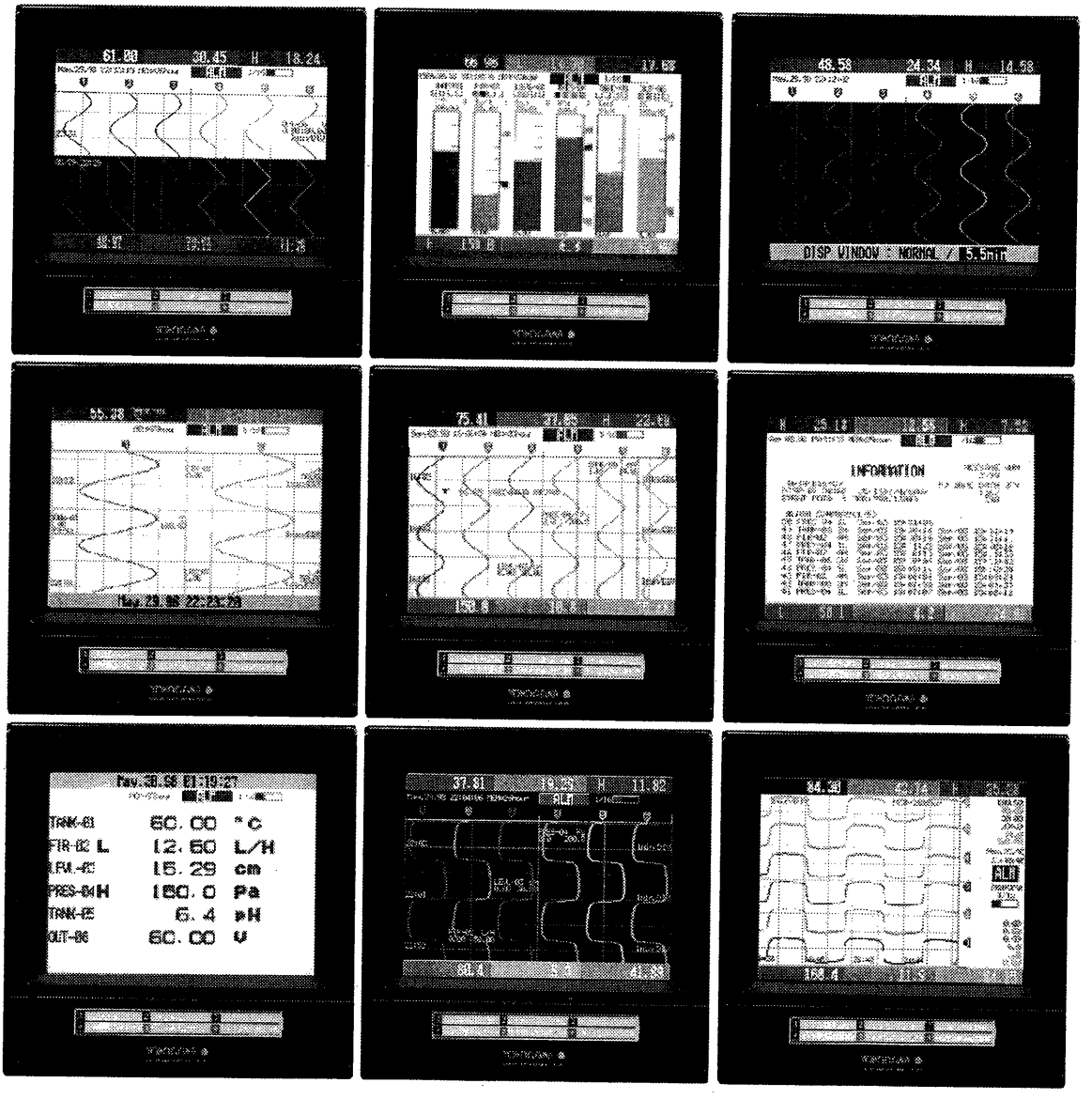
Technical Information

VR200 Functions:
- Basic Functions of Style 2
- Optional Mathematical Functions
- Optional Large Memory

VR200



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Preface

This document describes the basic functions of the VR200 wide-view recorder style 2, and introduces the specifications of the optional mathematical functions and large memory.

The VR200 paper-less recorder is expanding its market all over the world by offering computer-friendly and easy-to-use features and promising a reduction of running and maintenance costs.

The change to style 2 has made the VR200's display functions even more powerful, offering new, handy options such as the mathematical functions and large memory.

This document is designed to help you obtain the full performance from your VR200 recorder.

1. VR200 Overview

The VR200 wide-view recorder displays measured data on a high-resolution TFT color LCD in real-time and can save the data to a 3.5-inch floppy disk. It is therefore, a true paper-free recorder. The VR200 offers a wide angle-of-view from both sides and outstanding screen clarity. It also allows the user to set various display preferences such as the variable-width trend trace lines and trip lines.

The upgrade to style 2 includes the addition of a bar-graph display and large digital display functions, increasing the power of the display functions even more. The VR200 leads the way in paper-less recording.

Features

- **Saving measured data to floppy disk**

Saving the measured data in a floppy disk enables the data to be viewed and processed using data conversion and viewing software.

- **Reduced daily inspection and maintenance work**

The adoption of 3.5-inch floppy disks as the new recording medium means that you no longer have to replace the recording chart and inks.

- **Easy to use**

Measured data are regularly saved in the recorder's memory, and saving to disk is as easy as simply inserting the floppy disk.

- **Clear, high-resolution display**

The high-resolution (320 × 240 dpi), 5.5-inch, TFT color LCD provides a clear display.

Major Specifications

Inputs:	VR202 - 2 channels; VR204 – 4 channels; VR206 – 6 channels
Measuring period:	VR202/204 – 125 ms (fastest); VR206 – 1 s (fastest)
Input types:	DC voltage ranging from ±20 mV to ±20 V; thermocouple of types R, S, B, K, E, J, T, N, W, L, or U; resistance temperature detector as either the Pt100 or JPt100; operation record; DC current (by using an external shunt resistor)
Display:	5.5-inch TFT color LCD
Removable media drive:	3.5-inch high-density floppy disk drive
Storage capacity:	Data of 4 or 6 channels for 1 month at a sampling period of 60 seconds
Alarm types:	High and low limit alarms, deviation high and low limit alarms, velocity high and low limit alarms
Options:	Alarm outputs, RS-422A communication, remote control, fail and memory end outputs, Cu10 and Cu25 RTD inputs, mathematical functions, large memory, etc.

2. VR200 Style 2

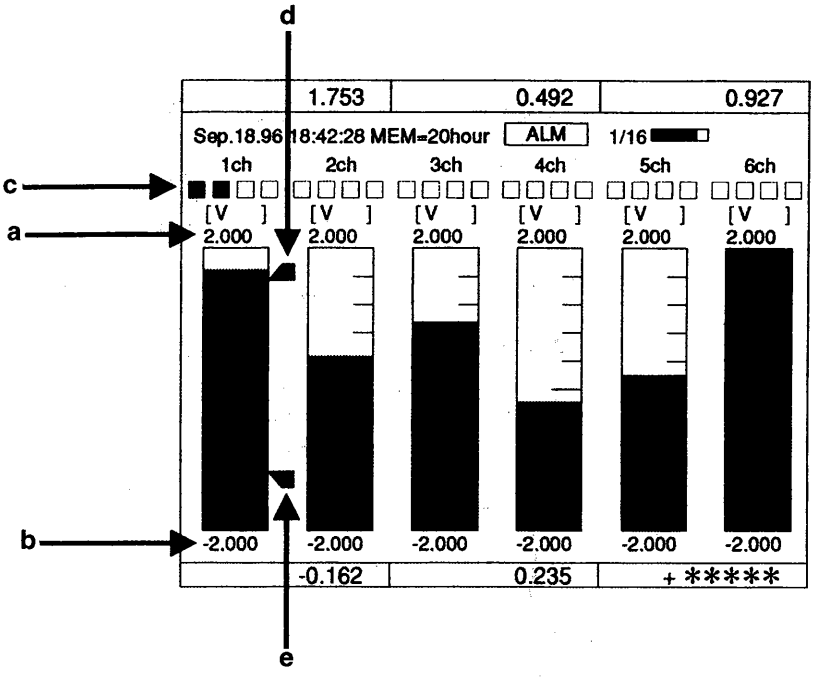
All VR200s shipped from July 7, 1998, are updated to style 2, which features the following additional functions.

Added Functions

1. Bar graph display: Displays the measured values as bar graphs.
2. Large digital display: Displays the measured values as large digits.
3. Information display: Displays the recent alarm events as well as the status of the internal memory.
4. Parameter list display: Displays the list of parameter settings made in the SET and SETUP modes.
5. Message display
6. Enlarged font in digital display
7. Indication of waveform span rate
8. Increased selections for number of divisions of grid lines (4 to 12 divisions)
9. Increased number of trip lines (from 2 levels to 6 levels)
10. Switching on/off of waveforms of individual channels
11. Added display colors–cyan, orange, and gray–for VR202 and VR204

2.1 Bar Graph Display

The measured values are displayed in easy-to-read bar graphs, allowing you to see at a glance the current measured value and alarm status of each channel.



a. Upper scale limit

b. Lower scale limit

c. Alarm status indicators

Displays the status of each alarm level for each channel.

Unfilled rectangle: No alarm setting

Green rectangle: Returned to normal

Red rectangle: Alarm is occuring

d. High-limit alarm setting

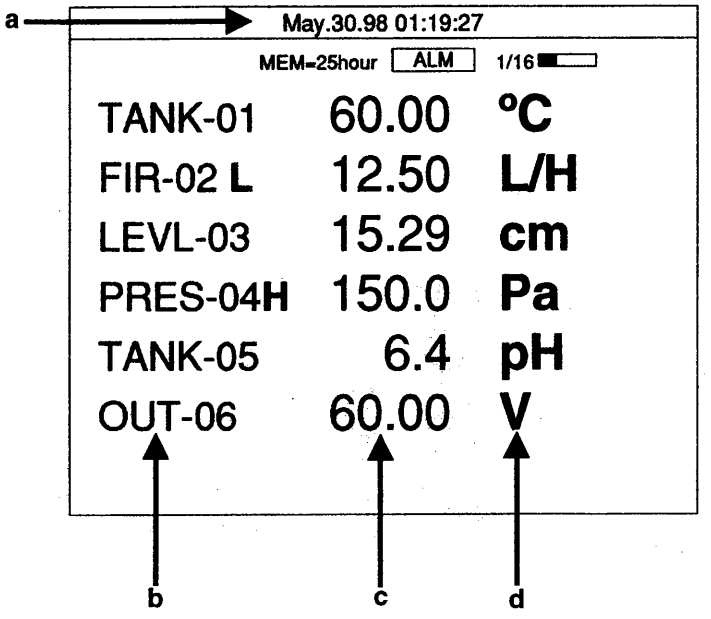
Green during normal status; red during alarm

e. Low-limit alarm setting

Green during normal status; red during alarm

2.2 Large Digital Display

The measured values are displayed in large digits–ideal for monitoring the exact measured values.



a. Date and time

b. Channel or tag number

Displays the channel or tag number of each channel.

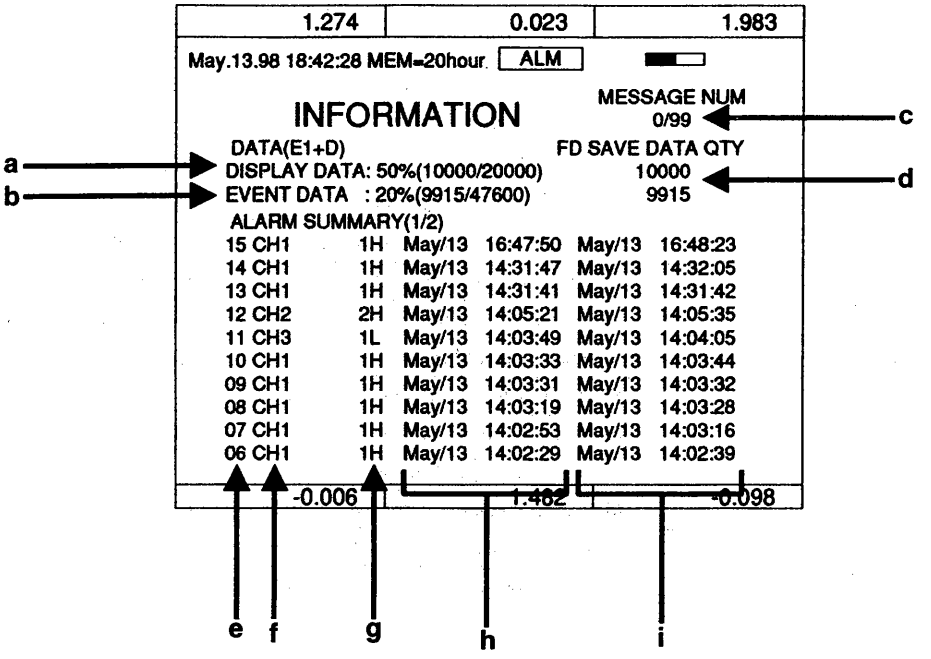
c. Measured values

Displayed in red during an alarm.

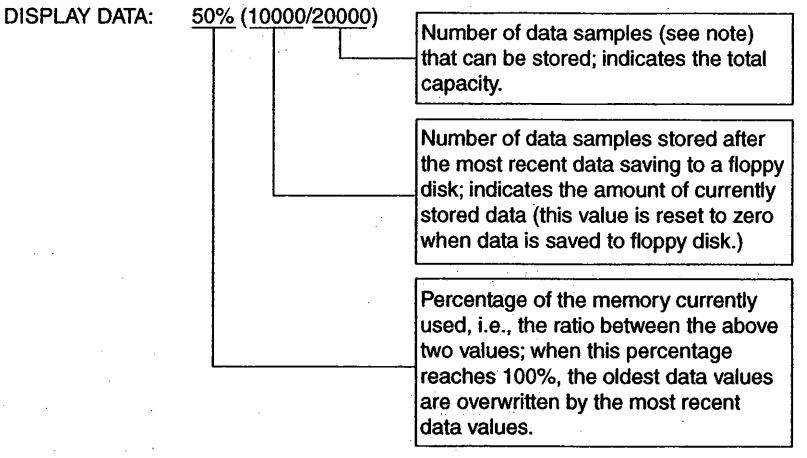
d. Unit

2.3 Information Display

The internal memory status and the past alarm information are displayed in list form.



a. Status of memory for display data file



b. Status of memory for event file

The displayed information is the same as that for the display data file.

c. Number of messages

Displays the number of messages currently stored and the number of messages that can be stored.

d. Number of data samples

Indicates the number of data samples to be stored to a floppy disk.

e. Alarm number

Serial numbers are assigned to alarms in chronological order from the oldest occurrence. Up to fifty of the most recent alarm events are displayed.

f. Channel number

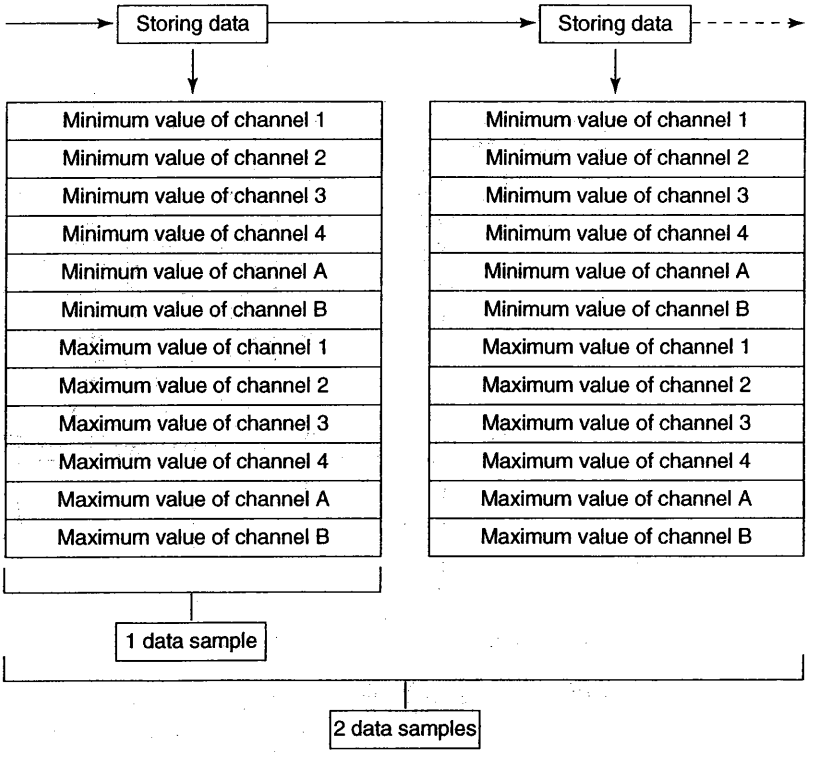
g. Alarm level and type

h. Time of alarm occurrence

i. Time of alarm recovery

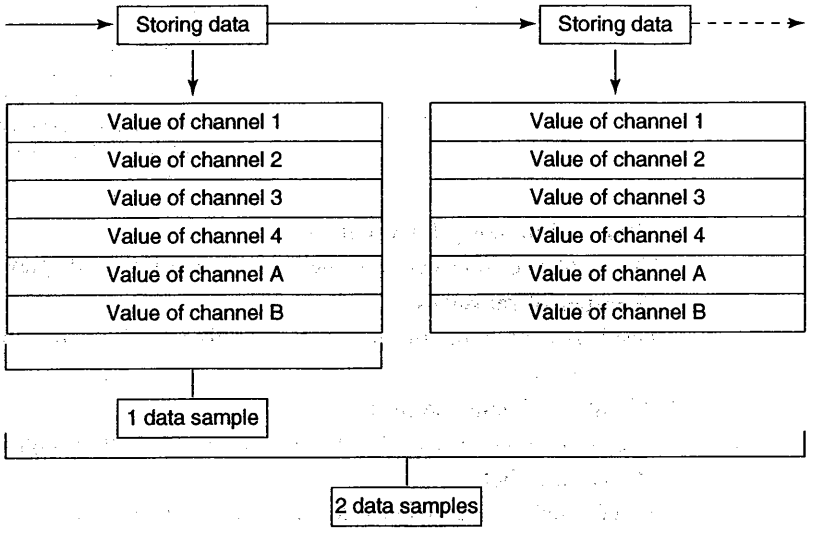
NOTE: "Number of data samples" is determined as follows. The figure below shows an example when the number of measuring channels is four (channels 1-4), and the number of computed-value channels is two (channels A and B).

Display Data File



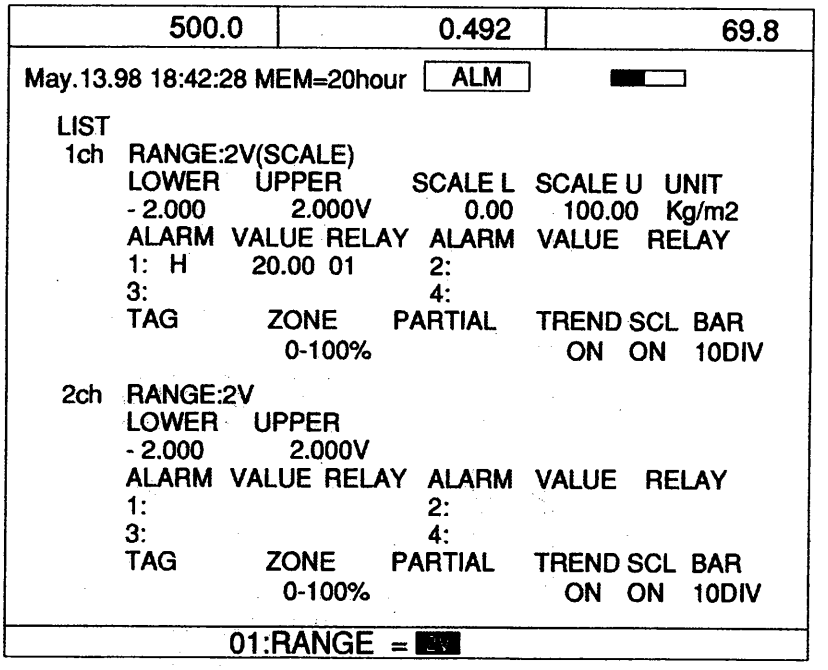
Event File

Display Data File

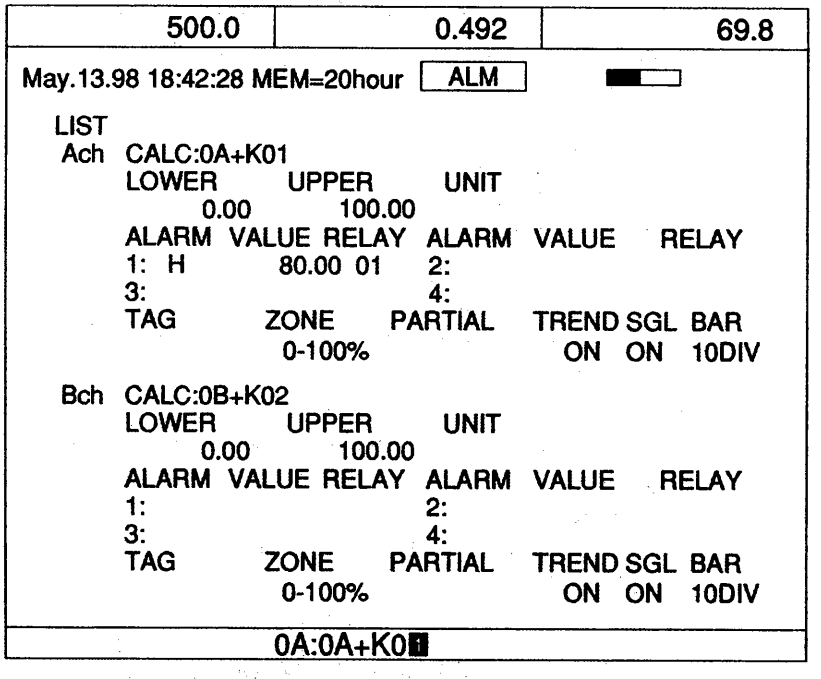


2.4 Parameter List Display

A list of the parameter settings in the SET and SETUP modes is displayed. The display contents vary depending on the parameter selected.



Parameter List Display for Range Settings

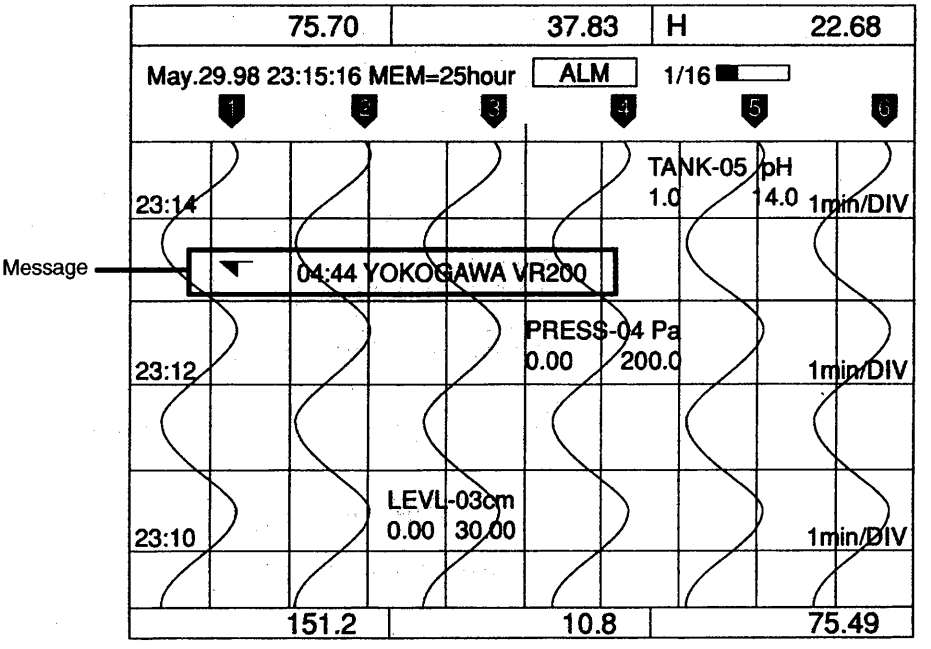


Parameter List Display for Calculation Settings

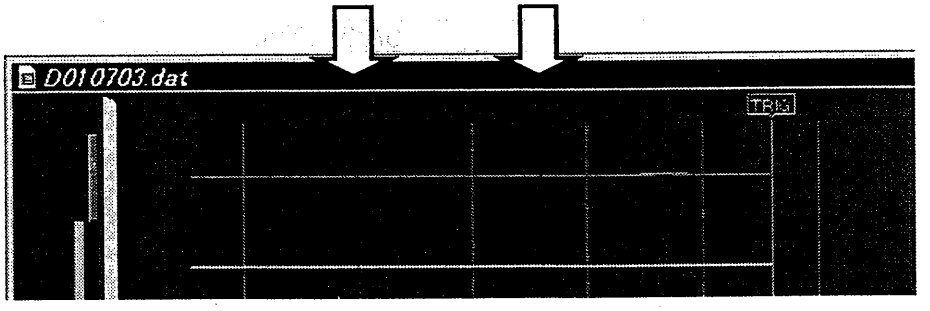
2.5 Message Display

Messages can be activated by both a remote contact signal and the panel keys for display on the waveform display.

The displayed messages can also be redisplayed when viewing the same waveforms on a personal computer screen later using the VR Data Viewer for Windows 95 (VA200-02) version R2.01.01 or later.



- Five messages consisting of up to sixteen characters and each in a different color, can be set.
  Message 1: Red
  Message 2: Green
  Message 3: Blue
  Message 4: Brown
  Message 5: Red purple
- Messages can be displayed only when the waveform display direction is vertical. When it is horizontal, only event marks are drawn and the message texts are stored in memory.
- Up to ninety-nine of the most recently occurring messages are stored. If a message was written at the same time that a measured value was stored, then that message is also deleted from memory when the measured value is overwritten by a more recent measured value.
- The messages are displayed in a window of VR Data Viewer for Windows 95 as shown below.



3. Optional Mathematical Functions

The optional mathematical functions enhance all applications of your VR200.

3.1 Available Operators

General Arithmetic Operators

Operation		Code	Syntax (Example)	Description
Basic four arithmetic operations	Summation	+	0A : 01 + 02	Adds the value of channel 1 to the value of channel 2, and sets the result in channel A.
	Subtraction	-	0B: 02 - 01	Subtracts the value of channel 1 from the value of channel 2, and sets the result in channel B.
	Multiplication	*	0C : 03 * K01	Multiplies the value of channel 3 by the value of constant K01, and sets the result in channel C.
	Division	/	0D : 04 / K10	Divides the value of channel 4 by the value of constant K10, and sets the result in channel D.
Square root		SQR	0A : SQR(01)	Sets the square root of the value of channel 1, in channel A.
Absolute		ABS	0B : ABS(02)	Sets the absolute value of the value of channel 2, in channel B.
Common logarithm		LOG	0C : LOG(03)	Sets the common logarithm of the value of channel 3, in channel C.
Exponential		EXP	0D : EXP(04)	Raises e (the base of a natural logarithm) to the power given by the value of channel 04, and sets the result in channel D.

Comparators

Operation	Code	Syntax (Example)	If ...	Then ...
=	.EQ.	0A : e1.EQ.e2	e1 = e2	0A = 1
			e1 ≠ e2	0A = 0
≠	.NE.	0A : e1.NE.e2	e1 ≠ e2	0A = 1
			e1 = e2	0A = 0
>	.GT.	0A : e1.GT.e2	e1 > e2	0A = 1
			e1 ≤ e2	0A = 0
<	.LT.	0A : e1.LT.e2	e1 < e2	0A = 1
			e1 ≥ e2	0A = 0

Logical Operators

Operation	Code	Syntax (Example)	If ...	Then ...
Logical AND	AND	0A : e1ANDe2	e1 = 0, and e2 = 0	0A = 0
			e1 ≠ 0, and e2 = 0	0A = 0
			e1 = 0, and e2 ≠ 0	0A = 0
			e1 ≠ 0, and e2 ≠ 0	0A = 1
Logical OR	OR	0A : e1ORe2	e1 = 0, and e2 = 0	0A = 0
			e1 ≠ 0, and e2 = 0	0A = 1
			e1 = 0, and e2 ≠ 0	0A = 1
			e1 ≠ 0, and e2 ≠ 0	0A = 1
Exclusive OR	XOR	0A : e1XORe2	e1 = 0, and e2 = 0	0A = 0
			e1 ≠ 0, and e2 = 0	0A = 1
			e1 = 0, and e2 ≠ 0	0A = 1
			e1 ≠ 0, and e2 ≠ 0	0A = 0
Logical NOT	NOT	0A : NOTe1	e1 = 0	0A = 1
			e1 ≠ 0	0A = 0

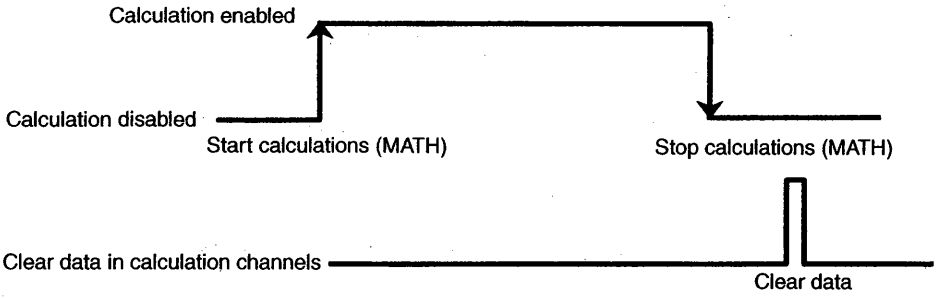
Statistic Operators

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

Operation	Code	Syntax (Example)	Description
Maximum	TLOG.MAX	0A : TLOG.MAX(01)	Sets the maximum value of channel 1 in channel A.
Minimum	TLOG.MIN	0B : TLOG.MIN(02)	Sets the minimum value of channel 3 in channel B.
Average	TLOG.AVE	0C : TLOG.AVE(03)	Sets the average of values of channel 3 in channel C.
Total	TLOG.SUM	0D : TLOG.SUM(04)	Sets the total of values of channel 4 in channel D.

3.2 Starting and Stopping Calculations

Calculations defined using the optional mathematical functions can be started and stopped locally by the panel keys as well as remotely by external signals and communication. (Remote control by external signals and by communication requires the optional remote control function and RS-422A communication interface, respectively.)



- The Clear 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.

3.3 Intervals of Statistical Calculations (TLOG)

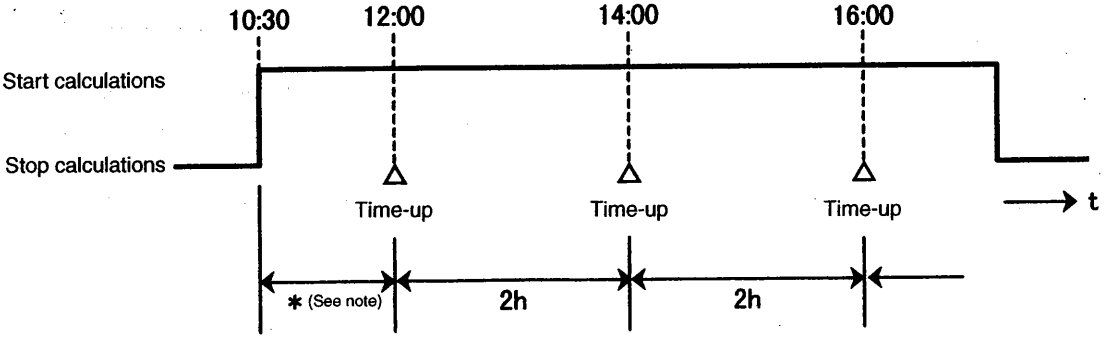
The intervals of statistical calculations (TLOG) can be specified and set as starting from either:

- **a specified time, or**
- **the time when mathematical calculation (MATH) starts.**

(1) Specified Intervals from Specified Time (example)

Settings:

TLOG_INTERVAL (Interval control) = ABS
START_TIME = 00:00
INTERVAL = 2h

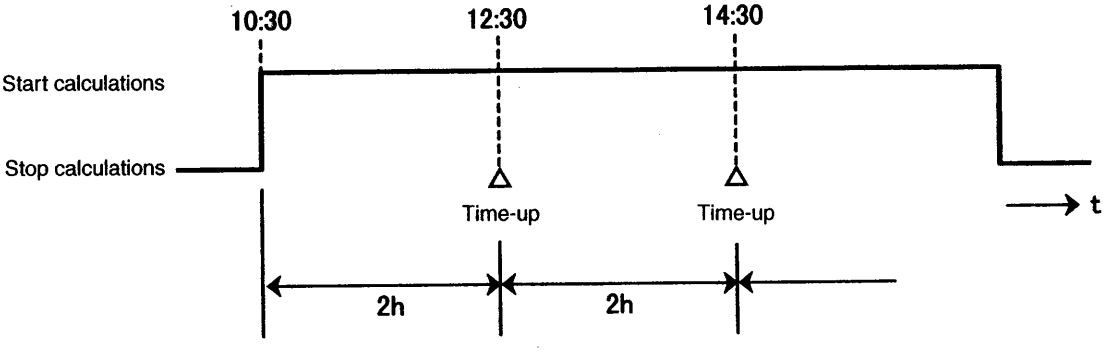


Note: After mathematical calculation (MATH) starts, the first interval of the statistical calculations (TLOG) ends when the nearest interval time, which is determined by the START_TIME and INTERVAL settings, is reached.

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

Settings:

TLOG_INTERVAL (Interval control) = RELTV
INTERVAL = 2h



3.4 Setting Restrictions and Supplement Information

Channels Used

VR200 series recorders with optional mathematical functions have the following computed-value channels.

- VR202 and VR204: 4 channels (channels A to D)
- VR206: 6 channels (channels A to F)

Use these channels for mathematical calculations; you cannot use measuring channels (channels 1-4 or 1-6) for calculations.

You must specify channels in two digits, such as 01, 02, 0A, and 0B, in the calculation settings.

Range Limit of Calculation

If an intermediate result exceeds $\pm 3.4 \times 10^{\pm 38}$ during calculation, the calculation result becomes "+****", indicating a positive calculation overflow.

Constants

Up to ten constants can be set.

- Range of constants: 9.9999E+29 to 1.0000E-30
  0
  –1.0000E-30 to –9.9999E+29
- Number of significant digits: 5

Constants must begin with a letter, "K", such as K02.

Display

The calculation results can be displayed as waveforms and digital values.

Range of Waveform and Digital Display Values

The range of waveform and digital display values is –9999999 to 99999999.

Stacks

Stacks are the items defined in a calculation expression, such as the measured values specified by channel numbers and constants. In a VR200 series recorder, up to eight stacks can be set in each calculation. Setting more than eight stacks results in a calculation error and causes the calculation result to be set as "+****" (positive overflow).

Example of more than eight stacks: 01 + 01 * (01 + 01 * (01 + 01 * (01 + 01 * 01)))

This example uses nine 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.

Measurement period

If one or more computed-value channel is set, measurement is performed at 250-ms intervals for a VR202 and VR204. (If no computed-value channel is set, it is performed at intervals of 125 ms.) In this case, the sampling period of the event file(s) is also 250 ms (at the fastest sampling rate).

Scale Settings for Statistical Calculations

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

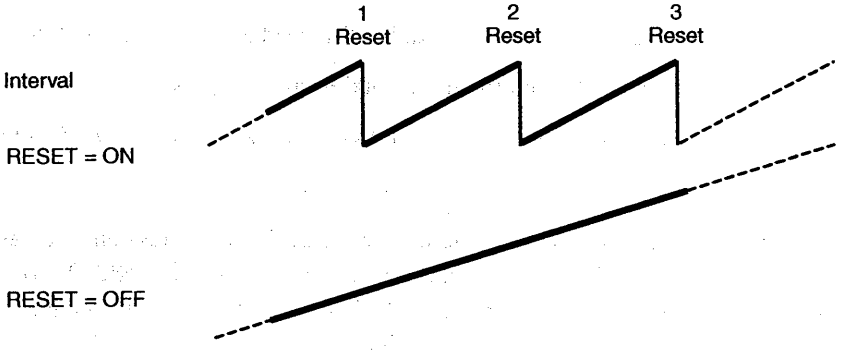
Assume that a per-second flow rate is measured by a VR204. The summation of four measured values for each minute is calculated by simply integrating the measured values of the corresponding channel, which produces a value four times greater than the correct totalized flow rate since the measurement period is 250 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 a VR204.

Input:	Flow rate (□□m³/h)
Measurement period:	250 ms (4 times per second)
Scale:	/s

Resetting of Statistics

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.

Example: Results of Totalization (SUM)



3.5 Saving of Computed Values

Files to Which Computed Values Are to Be Saved

Just like the values of measurement channels, values of computed-value channels are also saved to the display data file and event data file(s). (Using computed-value channels shortens the sampling time, i.e., the time span for data saving. For details, see the General Specifications GS 4N2A1-E.) When statistical calculations (TLOG) are used, the computed statistics are saved to an additional file referred to as the TLOG interval data file.

TLOG Interval Data File

The TLOG interval data file contains the statistics computed at the most recent time-up of the TLOG's interval.

File contents: Start time of MATH (calculations)

Unit and decimal point position of each channel

Value of each of the measurement channels and computed-value channels upon time-up of the interval

Stop time of MATH and value of each channel at that time

Data type: Binary (VR recorder's special format)

File type: TLOG interval data file (*.TLG)

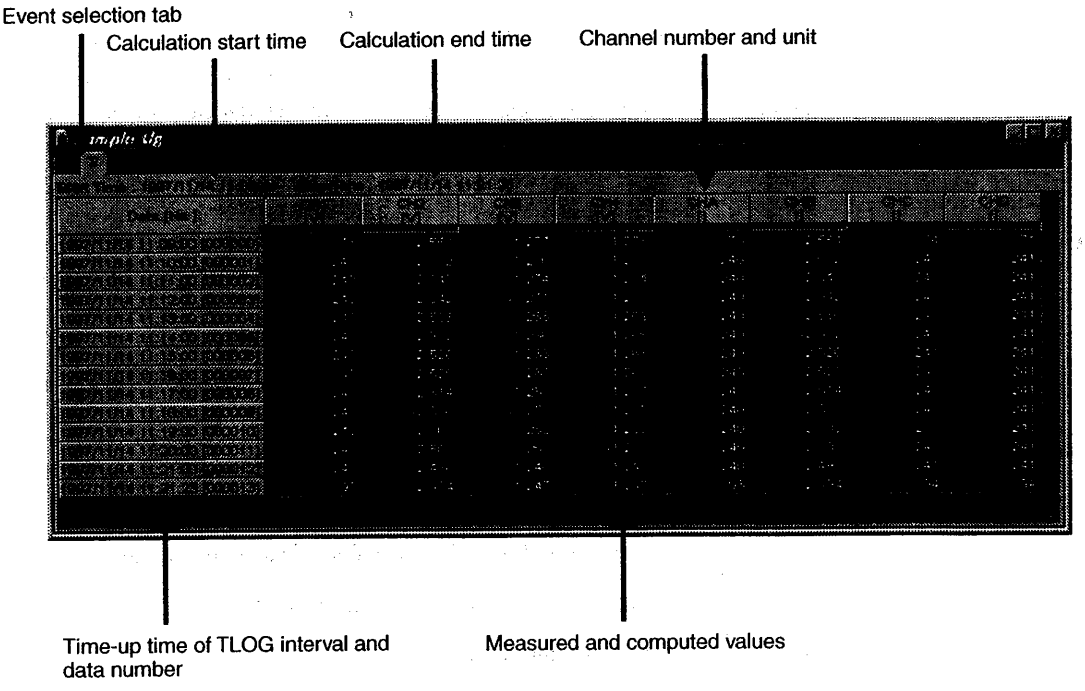
Filename: The name of the file for the corresponding measured value is set automatically.

Number of data values that can be saved: 770 (for approx. 32 days at 1-hour intervals)

Number of *events*: 12

Note: An *event* indicates each time period from the start until the end of a MATH calculation. Data values will not be saved to the file after the number of data saved or the number of events reaches its limit, whichever comes first. This means that if the number of data saved reaches 770 before the number of events reaches 12, then the file contains the most recent 770 data values only; on the other hand, if the number of events exceeds 12 before 770 data values are saved, then the file contains the data values of the most recent 12 events only.

The contents of the TLOG interval data file can be viewed on a personal computer screen (using VR Data Viewer for Windows 95) as shown below.



The TLOG interval data file can be converted to a Microsoft Excel file, Lotus 1-2-3 file, or ASCII text file using VR Data Viewer for Windows 95. The figure below shows the file contents after converted to an Excel file.

VR Series	TLOG								
TLOG Count	2								
No.	2								
Start Time	1997/11/14	11:08:41							
Stop Time	1997/11/14	11:21:23							
Data Count	14								
	Ch.	CH1	CH2	CH3	CH4	CHA	CHB	CHC	CHD
Date	Time	V	V	V	V				
11/14	11:09:00	73	-2.554	-1.277	-1.278	73	-2.554	74	74
11/14	11:10:00	240	-2.552	-1.276	-1.276	240	-2.552	241	241
11/14	11:11:00	240	-2.548	-1.274	-1.274	240	-2.548	241	241
11/14	11:12:00	240	-2.542	-1.271	-1.271	240	-2.542	241	241
11/14	11:13:00	240	-2.536	-1.268	-1.269	240	-2.536	241	241
11/14	11:14:00	240	-2.532	-1.266	-1.266	240	-2.532	241	241
11/14	11:15:00	240	-2.526	-1.263	-1.263	240	-2.526	241	241
11/14	11:16:00	240	-2.520	-1.260	-1.261	240	-2.520	241	241
11/14	11:17:00	240	-2.514	-1.257	-1.257	240	-2.514	241	241
11/14	11:18:00	240	-2.510	-1.255	-1.255	240	-2.510	241	241
11/14	11:19:00	240	-2.505	-1.253	-1.253	240	-2.505	241	241
11/14	11:20:00	240	-2.500	-1.250	-1.250	240	-2.500	241	241
11/14	11:21:00	240	-2.496	-1.248	-1.248	240	-2.496	241	241
11/14	11:21:23	93	-2.494	-1.247	-1.247	93	-2.494	94	94

You can easily create simple daily and monthly reports by editing the TLOG interval data file, which contains the computed and measured values at each interval, using common spreadsheet applications such as Excel and Lotus 1-2-3.

3.6 Some Applications of Mathematical Functions

3.6.1 Monitoring of Pressure in Clean Room or Environmental Test Room and Pressure Alarm Output

The internal pressure of a clean room or environmental test room is set higher than the external atmospheric pressure in order to prevent dust and debris from entering. Thus, in most cases, the internal pressure needs to be monitored.

In this application, if the alarm is set for instantaneous changes in the value of the room internal pressure, the alarm occurs whenever the door is opened by a person entering or exiting the room. Hence, the alarm must be set so that it is activated only if the internal pressure is kept below the standard level for a specified time.

Using the mathematical functions of the VR200 series recorders, you can set an alarm for the time period during which a specified abnormality occurs.

Example of Setting in VR206

(1) Input, Constant, and Calculations

K01 (constant): Standard internal pressure of the room

Channel 1 (measurement channel): Assigned for measuring the internal pressure of the room

Channel A (computed-value channel): The calculation **0A : 01.LT.K01** is set.

- If the current internal pressure is less than the standard internal pressure, then 0A = 1 is set.
- If the current internal pressure is equal to or greater than the standard internal pressure, then 0A = 0 is set.

Channel B (computed-value channel): The calculation **0B : (0B + 0A) * 0A** is set.

- Channel B integrates the value of channel A (0 or 1).
- If the current internal pressure is less than the standard internal pressure, then the value of channel B is incremented by 1 at each scanning period (= 1 second for the VR206).
- If the current internal pressure is equal to or greater than the standard internal pressure, then the value of channel B is reset to zero.

(2) Setting of Alarm

Channel B: Computed-value channel; the following settings are made:

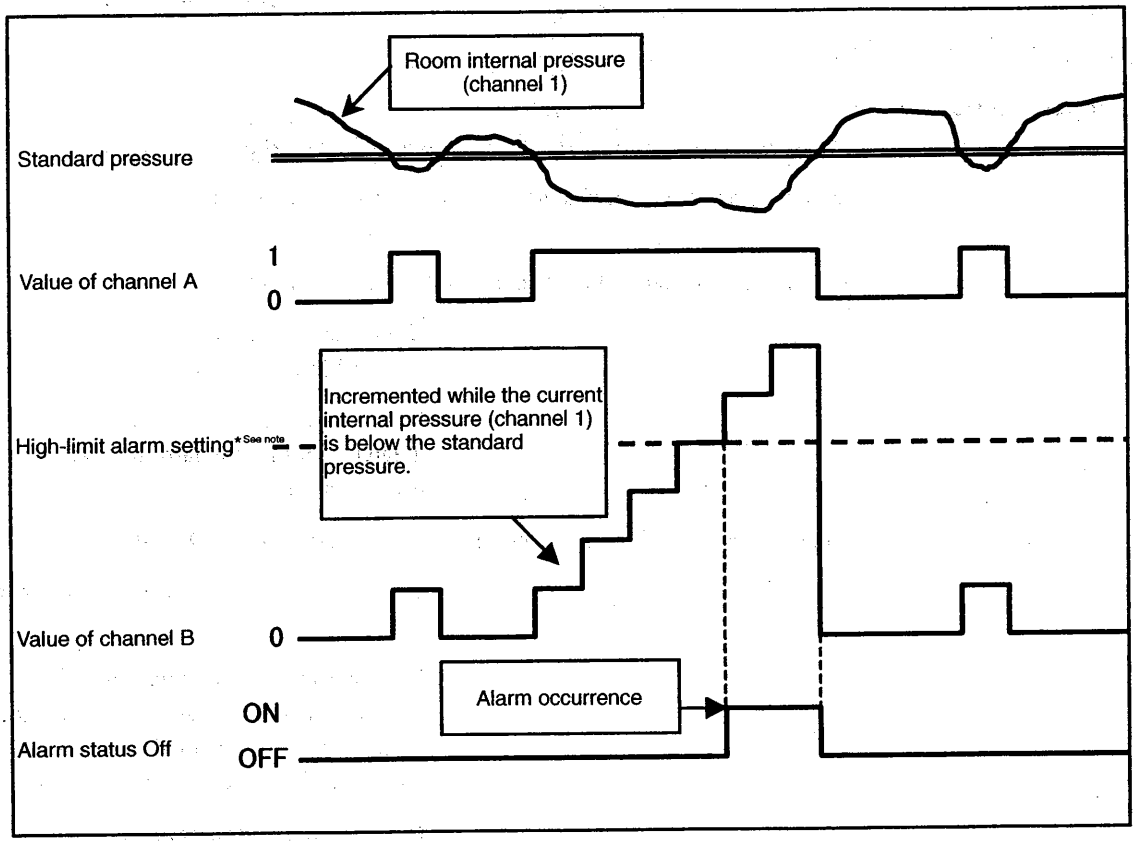
0B/1 : TYPE = H

0B/1 : VALUE = 60

- The high-limit alarm (level 1 alarm) is set for the value of channel B, and the alarm setting is 60.

- Since the scanning period of the VR206 is 1 second, the value of channel B is incremented by 1 at each scanning period (= 1 second for the VR206) leaving the current internal pressure at less than the standard internal pressure. This means that if the current internal pressure is left at a value less than the standard internal pressure for a period of 60 seconds, then the value of channel B reaches the alarm setting and thereby activates the alarm.

Monitoring and Alarm Occurrence



Note: The value of channel B is incremented by 1 at each measurement period, which varies according to the model and specifications as follows:

- 250 ms for VR202 and VR204 (when using computed-value channels)
- 1 s for VR206 when the A/D integration time is not set to 100 ms
- 2 s for VR206 when the A/D integration time is set to 100 ms

This means that, when you want to activate an alarm when the internal pressure of the room is left below the standard pressure for 1 minute (60 seconds), you must:

(1) Set the high-limit alarm setting of channel B to 240 (60 seconds divided by 0.25 second) for the VR202 or VR204.
(2) Set the high-limit alarm setting of channel B to 60 (60 seconds divided by 1 second) for the VR206 when the A/D integration time is not set to 100 ms.
(3) Set the high-limit alarm setting of channel B to 30 (60 seconds divided by 2 seconds) for the VR206 when the A/D integration time is set to 100 ms.

3.6.2 Sterilization Management at Food Production Plant

In heat sterilization of preserved foods and the like, all bacteria must be completely killed without causing any thermal change in the products (which may degrade the taste). Hence, the integrated fatality (*F value*) must be recorded and managed in most sterilization processes. The mathematical functions of the VR200 series recorders allow the fatality to be computed and recorded.

F value. The integrated value of the fatality, *Li*, over time Δt, is expressed by the following function of the sterilization temperature.

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

If *Ti* is constant, the F value over time Δt, can be expressed as:

$$F = \Delta t \sum_{i=1}^{n} Li \quad \text{..... Eq. 1}$$

Let us change this equation to a form that can be calculated by a VR200 series recorder. Assume that Tr = 121.1°C and Z = 10°C. From the equation,

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

we obtain

$$\log Li \quad \frac{Ti-121.1}{10}$$

From this, we can obtain the following:

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

A power of ten, 10^x, can be obtained in a VR200 series recorder by using the exponential operator as follows:

$10^x = e^{x\ln 10}$

$\ln 10 \approx 2.302585....$

Hence,

$10^x = e^{2.3026x}$

Therefore, *Li* can be expressed as:

$$\therefore Li = e^{2.3026\left(\frac{Ti-121.1}{10}\right)} \quad \text{..... Eq. 2}$$

Set Eq. 1 and 2 in a VR200 series recorder to perform the calculations.

Settings of Input, Constants, and Calculations in VR206

K01 (constant):	**10.000**; a constant used for calculating the F value (See note.)
K02 (constant):	**121.1**; a constant used for calculating the F value (See note.)
K03 (constant):	**2.3026**; a constant representing the value of ln10 (See note.)
K04 (constant):	**0.1667**; a constant representing the value of the measurement period divided by 60 seconds, when the unit of time is 60 seconds (See note.)
K05 (constant):	**100**; a constant used for resetting the integrated value (See note.)
Channel 1 (measurement channel):	Assigned to measure the temperature of the food.
Channel A (computed-value channel):	**0A : EXP((01 - K02) * K03 / K01)** • Corresponding to Eq. 2; calculating fatality *Li*
Channel B (computed-value channel):	**0B : (0B + 0A * K04) * (01.GT.K05)** • Corresponding to Eq. 1; calculating the F value, i.e., the integration of fatality *Li* over time Δt • If the current food temperature decreases to 100°C, then the value of channel B is reset to zero.

Note: The values of constants K01 to K05 vary with the conditions.

4. Optional Large Memory

The internal memory of a VR200 series recorder can be expanded, which is useful when using the mathematical functions or when using the VR200 for data recording at monitoring stations that are left unmanned for a long time. More specifically, the sampling time can be made equal to that of a standard model when using the mathematical functions (that shorten the sampling time).

4.1 Major Specifications

Internal Memory Size

- VR202 and VR204: 1 MB (standard) + 4 MB (expandable) = 5 MB
- VR206: 2 MB (standard) + 4 MB (expandable) = 6 MB

Note that the internal memory includes a reserved area used for preventing data from being overwritten during data saving to a floppy disk, and hence the internal memory size is not the same as the amount of measured values that can be saved. For the sampling time when using the large memory, see Section 4.2.

Number of Floppy Disks Required for Saving the Data

The data stored in the expanded memory is saved to:

- 3 floppy disks for VR202 and VR204
- 4 floppy disks for VR206

Floppy Disk Format

Only the MS-DOS 1.44-MB format is allowed.

Data Saving Method

As the data saving method, you can select either of the following settings:

- **ALL** (default setting): Saves all the measured values stored in the internal memory.
- **UNSAVED**: Saves the measured values stored into the internal memory after the most-recent saving of data to floppy disks.

4.2 Sampling Time

The tables below show the sampling time of the extended memory, which is nearly three times longer than that of the standard memory.

VR204

(1) Event File + Display Data File

Display data file (when using all four input channels)

Waveform span rate (min/div)	1 min	5 min	10 min	20 min	30 min	60 min
Sampling time (approx.)	3 days	16 days	33 days	66 days	100 days	200 days

Event file (for four channel inputs)

Sampling period	125 ms	250 ms	500 ms	1 s
Sampling time (approx.)	3.1 hours	6.2 hours	12.4 hours	25 hours

Display data file (when using all four input channels and four computed-value channels)

Waveform span rate (min/div)	1 min	5 min	10 min	20 min	30 min	60 min
Sampling time (approx.)	26.6 hours	5 days	11 days	22 days	33 days	66 days

Event file (for four channel inputs and four computed-value channels)

Sampling period	250 ms	500 ms	1 s
Sampling time (approx.)	2 hours	4.1 hours	8.2 hours

(2) Event File Only

Event file (for four channel inputs)

Sampling period	125 ms	250 ms	500 ms	1 s
Sampling time (approx.)	12.5 hours	25 hours	2 days	4 days

Event file (for four channel inputs and four computed-value channels)

Sampling period	250 ms	500 ms	1 s
Sampling time (approx.)	8.3 hours	16.6 hours	33.3 hours

VR206

(1) Event File + Display Data File

Display data file (when using all six input channels)

Waveform span rate (min/div)	1 min	5 min	10 min	20 min	30 min	60 min
Sampling time (approx.)	3 days	16 days	33 days	66 days	99 days	198 days

Event file (for six channel inputs)

Sampling period	1 s	2 s	10 s	30 s	60 s	120 s
Sampling time (approx.)	16.6 hours	33.2 hours	6 days	20 days	41 days	83 days

Display data file (when using all six input channels and six computed-value channels)

Waveform span rate (min/div)	1 min	5 min	10 min	20 min	30 min	60 min
Sampling time (approx.)	26.4 hours	5 days	11 days	22 days	33 days	66 days

Event file (for six channel inputs and six computed-value channels)

Sampling period	1 s	2 s	10 s	30 s	60 s	120 s
Sampling time (approx.)	5.5 hours	11 hours	2 days	6 days	13 days	27 days

(2) Event File Only

Event file (for six channel inputs)

Sampling period	1 s	2 s	10 s	30 s	60 s	120 s
Sampling time (approx.)	3 days	7 days	38 days	116 days	233 days	466 days

Event file (for six channel inputs and six computed-value channels)

Sampling period	1 s	2 s	10 s	30 s	60 s	120 s
Sampling time (approx.)	31.1 hours	2 days	12 days	38 days	77 days	155 days

4.3 File Types

When inserting floppy disks into a VR200 series recorder with the extended internal memory in order to save the data, the following files are created on the floppy disks.

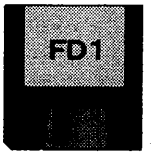
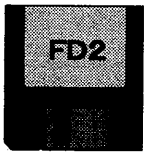
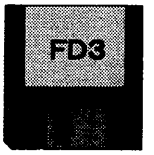
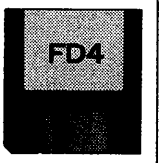
File Type		Contents	Type of Contained Data	Extension
Measured-value files	Display data file	The maximum and minimum values of the measured values within each time interval corresponding to each pixel of the time scale (i.e., data needed to trace waveforms)	Yokogawa standard format[Note] (binary)	*.DAT
	Event file(s)	Data collected and stored at the specified sampling period	Yokogawa standard format[Note] (binary)	*.DAT
Individual information file		Information on alarms and messages corresponding to the measured values saved on each floppy disk	ASCII text file	*.INF
Overall information file		Information on alarms and messages corresponding to the measured values saved on all floppy disks used at the time of data saving (3 or 4 floppy disks)	ASCII text file	*.INF
Setup parameter list file		Settings of parameters made in the SET and SETUP modes	ASCII text file	*.LST
TLOG interval data file		Values measured and computed at each interval of TLOG (See Section 3.5, "Saving of Computed Values."	Special format (binary)	*.TLG

Note: The same file format as used in other Yokogawa recorders.

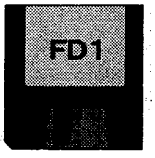
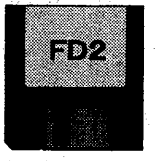
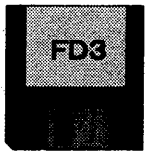
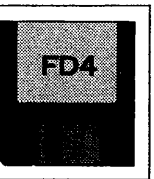
4.4 Files Created When Saving Data

When saving data from the expanded internal memory (with the optional large memory), the data are saved to multiple floppy disks. The table below shows the files created on the floppy disks at this time. The data saving is performed in the order from floppy disk 1 to 4. For the same kind of files, data are saved to floppy disks in chronological order starting from the oldest.

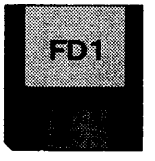
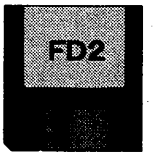
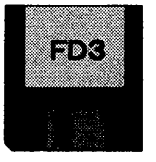
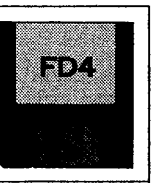
When Internal Memory Consists of 1 Display Data File + 1 Event Data File

File Type				
Display data file	DxxxxxxL.DAT	DxxxxxxM.DAT	DxxxxxxN.DAT	-
Event data file	-	-	-	ExxxxxxP.DAT
Individual information file	DxxxxxxL.INF	DxxxxxxM.INF	DxxxxxxN.INF	ExxxxxxP.INF
Overall information file*1	Dxxxxxx.INF	Dxxxxxx.INF	Dxxxxxx.INF	Dxxxxxx.INF
Setup parameter list file*1	Dxxxxxx.LST	Dxxxxxx.LST	Dxxxxxx.LST	Dxxxxxx.LST
TLOG interval data file*2	Dxxxxxx.TLG	-	-	-

When Internal Memory Consists of 1 Display Data File + 16 Event Data Files

File Type				
Display data file	DxxxxxxL.DAT	DxxxxxxM.DAT	DxxxxxxN.DAT	-
Event data file	-	-	-	Exxxxxx1.DAT Exxxxxx2.DAT ... ExxxxxxG.DAT
Individual information file	DxxxxxxL.INF	DxxxxxxM.INF	DxxxxxxN.INF	ExxxxxxP.INF
Overall information file*1	Dxxxxxx.INF	Dxxxxxx.INF	Dxxxxxx.INF	Dxxxxxx.INF
Setup parameter list file*1	Dxxxxxx.LST	Dxxxxxx.LST	Dxxxxxx.LST	Dxxxxxx.LST
TLOG interval data file*2	Dxxxxxx.TLG	-	-	-

When Internal Memory Consists of 1 Event Data File Only

File Type				
Display data file	-	-	-	-
Event data file	ExxxxxxP.DAT	ExxxxxxQ.DAT	ExxxxxxR.DAT	ExxxxxxS.DAT
Individual information file	ExxxxxxP.INF	ExxxxxxQ.INF	ExxxxxxR.INF	ExxxxxxS.INF
Overall information file*1	Exxxxxx1.INF	Exxxxxx1.INF	Exxxxxx1.INF	Exxxxxx1.INF
Setup parameter list file*1	Exxxxxx1.LST	Exxxxxx1.LST	Exxxxxx1.LST	Exxxxxx1.LST
TLOG interval data file*2	Exxxxxx1.TLG	-	-	-

*1: The same overall information file and setup parameter list file are saved to each floppy disk.

*2: The TLOG interval data file is saved only when the TLOG statistical calculation functions are used.

5. FAQ

The following tables contain frequently asked questions and their answers. Please refer to this table when you have a question about the VR200 series recorders.

About Input

Question	Answer
What kinds of sensors can be input?	Available input types are as follows. **DC voltage**: 20 mV, 60 mV, 200 mV, 2 V, 6 V, 20 V **Thermocouple**: Types R, S, B, K, E, J, T, N, W, L, U **Resistance temperature detector**: Pt100, JPt100, (optionally, Cu10, Cu25) **On/off signal**: Contact input, TTL input **DC current**: Requires an external shunt resistor. The ranges correspond to the DC voltage input ranges.
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?	125 milliseconds for the VR202 and VR204 (or 250 ms when using computed-value channels) 1 second for the VR206 (or 2 seconds when the A/D integration time is set to 100 ms)
What is the A/D conversion resolution?	20,000 counts (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 switched on and off commonly for all channels. Upscale (100%) or downscale (0%) can be selected. The criteria for burnout detection are as follows: If ≤2 kΩ, then normal; if ≥10 MΩ, then burnout; using a detection current of approx. 100 nA.
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.) Refresh Rate — Waveform Span Rate a) 120 seconds — 60 min/div (approx. 10.2 mm/h) b) 60 seconds — 30 min/div (approx. 20.5 mm/h) c) 40 seconds — 20 min/div (approx. 30.7 mm/h) d) 20 seconds — 10 min/div (approx. 61.5 mm/h) e) 10 seconds — 5 min/div (approx. 123.0 mm/h) f) 2 seconds — 1 min/div (approx. 615.0 mm/h)
What does "div" in "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 wavforms advances 1 grid interval in 60 minutes.
What is the refresh rate of the current value (the cursur 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?.	The VR200 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 storesd 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.
Are the traces synchronized between channels?	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.
If the internal memory is set as "one event file only," what can be done on the past-data reference screen?	Up to 4000 data values for 4 channels, and up to 2730 data values for 6 channels can be displayed for reference.
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, an alarm occurs, or a floppy disk is inserted. The LCD brightness can be selected from 15 levels.
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 7 characters can be displayed above the units.
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 5 messages of up to 16 characters to be displayed in the previously set conditions. The displayed messages are also stored in memory. (See Section 2.5, "Message Display.")
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, red-purple, orange, light blue, brown, and gray.

About Data Storage

Question	Answer
What is the capacity of the display data file and event file?	1) When Allocating the Internal Memory between the Display Data File + Event File • Display data file - VR202 and VR204: 768 KB - VR206: 1140 KB • Event file: 256 KB (When dividing the internal memory between 1 display data file and 16 event files, the size of each event file is 16 KB.) 2) When Allocating the Internal Memory to the Event File Only • Display data file - VR202 and VR204: 960 KB - VR206: 1344 KB Note: For the expanded internal memory (with the optional large memory), the capacity is nearly three times more than the above standard.
What is the difference between the display data file and event file?	See Appendix, "Measured-data Files."
What is the relationship between the waveform span rate and data saving period?	See Appendix, "Measured-data Files."
What is the data format in the files?	The measured values are Yokogawa standard, 2-byte binary data. The computed values are Yokogawa standard, 4-byte binary data. The parameter settings, messages, and power failure and alarm information are ASCII text data.
Can the parameter settings be saved to a floppy disk?	The settings made in both the SET and SETUP modes can be saved.
How to back up the measured data during a power failure?	The measured data are written to a flash ROM (non-volatile memory), and hence there is no limit for the backup time during power failure.
Are the time indications that appear when the file contents are displayed on a personal computer, correct even if there was a power failure or power-off period during recording?	Information on up to ten of the most-recent power failures (including power-off/on operations) is stored. For the display data file, the time indications are correct if there were no more than ten power failures. This does not apply to the event file. If you want to display the correct time indications for the event file later, save the data to a floppy disk(s) before turning off the power.
How can we find out how much internal memory is left?	For the display data file, the remaining time is displayed on the LCD once it falls to 99 hours. As an optional feature, a contact signal can be output when the remaining time reaches a preset value (selected from 1, 2, 5, 10, 20, 50, and 100 hours). For the event file, the memory status is displayed as a bar graph when sampling the data in the trigger-on or trigger-rotation mode. The remaining space of the internal memory is also displayed in the information display. (See Section 2.3, "Information Display.")
What happens when the memory is all used?	For the display data file, the oldest data is overwritten by the latest. For the event file, the data are overwritten in the trigger-free or trigger-rotation mode. In the trigger-on mode, data collection stops and collected data are retained.
Is the alarm information stored?	Yes. The information of up to 50 of the most-recent alarm events–each of which contains the channel in which the alarm occurred, alarm type and level, data and time of alarm occurrence, and date and time of alarm recovery–is stored as ASCII text data.
How many messages are stored?	Up to 99 of the most-recently occurring messages are stored together with the date and time of occurrence, as ASCII text data.
Is it possible to divide the data and save them to separate files as desired?	No. You cannot freely stop and start data saving in order to save the data to multiple files. You can however divide the event file area into 16 event files and activate the trigger to start storing data as you wish.

Question	Answer
How can I set the filenames of the measured-data files?	As the default, the filenames are automatically set (as the month, day, and hour of when the trigger is raised or when the data is saved to the floppy disk). Therefore, the filenames need not be set. You can set desired filenames if you want however. Also, you can use the auto increment setting, which automatically increments the numerical part of the filenames by one.
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 3 channels, the data storage period is nearly twice longer than the period when using 6 channels. Setting the range of a channel to SKIP does not make change the data storage period.

About Application Software

Question	Answer
What kinds of data viewer software are available?	There are three data viewer software titles available: 1) 1) VR Application Software Package (VP100-02) • Runs under the MS-DOS or Windows 3.1 operating system. • The main feature is converting data to Excel and Lotus 1-2-3 files. 2) VR Enhanced Data Viewer Software (VA100-02) • Runs under the Windows 3.1 or Windows 95 operating system. • Features extensive Windows 3.1-based data display functions. 3) VR Data Viewer for Windows 95 (VA200-02) • Runs under the Windows 95 operating system. • Its Windows 95-based design makes it quick and easy-to-use.
Is there any plan to upgrade the data viewer software for Windows 98?	Yes. The software titles will be upgraded in order.
Can waveforms of different files be displayed on the same graph?	Yes. Convert the files to Excel or Lotus 1-2-3 files, and use the graph function of your preferred spreadsheet application. Alternatively, you can display the waveforms of different files in different windows at the same time.

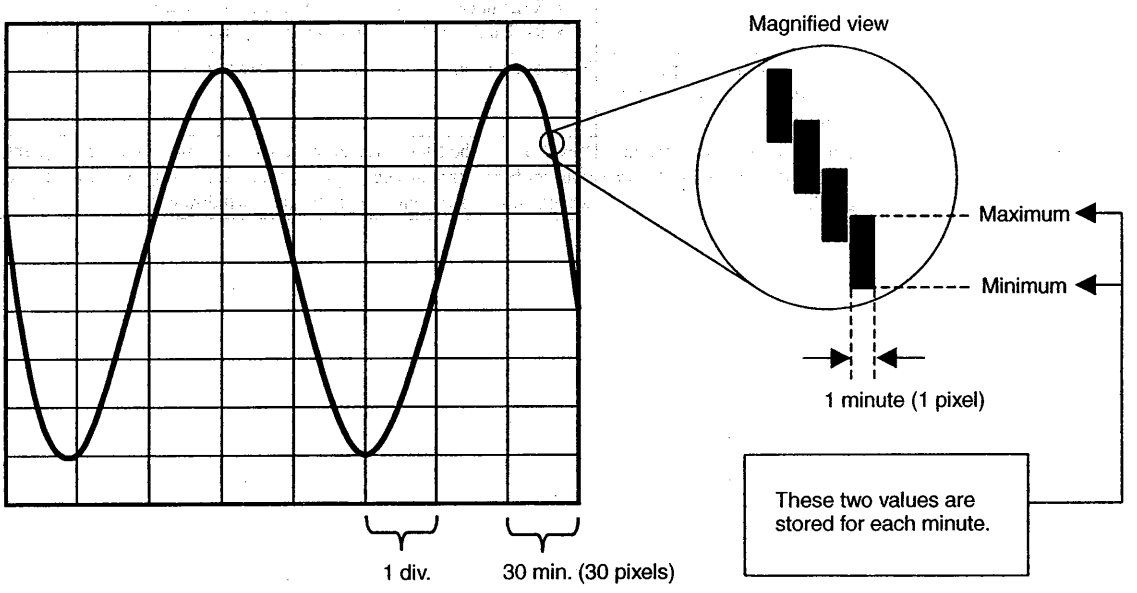
Appendix. Measured-data Files

The VR200 series recorders use 3.5-inch floppy disks as the recording media instead of the recording chart of conventional recorders. This electronic recording method achieves a versatile recording (filing) format. This Appendix describes the measured-data files and will help you to use your VR200 more effectively.

A VR200 recorder can create two kinds of data files simultaneously: a **display data file** and **event file(s)**. The former stores the data sampled at the interval determined by the waveform span rate set. The latter stores the data sampled at the specified interval. Both of these files are outlined here.

Display Data File

The display data file contains the measured values used for tracing the waveforms. **The maximum and minimum values of the measured values**, which are sampled at the measurement period (125 milliseconds at the fastest for the VR202 and VR204; 1 second at the fastest for the VR206) within the time interval corresponding to each pixel of the waveform, are stored. Data can be saved at rather long intervals (2-120 seconds) for as long a time as performed by conventional recording on charts.



Waveform Display of Display Data File (When Waveform Span Rate = 30 min/div)

In the example above, one pixel of the waveform is traced every minute. A VR202 or VR204 performs measurement every 125 ms at the fastest, that is, 480 times a minute. A VR206 performs measurement every second at the fastest of 60 times a minute. The maximum and minimum values of these measured values (480 values for a VR202 or VR204, and 60 values for a VR206) are stored for each minute.

Hence, even if there is a sudden change within one minute, the VR200 surely captures the peak values.

The table below shows the relationship between the waveform span rate (span of each division of the time axis), data saving period, and data storage time span.

VR204 and VR206 (without Mathematical Functions and Large Memory)

Waveform Span Rate	Data Saving Period	Storage Time Span (Approx.)	Waveform Display Speed (Approx.)
1 min/div	2 s	26 hours	615 mm/h
5 min/div	10 s	5 days	123 mm/h
10 min/div	20 s	11 days	61.5 mm/h
20 min/div	40 s	22 days	30.7 mm/h
30 min/div	60 s	33 days	20.5 mm/h
60 min/div	120 s	66 days	10.2 mm/h

Event File

An event file is used to store data at the specified sampling period (which can be selected from 125, 250, and 500 ms for a VR202 or VR204, or from 1, 2, 10, 30, 60, and 120 seconds for a VR206) for examining data at a personal computer. An event file is useful for saving the data you want to analyze, such as those for troubleshooting.

Combination of Files

The VR200 recorders allow you to choose, according to your needs, how to share the internal memory among the two kinds of data files and in the following combinations:

(1) 1 Display Data File and 1 Event File
This combination is suitable when you want, for example, a long-term trend and also want to examine the measured data for several hours before and after you insert a floppy disk.

(2) 1 Display Data File and 16 Event Files
This combination is suitable when you want, for example, a long-term trend and also want to examine the measured data around particular events by using alarms, external contact signals, and so on as the sampling triggers.

(3) 1 Event File Only
This configuration is suitable when you do not need, for example, a long-term trend with a long sampling period but you want to save the data for as long a time period as possible at a fast sampling period.

An Application Using Both Kinds of Files

The following measurement can be performed using both kinds of files.

Desired Application

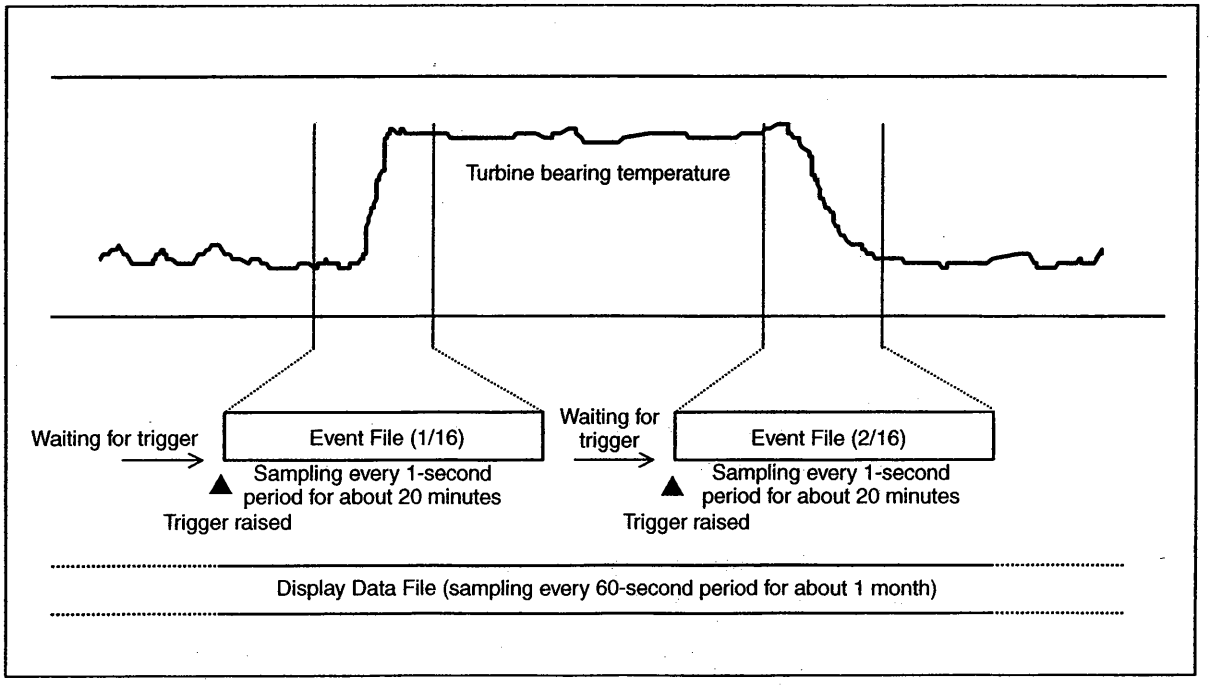
To record the bearing temperature of a turbine for power generation, obtain data at 1-minute intervals normally, and analyze in detail the data over a 5-minute period twice a day during the startup and shutdown of the turbine.

Solution
Choose the combination of 1 display data file and 16 event files.

Save the normal-state data in the display data file with the waveform span rate set at 30 min/div. (The data of 6 channels can be saved for a period of about 33 days.)

Using an external contact as the trigger, start saving the data during the startup and shutdown of the turbine at a 1-second sampling period to one of the sixteen event files. (In each event file, the data of each of the 6 channels can be saved for a period of about 20 minutes.)

Time Chart



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