000E-30	
	0	
	-1.0000E-30 to -9.9999E+29	
Number of significant digits	: five digits	

Remote status input

Use "1" and "0" for "H" and "L" conditions of the remote contact in the computing equation.

Number of inputs : eight (D1, D2, D3, D4, D5, D6, D7, and D8)

Inputs always start with the letter D (D2, for example).

4.1.2 Available Operators

General Arithmetic Operators

Operation		Operator	Syntax (Example)	Description
Basic four arithmetic operations	Summation	+	31 : 1 + 2	Adds the value of Ch. 1 to the value of Ch. 2, and sets the result in Ch. 32.
	Subtraction	-	32 : 2 - 1	Subtracts the value of Ch.1 from the value of Ch.2, and sets the result in Ch.32.
	Multiplication	*	33 : 3 * K1	Multiplies the value of Ch.3 by the value of constant K1, and sets the result in Ch.33.
	Division	/	34 : 4 / K10	Divides the value of Ch.4 by the value of constant K10, and sets the result in Ch.34.
Square root		SQR	35 : SQR(1)	Sets the square root of the value of Ch.1, in Ch.35.
Absolute		ABS	36 : ABS(2)	Sets the absolute value of Ch.2, in Ch.36.
Common logarithm		LOG	37 : LOG(3)	Sets the common logarithm of the value of Ch.3, in Ch.37.
Exponential		EXP	38 : EXP(4)	Raises e (the base of a natural logarithm) to the power given by the value of Ch.4, and sets the result in Ch.38.
Power		**	39 :5**K20	Sets Ch.5 to the constant 20 power, in Ch.39.

Relational Operators

Operation	Operator	Syntax (Example)	If…	Then…
＝	.EQ.	31 : e1.EQ.e2	e1 = e2	31 = 1
			e1≠e2	31 = 0
≠	.NE.	32 : e1.NE.e2	e1≠e2	32 = 1
			e1 = e2	32 = 0
＞	.GT.	33 : e1.GT.e2	e1＞e2	33 = 1
			e1≦e2	33 = 0
＜	.LT.	34 : e1.LT.e2	e1＜e2	34 = 1
			e1≧e2	34 = 0
≧	.GE.	35 : e1.GE.e2	e1≧e2	35 = 1
			e1＜e2	35 = 0
≦	.LE.	36 : e1.LE.e2	e1≦e2	36 = 1
			e1＞e2	36 = 0

Logical operators

Operation	Operator	Syntax (Example)	If…	Then…
Logical AND	AND	31 : e1ANDe2	e1 = 0, e2 = 0	31 = 0
			e1≠0, e2 = 0	31 = 0
			e1 = 0, e2≠0	31 = 0
			e1≠0, e2≠0	31 = 1
Logical OR	OR	31 : e1ORe2	e1 = 0, e2 = 0	31 = 0
			e1≠0, e2 = 0	31 = 1
			e1 = 0, e2≠0	31 = 1
			e1≠0, e2≠0	31 = 1
Exclusive OR	XOR	31 : e1XORe2	e1 = 0, e2 = 0	31 = 0
			e1≠0, e2 = 0	31 = 1
			e1 = 0, e2≠0	31 = 1
			e1≠0, e2≠0	31 = 0
Logical NOT	NOT	31 : NOTe1	e1 = 0	31 = 1
			e1≠0	31 = 0

Statistic Operators

Each statistical operator calculates one statistic of the time series value of a specified channel.

Operation	Operator	Syntax (Example)	Description
Maximum	MAX	31 : TLOG.MAX(1)	Set the maximum value of Ch.1 in Ch.31.
Minimum	MIN	32 : TLOG.MIN(2)	Set the minimum value of Ch.2 in Ch.32.
Maximum-Minimum	P-P	33 : TLOG.P-P(3)	Set the P-P value of Ch.3 in Ch.33.
Average	AVE	34 : TLOG.AVE(4)	Set the average value of Ch.4 in Ch.34.
Total	SUM	35 : TLOG.SUM(5)	Set the total of value of Ch.5 in Ch.35.

4.1.3 Statistical Computation(TLOG)

You can configure up to three timers for statistical computation.
The TLOG timer (1 to 3) is assigned to each statistical computing channel.
Each TLOG timer has configured parameters as follows.

Mode : Absolute or Relative

Absolute

Interval : Select from 1,2,3,4,5,6,10,12,15,20,30min, 1,2,3,4,6,8,12,24hour

Reference time : Input 00:00 to 23:00

Relative

Time : Input 00:01 to 24:00

Reset : You can select whether to reset the results of statistical calculations upon time-up of each interval, or to retain the results and continue the calculations.

ON ; Result of computation is reset
OFF ; Without resetting data

Action : Define behavior on timeup

OFF ; Without appending the data in file on timeup
Data save ; Data is saved in internal memory at timeup.
In Auto save mode, data is saved in external media automatically.

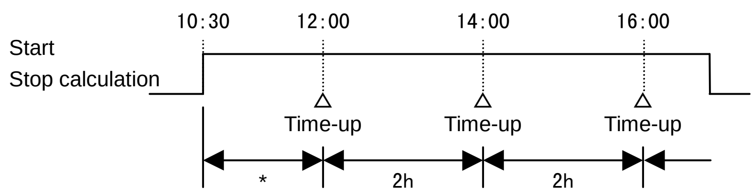
Intervals of Statistic calculations

The intervals of statistical calculations (TLOG) can be specified and set as starting from either:

A specified time
or
The time when mathematical calculation (MATH) starts

(1) Specified Intervals from Specified Time (example)

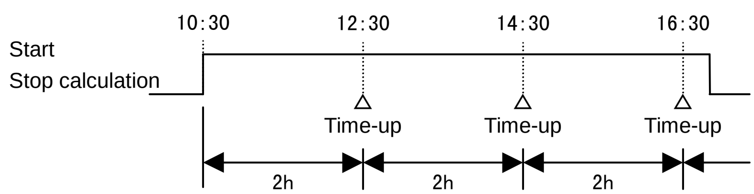
(Setting)
Mode : Absolute
Interval : 2h
Reference time : 00:00



*After mathematical calculation (MATH) starts, the first interval of the statistical calculations (TLOG) ends when the nearest interval time, which is determined by the **Reference time** and **Interval** setting, is reached.

(2) Specified Intervals from When Mathematical calculation (MATH) Starts (example)

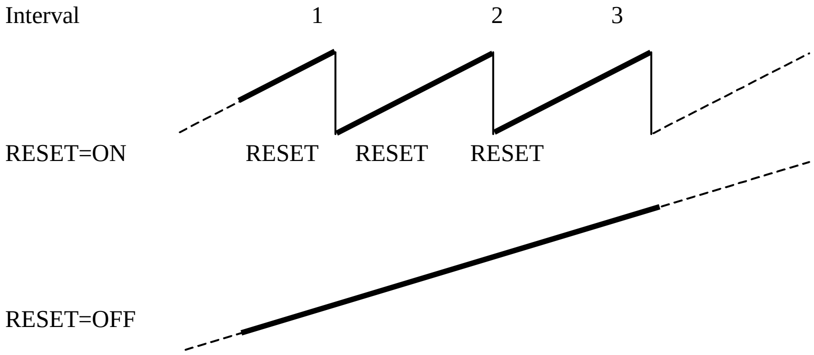
(Setting)
Mode : Relative
Time : 2h



Resetting the computed result

You can select whether to reset the computed result when the end of the interval is reached or to retain the result and continue with the calculation.

Example: Result of SUM computation



Scale Settings for Statistical Calculations

When using a time-based summation (SUM) function for obtaining a to talized flow rate or the like, the unit of the base time can be selected from per second, per minute, and per hour.

Assume that a per-second flow rate is measured by a DX104. The summation of eight measured values for each minute is calculated by simply integrating the measured values of the corresponding channel, which produces a value eight times greater than the correct totalized flow rate since the measurement period is 125 ms. Setting the scale to ”/s” (per second) will calculate the correct totalized rate based on the measurement period.

The following shows an example of settings for DX104.

Input	: Flow rate（ m^3/s）
Measurement period	: 125ms（8times per second）
Scale	: /s

4.1.4 Rolling average

Taking the rolling average can monitor measured values.

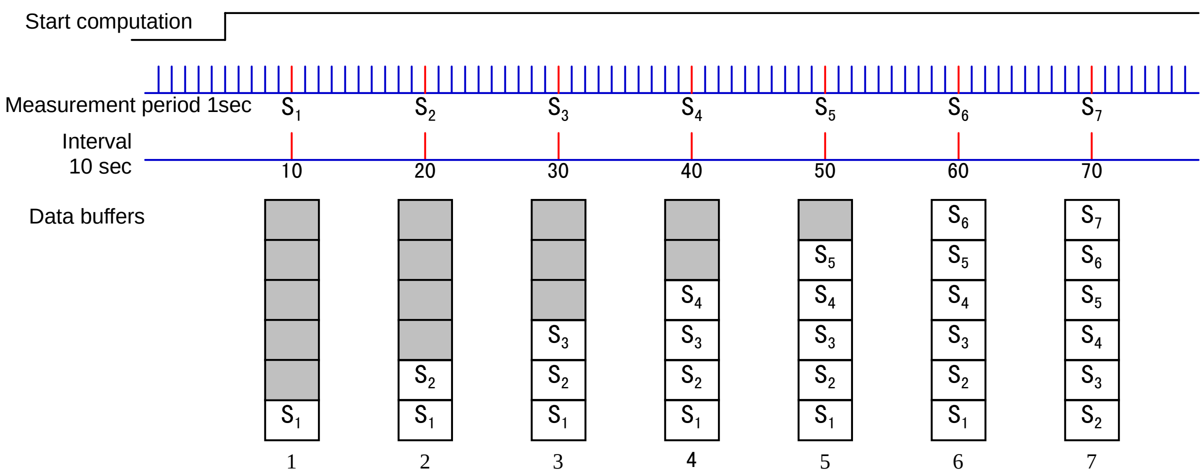
The rolling average can be set on each computation channel.

Interval	: The data stored to the buff every interval time. Select from 1,2,3,4,5,6,10,12,15,20,30sec, 1,2,3,4,5,6,10,12,15,20,30,60min
Number of average	: Select number of average from 1 to 64. The same number of data buffers as number of average time are assured for rolling average

Example: 1 minute rolling average of 10 second samples by DX112 (Measurement period 1sec)

Interval : 10 second

Number of average : 6 (=60 second / 10 second)



Average of the first interval 1	$=(S_1)/1$
Average of the second interval 2	$=(S_1+S_2)/2$
Average of the third interval 3	$=(S_1+S_2+S_3)/3$
Average of the fourth interval 4	$=(S_1+S_2+S_3+S_4)/4$
Average of the fifth interval 5	$=(S_1+S_2+S_3+S_4+S_5)/5$
Average of the sixth interval 6	$=(S_1+S_2+S_3+S_4+S_5+S_6)/6$
Average of the seventh interval 7	$=(S_2+S_3+S_4+S_5+S_6+S_7)/6$

The difference between the moving average and the rolling average

The moving average is a type of input filter, and is used to suppress the input fluctuation. The moving average applied at the input becomes the measured data.

The rolling average is a type of computation function that performs a moving average on the input data. It can also be used to measure the moving average of the computed result. The rolling average can be used to determine the long-term moving average.

4.1.5 Report Function

Using the report function provided by the computation option, various reports on the measured data can be created directly on the DX Series. The report can be displayed on the screen, saved to a file, or output via communications.
Since the report data created and saved on the DX Series can be recalled and processed on a PC, creating reports becomes much more efficient.

Report types

Type	Making Report Interval	Computing
Hourly report	Every hour	An hour's average, maximum and minimum An hour's sum
Daily report	Every other day	A day's average, maximum and minimum A day's sum
Daily and Weekly report	Every other day	A day's average, maximum and minimum A day's sum
	Every week	A week's average, maximum and minimum A week's sum
Daily and Monthly report	Every other day	A day's average, maximum and minimum A day's sum
	Every month	A month's average, maximum and minimum A month's sum

Time to make report

Select from hourly, daily, daily and weekly, or daily and monthly report.
Set the time to make a report in the format day of month, a day of the week, and time.
Define the date within 1 to 28, time within 00 to 23, a day of the week from Sun., Mon., Tue., Wed, Thu., Fri., Sat..
Hourly report : The DX makes reports every hour on the hour (1:00, 2:00…24:00).
Daily report : The DX makes reports at a preset time
Daily and Weekly report : The DX makes reports at a preset time of the day and a day of the week.
Daily and Monthly report : The DX makes reports at a preset time of the day.

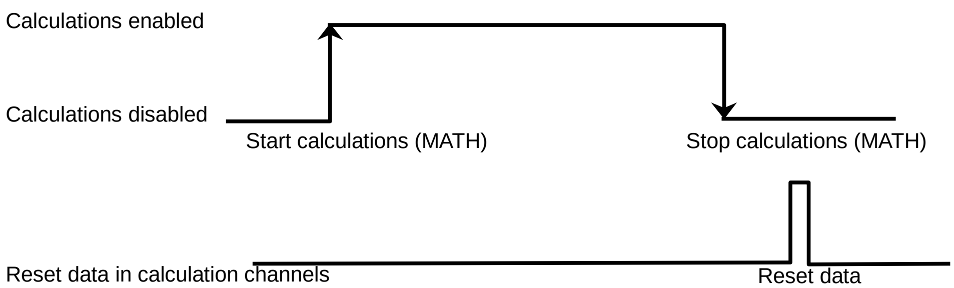
Report channels

There are thirty report channels.
You can assign channels for measuring or computing channels.

4.1.6 Starting and Stopping Calculations

Calculations defined using the optional mathematical functions can be started and stopped locally by the keys as well as remotely by external signals and communication.

- Remote control by external signals requires the optional remote control function.
- Remote control by communication requires the standard Ethernet communication or the optional serial communication interface.



- The Reset Data request is effective only when calculation is stopped
- When calculation is stopped, the most recent calculation results are retained and used as the channel values for display and communication
- When calculation is stopped, the alarm outputs for the computed-value channels are reset.

4.1.7 Applications in which the Computation Function is Used

Monitoring the Sterilization Process during Food Manufacturing

When sterilizing preserved foods by heating, bacteria must be completely annihilated without changing the heat of the product (a degradation of the taste). In most cases, the integrated fatality (F value) must be recorded and monitored. By using the computation function of the DX Series (relational computation, four arithmetical operations, and exponential computation), the F value can be calculated and recorded.

*F value

The integrated fatality of the bacteria obtained by heat sterilization. It is the integrated value of the fatality rate (Li) of the bacteria per unit amount of time (Δt), and Li is a function of the sterilization temperature.

$$Li = \frac{1}{\log^{-1}\frac{Tr-Ti}{Z}}$$

$$\log Li = \frac{Ti-Tr}{Z}$$

$$Li = 10^{\frac{Ti-Tr}{Z}}$$

Tr=121.1℃ and Z=10℃

$$Li = 10^{\frac{Ti-121.1}{10}} \quad \ldots 1$$

If the Ti is constant, the F value per unit amount of time (Δt) is expressed with the following equation.

$$F = \Delta t \sum_{i=1}^{n} Li \quad \ldots 2$$

Configuration Example on the DX106

Set equations *1* and *2* on the DX Series and perform the computation.
The configuration of the input, constant, and equation is shown below.

K1 (constant) : 10 ···constant used to compute the Li value
K2 (constant) : 10.000 ···constant used to compute the F value
K3 (constant) : 121.1 ···constant used to compute the F value
K4 (constant) : 60 ···1/unit time (except when the unit time is 60 s)
K5 (constant) : 100 ···constant used to reset the integrated value
* Constant K2 to K5 may vary depending on the conditions.

CH1 (measurement channel): Food temperature measurement

Define the fatality rate Li of the bacteria (equation *1*) in computation channel CH31.
CH31 (computation channel): 31: K1 ** ((1 - K3) / K2)

Define the F value (the integral value of the bacterial fatality rate LI per unit time Δt: corresponds to equation *2*) in computation channel CH32.
When the food temperature falls to 100℃, reset the value of CH32 to 0.

CH32 (computation channel): 32: (32 + 31/ K4) * (1 .GT. K5)

4.1.8 Setting Restrictions and Supplement Information

Stacks

Stacks are the items defined in a calculation expression, such as the measured values specified by channel number and constants. In a DX Series, up to 16 stacks can be set in each calculation. Setting more than 16 stacks results in a calculation error and the result to be set as “+****” (positive overflow).

Example: 01＋01*(01+01*(01+01*(01+01*(01+01*(01+01*(01+01*(01+01*01)))))))

This example uses 17 stacks, and hence results in a calculation error.

Calculation Errors

The following calculations result in a calculation error and cause the calculation result to be output as “+****” (positive overflow).

- X/0
- $\sqrt{-X}$
- LOG(-X)
- When a calculation expression contains a channel number which is set as being skipped.

4.2 Batch Function (/BT1)

The batch function option is used to add batch numbers and comments to the batch files.
The batch information is written to the header section of the measurement data file. The batch information can be viewed along with the measured data on a PC and output to a printer by using the viewer of DAQEXPLORER(option).

Application name : Up to 16 alphanumeric characters

Batch name : Batch number + Lot number

Batch number	Number of characters	: Up to 16 alphanumeric characters
Lot number	Number of digits	: Up to four digits
Auto increment		:Lot numbers isincrease automatically at every batch start.

Comments

Number of lines	: three lines
Number of characters	: Up to 32 alphanumeric characters per line

User name : Up to 16 alphanumeric characters
Manager name : Up to 16 alphanumeric characters
Supervisor name : Up to 16 alphanumeric characters

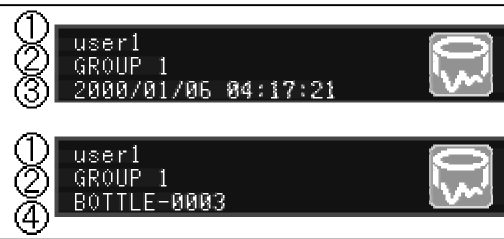
■Configuration and input of batch information by communication.

Manager name, supervisor name, application name, batch name, and comment can be set by using communication.

■Batch name display

Current time and batch name are changed every 5 seconds.

Log on status



Log off or
not use key log in

①Log in user name
②Display group
③Current date and time

4.3 Contact Input/Output

4.3.1 Remote Control Function (/R1)

As an option, external contacts can be used to control the function of the recorder.

Controlled items : The following items can be controlled using contact input (up to eight points)
1. Start/stop memory (level)
2. Event file external trigger input (Trigger, 250 ms or more)
3. Set the time (Set the time precisely on the hour using contact point, trigger, 250 ms or more)
4. Start/stop computation (level)
5. Computed data reset (trigger, 250 ms or more)
6. Manual sampling (trigger, 250 ms or more)
7. Message entry (Up to eight points, trigger, 250 ms or more)
8. Load setup (Up to three points, trigger, 250 ms or more)
9. Alarm ACK (trigger, 250 ms or more)

Input signal : Dry contact, open collector (TTL or transistor)
Input condition : ON voltage : 0.5 V or less (30 mADC)
Leak current when OFF : 0.25 mA or less
Signal width : 250 ms or more
Input format : Photocoupler isolation (one side common)
Built-in isolation power supply
Withstand voltage : Between input terminal and ground terminal: 500 Vdc for one minute

4.3.2 Alarm Output Relay (/A1,/A2,/A3,/A4,/A5)

As an option, the alarm condition can be output to external devices.

Number of output points : DX100: Select from 2 (/A1), 4(/A2), 6(/A3) points
DX200: Select from 2(/A1), 4(/A2), 6(/A3), 12(/A4), and 24(/A5) points
Output format : NO-C-NC
(energizing/de-energizing, AND/OR, hold/non-hold can be switched)
Contact capacity : 250 VDC/0.1 A (resistive load), 250 VAC (50/60 Hz)/3 A

4.3.3 FAIL/Memory End Output (/F1)

FAIL output indicates a system error by activating a relay from the back panel.

Memory end output activates a relay output from the back panel immediately before the display data file is overwritten.
When the file combination is set to event data only and the trigger is set to free, the relay output is activated immediately before writing to the event file.

Specified time before overwriting : Select from 1, 2, 5, 10, 20, 50, 100 hours.
Remaining external medium : Outputs a signal when the remaining capacity on the external medium falls to 10% (auto mode).
Output format : FAIL relay ; NO-C-NC (de-energizing)
Memory end relay ; NO-C-NC (energizing)
Contact capacity : 250 VDC/0.1 A (resistive load), 250 VAC (50/60 Hz)/3 A

4.4 Serial Communications (/C2,/C3)

By using serial communications, the DX100/200 can be controlled and configured from a host computer, and data can be transferred to the host. In addition, the MODBUS communication protocol can be selected.

4.4.1 RS-232(/C2)

Electrical and mechanical specifications	: Conforms to EIA RS-232-C (9 pins)
Connection format	: point to point
Communication format	: full duplex
Synchronization method	: start-stop asynchronous transmission
Control format	: Select from CS-RS, Xon/Xoff, Xon-RS,and None
Data length	: 7,8 [bit]
Baud rate	: Select from 1200, 2400, 4800, 9600, 19200, 38400 [bps]
Start bit	: 1 [bit]
Stop bit	: 1 [bit]
Parity	: Select from ODD, EVEN, and NONE
Communication data format	: Measured data : Select ASCII or binary Configuration and control: ASCII

4.4.2 RS-422-A/485(/C3)

Electrical and mechanical specifications	: Conforms to EIA RS-422-A
Connection format	: Multidrop (1:N(N=1 to 32))
Communication format	: Four-wire half duplex
Synchronization method	: start-stop asynchronous transmission
Control format	: None
Data length	: 7,8 [bit]
Baud rate	: Select from 1200, 2400, 4800, 9600, 19200, 38400 [bps]
Start bit	: 1 [bit]
Stop bit	: 1 [bit]
Parity	: Select from ODD, EVEN, and NONE
Communication distance	: 1.2 km maximum
Communication data format	: Measured data : Select ASCII or binary Configuration and control: ASCII

4.4.3 MODBUS Protocol

Basic specifications

Transmission medium	: RS-232 or RS-422-A/485
Control format	: None
Baud rate	: Select from 1200, 2400, 4800, 9600, 19200, 38400 [bps]
Start bit	: 1 [bit]
Stop bit	: 1 [bit]
Parity bit	: Select from Odd, Even, and None
Transfer mode	: RTU (Remote Terminal Unit) mode
Data length	: 8 [bit]
Data interval	: 24 [bit time] or less The end of the message is determined by a blank time period of 3.5 characters or more.
Error detection	: Uses CRC-16

Supported functions of the MODBUS

The following MODBUS communication functions are supported by the DX100/200.

FC code	Function	Operation
3	Read the hold register (4xxxx)	Read communication input data
4	Read the input register (3xxxx)	Read the measurement, computation, time data
8	Loopback test	Message return Supports only (diagnosis code 0x00)
16	Write to the hold register (4xxxx)	Write communication input data

MODBUS Register Assignment

Address	Data
30001 30002 : 30030	CH01 measured data CH02 measured data CH30 measured data
31001 31002 : 31030	CH01 measured data alarm status CH02 measured data alarm status CH30 measured data alarm status
32001 32002 32003 32004 : 32059 32060	CH31 computed data (MSB) CH31 computed data (LSB) CH32 computed data (MSB) CH32 computed data (LSB) CH60 computed data (MSB) CH60 computed data (LSB)
33001 33002 : 33030	CH31 Alarm status of computed data CH32 Alarm status of computed data CH60 Alarm status of computed data
39001 39002 39003 39004 39005 39006 39007 39008	year (four digits) Month Date Time Minute Second Msec Summer time / winter time
40001 40002 : 40030	C1 Digital data C2 Digital data C30 Digital data

Because the register values do not include the unit and the decimal position information, the MODBUS master must know beforehand the unit and the decimal position.

Appendix

Examples of sampling time(maximum recording time)

■Only display data file(The number of measure channels and computation channels depends on its models) .

Display update interval[/div]		1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
Saving interval		2sec	4sec	10sec	20sec	40sec	1min	2min	4min	8min
Meas. ch q'ty	Math. ch q'ty									
1	0	55hr	4days	11days	23days	46days	69days	138days	227days	555days
2										
3										
4		41hr	83hr	8days	17days	34days	52days	104days	208days	416days
5		33hr	66hr	6days	13days	27days	41days	83days	166days	333days
6		27hr	55hr	5days	11days	23days	34days	69days	138days	277days
8		20hr	41hr	4days	8days	17days	26days	52days	104days	208days
10		16hr	33hr	83hr	6days	13days	20days	41days	83days	166days
12		13hr	27hr	69hr	5days	11days	17days	34days	69days	138days
20		8hr	16hr	41hr	83hr	6days	10days	20days	41days	83days
30		5hr	11hr	27hr	55hr	4days	6days	13days	27days	55days
1	4	18hr	37hr	92hr	7days	15days	23days	46days	92days	185days
2		16hr	33hr	83hr	6days	13days	20days	41days	83days	166days
3		15hr	30hr	75hr	6days	12days	18days	37days	75days	151days
4		13hr	27hr	69hr	5days	11days	17days	34days	69days	138days
1	8	9hr	19hr	49hr	98hr	8days	12days	24days	49days	98days
2		9hr	18hr	46hr	92hr	7days	11days	23days	46days	92days
3		8hr	17hr	43hr	87hr	7days	10days	21days	43days	87days
4		8hr	16hr	41hr	83hr	6days	10days	20days	41days	83days
5		7hr	15hr	39hr	79hr	6days	9days	19days	39days	79days
6		7hr	15hr	37hr	75hr	6days	9days	18days	37days	75days
8		6hr	13hr	34hr	69hr	5days	8days	17days	34days	69days
5	12	5hr	11hr	28hr	57hr	4days	7days	14days	28days	57days
6		5hr	11hr	27hr	55hr	4days	6days	13days	27days	55days
8		5hr	10hr	26hr	52hr	4days	6days	13days	26days	52days
10		4hr	9hr	24hr	49hr	98hr	6days	12days	24days	49days
12		4hr	9hr	23hr	46hr	92hr	5days	11days	23days	46days
10	30	2hr	4hr	11hr	23hr	47hr	71hr	5days	11days	23days
12		2hr	4hr	11hr	23hr	46hr	69hr	5days	11days	23days
20		2hr	4hr	10hr	20hr	41hr	62hr	5days	10days	20days
30		1hr	3hr	9hr	18hr	37hr	55hr	4days	9days	18days

■Only event data file(The number of measure channels and computation channels depends on its models .)
The saving interval of DX106, DX112, DX210, DX220, and DX230 can be selected from 1 second to 2 minutes.

Ch q'ty		Saving interval									
Meas. ch	Math. Ch	125ms	250ms	500ms	1sec	2sec	5sec	10sec	30sec	1min	2min
1	0	4hr	8hr	16hr	33hr	66hr	6days	13days	41days	83days	166days
2											
3											
4											
5											
6		3hr	6hr	13hr	27hr	55hr	5days	11days	34days	69days	138days
8		2hr	5hr	10hr	20hr	41hr	4days	8days	26days	52days	104days
10		2hr	4hr	8hr	16hr	33hr	83hr	6days	20days	41days	83days
12		1hr	3hr	6hr	13hr	27hr	69hr	5days	17days	34days	69days
20		1hr	2hr	4hr	8hr	16hr	41hr	83hr	10days	20days	41days
30		41min	1hr	2hr	5hr	11hr	27hr	55hr	6days	13days	27days
1	4	2hr	4hr	9hr	18hr	37hr	92hr	7days	23days	46days	92days
2		2hr	4hr	8hr	16hr	33hr	83hr	6days	20days	41days	83days
3		1hr	3hr	7hr	15hr	30hr	75hr	6days	18days	37days	75days
4		1hr	3hr	6hr	13hr	27hr	69hr	5days	17days	34days	69days
1	8	73min	2hr	4hr	9hr	19hr	49hr	98hr	12days	24days	49days
2		69min	2hr	4hr	9hr	18hr	46hr	92hr	11days	23days	46days
3		65min	2hr	4hr	8hr	17hr	43hr	87hr	10days	21days	43days
4		62min	2hr	4hr	8hr	16hr	41hr	83hr	10days	20days	41days
5		59min	1hr	3hr	7hr	15hr	39hr	79hr	9days	19days	39days
6		56min	1hr	3hr	7hr	15hr	37hr	75hr	9days	18days	37days
8		52min	1hr	3hr	6hr	13hr	34hr	69hr	8days	17days	34days
5	12	43min	86min	2hr	5hr	11hr	28hr	57hr	7days	14days	28days
6		41min	83min	2hr	5hr	11hr	27hr	55hr	6days	13days	27days
8		39min	78min	2hr	5hr	10hr	26hr	52hr	6days	13days	26days
10		36min	73min	2hr	4hr	9hr	24hr	49hr	6days	12days	24days
12		34min	69min	2hr	4hr	9hr	23hr	46hr	5days	11days	23days
10	30	17min	35min	71min	2hr	4hr	11hr	23hr	71hr	5days	11days
12		17min	34min	69min	2hr	4hr	11hr	23hr	69hr	5days	11days
20		15min	31min	62min	2hr	4hr	10hr	20hr	62hr	5days	10days
30		13min	27min	55min	1hr	3hr	9hr	18hr	55hr	4days	9days

■Display data + event data file

●Display data file(The number of measure channels and computation channels depends on its models .)

Display update interval [/div]		1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
Saving interval		2sec	4sec	10sec	20sec	40sec	1min	2min	4min	8min
Meas. ch q'ty	Math. Ch q'ty									
1, 2, 3	0	41hr	83hr	8days	17days	34days	52days	104days	208days	416days
4	0	31hr	62hr	6days	13days	26days	39days	78days	156days	312days
5	0	25hr	50hr	5days	10days	20days	31days	62days	125days	250days
6	0	20hr	41hr	4days	8days	17days	26days	52days	104days	208days
8	0	15hr	31hr	78hr	6days	13days	19days	39days	78days	156days
10	0	12hr	25hr	62hr	5days	10days	15days	31days	62days	125days
12	0	10hr	20hr	52hr	4days	8days	13days	26days	52days	104days
20	0	6hr	12hr	31hr	62hr	5days	7days	15days	31days	62days
30	0	4hr	8hr	20hr	41hr	83hr	5days	10days	20days	41days
1	4	13hr	27hr	69hr	5days	11days	17days	34days	69days	138days
2	4	12hr	25hr	62hr	5days	10days	15days	31days	62days	125days
3	4	11hr	22hr	56hr	4days	9days	14days	28days	56days	113days
4	4	10hr	20hr	52hr	4days	8days	13days	26days	52days	104days
1	8	7hr	14hr	36hr	73hr	6days	9days	18days	36days	73days
2	8	6hr	13hr	34hr	69hr	5days	8days	17days	34days	69days
3	8	6hr	13hr	32hr	65hr	5days	8days	16days	32days	65days
4	8	6hr	12hr	31hr	62hr	5days	7days	15days	31days	62days
5	8	5hr	11hr	29hr	59hr	4days	7days	14days	29days	59days
6	8	5hr	11hr	28hr	56hr	4days	7days	14days	28days	56days
8	8	5hr	10hr	26hr	52hr	4days	6days	13days	26days	52days
5	12	4hr	8hr	21hr	43hr	86hr	5days	10days	21days	43days
6	12	4hr	8hr	20hr	41hr	83hr	5days	10days	20days	41days
8	12	3hr	7hr	19hr	39hr	78hr	4days	9days	19days	39days
10	12	3hr	7hr	18hr	36hr	73hr	4days	9days	18days	36days
12	12	3hr	6hr	17hr	34hr	69hr	4days	8days	17days	34days
10	30	1hr	3hr	8hr	17hr	35hr	53hr	4days	8days	17days
12	30	1hr	3hr	8hr	17hr	34hr	52hr	4days	8days	17days
20	30	1hr	3hr	7hr	15hr	31hr	46hr	93hr	7days	15days
30	30	1hr	2hr	6hr	13hr	27hr	41hr	83hr	6days	13days

●Event file(The number of measure channels and computation channels depends on its models .)
The saving interval of DX106, DX112, DX210, DX220, and DX230 can be selected from 1 second to 2 minutes.

Ch q'ty		Saving interval									
Meas. ch q'ty	Math. ch q'ty	125ms	250ms	500ms	1sec	2sec	5sec	10sec	30sec	1min	2min
1	0	1hr	2hr	4hr	8hr	16hr	41hr	83hr	10days	20days	41days
2											
3											
4											
5											
6		52min	1hr	3hr	6hr	13hr	34hr	69hr	8days	17days	34days
8		39min	1hr	2hr	5hr	10hr	26hr	52hr	6days	13days	26days
10		31min	1hr	2hr	4hr	8hr	20hr	41hr	5days	10days	20days
12		26min	52min	1hr	3hr	6hr	17hr	34hr	4days	8days	17days
20		15min	31min	1hr	2hr	4hr	10hr	20hr	62hr	5days	10days
30		10min	20min	41min	1hr	2hr	6hr	13hr	41hr	83hr	6days
1	4	34min	1hr	2hr	4hr	9hr	23hr	46hr	5days	11days	23days
2		31min	1hr	2hr	4hr	8hr	20hr	41hr	5days	10days	20days
3		28min	56min	1hr	3hr	7hr	18hr	37hr	4days	9days	18days
4		26min	52min	1hr	3hr	6hr	17hr	34hr	4days	8days	17days
1	8	18min	36min	1hr	2hr	4hr	12hr	24hr	73hr	6days	12days
2		17min	34min	1hr	2hr	4hr	11hr	23hr	69hr	5days	11days
3		16min	32min	1hr	2hr	4hr	10hr	21hr	65hr	5days	10days
4		15min	31min	1hr	2hr	4hr	10hr	20hr	62hr	5days	10days
5		14min	29min	59min	1hr	3hr	9hr	19hr	59hr	4days	9days
6		14min	28min	56min	1hr	3hr	9hr	18hr	56hr	4days	9days
8		13min	26min	52min	1hr	3hr	8hr	17hr	52hr	4days	8days
5	12	10min	21min	43min	1hr	2hr	7hr	14hr	43hr	86hr	7days
6		10min	20min	41min	1hr	2hr	6hr	13hr	41hr	83hr	6days
8		9min	19min	39min	1hr	2hr	6hr	13hr	39hr	78hr	6days
10		9min	18min	36min	1hr	2hr	6hr	12hr	36hr	73hr	6days
12		8min	17min	34min	1hr	2hr	5hr	11hr	34hr	69hr	5days
10	30	4min	8min	17min	35min	1hr	2hr	5hr	17hr	35hr	71hr
12		4min	8min	17min	34min	1hr	2hr	5hr	17hr	34hr	69hr
20		3min	7min	15min	31min	1hr	2hr	5hr	15hr	31hr	62hr
30		3min	6min	13min	27min	55min	2hr	4hr	13hr	27hr	55hr

Automatic saving interval

Following automatic saving interval can be selected.

DX102　Only display data file
Measurement ch：2
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day	✔	✔	✔	✔	✔	✔	✔	✔	✔
2		✔	✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5			✔	✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10				✔	✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31						✔	✔	✔	✔

Only display data file
Measurement ch：2
Computation ch：4

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14						✔	✔	✔	✔
31							✔	✔	✔

DX102 Display data + event data file
Measurement ch : 2
Computation ch : None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day	✔	✔	✔	✔	✔	✔	✔	✔	✔
2		✔	✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5			✔	✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10				✔	✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31						✔	✔	✔	✔

Display data + event data file
Measurement ch : 2
Computation ch : 4

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14						✔	✔	✔	✔
31							✔	✔	✔

DX104 Only display data file
Measurement ch：4
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day	✔	✔	✔	✔	✔	✔	✔	✔	✔
2		✔	✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5			✔	✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10				✔	✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31						✔	✔	✔	✔

Only display data file
Measurement ch：4
Computation ch：4

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14						✔	✔	✔	✔
31							✔	✔	✔

DX104 Display data + event data file
Measurement ch：4
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2 min	5 min	10 min	20 min	30 min	1 hr	2 hr	4 hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 Day	✔	✔	✔	✔	✔	✔	✔	✔	✔
2		✔	✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5			✔	✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10				✔	✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31						✔	✔	✔	✔

Display data + event data file
Measurement ch：4
Computation ch：4

Automatic saving interval	Waveform update rate[/DIV]								
	1 min	2 min	5 min	10 min	20 min	30 min	1 hr	2 hr	4 hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12		✔	✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5					✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10						✔	✔	✔	✔
14							✔	✔	✔
31								✔	✔

DX106 Only display data file
Measurement ch：6
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day	✔	✔	✔	✔	✔	✔	✔	✔	✔
2		✔	✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5			✔	✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10				✔	✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31						✔	✔	✔	✔

Only display data file
Measurement ch：6
Computation ch：12

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6		✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12			✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5						✔	✔	✔	✔
7							✔	✔	✔
10							✔	✔	✔
14								✔	✔
31									✔

DX106 Display data + event data file
Measurement ch：6
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31							✔	✔	✔

Display data + event data file
Measurement ch：6
Computation ch：12

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6		✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12			✔	✔	✔	✔	✔	✔	✔
1 day				✔	✔	✔	✔	✔	✔
2					✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5						✔	✔	✔	✔
7							✔	✔	✔
10							✔	✔	✔
14								✔	✔
31									✔

DX112 Only display data file
Measurement ch：12
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14						✔	✔	✔	✔
31							✔	✔	✔

Only display data file
Measurement ch：12
Computation ch：12

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6		✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12			✔	✔	✔	✔	✔	✔	✔
1 day				✔	✔	✔	✔	✔	✔
2					✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5						✔	✔	✔	✔
7							✔	✔	✔
10							✔	✔	✔
14								✔	✔
31									✔

DX112 Display data + event data file
Measurement ch : 12
Computation ch : None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12		✔	✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5					✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10						✔	✔	✔	✔
14							✔	✔	✔
31								✔	✔

Display data + event data file
Measurement ch : 12
Computation ch : 12

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4		✔	✔	✔	✔	✔	✔	✔	✔
6		✔	✔	✔	✔	✔	✔	✔	✔
8			✔	✔	✔	✔	✔	✔	✔
12			✔	✔	✔	✔	✔	✔	✔
1 day				✔	✔	✔	✔	✔	✔
2					✔	✔	✔	✔	✔
3						✔	✔	✔	✔
5							✔	✔	✔
7							✔	✔	✔
10								✔	✔
14								✔	✔
31									✔

DX204 Only display data file
Measurement ch：4
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day	✔	✔	✔	✔	✔	✔	✔	✔	✔
2		✔	✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5			✔	✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10				✔	✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31						✔	✔	✔	✔

Only display data file
Measurement ch：4
Computation ch：8

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12		✔	✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5					✔	✔	✔	✔	✔
7						✔	✔	✔	✔
10						✔	✔	✔	✔
14							✔	✔	✔
31								✔	✔

DX204 Display data + event data file
Measurement ch ： 4
Computation ch ： None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day	✔	✔	✔	✔	✔	✔	✔	✔	✔
2		✔	✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5			✔	✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10				✔	✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31						✔	✔	✔	✔

Display data + event data file
Measurement ch ： 4
Computation ch ： 8

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12		✔	✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5					✔	✔	✔	✔	✔
7						✔	✔	✔	✔
10							✔	✔	✔
14							✔	✔	✔
31								✔	✔

DX208 Only display data file
Measurement ch：8
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7				✔	✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14					✔	✔	✔	✔	✔
31							✔	✔	✔

Only display data file
Measurement ch：8
Computation ch：8

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12		✔	✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5					✔	✔	✔	✔	✔
7						✔	✔	✔	✔
10							✔	✔	✔
14							✔	✔	✔
31								✔	✔

DX208 Display data + event data file
Measurement ch : 8
Computation ch : None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14						✔	✔	✔	✔
31							✔	✔	✔

Display data + event data file
Measurement ch : 8
Computation ch : 8

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6		✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12			✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5						✔	✔	✔	✔
7							✔	✔	✔
10							✔	✔	✔
14								✔	✔
31									✔

DX210 Only display data file
Measurement ch：10
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3			✔	✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14						✔	✔	✔	✔
31							✔	✔	✔

Only display data file
Measurement ch：10
Computation ch：30

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3		✔	✔	✔	✔	✔	✔	✔	
4		✔	✔	✔	✔	✔	✔	✔	✔
6			✔	✔	✔	✔	✔	✔	✔
8			✔	✔	✔	✔	✔	✔	✔
12				✔	✔	✔	✔	✔	✔
1 day					✔	✔	✔	✔	✔
2						✔	✔	✔	✔
3							✔	✔	✔
5							✔	✔	✔
7								✔	✔
10								✔	✔
14									✔
31									

DX210 Display data + event data file
Measurement ch : 10
Computation ch : None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12	✔	✔	✔	✔	✔	✔	✔	✔	✔
1 day		✔	✔	✔	✔	✔	✔	✔	✔
2			✔	✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5				✔	✔	✔	✔	✔	✔
7					✔	✔	✔	✔	✔
10					✔	✔	✔	✔	✔
14						✔	✔	✔	✔
31							✔	✔	✔

Display data + event data file
Measurement ch : 10
Computation ch : 30

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2		✔	✔	✔	✔	✔	✔	✔	
3		✔	✔	✔	✔	✔	✔	✔	
4			✔	✔	✔	✔	✔	✔	✔
6			✔	✔	✔	✔	✔	✔	✔
8			✔	✔	✔	✔	✔	✔	✔
12				✔	✔	✔	✔	✔	✔
1 day					✔	✔	✔	✔	✔
2						✔	✔	✔	✔
3							✔	✔	✔
5								✔	✔
7								✔	✔
10									✔
14									✔
31									

DX220 Only display data file
Measurement ch : 20
Computation ch : None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔	✔	✔	✔	✔
12		✔	✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3				✔	✔	✔	✔	✔	✔
5					✔	✔	✔	✔	✔
7						✔	✔	✔	✔
10						✔	✔	✔	✔
14							✔	✔	✔
31								✔	✔

Only display data file
Measurement ch : 20
Computation ch : 30

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3		✔	✔	✔	✔	✔	✔	✔	
4		✔	✔	✔	✔	✔	✔	✔	✔
6			✔	✔	✔	✔	✔	✔	✔
8			✔	✔	✔	✔	✔	✔	✔
12				✔	✔	✔	✔	✔	✔
1 day					✔	✔	✔	✔	✔
2						✔	✔	✔	✔
3							✔	✔	✔
5							✔	✔	✔
7								✔	✔
10								✔	✔
14									✔
31									

DX220 Display data + event data file
Measurement ch：20
Computation ch：None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6	✔	✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12		✔	✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5					✔	✔	✔	✔	✔
7						✔	✔	✔	✔
10							✔	✔	✔
14							✔	✔	✔
31								✔	✔

Display data + event data file
Measurement ch：20
Computation ch：30

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2		✔	✔	✔	✔	✔	✔	✔	
3		✔	✔	✔	✔	✔	✔	✔	
4			✔	✔	✔	✔	✔	✔	✔
6			✔	✔	✔	✔	✔	✔	✔
8				✔	✔	✔	✔	✔	✔
12				✔	✔	✔	✔	✔	✔
1 day					✔	✔	✔	✔	✔
2							✔	✔	✔
3							✔	✔	✔
5								✔	✔
7								✔	✔
10									✔
14									✔
31									

DX230 Only display data file
Measurement ch : 30
Computation ch : None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6		✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12			✔	✔	✔	✔	✔	✔	✔
1 day			✔	✔	✔	✔	✔	✔	✔
2				✔	✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5						✔	✔	✔	✔
7							✔	✔	✔
10							✔	✔	✔
14								✔	✔
31									✔

Only display data file
Measurement ch : 30
Computation ch : 30

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2		✔	✔	✔	✔	✔	✔	✔	
3		✔	✔	✔	✔	✔	✔	✔	
4			✔	✔	✔	✔	✔	✔	✔
6			✔	✔	✔	✔	✔	✔	✔
8			✔	✔	✔	✔	✔	✔	✔
12				✔	✔	✔	✔	✔	✔
1 day					✔	✔	✔	✔	✔
2						✔	✔	✔	✔
3							✔	✔	✔
5								✔	✔
7								✔	✔
10									✔
14									✔
31									

DX230 Display data + event data file
Measurement ch : 30
Computation ch : None

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2	✔	✔	✔	✔	✔	✔	✔	✔	
3	✔	✔	✔	✔	✔	✔	✔	✔	
4	✔	✔	✔	✔	✔	✔	✔	✔	✔
6		✔	✔	✔	✔	✔	✔	✔	✔
8		✔	✔	✔	✔	✔	✔	✔	✔
12			✔	✔	✔	✔	✔	✔	✔
1 day				✔	✔	✔	✔	✔	✔
2					✔	✔	✔	✔	✔
3					✔	✔	✔	✔	✔
5						✔	✔	✔	✔
7							✔	✔	✔
10							✔	✔	✔
14								✔	✔
31									✔

Display data + event data file
Measurement ch : 30
Computation ch : 30

Automatic saving interval	Waveform update rate[/DIV]								
	1min	2min	5min	10min	20min	30min	1hr	2hr	4hr
10 min	✔	✔	✔	✔					
20	✔	✔	✔	✔					
30	✔	✔	✔	✔					
1 hr	✔	✔	✔	✔	✔	✔	✔		
2		✔	✔	✔	✔	✔	✔	✔	
3			✔	✔	✔	✔	✔	✔	
4			✔	✔	✔	✔	✔	✔	✔
6			✔	✔	✔	✔	✔	✔	✔
8				✔	✔	✔	✔	✔	✔
12				✔	✔	✔	✔	✔	✔
1 day					✔	✔	✔	✔	✔
2							✔	✔	✔
3							✔	✔	✔
5								✔	✔
7									✔
10									✔
14									
31									

FAQ

This section contains frequently asked questions regarding the DX series and their answers. Please refer to this section when you have a question about the product.

【About Input】

Question	Answer
What kinds of sensors can be input?	DCV: 20,60,200mV,2,6,20V Thermocouple: R,S,B,K,E,J,T,N,W,L,U Resistance temperature detector:Pt100,JPt100,(Cu10,25 option) On/Off signal: Contact input, TTL DC current (Requires an external shunt resistor)
Can different settings be made for each input as desired?	Yes, each input can be set to the desired specifications using the panel keys.
Are the input channels isolated from each other?	Yes, the terminals for each input channel are isolated from those of the other channels.
What is the measurement period?	DX102/104/204/208 : 125ms or 250ms DX106/112/210/220/230 : 1 sec or 2 sec (2 sec when A/D integration time is set to 100ms)
What is the A/D conversion resolution?	20,000 count (approx.14 bits)
Can the reference junction compensation (RJC) be switched on and off?	The RJC can be set as either INT (internal compensation on) or EXT (external compensation on), for each channel.
Can the burnout upscale/downscale function be set for a thermocouple input?	The thermocouple burnout detection can be set On/Off and upscale (100%) and downscale (100%) for each channel. The criteria for burnout detection are as follows: If ≦2k ohm, then normal, if ≧10M ohm, then burnout; using a detection current of approx.100nA
Is input scaling possible?	Linear scaling can be set for DC voltage, thermocouple, and resistance temperature detector input ranges. The unit can be set with up to 6 characters.

【About Display Functions】

Question	Answer
What is the refresh rate of the waveform display?	The refresh rate is determined by the waveform span rate you select as follows. (The values in parentheses indicate the equivalent chart speed of a conventional chart recorder.) Waveform Span Rate : Refresh Rate a) 4 hours/div (approx.2.5mm/h) : 480 sec b) 2 hours/div (approx.5.1mm/h) : 240 sec c) 1 hour/div (approx.10.2mm/h) : 120 sec d) 30 min/div (approx.20.5mm/h) : 60 sec e) 20 min/div (approx.30.7mm/h) : 40 sec f) 10 min/div (approx.61.5mm/h) : 20 sec g) 5 min/div (approx.123.0mm/h): 10 sec h) 2 min/div (approx.307.5mm/h): 4 sec i) 1 min/div (approx.615.0mm/h): 2 sec
What does “div” in “60 min/div”, the unit of the waveform span rate, stand for?	“Div” stands for each division (i.e., grid interval) of the time scale on the waveform display. Hence, if the waveform span rate is 60 min/div, the waveforms advance 1 grid interval in 60 minutes. 1 div consists of 30 pixels.
What is the refresh rate of the current value (the cursor point) on the waveform display?	The same as the measurement period.
What happens to the waveform display if a drastic change suddenly occurs in a measured value within the time interval between refreshments?	DX series traces the maximum and minimum values of the measured values, which are sampled at the measurement period within the time interval corresponding to each pixel of the time scale. These values are, used to draw the waveform on the screen and are stored in the display data file. Hence, no matter how slow the refresh rate is, the maximum and minimum values between each interval are displayed and stored. For example, when a measured value fluctuates significantly like it usually does for a flow rate, its waveform shows the same wide trace as a conventional pen recorder would.
Is there pen offset compensation function?	There is no phase difference between the cursor points and waveform traces between channels.
On the past-data reference screen, data from how long prior can be displayed?	All data in the display data file can be displayed.
How long is the life of the LCD?	The life of the LCD is determined by the life of the backlight, which is 5 years in general (but varies according to the use of the LCD saver and the brightness setting). The replacement of the LCD must be performed by Yokogawa Engineering Service Corporation or an authorized service representative.
Can the display be switched off in order to prolong the life of the LCD?	By setting the LCD saver on, the backlight automatically dims if there is no key operation over a certain length of time. The backlight returns to the original brightness setting whenever a key is touched or an alarm occurs. The LCD brightness ca be selected from 8 levels for DX100 and 4 levels for DX200.
It does not look the LCD brightness changed when LCD saver is used.	When LCD saver is used, the change may not be seen obviously, however, the current value is saved by 50% compared with normal usage.
What is the refresh rate of the digital values?	1 second.
Can the tag number of the each channel be displayed?	Yes, tag numbers of up to 16 characters can be displayed.
Is it possible to display the trend trace of each channel in discrete zones on the screen? Is it possible to compress or expand part of the display range?	Both are possible.
Is it possible to display a desired text on the screen?	You can define 8 messages of up to 16 characters to be displayed and also stored in memory. (Refer to “3.1.1 Message Entry”.)
Is it possible to set the desired colors for the waveform traces?	For each channel, you can select the desired color from among red, green, blue, blue-violet, brown, orange, yellow-green, light-blue, violet, gray, lime, cyan, dark-blue, yellow, light-gray, and purple (16 colors).
Is it possible to re-display display data file stored in media on DX screen?	Yes, it can be re-displayed by file operation in SET mode.

【About Data Storage】

Question	Answer
What is the capacity of the display data file and event file?	Display data file only : 1.2MB Event file only :1.2MB Display data + Event file : Display data ; 900kB Event file ; 300kB
What is the difference between the display data file and event file?	Please refer to “2.4.3 Description of Files”.
What is the relationship between the waveform span rate and data saving period?	
What is the data format?	The measured values are Yokogawa standard, 2-byte binary data. The computed values are Yokogawa standard, 4-byte binary data.
Can the parameter settings be saved to a removable storage media?	The settings made in both SET and SETUP modes can be saved.
How to back up the measured data during a power failure?	Since the measured data are written to a flash ROM (non-volatile memory), there is no limit for the backup time during power failure.
How can we find out how much internal memory is left?	It is displayed on status display at the top section of the screen. It is also possible to make a contact output at specified remained time (specify from 1,2,5,10,20,50,100 hours)(optional function). As for event file, memory status is displayed by bar graph when sampling in trigger mode. Memory summary display also shows how much internal memory is left. (Refer to “2.3.4 Display Types”.)
What happens when the memory is all used?	For the display data file, the oldest data is overwritten by the latest. For event file, the data are overwritten in the trigger-free or trigger-rotation mode. In trigger-on mode, collected data are retained. Memory media (FD, Zip, memory card) are not overwritten.
What happens if a media is not inserted at auto save timing?	It is saved when a media is inserted.
How many messages are stored?	Up to 100 of the most-recent messages are displayed on message summary display. In auto save mode, up to 100 of the most-recent messages are saved in measured data file.
Is it possible to divide the data and save them to separate files as desired?	Yes. It is possible to divide data and save them to separate files by start/stop data saving as desired.
How can I set the filenames of the measured-data files?	DX sets each file name automatically. It is possible to specify the folder name to store these files.
Does the data storage period vary with the number of channels used?	Yes. The data storage period differs depending on the number of channels you set for use in the SETUP mode. For example, if you set DX106 to use 3 channels, the data storage period is nearly twice longer than that of using 6 channels. Setting the range of a channel to SKIP does not make change the data storage period.

【About Network】

Question	Answer
What kind of network functions does DX series have?	FTP is implemented. It has FTP client and FTP server functions, which enable to transfer files via network.
How fast can we transfer data by Ethernet compared with using RS communication?	DX adopts 10BASE-T and its communication speed is 10Mbps. DX RS communication speed is 38kbps. It comes it is 260 times by simple calculation, however, it is difficult to say due to network environment, PC, or DX data processing time. It is an advantage of Ethernet that it can handle more devices simultaneously.
Is Ethernet communication more reliable compared with RS communication?	It is superior due to error detection or send-recovery functions provided by TCP/IP.
How can we connect DX and PC?	They are connected via HUB. Between PC and HUB, and the HUB and DX are connected by straight 10BASE-T cables. (Refer to “3.4.3 Network Configuration Example”)
How can we set DX IP address?	It can be set in SETUP mode from DX. (Refer to “3.4.3 Network Configuration Example”)
How about FTP setting?	It can be set in SETUP mode from DX. (Refer to “3.4.3 Network Configuration Example”)
Is it possible to transfer data at alarm occurring?	Yes. It is possible to transfer event data files automatically by using Event-trigger in Auto save mode.
Can DX communicate over Subnet?	Yes. It can communicate over Subnet.
Is it possible to access DX via public phone line?	Yes, it is possible by using ISDN router or dial-up router. There are various kinds of ISDN routers or dial-up routers to connect public phones for home use to company use.

【About Application Software】

Question		Answer
What kinds of application software are available?		There are three software to support DX series. DX standard software (Standard accessory) DAQLOGGER (Option) DAQEXPLORER (Option)
What kinds of functions are available by each software?	DX standard software	DX setting (External memory media or communication) Data viewer Printout of replay data File conversion (ASCII, Lotus1-2-3, MS-Excel)
	DAQLOGGER	DX setting (External memory media or communication) Data viewer Printout of replay data File conversion (ASCII, Lotus1-2-3, MS-Excel) Real-time data logging
	DAQEXPLORER	DX setting (External memory media or communication) Data viewer Printout of replay data File conversion (ASCII, Lotus1-2-3, MS-Excel) File transfer by icon operation Remote monitor
What is the difference between monitoring and logging?		Monitor is to display DX gathering data on PC via communication at real-time. Data files are not generated in PC. Logging is to display DX gathering data on PC via communication at real-time and to generate data files in PC at the same time.
Can DAQLOGGER handle Ethernet and RS communications at the same time?		Yes. It can connect DX series by Ethernet and connect uR by RS-422-A/485.
Is it possible to display waveforms of different files overlapped?		Please convert the data to Excel or Lotus1-2-3 format and use graph functions of the spreadsheet. It is also possible to display waveforms of different files in tiles on Windows.