Instruction Manual

Model VR202/VR204/VR206
VR200 View Recorder
/M1 Mathematical Functions

YOKOGAWA ◆
Yokogawa Electric Corporation

■ APPENDIX

If the VR has the /E4 (large memory) option, then the number of data values and storage time span is approximately three times.

Additional tables

VR204 and VR202

E1+D or E16+D

Dysplay data file (approx 768K bytes)

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.) Waveform Span Rate 30min/div
1	0	192000	133 days
2	0	96000	66 days
3	0	64000	44 days
4	0	48000	33 days
1	1	64000	44 days
2	1	48000	33 days
3	1	38400	26 days
4	1	32000	22 days
1	2	38400	26 days
2	2	32000	22 days
3	2	27400	19 days
4	2	24000	16 days
1	3	27400	19 days
2	3	24000	16 days
3	3	21300	14 days
4	3	19200	13 days
1	4	21300	14 days
2	4	19200	13 days
3	4	17400	12 days
4	4	16000	11 days

Strage Time Span of VR206 with Math Option

E1+D or E16+D

Dysplay data file (approx 1140K bytes)

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.) Waveform Span Rate 30min/div
1	0	285600	198 days
2	0	142800	99 days
3	0	95200	66 days
4	0	71400	49 days
6	0	47600	33 days
1	1	86600	60 days
2	1	65000	45 days
3	1	52000	36 days
4	1	43300	30 days
6	1	32500	22 days
1	2	52000	36 days
2	2	43300	30 days
3	2	37100	25 days
4	2	32500	22 days
6	2	26000	18 days
1	3	37100	25 days
2	3	32500	22 days
3	3	28800	20 days
4	3	26000	18 days
6	3	21600	15 days
1	4	28800	20 days
2	4	26000	18 days
3	4	23600	16 days
4	4	21600	15 days
6	4	18500	12 days
1	6	20000	13 days
2	6	18500	12 days
3	6	17300	12 days
4	6	16200	11 days
6	6	14400	10 days

Please note the following alterations to the IM4N2A1-51E

■ Chapter 6

Additional Commands (For the VR200 with style number 2 or higher)

Setting of the Number of Divisions of the Bar Graph Scale (BAR_SCALE_DIV) (see section 4.9 in the instruction manual, IM 4N2A1-01E)

Format	MHp1, p2
Description	

P1:   Channel number (0A to 0F)
P2:   Number of divisions (4 to 12)

Example   MH0A, 7
(Set seven divisions on the bar graph scale of channel A.)

Switching the Display Mode

format: UDp1

p1:   Display mode
4   Returns the digital values and the units for channels A to C.
5   Returns the digital values and the units for channels D to F.
6   Returns the digital values for channels A to F.

INTRODUCTION

This Instruction Manual describes the Mathematical option for the VR200 view recorder.
For details concerning the operation of the view recorder, refer to IM 4N2A1-01E.

NOTE
• YOKOGAWA reserves the right to change this manual at any time without notice.
• If you find any ambiguities or errors in this manual, please inform YOKOGAWA.

Revision Record
• January 1998: First edition

CONTENTS

1 OUTLINE

This chapter describes which computations can be used when your VR200 is equipped with the /M1 option. In this chapter you can also find a list of symbols used throughout this manual and on the display of the recorder.

1.1 Available Computations

The following computations are available for the measured data:

Arithmetic computation
Addition, subtraction, multiplication and division

SQR
Extracts the square root $\sqrt{}$

ABS
Returns the absolute value of its argument

LOG
Returns the common logarithm of its argument ($y=\log_{10}x$)

EXP
Calculates the power of 'e'. ($y=e^{x}$)

Relational computation
Outputs '0' or '1' for computation results of $<, >, =, \neq$

Logical computation
Outputs '0' or '1' for computation results of 'AND', 'OR' and 'XOR' in two channels or 'NOT' in an arbitrary channel

Statistical computation (TLOG)
Performs computation in a specified channel as summation, maximum, minimum and average

1.2 Available Channels

The VR202 and VR204 have four extra channels (A, B, C, D) for computation available.
The VR206 has six extra channels (A, B, C, D, E, F) for computation available.

You can use only the extra channels for computation.

1.3 Used Symbols

The symbols used in this manual and on the display are as follows:

+	Computes the addition
−	Computes the subtraction
/	Computes the division
*	Computes the multiplication

SQR(	Computes the square root
ABS(	Computes the absolute value
LOG(	Computes common logarithms ($y=\log_{10}x$)
EXP(	Raises 'e' to the specified power ($y=e^x$)

EQ.	Outputs '1' when two data e1 and e2 have the same value, outputs '0' when the values are different
.NE.	Outputs '1' when two data e1 and e2 have different values, outputs '0' when the values are the same
.GT.	Outputs '1' when e1 > e2, and '0' when otherwise (if e1.GT.e2 is set)
.LT.	Outputs '1' when e1 < e2, and '0' when otherwise (if e1.LT.e2 is set)

AND	Computes logical product of two data
OR	Computes logical sum of two data
NOT	Computes logical negation of an arbitrary data
XOR	Computes mutually exclusive logical sum of two data

TLOG.AVE(	Obtains the average value of the specified data
TLOG.MAX(	Obtains the maximum value of the specified data
TLOG.MIN(	Obtains the minimum value of the specified data
TLOG.SUM(	Obtains the total value of the specified data

)	Used as a counterpart of '('

K	Used to specify a constant (K01 to K10)

2 INFORMATION BEFORE SETTING

This chapter describes information which is useful to read before you start the setting process.

2.1 Limitations of settings
2.2 Flow charts
2.3 Displaying Computation channels
2.4 Parameters Controlled by Remote Control and Input Types

2.1 Limitations of Settings

Channels with computational functions

The VR202 and VR204 have four extra channels (A, B, C, D) for computation available.
The VR206 has six extra channels (A, B, C, D, E, F) for computation available.

You can use only the extra channels for computation. Note that channel numbers consist of 2 digits and that you can copy also the settings of channel A to channels B, C etc..

Range of computation

The range of the results of computation, including the computations during the computation, is $\pm3.4 \times 10^{\pm38}$. An error will occur if this range is exceeded and the result will be $+ ****$.

Constants

Up to 10 constants can be set. The ranges of the constants are:
$$\begin{cases} 9.9999E+29 \text{ to } 1.0000E-30 \\ 0 \\ -1.0000E-30 \text{ to } -9.9999E+29 \end{cases}$$
The number of significant digits is 5, while the rest will be truncated.
K02 stands for constant number 2.

Display

The computed results can be displayed as waveforms or digital values.

Range of the waveform display and digital value display

Display range of waveforms and digital values of the computed result is from -9999999 to 99999999.

Stacks

The VR200 can perform computations using up to 8 stacks within one channel. If more than 8 stacks are set, an error will occur and the result will be $+ ****$.
Example: 01+01*(01+01*(01+01*(01+01*01)))
An error will occur because 9 stacks are set.
For entering a formula within one channel, up to 36 characters may be used.

Errors

Errors will occur if any of the following is set:
- x/0, $\sqrt{(-x)}$ or LOG(-x);
- If SKIP channels are included in the computational expression.
The result will be $+ ****$.

2.2 Flow Charts

This paragraph describes the setting flows of the three modes.
2.2.1 Operation Mode
2.2.2 SET Mode
2.2.3 SET UP Mode

Copy

Setting parameters for a computation on a channel can be copied to another channel according to the procedure given in Section 3.7. However, copying from a measurement channel to a channel dedicated to computation is not possible.

Data Storage Action

For storing data, this recorder has 1 MB (for VR202/VR204) or 1.44 MB (for VR206) of internal memory and is equipped with a 3.5-inch floppy disk drive (1.44 MB 2HD for DOS). (Floppy disks formatted as 1.2 MB 2HD can be used only for the VR202/VR204 for users of an NEC 9800 series PC with Japanese-version OS (DOS/V).) The computed data are always stored in the internal memory. Once the floppy disk is inserted, the recorder starts copying the measured data from the internal memory to the floppy disk automatically.

Data Types

The table below shows the data types and contents which are saved on FDC.

Data Type		Storage Contents and Action	File Format	File (Extension)	File Naming Method
Measured data /Computed data	Display data	• These are the data used to display the traces on the LCD. • The data are stored up to the predefined memory length and overwritten when the memory becomes full.	Yokogawa standard format Note	Display data file (.DAT)	Automatic setting or user specified
	Event data	• Collected and stored at the specified sampling period. • The data writing action differs depending on the trigger setting. (For details, see Section 6.6.1.)	Yokogawa standard format Note	Event file (.DAT)	Automatic setting or user specified
Time-axis mark information		• Information at the points of time where the time-axis marks are drawn (for the latest 32 marks) is saved.	ASCII format	Information file (.INF)	The file name of the measured data is set automatically.
Power failure information		• Information at the times of (the latest ten) power failures is saved.			
Alarm information		• Information on (the latest fifty) alarms is saved.			
Setup parameter list		• These data are used to view the list of major parameters to set up in the SET and SETUP modes. • The file is automatically created when measured data starts to be saved, and is saved together with the measured data.	ASCII format	Parameter list file (.LST)	The file name of the measured data is set automatically.
Parameter settings		• These data are used to view the parameter settings made in the SET and SETUP modes. (The user can set up the recorder using these data.) • The contents can be saved, read, or modified in the SET or SETUP mode.	ASCII format	SET/SETUP configuration files (• Settings in the SET mode: .PNL) (• Settings in the SETUP mode: .PNS)	User specified

Note: • The same file format as used in other Yokogawa recorders.
• The power failure information is not stored when sixteen event files and one data file are created.

Measuring period

The measuring period of the VR202/VR204 is 250 ms, when the number of computation channels is set to one or more.
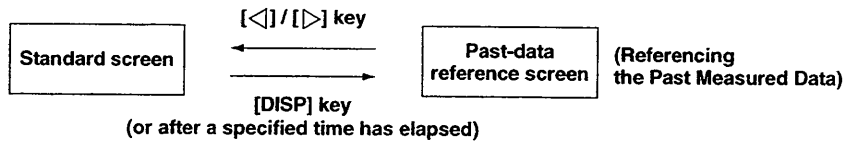
Sampling period of the event file

The sampling period of the event file is set to 250 ms (maximum), when the number of computation channels is set to one or more. (You can set 125 ms, but it is automatically changed to 250 ms.)

2.2.1 Operation Mode

In the operation mode, the switching between the standard screen and past-data reference screen differs from the other operations. The following shows the flows of these two types of operation.

Screen Switching

```
                        [◁]/[▷] key
┌─────────────────┐    ◄───────────    ┌──────────────────┐   (Referencing
│ Standard screen │                    │    Past-data     │   the Past Measured Data)
└─────────────────┘    ───────────►    │ reference screen │
                          [DISP] key   └──────────────────┘
              (or after a specified time has elapsed)
```

Other Operations

```
┌──────────────────────────────┐
│ PUSH [◁] TO MARK EVENT       │  (Writing the Time-axis Mark)
└──────────────────────────────┘
              │
┌──────────────────────────────┐ *1    ┌──────────────────────────────┐ *1
│ DISP WINDOW: NORMAL/8 min    │ ────► │ DISP WINDOW: NORMAL/8 min    │ ◄┐ (Zooming/Reducing
└──────────────────────────────┘ [▷]key└──────────────────────────────┘  │  the Time Axis)
              │                               ▲
              │                        ┌──────────────────────────────┐ *1
[DISP]        │                        │ DISP WINDOW: NORMAL/24 min   │    [△]/[▽] key
key           │                        └──────────────────────────────┘  │
              │                               ▲
              │                        ┌──────────────────────────────┐ *1
              ▼                        │ DISP WINDOW: NORMAL/40 min   │ ◄┘
┌──────────────────────────────┐ *2   └──────────────────────────────┘
│ PUSH [◁] TO TRIGGER          │  (Start Storing the Measured Data by Manual Trigger)
└──────────────────────────────┘
MATH          │
┌──────────────────────────────┐ *3
│ [◁] : START                  │
└──────────────────────────────┘
              │
┌──────────────────────────────┐ *4
│ [◁] : STOP                   │
└──────────────────────────────┘
              │
┌──────────────────────────────┐ *3
│ [◁] : CLEAR                  │
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Standard screen              │
└──────────────────────────────┘
```

*1: The example above shows the display sequence of the display span time called up when the direction of the waveform display is set as horizontal. If it is set as vertical, the display sequence is 5.5, 16.5, and then 27.5 minutes.

*2: Displayed only when the "key trigger" is set.

*3: Displayed only during MATH stop.

*4: Displayed only during MATH start.

2.2.2 SET Mode

```
┌──────────┐
│ RANGE    │
└──────────┘

┌──────────┐
│ ALARM    │
└──────────┘

┌──────────┐
│ UNIT     │
└──────────┘

┌──────────┐
│ TIME/DIV │
└──────────┘

┌──────────┐
│ CLOCK    │
└──────────┘

┌──────────┐
│ COPY     │
└──────────┘

┌──────────┐       ┌─────────┐     ┌─────────┐     ┌────────────┐
│ MATH     │───────│ CONST   │─────│ K□□No.  │─────│ K□□ =      │ (Section 3.1)
└──────────┘       └─────────┘     └─────────┘     └────────────┘

                   ┌──────────┐  ┌────────┐  ┌────────┐  ┌──────────────┐  ┌───────┐  ┌──────────┐
                   │ MATH_SET │──│ CALC   │──│ CH. No.│──│ MODE ON/OFF  │──│ □□ =  │──│ LOWER    │
                   └──────────┘  └────────┘  └────────┘  └──────────────┘  └───────┘  └──────────┘
                                                          ┌───────────┐
                                                          │ UPPER     │ (Section 3.2 to 3.6)
                                                          └───────────┘
                                 ┌────────┐  ┌────────┐  ┌────────────┐  ┌───────────────┐  ┌───────┐
                                 │ ALARM  │──│ CH. No.│──│ LEVEL(1-4) │──│ ALARM ON/OFF  │──│ TYPE  │
                                 └────────┘  └────────┘  └────────────┘  └───────────────┘  └───────┘
                                             ┌────────┐  ┌──────────────┐  ┌────────────┐
                                             │ VALUE  │──│ RELAY ON/OFF │──│ RELAY NO.  │ (Section 4.1)
                                             └────────┘  └──────────────┘  └────────────┘
                                 ┌────────┐  ┌────────┐  ┌─────────────────┐
                                 │ UNIT   │──│ CH. No.│──│ UNIT CHARACTERS │ (Section 4.6)
                                 └────────┘  └────────┘  └─────────────────┘
                                 ┌────────┐  ┌────────────┐  ┌────────────┐
                                 │ COPY   │──│ FROM CH □□  │──│ TO CH □□   │ (Section 3.7)
                                 └────────┘  └────────────┘  └────────────┘
                                 ┌────────┐  ┌────────┐  ┌──────────┐  ┌───────────┐  ┌────────────┐
                                 │ AUX    │──│ ZONE   │──│ CH.No.   │──│ ZONE LOWER│──│ ZONE UPPER │
                                 └────────┘  └────────┘  └──────────┘  └───────────┘  └────────────┘
                                                                                  (Section 4.2)
                                             ┌────────┐  ┌────────┐  ┌─────────────────┐
                                             │ PART   │──│ CH.No. │──│ PARTIAL ON/OFF  │
                                             └────────┘  └────────┘  └─────────────────┘
                                                         ┌──────────────┐  ┌────────────┐
                                                         │ EXPAND FROM  │──│ BOUNDARY   │ (Section 4.3)
                                                         └──────────────┘  └────────────┘
                                             ┌───────────┐  ┌──────────────────┐  ┌─────────┐
                                             │ DISP_WAVE │──│ DISP WAVE ON/OFF │──│ CH.No.  │
                                             └───────────┘  └──────────────────┘  └─────────┘
                                                            ┌──────────────────┐
                                                            │ DISP SCALE ON/OFF │ (Section 4.4)
                                                            └──────────────────┘
                                             ┌────────┐  ┌────────┐  ┌────────────────┐
                                             │ TAG    │──│ CH.No. │──│ TAG CHARACTERS │ (Section 4.5)
                                             └────────┘  └────────┘  └────────────────┘
                                             ┌──────────────────┐  ┌─────────┐
                                             │ INIT_TLOG_MEMORY │──│ YES/NO  │ (Section 3.9)
                                             └──────────────────┘  └─────────┘

┌──────────┐
│ AUX      │
└──────────┘

┌──────────┐
│ FD_SET   │
└──────────┘
```
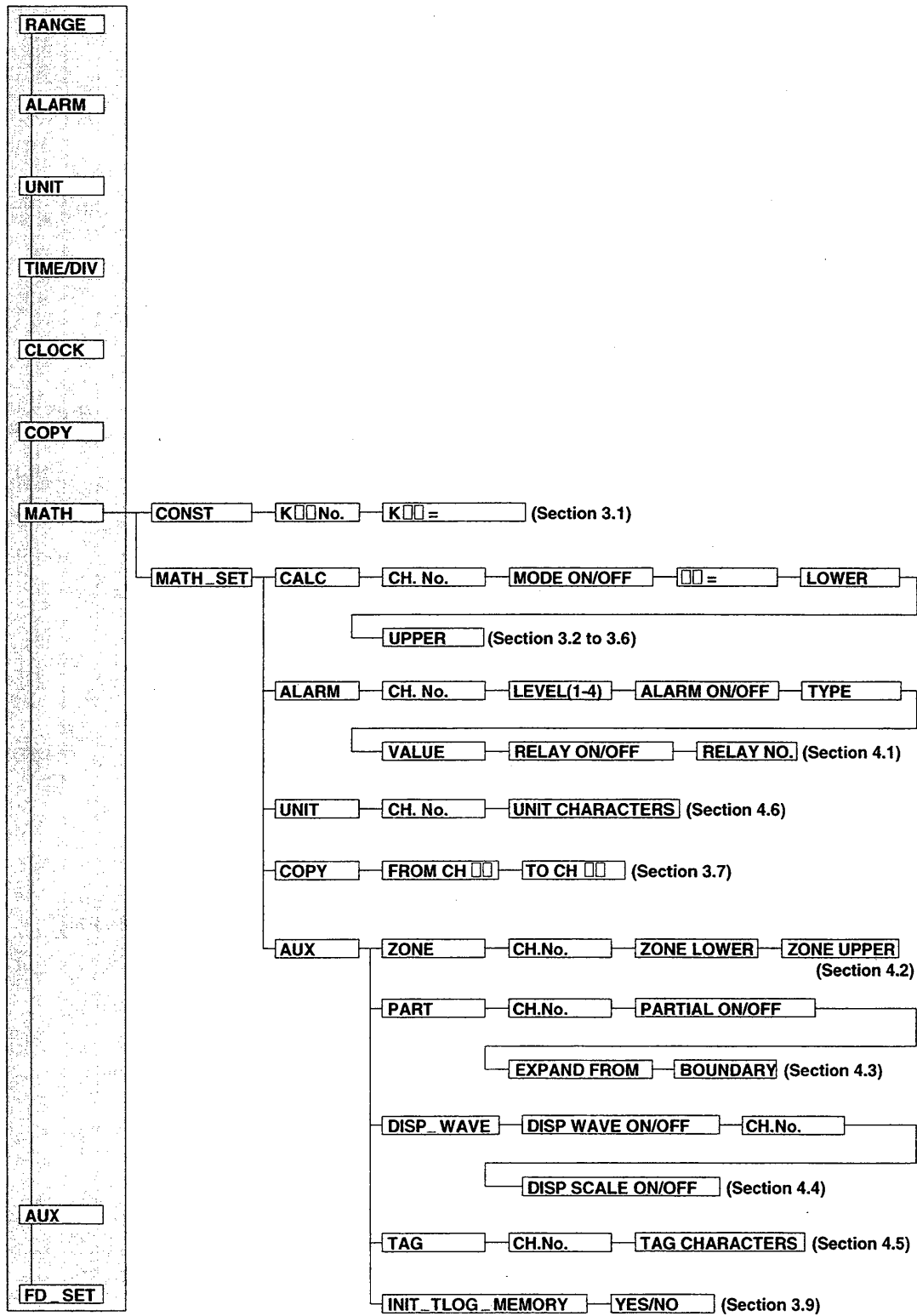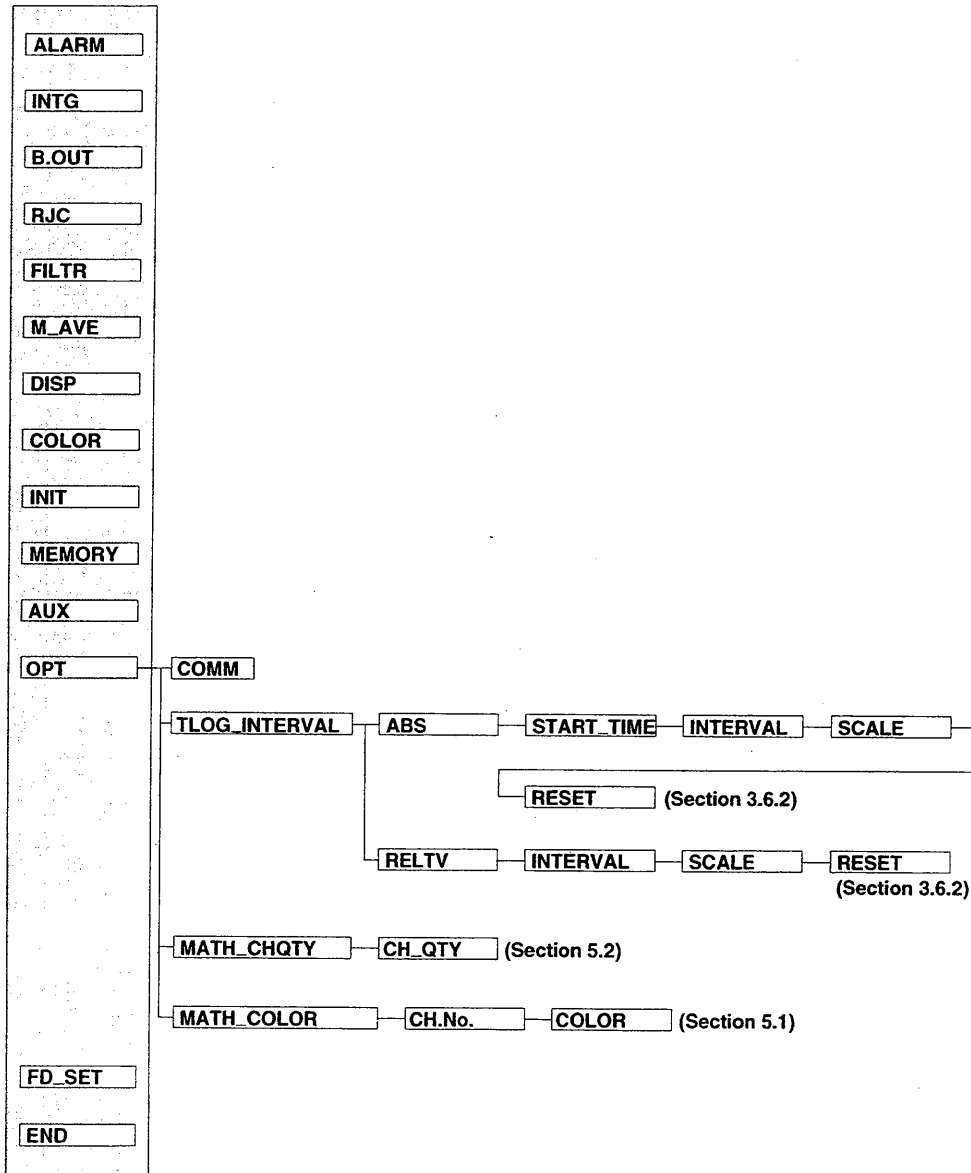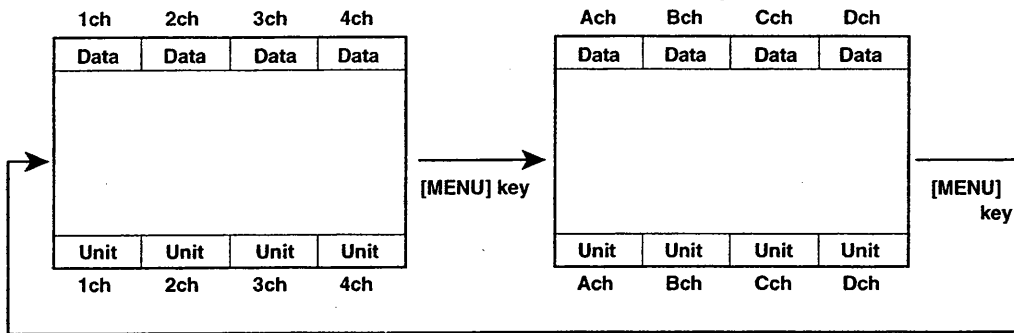
2.2.3 SET UP Mode

```
┌─────────────────┐
│  ALARM          │
│                 │
│  INTG           │
│                 │
│  B.OUT          │
│                 │
│  RJC            │
│                 │
│  FILTR          │
│                 │
│  M_AVE          │
│                 │
│  DISP           │
│                 │
│  COLOR          │
│                 │
│  INIT           │
│                 │
│  MEMORY         │
│                 │
│  AUX            │
│                 │
│  OPT ───────┬── COMM
│             │
│             ├── TLOG_INTERVAL ──┬── ABS ── START_TIME ── INTERVAL ── SCALE ──┐
│             │                   │                                             │
│             │                   │              ┌── RESET    (Section 3.6.2) ──┘
│             │                   │
│             │                   └── RELTV ── INTERVAL ── SCALE ── RESET
│             │                                                     (Section 3.6.2)
│             │
│             ├── MATH_CHQTY ── CH_QTY  (Section 5.2)
│             │
│             └── MATH_COLOR ── CH.No. ── COLOR  (Section 5.1)
│                 │
│  FD_SET         │
│                 │
│  END            │
└─────────────────┘
```

INFORMATION BEFORE SETTING

2

2.3 Displaying Computation channels

Displaying digital values

When there are four measurement channels and four computation channels

	1ch	2ch	3ch	4ch
	Data	Data	Data	Data

[MENU] key →

	Ach	Bch	Cch	Dch
	Data	Data	Data	Data

	Unit	Unit	Unit	Unit
	1ch	2ch	3ch	4ch

	Unit	Unit	Unit	Unit
	Ach	Bch	Cch	Dch

[MENU] key

The measurement channels and computation channels are displayed alternately by pressing the **MENU** key.

When there are six measurement channels and six computation channels

Digital value display of 1ch to 3ch	Digital value display of 4ch to 6ch	Digital value display of 1ch to 3ch	Digital value display of Ach to Cch	Digital value display of Dch to Fch	Digital value display of Ach to Cch
Unit of 1ch to 3ch	Unit of 4ch to 6ch	Digital value display of 4ch to 6ch	Unit of Ach to Cch	Unit of Dch to Fch	Digital value display of Dch to Fch

[MENU] key
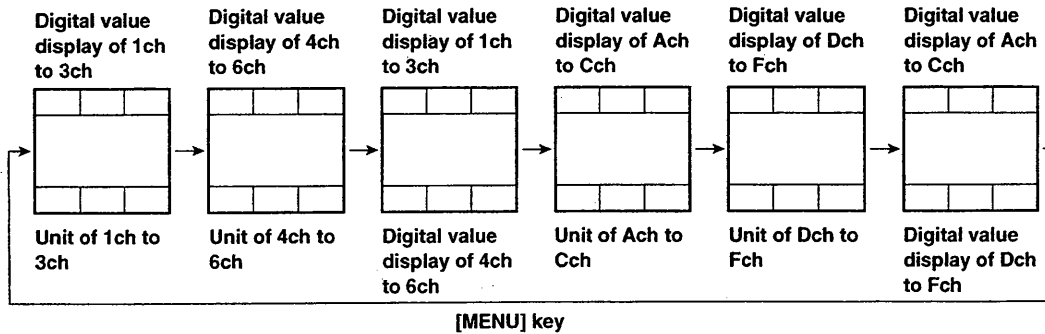
Displaying scale values

When the waveform is displayed horizontally

If the scale value display is turned ON, the channel numbers and scale values of the channels are displayed in the order of priority (up to six channels). The priority is shown below.

Channel	1	2	3	4	5	6	A	B	C	D	E	F
	Highest					Priority				Lowest		

When the waveform is displayed vertically

The scale values of all displayed channels are displayed.

2.4   Parameters Controlled by Remote Control and Input Types

Terminal No.	Function	Input Type
1	Writing of time-axis mark - writes a time-axis mark on the display and file.	Trigger (250 ms or longer duration): energized when on
2	External trigger - inputs the external trigger signal to start storing data in the event file.	
3	Time adjustment - depending on the time when the trigger is raised, corrects the internal clock as follows.	

Time of Trigger-on	Processing
hh:00:00 to hh:01:59	Cut off readings of less than one minute. E.g., 10:00:50 is corrected as 10:00:00.
hh:58:00 to hh:59:59	Round up readings of less than one minute. E.g., 10:59:50 is corrected as 11:00:00.
hh:02:00 to hh:57:59	No processing is to be performed.

Terminal No.	Function	Input Type
4*	Start/Stop computation (MATH) ON ⌐‾‾‾‾‾‾‾‾‾‾‾‾⌐ OFF ___↑_____↓___ Computation (MATH) start Computation (MATH) stop	
5*	Clear computed data Clears the computed data (computed results on channels A to F). Valid only when the computation is stopped.	Trigger (250 ms or longer duration): energized when on

* Remote control is not effective while storing measured data to the floppy disk.

For information on the wiring of the remote control signal wires, see Section 2.3.4 "Remote Control Wiring" in the "VR202/VR204/VR206 VR200 View Recorder" manual (IM4N2A1-01E).

2

INFORMATION BEFORE SETTING

3 HOW TO SET COMPUTATIONS

This chapter describes the way to set the recorder to perform computations.

3.1 Setting a Constant
3.2 Setting an Arithmetic Computation (+, −, /, *)
3.3 Setting SQR, ABS, LOG, EXP computations
3.4 Setting a Relational Computation (<, >, =, ≠)
3.5 Setting a Logical Computation (AND, OR, XOR, NOT)
3.6 Setting a Statistical Computation (MAX, MIN, AVE, SUM)
3.7 Copying Setting Parameters to Other Channels
3.8 Starting/Stopping/Clearing Computation
3.9 Initializing Periodic TLOG Data Memory

3.1 Setting a Constant

The following setting performs the setting of constant K which can be used in expressions. You can set up to 10 constants. The range of the constant must be within:

$$\begin{cases} +9.9999E+29 \text{ to } 1.0000E-30 \\ 0 \\ -1.0000E-30 \text{ to } -9.9999E+30 \end{cases}$$

The number of significant digits is 5, while the rest will be truncated. For example: 1234567 will become 1.2345E+6.
The initial values of all constants are 1.0000

To set a constant K, proceed as follows:

MENU:

[Δ] key				
	RANGE	CONST	CONST No.	value
	ALARM	MATH_SET	K01	150
	UNIT			
	TIME/DIV			
	CLOCK			
	COPY			
	MATH			
	AUX			
	FD_SET			

PROCEDURE:

Key Sequence — Display

1. [MENU ESC 3 sec] [ACK Δ / ◄ ▽ DISP ↵]   — SET=MATH
Press the **MENU** key for three seconds to enter the SET Mode. Select the 'SET=MATH' display using the [△]/[▽] keys. Then press the [↵] key.

2. [ACK Δ / ◄ ▽ DISP ↵]   — MATH=CONST
Select the 'MATH=CONST' display using the [△]/[▽] keys. Then press the [↵] key.

3. [ACK Δ / ◄ ▽ DISP ↵]   — CONST=K01
Select the constant number you want to enter using the [△]/[▽] keys. Up to 10 constants can be entered (K01 to K10). Then press the [↵] key.

4. [ACK Δ / ◄ ▽ ◄ ▷ DISP ↵]   — 150
Then enter the value of the constant using the [△]/[▽] and [▷] keys. Up to 11 characters may be used. Then press the [↵] key.

5. [DISP ↵ / MENU ESC 3 sec]   — * SET OK *
The setting is completed.
Press the [↵] key to return to the 'CONST= ▢' display; or press the **ESC** key to return to go to the 'SET=MATH' display; or press the **MENU** key for three seconds to return to the Operation Mode.

3.2 Setting an Arithmetic Computation (+, −, /, *)

The following setting performs the setting of arithmetic computation as addition, subtraction, division and multiplication.

CAUTION

Setting the expression initializes the data memory (which can then not be restored) and the information file. If necessary, save the data in memory to a floppy disk before setting.

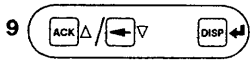To set arithmetic computations, proceed as follows:

MENU:

[Δ] key	RANGE	CONST	MATH_SET	channel	ON/OFF	equation	SPAN L	SPAN U
↓	ALARM	MATH_SET	CALC	0A	ON	01/K02	0.000	20.000
	UNIT		ALARM	0B				
	TIME/DIV		UNIT	0C				
	CLOCK		COPY	0D				
	COPY		AUX					
↓	MATH							
	AUX							
	FD_SET							

PROCEDURE:

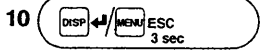|	Key Sequence	Display	
1	[MENU] ESC 3 sec / [ACK]Δ/[←]▽ [DISP]↵	SET=**MATH**	Press the **MENU** key for three seconds to enter the SET Mode. Select the 'SET=MATH' display using the [Δ]/[▽] keys. Then press the [↵] key.
2	[ACK]Δ/[←]▽ [DISP]↵	MATH=**MATH_SET**	Select the 'MATH=MATH_SET' using the [Δ]/[▽] keys. Then press the [↵] key.
3	[ACK]Δ/[←]▽ [DISP]↵	MATH_SET=**CALC**	Select the 'MATH_SET=CALC' using the [Δ]/[▽] keys. Then press the [↵] key.
4	[ACK]Δ/[←]▽ [DISP]↵	**0A**:MODE=	Select the desired extra channel for computation available using the [Δ]/[▽] keys. Then press the [↵] key. VR202 and VR204: 0A, 0B, 0C and 0D VR206:　　　　0A, 0B, 0C, 0D, 0E and 0F
5	[ACK]Δ/[←]▽ [DISP]↵	0A :MODE=**ON**	Select 'ON' using the [Δ]/[▽] key, then press the [↵] key. If you are not using the selected channel select 'OFF,' then press the [↵] key. The default is all channels set to 'OFF.'
6	[ACK]Δ/[←]▽[←]▷[DISP]↵	0A :**01/K02**	Enter your equation using maximum 36 characters by the [Δ]/[▽] and [▷] keys. Here you may use the preset constants. Then press the [↵] key.
7	[ACK]Δ/[←]▽[←]▷[DISP]↵	0A :LOWER=**0.000**	Enter the minimum value of the displaying span of the computation result using the [Δ]/[▽] and [▷] keys. The setting range is −9999999 to 99999999. Then press the [↵] key.
8	[ACK]Δ/[←]▽[←]▷[DISP]↵	0A:UPPER=**20.000**	Enter the maximum value of the displaying span of the computation result using the [Δ]/[▽] and [▷] keys. The setting range is −9999999 to 99999999.

Note _____

SPAN L must be less than SPAN U.

_____

Then press the [↵] key.

9 [ACK]△/[◄]▽   [DISP]◄┘ | INIT.DATA_MEMORY=**YES** | If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [◄┘] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.

10 [DISP]◄┘/[MENU]ESC 3 sec | ∗ SET OK ∗ | The setting is completed.
To continue setting another channel, press the [◄┘] key to return to the '☐ ☐:MODE=☐' display. To return to the 'SET=MATH' display, press the **ESC** key.
To return to the operation mode, press the **MENU** key for three seconds.

EXAMPLE:

Addition (+):	0A=01+02
	Computes the value of channel 1 plus the value of channel 2
Subtraction (−):	0B=01−02
	Computes the value of channel 1 minus the value of channel 2
Division (/):	0C=01/K02
	Computes the value of channel 1 divided by constant number 2
Multiplication (∗):	0D=01∗K03
	Computes the value of channel 1 multiplied by constant number 3

Note

When you set an expression as e.g. 0A=0A+02, the summation of channel number 2 will be displayed in channel A.

HOW TO SET COMPUTATIONS

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3.3 Setting SQR, ABS, LOG, EXP Computations

The following setting performs the setting of computations as square root, absolute value, common logarithm and exponent.

| **CAUTION** | Setting the expression initializes the data memory (which can then not be restored) and the information file. If necessary, save the data in memory to a floppy disk before setting. |

To set these computations, proceed as follows:

MENU:

[Δ] key

RANGE	CONST	MATH_SET	channel	ON/OFF	equation	SPAN L	SPAN U
ALARM	MATH_SET	CALC	0A	ON	LOG(01)	0.000	20.000
UNIT		ALARM	0B				
TIME/DIV		UNIT	0C				
CLOCK		COPY	0D				
COPY		AUX					
MATH							
AUX							
FD_SET							

PROCEDURE:

Key Sequence — Display

1. [MENU ESC 3 sec] [ACK Δ / ◄ ▽ DISP ↵] **SET=MATH**

Press the **MENU** key for three seconds to enter the SET Mode. Select the 'SET=MATH' display using the [Δ]/[▽] keys. Then press the [↵] key.

2. [ACK Δ / ◄ ▽ DISP ↵] **MATH=MATH_SET**

Select the 'MATH=MATH_SET' using the [Δ]/[▽] keys. Then press the [↵] key.

3. [ACK Δ / ◄ ▽ DISP ↵] **MATH_SET=CALC**

Select the 'MATH_SET=CALC' using the [Δ]/[▽] keys. Then press the [↵] key.

4. [ACK Δ / ◄ ▽ DISP ↵] **0A:MODE=**

Select the desired extra channel for computation available using the [Δ]/[▽] keys. Then press the [↵] key.
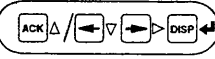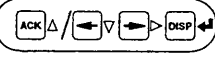VR202 and VR204: 0A, 0B, 0C and 0D
VR206:   0A, 0B, 0C, 0D, 0E and 0F

5. [ACK Δ / ◄ ▽ DISP ↵] **0A :MODE=ON**

Select 'ON' using the [Δ]/[▽] key, then press the [↵] key. If you are not using the selected channel select 'OFF,' then press the [↵] key. The default is all channels set to 'OFF.'

6. [ACK Δ / ◄ ▽ ► ▷ DISP ↵] **0A :LOG(01)**

Enter your equation using maximum 36 characters by the [Δ]/[▽] and [▷] keys. Here you may use the preset constants. Then press the [↵] key.

7. [ACK Δ / ◄ ▽ ► ▷ DISP ↵] **0A : LOWER = 0.000**

Enter the minimum value of the displaying span of the computation result using the [Δ]/[▽] and [▷] keys. The setting range is –9999999 to 99999999. Then press the [↵] key.
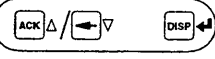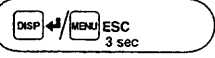
8. [ACK Δ / ◄ ► ▷ DISP ↵] **0A : UPPER = 20.000**

Enter the maximum value of the displaying span of the computation result using the [Δ]/[▽] and [▷] keys. The setting range is –9999999 to 99999999.

Note
SPAN L must be less than SPAN U.

Then press the [↵] key.

---

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9 ([ACK]△/[◄]▽ [DISP]◄┘) | INIT.DATA_MEMORY=**YES** | If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [◄┘] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.

10 ([DISP]◄┘/[MENU]ESC 3 sec) | * SET OK * | The setting is completed.
To continue setting another channel, press the [◄┘] key to return to the '□□:MODE=□' display. To return to the 'SET=MATH' display, press the **ESC** key.
To return to the operation mode, press the **MENU** key for three seconds.

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HOW TO SET COMPUTATIONS

EXAMPLE:

Square root √:	0A=SQR(01)
	Returns the square root of the measured value of channel 1
Absolute value:	0B=ABS(01)
	Returns the absolute value of the measured value of channel 1
Logarithm:	0C=LOG(01)
	Returns the common logarithm of the measured value of channel 1
Exponent:	0D=EXP(01)
	Raises e to the power of the measured value of channel 1

Special computations:

10^x Although this function is not directly provided, it can be obtained by using the following:
$10^x=e^{x\ln 10}$; but $\ln 10=2.3025851..$ Therefore, $10^x=\exp(x*2.3025851)$
For example, to raise 10 to the power of the value of channel 01, set K01 to 2.3026
Then the expression will become: EXP (01*K01)

$\ln x$ Also the natural logarithm is not directly provided, but can be obtained by using the following:
$\log_b x=\log_a x/\log_a b$ or $\ln x=\log x/\log e$
Therefore, to calculate the natural logarithm of the value of channel 01, set K01=1
Then the expression will become: LOG(01)/LOG(EXP(K01))

3.4 Setting a Relational Computation (<, >, =, ≠)

The following setting performs the setting of relational computations. Four types of relational computations are available:

e1.LT.e2   e1 < e2
e1.GT.e2   e1 > e2
e1.EQ.e2   e1 = e2
e1.NE.e2   e1 ≠ e2

If the condition is satisfied, the operation results in 1.
If the condition is not satisfied, the operation results in 0.

For e1 and e2, you can use:
- channels with measurement or computational functions
- channels with statistical (TLOG) functions (4 for the pen model, 6 for the dot model)
- constants (up to 10)

CAUTION

Setting the expression initializes the data memory (which can then not be restored) and the information file. If necessary, save the data in memory to a floppy disk before setting.

To set relational computations, proceed as follows:
MENU:

[△] key

RANGE	CONST	MATH_SET	channel	ON/OFF	equation	SPAN L	SPAN U
ALARM	MATH_SET	CALC	0A	ON	01.LT.03	0.000	1.000
UNIT		ALARM	0B				
TIME/DIV		UNIT	0C				
CLOCK		COPY	0D				
COPY		AUX					
MATH							
AUX							
FD_SET							

PROCEDURE:

Key Sequence   Display

1. [MENU ESC 3sec] [ACK]△/[←]▽ [DISP↵]
   SET=**MATH**
   Press the **MENU** key for three seconds to enter the SET Mode. Select the 'SET=MATH' display using the [△]/[▽] keys. Then press the [↵] key.

2. [ACK]△/[←]▽ [DISP↵]
   MATH=**MATH_SET**
   Select the 'MATH=MATH_SET' using the [△]/[▽] keys. Then press the [↵] key.

3. [ACK]△/[←]▽ [DISP↵]
   MATH_SET=**CALC**
   Select the 'MATH_SET=CALC' using the [△]/[▽] keys. Then press the [↵] key.

4. [ACK]△/[←]▽ [DISP↵]
   0A:MODE=
   Select the desired extra channel for computation available using the [△]/[▽] keys. Then press the [↵] key.
   VR202 and VR204: 0A, 0B, 0C and 0D
   VR206:   0A, 0B, 0C, 0D, 0E and 0F

5. [ACK]△/[←]▽ [DISP↵]
   0A :MODE=**ON**
   Select 'ON' using the [△]/[▽] key, then press the [↵] key. If you are not using the selected channel select 'OFF,' then press the [↵] key. The default is all channels set to 'OFF.'

6. [ACK]△/[←]▽[←]▷[DISP↵]
   0A :**01.LT.03**
   Enter your equation using maximum 36 characters by the [△]/[▽] and [▷] keys. Here you may use the preset constants. Then press the [↵] key.

7 ⟨ ACK △/◄ ▽ ► ▷ DISP ↵ ⟩   `0A :LOWER=0.000` Enter the minimum value of the displaying span of the computation result using the [△]/[▽] and [▷] keys. The setting range is –9999999 to 99999999. Then press the [↵] key.

8 ⟨ ACK △/◄ ▽ ► ▷ DISP ↵ ⟩   `0A :UPPER=1.000` Enter the maximum value of the displaying span of the computation result using the[△]/[▽] and [▷] keys. The setting range is –9999999 to 99999999.

Note _____
SPAN L must be less than SPAN U.
_____

Then press the [↵] key.

9 ⟨ ACK △/◄ ▽   DISP ↵ ⟩   `INIT.DATA_MEMORY=YES` If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.

10 ⟨ DISP ↵ / MENU ESC 3 sec ⟩   `* SET OK *` The setting is completed.
To continue setting another channel, press the [↵] key to return to the '☐☐:MODE=☐' display. To return to the 'SET=MATH' display, press the **ESC** key.
To return to the operation mode, press the **MENU** key for three seconds.

EXAMPLE:
0A=02.LT.03
The value of channel 1 will be '1' if the measured value in channel 2 is less than the measured value in channel 3, otherwise the value will be '0'.

3

HOW TO SET COMPUTATIONS

3.5 Setting a Logical Computation (AND, OR, XOR, NOT)

The following setting performs the setting of logical computations. Four types of logical computations are available:

AND Logical product
OR Logical sum
XOR Mutually exclusive logical sum
NOT Logical negation

The two data e1 and e2 will be checked to be '0' or 'non 0'. In the case of 'NOT', only e1 will be checked.
If the condition is satisfied, the operation results in 1.
If the condition is not satisfied, the operation results in 0.

For e1 and e2, you can use:
- channels with measurement or computational functions
- channels with statistical (TLOG) functions
- constants (up to 10)
Note that channel numbers consist of 2 digits.

AND Logical product
Syntax: e1ANDe2
Condition: If both e1 and e2 are 'non 0', the operation results in '1', otherwise in '0'.
Status:
$\left.\begin{array}{l} e1=0 \\ e2=0 \end{array}\right\}$ e1ANDe2=0
$\left.\begin{array}{l} e1\neq0 \\ e2=0 \end{array}\right\}$ e1ANDe2=0
$\left.\begin{array}{l} e1=0 \\ e2\neq0 \end{array}\right\}$ e1ANDe2=0
$\left.\begin{array}{l} e1\neq0 \\ e2\neq0 \end{array}\right\}$ e1ANDe2=1

OR Logical sum
Syntax: e1ORe2
Condition: If both e1 and e2 are '0', the operation results in '0', otherwise in '1'.
Status:
$\left.\begin{array}{l} e1=0 \\ e2=0 \end{array}\right\}$ e1ORe2=0
$\left.\begin{array}{l} e1\neq0 \\ e2=0 \end{array}\right\}$ e1ORe2=1
$\left.\begin{array}{l} e1=0 \\ e2\neq0 \end{array}\right\}$ e1ORe2=1
$\left.\begin{array}{l} e1\neq0 \\ e2\neq0 \end{array}\right\}$ e1ORe2=1

XOR Mutually exclusive logical sum
Syntax: e1XORe2
Condition: If e1 and e2 have different values, the operation results in '1', otherwise in '0'.
Status:
$\left.\begin{array}{l} e1=0 \\ e2=0 \end{array}\right\}$ e1XORe2=0
$\left.\begin{array}{l} e1\neq0 \\ e2=0 \end{array}\right\}$ e1XORe2=1
$\left.\begin{array}{l} e1=0 \\ e2\neq0 \end{array}\right\}$ e1XORe2=1
$\left.\begin{array}{l} e1\neq0 \\ e2\neq0 \end{array}\right\}$ e1XORe2=0

NOT Logical negation
Syntax: NOTe1
Condition: Reverses the value of data e1
Status:
e1=0   NOTe1=1
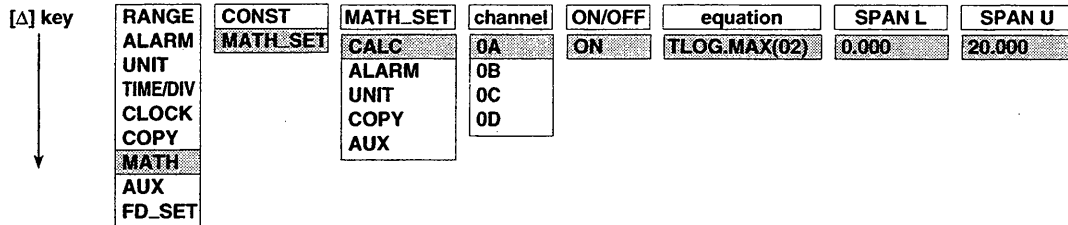e1≠0   NOTe1=0

CAUTION	Setting the expression initializes the data memory (which can then not be restored) and the information file. If necessary, save the data in memory to a floppy disk before setting.

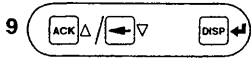To set relational computations, proceed as follows:

MENU:

[Δ] key

RANGE	CONST	MATH_SET	channel	ON/OFF	equation	SPAN L	SPAN U
ALARM	MATH_SET	CALC	0A	ON	01AND02	0.000	1.000
UNIT		ALARM	0B				
TIME/DIV		UNIT	0C				
CLOCK		COPY	0D				
COPY		AUX					
MATH							
AUX							
FD_SET							

PROCEDURE:

Key Sequence — Display

1 [MENU/ESC 3 sec] [ACK Δ / ◄ ▽] [DISP ↵]

Display: **SET=MATH**

Press the **MENU** key for three seconds to enter the SET Mode. Select the 'SET=MATH' display using the [Δ]/[▽] keys. Then press the [↵] key.

2 [ACK Δ / ◄ ▽] [DISP ↵]

Display: **MATH=MATH_SET**

Select the 'MATH=MATH_SET' using the [Δ]/[▽] keys. Then press the [↵] key.

3 [ACK Δ / ◄ ▽] [DISP ↵]

Display: **MATH_SET=CALC**

Select the 'MATH_SET=CALC' using the [Δ]/[▽] keys. Then press the [↵] key.

4 [ACK Δ / ◄ ▽] [DISP ↵]

Display: **0A :MODE=**

Select the desired extra channel for computation available using the [Δ]/[▽] keys. Then press the [↵] key.
VR202 and VR204: 0A, 0B, 0C and 0D
VR206: 0A, 0B, 0C, 0D, 0E and 0F

5 [ACK Δ / ◄ ▽] [DISP ↵]

Display: **0A :MODE=ON**

Select 'ON' using the [Δ]/[▽] key, then press the [↵] key. If you are not using the selected channel select 'OFF,' then press the [↵] key. The default is all channels set to 'OFF.'

6 [ACK Δ / ◄ ▽ ► ▷ DISP ↵]

Display: **0A :01AND02**

Enter your equation using maximum 36 characters by the [Δ]/[▽] and [▷] keys. Here you may use the preset constants. Then press the [↵] key.

7 [ACK Δ / ◄ ▽ ► ▷ DISP ↵]

Display: **0A :LOWER=0.000**

Enter the minimum value of the displaying span of the computation result using the [Δ]/[▽] and [▷] keys. The setting range is –9999999 to 99999999. Then press the [↵] key.

8 [ACK Δ / ◄ ▽ ► ▷ DISP ↵]

Display: **0A :UPPER=1.000**

Enter the maximum value of the displaying span of the computation result using the [Δ]/[▽] and [▷] keys. The setting range is –9999999 to 99999999.

Note

SPAN L must be less than SPAN U.

Then press the [↵] key.

HOW TO SET COMPUTATIONS

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9 (`ACK`$\triangle$/`◄`$\triangledown$ `DISP`$\hookleftarrow$) INIT.DATA_MEMORY=**YES**   If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [$\hookleftarrow$] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.

10 (`DISP`$\hookleftarrow$/`MENU`ESC 3 sec)   * SET OK *   The setting is completed.
To continue setting another channel, press the [$\hookleftarrow$] key to return to the '□ □:MODE=□' display. To return to the 'SET=MATH' display, press the **ESC** key.
To return to the operation mode, press the **MENU** key for three seconds.

EXAMPLE:
0A=01AND02
Channel 3 is set to compute the logical product of channel 1 and channel 2.

3.6 Setting a Statistical Computation (MAX, MIN, AVE, SUM)

The following setting describes the way to set and use computational processing of time series in a specified channel. The following functions are available:

TLOG.MAX(Maximum
TLOG.MIN(Minimum
TLOG.AVE(Average
TLOG.SUM(Summation

For e1, you can use:
- values of the channels 01 and 02 in case of the VR202
- values of the channels 01 to 04 in case of the VR204
- values of the channels 01 to 06 in case of the VR206
Note that channel numbers consist of 2 digits.

TLOG.MAX(Maximum
                  Syntax: TLOG.MAX(e1)
                  Result: Computes the maximum value of channel e1

TLOG.MIN(Minimum
                  Syntax: TLOG.MIN(e1)
                  Result: Computes the minimum value of channel e1

TLOG.AVE(Average
                  Syntax: TLOG.AVE(e1)
                  Result: Computes the average value of channel e1

TLOG.SUM(Summation
                  Syntax: TLOG.SUM(e1)
                  Result: Computes the summation of channel e1

The way to set and use the statistical computation can be broken down into three parts.
3.6.1 Entering the Expression
3.6.2 Making Basic Setting for Statisical Computation

3

HOW TO SET COMPUTATIONS

3.6.1 Entering the Expression

CAUTION

Setting the expression initializes the data memory (which can then not be restored) and the information file. If necessary, save the data in memory to a floppy disk before setting.

Proceed as follows:

MENU:

[Δ] key

RANGE	CONST	MATH_SET	channel	ON/OFF	equation	SPAN L	SPAN U
ALARM	MATH_SET	CALC	0A	ON	TLOG.MAX(02)	0.000	20.000
UNIT		ALARM	0B				
TIME/DIV		UNIT	0C				
CLOCK		COPY	0D				
COPY		AUX					
MATH							
AUX							
FD_SET							

PROCEDURE:

Key Sequence   Display

1. [MENU ESC 3 sec] [ACK Δ / ◄ ▽ DISP ↵]   **SET=MATH**

Press the **MENU** key for three seconds to enter the SET Mode. Select the 'SET=MATH' display using the [△]/[▽] keys. Then press the [↵] key.

2. [ACK Δ / ◄ ▽ DISP ↵]   **MATH=MATH_SET**

Select the 'MATH=MATH_SET' using the [△]/[▽] keys. Then press the [↵] key.

3. [ACK Δ / ◄ ▽ DISP ↵]   **MATH_SET=CALC**

Select the 'MATH_SET=CALC' using the [△]/[▽] keys. Then press the [↵] key.

4. [ACK Δ / ◄ ▽ DISP ↵]   **0A :MODE=**

Select the desired extra channel for computation available using the [△]/[▽] keys. Then press the [↵] key.
VR202 and VR204: 0A, 0B, 0C and 0D
VR206: 0A, 0B, 0C, 0D, 0E and 0F

5. [ACK Δ / ◄ ▽ DISP ↵]   **0A :MODE=ON**

Select 'ON' using the [△]/[▽] key, then press the [↵

↵] key. The default is all channels set to 'OFF.'

6. [ACK Δ / ◄ ▽ ◄ ▷ DISP ↵]   **0A :TLOG.MAX(02)**

Enter your equation using maximum 36 characters by the [△]/[▽] and [▷] keys. Here you may use the preset constants. Then press the [↵] key.

7. [ACK Δ / ◄ ▽ ◄ ▷ DISP ↵]   **0A :LOWER=0.000**

Enter the minimum value of the displaying span of the computation result using the [△]/[▽] and [▷] keys. The setting range is –9999999 to 99999999. Then press the [↵] key.

8. [ACK Δ / ◄ ▽ ◄ ▷ DISP ↵]   **0A :UPPER=1.000**

Enter the maximum value of the displaying span of the computation result using the [△]/[▽] and [▷] keys. The setting range is –9999999 to 99999999.

Note

SPAN L must be less than SPAN U.

Then press the [↵] key.

9 ([ACK]△/[◄]▽   [DISP]◄) | INIT.DATA_MEMORY=**YES** | If the settings are changed, this message appears. If you do not mind initializing the data memory, select 'YES' and press the [◄] key. Selecting 'NO' does not initialize the data memory, and the settings are not changed.

10 ([DISP]◄/[MENU]ESC 3 sec) | * SET OK * | The setting is completed.
To continue setting another channel, press the [◄] key to return to the '□ □:MODE=□' display. To return to the 'SET=MATH' display, press the **ESC** key.
To return to the operation mode, press the **MENU** key for three seconds.

Note

During computations in the channels A, B...etc. are in progress, the expressions cannot be changed.

3.6.2 Making Basic Settings for Statistical Computation

CAUTION

- Selecting the 'SETUP=END' and then 'END&INIT. DATA=STORE' display and pressing the [↵] key at the end of each procedure (described in this chapter) initializes the data memory and information file. If necessary, save the data memory contents (e.g., measured data) to a floppy disk before setting.
- Do not turn off the power before switching back to the operation mode after executing 'SETUP=END' and 'END&INIT.DATA=STORE,' otherwise the calibration data in the recorder may be destroyed.

Makes the following basic settings for the statistical computation (TLOG)
- Select TLOG start/stop trigger
- Set the start reference time for the recording of the computed result
- Set the interval for printing the record of the computed result
- Select whether or not to reset the data after printing the record of the computed result
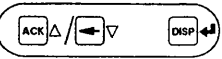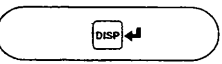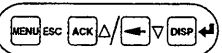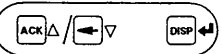
Setup item	OPT item	Select interval control	Reference time	Interval time
SETUP= OPT	→ OPT= TLOG_INTERVAL	→ TLOG_INTERVAL= ABS RELTV	→ START_TIME= 00:00	→ INTERVAL= 000
				→ INTERVAL= 00:00

Scaling during the SUM computation	Data reset at interval timeout
→ SCALE= OFF /s /min /h	→ RESET= ON OFF

PROCEDURE:

Key Sequence / Display

1 [DISP]↵   SET=**OPT**

[ACK]△/[◄]▽ [DISP]↵

While pressing the [↵] key, turn on the power to enter the SETUP mode.
Select the display 'SETUP=OPT' using the [△]/[▽] keys. Then press the [↵] key.

2 [ACK]△/[◄]▽ [DISP]↵   OPT=**TLOG_INTERVAL**

Use the [△]/[▽] keys to select 'OPT=TLOG_INTERVAL' and press the [↵] key.

3 [ACK]△/[◄]▽ [DISP]↵   TLOG_INTERVAL=**ABS**

Select whether to set the interval timeout time to the internal clock (TLOG_INTERVAL=ABS) or to the time computation is started, using the [△]/[▽] key. Then, press the [↵] key.

4 [ACK]△/[◄]▽[►]▷[DISP]↵   START_TIME=**00** : 00

Enter the reference time and press the [↵] key. (You do not set this parameter if you selected RELTV.)

5 [ACK]△/[◄]▽ [DISP]↵   INTERVAL= **000**

When ABS is selected
Select the interval time from the 18 steps (1 min to 24 h) using the [△]/[▽] key. Then press the [↵] key.

6 [ACK]△/[◄]▽[►]▷[DISP]↵   INTERVAL=**00:00**

When RELTV is selected
You can set the interval time between 1 min to 24 h in one minute resolution. Enter the value using the [△]/[▽] and [▷] keys. Then press the [↵] key.

7 [ACK]△/[◄]▽ [DISP]↵   SCALE=**OFF**

Selects the scale when performing SUM computation. Data for the SUM computation are collected every measurement sampling period. However, for inputs having units □/s, □/min, and □/h as in the flow rate, SUM computation can be performed as if the data have been summed every unit of time. Select /s, /min, /h, and OFF using the [△]/[▽] key, then press the [↵] key. Scaling is only relevant for the SUM computation.

8 ⟨ACK⟩△/⟨◄⟩▽ ⟨DISP⟩↵ | RESET=ON |

Selects whether or not to reset the computed result at interval timeout time. Select 'RESET=ON' or 'RESET=OFF' using the [△]/[▽] key. Then press the [↵] key.

9 ⟨DISP⟩↵ | * TLOG SET * |

Before leaving the SETUP mode, you must store the new setting in the internal memory.
Press the [↵] key several times, or proceed to and finish other alarm settings, until the display '*TLOG SET*' appears.

10 ⟨MENU⟩⟨ESC⟩⟨ACK⟩△/⟨◄⟩▽⟨DISP⟩↵ | SETUP=END |

Press the **ESC** key to return to the 'SETUP=OPT' display, then select the 'SETUP=END' display using the [△]/[▽] keys. Then press the [↵] key.

11 ⟨ACK⟩△/⟨◄⟩▽ ⟨DISP⟩↵ | END&INIT.DATA=STORE |

Finally,
• to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [△]/[▽] keys. Then press the [↵] key; or
• to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [△]/[▽] keys. Then press the [↵] key.
The mode is then released from SETUP to operation.

Explanation on the basic setting
If the interval control is set to 'ABS,' the interval timeout time is determined by the reference time and the interval time. Even if MATH start is not initiated on the hour, the interval timeout occurs at the predetermined times.

Example 1:   Reference time: START_TIME=00:00
                Interval: INTERVAL=12h
                Interval timeout times are at 00:00 and 12:00
Example 2:   Reference time: START_TIME=01:00
                Interval: INTERVAL=10min
                Interval timeout times are at 01:10, 01:20, and so on.

The start reference time when 'RELTV' is set, is set to the time of the TLOG start.

Example: Interval: INTERVAL=00:13
Interval timeout occurs every 13 minutes after MATH start.

• Scaling(SCALE=)
Example: Input: Flow rate
            Measurement sampling period: 250 m/s (four times/s)(for VR204)
            SCALE: /s
In this case, the data summed every measurement sampling period becomes one-fourth the input (□ m³/4s), and the correct total value of the flow rate is obtained.

• Resetting the computed result(RESET=)
Selects whether or not to clear the past computed results when printing the record of the computed results.

Example: Result of SUM computation
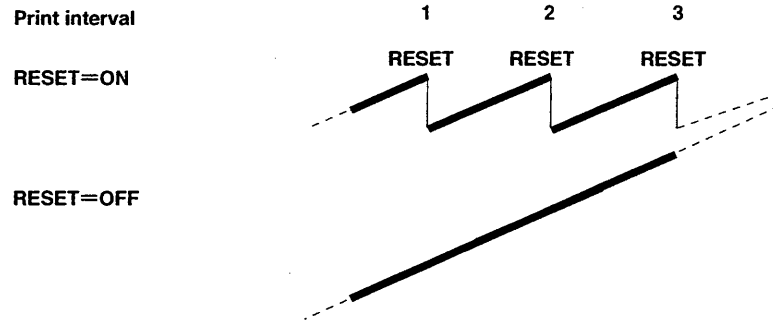
TLOG interval time out data file
Stores only the data at the TLOG interval timeout.

Recorded information: MATH start time and unit/decimal point information of each channel
Data on each channel at the time of TLOG interval timeout (time and data)
MATH stop time and the data on each channel.
Data format: Binary (original format)
Storage file: TLOG interval timeout data file (.TLG)
Method to specify file name:File name of the measurement data are automatically set
Number of data points: 770 (About 32 days at an interval of one hour)
Number of sets: 12

One set consists of one Math start and one Math stop. The storage range is either the maximum value of the number of data points or the maximum number of sets.

3.7 Copying Setting Parameters to Other Channel

It is possible to copy settings from one channel to another. All settings concerning equation, alarm, unit, zone display, partial expanded display, and tag number are copied. For details of the settings concerning zone display, partial expanded display, and tags, see Section 4.2. These settings are all copied, and it is impossible to copy certain settings only, such as alarm settings.

Exactly the same values as these settings are copied to the specified channel.

To copy the settings, follow the procedure below.

MENU:

[△] key

RANGE	CONST	MATH_SET	FROM CH	TO CH
ALARM	MATH_SET	CALC	0A	0C
UNIT		ALARM		
TIME/DIV		UNIT		
CLOCK		COPY		
COPY		AUX		
MATH				
AUX				
FD_SET				

PROCEDURE:

Key Sequence | Display

1. [MENU] ESC 3 sec — [ACK]△/[◄]▽ [DISP]↵ — **SET= MATH**

   Press the **MENU** key for three seconds to enter the SET mode. Select the 'SET=MATH' display using the [△]/[▽] keys. Then press the [↵] key.

2. [ACK]△/[◄]▽ [DISP]↵ — **MATH= MATH_SET**

   Select the 'MATH=MATH_SET' display using the [△]/[▽] keys. Then press the [↵] key.

3. [ACK]△/[◄]▽ [DISP]↵ — **MATH_SET= COPY**

   Select the 'MATH_SET=COPY' display using the [△]/[▽] keys. Then press the [↵] key.

4. [ACK]△/[◄]▽ [DISP]↵ — **COPY FROM 0A TO**

   Enter the channel number from which you want to copy using the [△]/[▽] keys.

   Note

   You can only copy from a lower channel number to a higher channel number.

   Then press the [↵] key.

5. [ACK]△/[◄]▽ [DISP]↵ — **COPY FROM 0A TO 0C**

   Enter the channel number to which you want to copy using the [△]/[▽] keys. Then press the [↵] key.

6. [ACK]△/[◄]▽ [DISP]↵ — **INIT.DATA_MEMORY= YES**

   This message then appears to announce that copying the channel settings initializes the data memory. If you do not mind initializing the data memory, select 'YES' and press the [↵] key. Selecting 'NO' does not initialize the data memory, and the settings are not copied.

7. [DISP]↵/[MENU] ESC 3 sec — *** SET OK ***

   The setting is completed.
   To continue copying the channel settings to another channel, press the [↵] key to return to the 'COPY FROM □ TO □' display.
   To return to the 'SET=MATH' display, press the **ESC** key.
   To return to the operation mode, press the **MENU** key for three seconds.

3.8 Starting/Stopping/Clearing Computation

The way to start/stop computation can be done by panel, by remote triggering or by RS-422-A communication. For remote triggering, refer to 2.3.4 of IM4N2A1-01E. For communication by RS-422-A, refer to 6.4 of this manual.
The operation by panel keys is described below.

To start the computation
1. Press the **DISP** key three or four (during key trigger setting) times at the standard screen. '[↵] MATH Start' is displayed on the last line of the screen.
2. To start the computation (MATH start), press the [↵] key.
   Computation starts and the screen returns to the standard screen.
   If you do not wish to start the computation, press the **DISP** key twice to return to the standard screen.

Note _____
The screen above appears only when the computation is stopped and the computation can be started only on this screen.

To stop the computation
1. Press the **DISP** key three or four (during key trigger setting) times at the standard screen. '[↵] MATH Stop' is displayed on the last line of the screen.
2. To stop the computation (MATH stop), press the [↵] key.
   Computation stops and the screen returns to the standard screen.
   If you do not wish to stop the computation, press the **DISP** key to return to the standard screen.

Note _____
The screen above appears only when the computation is started and the computation can be stopped only on this screen.

To clear the computed data (computed result on channels 0A to 0F)
Computed data can be cleared only when the computation is stopped. (Data cannot be cleared when the computation is started.)
1. Press the **DISP** key four or five (during key trigger setting) times at the standard screen. '[↵] MATH Clear' is displayed on the last line of the screen.
2. To clear the computed data, press the [↵] key.
   Computed data are cleared and the screen returns to the standard screen.
   If you do not wish to clear the computed data, press the **DISP** key to return to the standard screen.

Note _____
The screen above appears only when the computation is stopped and the computed data can be cleared only on this screen.

Note _____
• When the computation is stopped. the computed result up to that point are held. This result is what is displayed and output to the communication port.
• When the computation is stopped. alarm outputs of the dedicated computation channels (A to D: VR202/VR204, A to F: VR206) are reset.
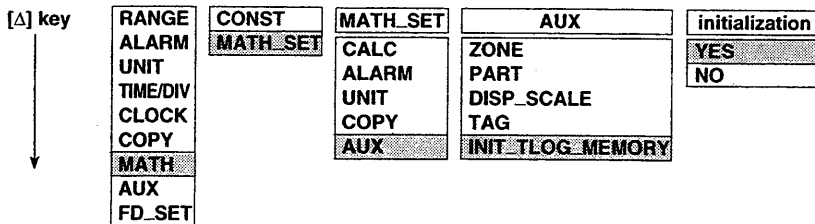
3.9 Initializing Periodic TLOG Data Memory

Follow the procedure below to initialize the TLOG data file.

CAUTION

Once initialized, the data memory can not be restored. Save the data in memory to a floppy disk before initializing, if necessary.

MENU:

[△] key

RANGE	CONST	MATH_SET	AUX	initialization
ALARM	MATH_SET	CALC	ZONE	YES
UNIT		ALARM	PART	NO
TIME/DIV		UNIT	DISP_SCALE	
CLOCK		COPY	TAG	
COPY		AUX	INIT.TLOG_MEMORY	
MATH				
AUX				
FD_SET				

PROCEDURE:

Key Sequence | Display

1 [MENU ESC 3 sec] [ACK △ / ◄ ▽ | DISP ↵]   **SET= MATH**

Press the **MENU** key for three seconds to enter the SET mode. Select the 'SET=MATH' display using the [△]/[▽] keys. Then press the [↵] key.

2 [ACK △ / ◄ ▽ | DISP ↵]   **MATH= MATH_SET**

Select the 'MATH=MATH_SET' display using the [△]/[▽] keys. Then press the [↵] key.

3 [ACK △ / ◄ ▽ | DISP ↵]   **MATH_SET= AUX**

Select the 'MATH_SET=AUX' display using the [△]/[▽] keys. Then press the [↵] key.

4 [ACK △ / ◄ ▽ | DISP ↵]   **MODE= INIT.TLOG_MEMORY**

Select the 'MODE=INIT.TLOG_MEMORY' display using the [△]/[▽] keys. Then press the [↵] key.

5 [ACK △ / ◄ ▽ | DISP ↵]   **INIT OK= YES**

Select 'YES' to execute initialization or 'NO' to cancel initialization using the [△]/[▽] keys. Then press the [↵] key. If 'YES' is selected, the data memory is initialized.

6 [DISP ↵ / MENU ESC 3 sec]   **∗ SET OK ∗**

Initialization is completed (when 'YES' was entered) or canceled (when 'NO' was entered). To return to the 'INIT OK=□ □' display, press the [↵] key. To return to the 'SET=MATH' display, press the **ESC** key. To return to the operation mode, press the **MENU** key for three seconds.

3

HOW TO SET COMPUTATIONS

4 HOW TO SET AN ALARM, DISPLAY FORMAT AND UNIT

This chapter describes the way to set an alarm for channels used for computations.
4.1 How to Set an Alarm on the Extra Computation Channels
4.2 Setting of Discrete Display
4.3 Setting of Partial Expanded Display
4.4 On/Off Setting for Scale and waveform Indication
4.5 Tag Setting
4.6 How to Append Units to the Extra Computation Channels

4.1 How to Set an Alarm on the Extra Computation Channels

It is possible to set alarms on the extra channels used for computation (0A to 0D for the VR202/VR204, 0A to 0F for the VR206). In this case only 2 types of alarms are selectable, namely High (H) and Low (L). Hysteresis for these alarms is always 0%. Alarms can not be set (or will be canceled) to computational channels whose mode have been set (or have been changed) to OFF.

To set an alarm on an extra computation channel, proceed as follows:

MENU:

[Δ] key	RANGE	CONST	MATH_SET	channel	LEVEL	ON/OFF	TYPE	value
	ALARM	MATH_SET	CALC	0A	1	ON	H	50.000
	UNIT		ALARM	0B				
	TIME/DIV		UNIT	0C				
	CLOCK		COPY	0D				
	COPY		AUX					
	MATH							
	AUX							
	FD_SET							

Relay ON/OFF	Relay No.
ON	I01

PROCEDURE:

	Key Sequence	DIsplay	
1	MENU ESC 3 sec / ACK Δ / ◄ ▽ DISP ◄┘	SET=MATH	Press the **MENU** key for three seconds to enter the SET Mode. Select the 'SET=MATH' display using the [Δ]/[▽] keys. Then press the [◄┘] key.
2	ACK Δ / ◄ ▽ DISP ◄┘	MATH=MATH_SET	Select the 'MATH=MATH_SET' display using the [Δ]/[▽] keys. Then press the [◄┘] key.
3	ACK Δ / ◄ ▽ DISP ◄┘	MATH_SET=ALARM	Select the 'MATH_SET=ALARM' display using the [Δ]/[▽] keys. Then press the [◄┘] key.
4	ACK Δ / ◄ ▽ DISP ◄┘	0A :ALARM LEVEL=	Select the channel (character) using the [Δ]/[▽] keys for which you want to set an alarm. Press the [◄┘] key.
5	ACK Δ / ◄ ▽ DISP ◄┘	0A :ALARM LEVEL=1	Then select the alarm level using the [Δ]/[▽] keys. Up to 4 levels can be set. Then press the [◄┘] key.
6	ACK Δ / ◄ ▽ DISP ◄┘	0A/1 :ALARM=ON	Select the status of the alarm (ON or OFF) by using the [Δ]/[▽] keys. Initially all are set to OFF. Then press the [◄┘] key. When OFF is selected, setting is completed.
7	ACK Δ / ◄ ▽ DISP ◄┘	0A/1 :TYPE=H	Then enter the type of alarm. Two types are available. After selection by using the [Δ]/[▽] keys, press the [◄┘] key.
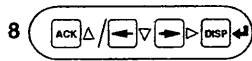
8 ([ACK] △ / [←] ▽ [→] ▷ [DISP] [◄]) `0A/1 :VALUE=50.000`

Then enter the alarm value using the [△]/[▽] and [▷] keys. After setting, press the [◄] key. The range is –9999999 to 99999999.
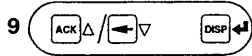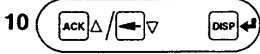
9 ([ACK] △ / [←] ▽   [DISP] [◄]) `0A/1 :RELAY=ON`
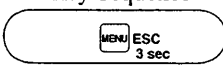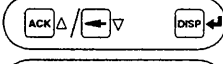
Specify whether an output relay should be activated (ON) or not (OFF).

Note _____

That output relays are optional (/A1, 2 or 3). After selection, using the [△]/[▽] keys, press the [◄] key.

10 ([ACK] △ / [←] ▽   [DISP] [◄]) `0A/1 :RELAY No.=01`

Then specify the output relay number using the [△]/[▽] keys. Up to 12 output relays I01 to I12 can be specified, depending on the option. Then press the [◄] key.
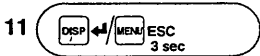
11 ([DISP] [◄] / [MENU] ESC 3 sec) `* SET OK *`

The setting is completed.
To continue setting another channel, press the [◄] key to return to the '□:ALARM_LEVEL= □' display.
To return to the 'SET=MATH' display, press the **ESC** key.
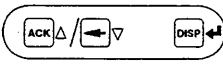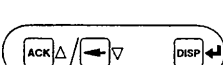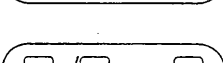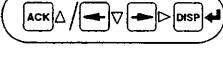To return to the operation mode, press the **MENU** key for three seconds.

4.2 Setting of Discrete Display

Discrete (zone) display enables you to define different bands for each channel on the screen. The traces of the trend graph will then not overlap, making it easier to see each trend (waveform).

MENU:

[Δ] key

RANGE	CONST	MATH_SET	AUX	ZONE LOWER	ZONE UPPER
ALARM	MATH_SET	CALC	ZONE	25%	50%
UNIT		ALARM	PART		
TIME/DIV		UNIT	DISP_SCALE		
CLOCK		COPY	TAG		
COPY		AUX	INIT_TLOG_MEMORY		
MATH					
AUX					
FD_SET					

PROCEDURE:

Key Sequence — Display

1 [MENU] ESC 3 sec / [ACK]Δ/[◄]∇ [DISP]↵ — **SET= MATH**

Press the **MENU** key for three seconds to enter the SET mode. Select the 'SET=MATH' display using the [Δ]/[∇] keys. Then press the [↵] key.

2 [ACK]Δ/[◄]∇ [DISP]↵ — **MATH= MATH_SET**

Select the 'MATH=MATH_SET' display using the [Δ]/[∇] keys. Then press the [↵] key.

3 [ACK]Δ/[◄]∇ [DISP]↵ — **MATH_SET= AUX**

Select the 'MATH_SET=AUX' display using the [Δ]/[∇] keys. Then press the [↵] key.

4 [ACK]Δ/[◄]∇ [DISP]↵ — **MODE= ZONE**

Select the 'MODE=ZONE' display using the [Δ]/[∇] keys. Then press the [↵] key.

5 [ACK]Δ/[◄]∇ [DISP]↵ — **0A :ZONE LOWER= %**

Select the desired channel using the [Δ]/[∇] keys. Then press the [↵] key.

6 [ACK]Δ/[◄]∇[►]▷[DISP]↵ — **0A :ZONE LOWER= 25%**

Specify the lower boundary on the graph using the [Δ]/[∇] and [▷] keys. On the trend graph screen, this lower boundary value corresponds to the lower span limit. (For example, if channel 2 has a display span of –2V to 2V, and if you specify the zone to start from 25%, then the display at 25% of the full span on the graph will correspond to the value of –2V.) Then press the [↵] key.

7 [ACK]Δ/[◄]∇[►]▷[DISP]↵ — **0A :ZONE UPPER= 50%**

Specify the upper boundary value using the [Δ]/[∇] keys. Then press the [↵] key.

Note

The upper boundary must be greater than the lower boundary by at least 5%.

8 [DISP]↵/[MENU] ESC 3 sec — **＊ SET OK ＊**

The setting is completed.
To continue setting another channel, press the [↵] key to return to the '☐:ZONE LOWER= ☐ ☐ ☐%' display.
To return to the 'SET=MATH' display, press the **ESC** key.
To return to the operation mode, press the **MENU** key for three seconds.
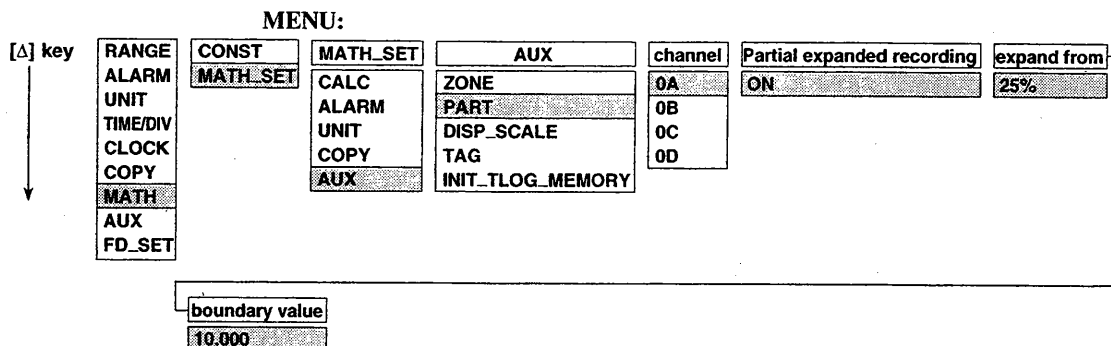
4 HOW TO SET AN ALARM, DISPLAY FORMAT AND UNIT

EXPLANATION:

The following figure shows an example of the display after discrete display has been set.
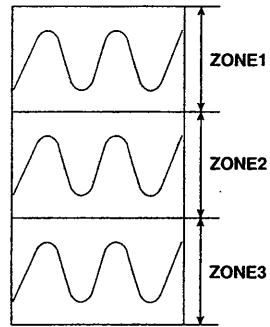
4.3 Setting of Partial Expanded Display

Partial expanded display enables you to compress part of the display span in order to examine the expanded (other) part of the range in more detail. The initial value is 'OFF'. To set partial expanded display, follow the procedure below.
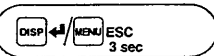
MENU:

[Δ] key	RANGE	CONST	MATH_SET	AUX	channel	Partial expanded recording	expand from
	ALARM	MATH_SET	CALC	ZONE	0A	ON	25%
	UNIT		ALARM	PART	0B		
	TIME/DIV		UNIT	DISP_SCALE	0C		
	CLOCK		COPY	TAG	0D		
	COPY		AUX	INIT_TLOG_MEMORY			
	MATH						
	AUX						
	FD_SET						

boundary value
10.000

PROCEDURE:

Key Sequence / Display

1 `MENU ESC 3 sec` | `ACK Δ / ◄ ▽` `DISP ↵` → SET=**MATH**

Press the **MENU** key for three seconds to enter the SET mode. Select the 'SET=MATH' display using the [Δ]/[▽] keys. Then press the [↵] key.

2 `ACK Δ / ◄ ▽` `DISP ↵` → MATH=**MATH_SET**

Select the 'MATH=MATH_SET' display using the [Δ]/[▽] keys. Then press the [↵] key.

3 `ACK Δ / ◄ ▽` `DISP ↵` → MATH_SET=**AUX**

Select the 'MATH_SET=AUX' display using the [Δ]/[▽] keys. Then press the [↵] key.

4 `ACK Δ / ◄ ▽` `DISP ↵` → MODE=**PART**

Select the 'MODE=PART' display using the [Δ]/[▽] keys. Then press the [↵] key.

5 `ACK Δ / ◄ ▽` `DISP ↵` → **0A**:PARTIAL=

Select the desired channel using the [Δ]/[▽] key. Then press the [↵] key.

6 `ACK Δ / ◄ ▽` `DISP ↵` → 0A :PARTIAL=**ON**

Select ON (or OFF if you set partial expanded display before and want to reset it now) using the [Δ]/[▽] keys. Then press the [↵] key.
If you selected OFF, the setting is now completed.

7 `ACK Δ / ◄ ▽ ► ▷ DISP ↵` → 0A :EXPAND FROM= 2**5**%

Specify the percentage (1 to 99%) of the full display span which is to be compressed, using the [Δ]/[▽] and [▷] keys. Then press the [↵] key.

8 `ACK Δ / ◄ ▽ ► ▷ DISP ↵` → 0A :BOUNDARY= 10.00**0**

The display which then appears prompts you to set the boundary value. The boundary value corresponds to the compressed part which was previously set. See also the figure on the next page. Set this value using the [Δ]/[▽] and [▷] keys.

Note _____

This boundary value must be within the display span. (If scaling is ON, this value must be within the scaling range.)

_____

Then press the [↵] key.

4 *HOW TO SET AN ALARM, DISPLAY FORMAT AND UNIT*

9 ([DISP] [↵]/[MENU] ESC 3 sec) | * SET OK * |

The setting is completed.
To continue setting another channel, press the [↵] key to return to the '□:PARTIAL=□ □' display.
To return to the 'SET=MATH' display, press the **ESC** key.
To return to the operation mode, press the **MENU** key for three seconds.

Note

All the partial expanded display settings of a channel is cancelled when the following events occur.
* When the computation is set to OFF.
* When the computing equation is changed.
* When the display span is changed (includes changing the decimal point position).
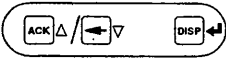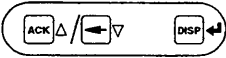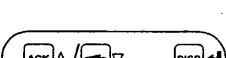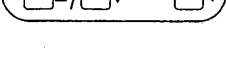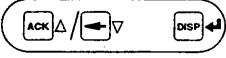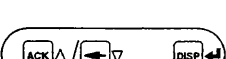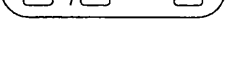
4.4 On/Off Setting for Scale and waveform Indication

To set whether to display the scale values and waveform for each channel, follow the procedure below.

MENU:

[△] key	RANGE	CONST	MATH_SET	AUX	channel	DISP_WAVE	DISP_SCALE
	ALARM	MATH_SET	CALC	ZONE	0A	ON	ON
	UNIT		ALARM	PART	0B	OFF	OFF
	TIME/DIV		UNIT	DISP_WAVE	0C		
	CLOCK		COPY	TAG	0D		
	COPY		AUX	INIT_TLOG_MEMORY			
	MATH						
	AUX						
	FD_SET						

PROCEDURE:

Key Sequence   Display

1 [MENU]ESC 3 sec | SET= MATH |

Press the **MENU** key for three seconds to enter the SET mode. Select the 'SET=MATH' display using the [△]/[▽] keys. Then press the [↵] key.

[ACK]△/[◄]▽ [DISP]↵

2 [ACK]△/[◄]▽ [DISP]↵ | MATH= MATH_SET |

Select the 'MATH=MATH_SET' display using the [△]/[▽] keys. Then press the [↵] key.

3 [ACK]△/[◄]▽ [DISP]↵ | MATH_SET= AUX |

Select the 'MATH_SET=AUX' display using the [△]/[▽] keys. Then press the [↵] key.

4 [ACK]△/[◄]▽ [DISP]↵ | MODE= DISP_WAVE |

Select the 'MODE=DISP_WAVE' display using the [△]/[▽] keys. Then press the [↵] key.

5 [ACK]△/[◄]▽ [DISP]↵ | 0A :DISP_WAVE= |

Select the desired channel using the [△]/[▽] keys. Then press the [↵] key.

6 [ACK]△/[◄]▽ [DISP]↵ | 0A :DISP_WAVE= ON |

Select ON or OFF using the [△]/[▽] keys. Then press the [↵] key.
If you select OFF, '*SET OK*' is displayed and the setting is complete. Scale display is turned OFF.

7 [ACK]△/[◄]▽[◄]▷[DISP]↵ | 0A :DISP_SCALE= ON |

Select ON or OFF using the [△]/[▽] keys. Then press the [↵] key.

8 [DISP]↵/[MENU]ESC 3 sec | * SET OK * |

The setting is completed.
To continue setting another channel, press the [↵] key to return to the '□:DISP SCALE=□ □' display.
To return to the 'SET=MATH' display, press the ESC key.
To return to the operation mode, press the **MENU** key for three seconds.

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HOW TO SET AN ALARM, DISPLAY FORMAT AND UNIT

4.5 Tag Setting

Depending on the setting in the SETUP mode, the tag numbers can be used instead of the channel numbers for identifying the channels. The tag numbers which are set are displayed in the upper row of the unit display area on the screen and stored in files together when the data is saved. The maximum length of a tag number that can be specified for each channel is seven characters.

Note _____

To make the tag numbers take effect, you must switch from the channel numbers to tag numbers. (For details of the procedure, see Section 6.6.)

_____

Follow the procedure below to set a tag number.

MENU:

[△] key	RANGE	CONST	MATH_SET	AUX	Channel	TAG
	ALARM	MATH_SET	CALC	ZONE	0A	TAG1
	UNIT		ALARM	PART	0B	
	TIME/DIV		UNIT	DISP_SCALE	0C	
	CLOCK		COPY	TAG	0D	
	COPY		AUX	INIT_TLOG_MEMORY		
	MATH					
	AUX					
	FD_SET					

PROCEDURE:

	Key Sequence	Display	
1	[MENU] ESC 3 sec / [ACK]△/[◄]▽ [DISP]↵	SET=MATH	Press the **MENU** key for three seconds to enter the SET mode. Select the 'SET=MATH' display using the [△]/[▽] keys. Then press the [↵] key.
2	[ACK]△/[◄]▽ [DISP]↵	MATH=MATH_SET	Select the 'MATH=MATH_SET' display using the [△]/[▽] keys. Then press the [↵] key.
3	[ACK]△/[◄]▽ [DISP]↵	MATH_SET=AUX	Select the 'MATH_SET=AUX' display using the [△]/[▽] keys. Then press the [↵] key.
4	[ACK]△/[◄]▽ [DISP]↵	MODE=TAG	Select the 'MODE=TAG' display using the [△]/[▽] keys. Then press the [↵] key.
5	[ACK]△/[◄]▽ [DISP]↵	0A:TAG=	Select the desired channel using the [△]/[▽] keys. Then press the [↵] key.
6	[ACK]△/[◄]▽[►]▷[DISP]↵	0A :TAG= TAG1	Enter the desired characters (up to seven) using the [△]/[▽] and [▷] keys. Then press the [↵] key.
7	[DISP]↵/[MENU] ESC 3 sec	* SET OK *	The setting is completed. To continue setting another channel, press the [↵] key to return to the '□:TAG=□ □ □ □' display. To return to the 'SET=MATH' display, press the **ESC** key. To return to the operation mode, press the **MENU** key for three seconds.

4.6   How to Append Units to the Extra Computation Channels

It is possible to append units to the extra channels used for computation (0A to 0D for the VR202/VR204, 0A to 0F for the VR206).

To append units to an extra computation channel, proceed as follows:

MENU:

[Δ] key

RANGE	CONST	MATH_SET	channel	characters
ALARM	MATH_SET	CALC	0A	kg
UNIT		ALARM	0B	
TIME/DIV		UNIT	0C	
CLOCK		COPY	0D	
COPY		AUX		
MATH				
AUX				
FD_SET				

PROCEDURE:

Key Sequence   Display

1   MENU ESC 3 sec   SET= MATH

ACK Δ / ◄ ▽   DISP ↵

Press the **MENU** key for three seconds to enter the SET mode. Select the 'SET=MATH' display using the [Δ]/[▽] keys. Then press the [↵] key.

2   ACK Δ / ◄ ▽   DISP ↵   MATH= MATH_SET

Select the 'MATH=MATH_SET' display using the [Δ]/[▽] keys. Then press the [↵] key.

3   ACK Δ / ◄ ▽   DISP ↵   MATH_SET= UNIT

Select the 'MATH_SET=UNIT' display using the [Δ]/[▽] keys. Then press the [↵] key.

4   ACK Δ / ◄ ▽   DISP ↵   0A :UNIT=

Select the channel (character) using the [Δ]/[▽] keys to which you want to append a unit. Then press the [↵] key.

5   ACK Δ / ◄ ▽ ◄ ▷ DISP ↵   0A :UNIT= kg

Type the desired unit (up to six characters) using the [Δ]/[▽] and [▷] keys. Then press the [↵] key.

6   DISP ↵ / MENU ESC 3 sec   * SET OK *

The setting is completed.
Press the [↵] key to return to the '□ □:UNIT=□ □ □ □' display; or press the **ESC** key to go to the 'SET=MATH' display; or press the **MENU** key for three seconds to return to the Operation mode.

HOW TO SET AN ALARM, DISPLAY FORMAT AND UNIT

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5 HOW TO SET DISPLAY COLORS AND NUMBER OF CHANNEL TO USE

This chapter describes the way to set display colors and number of channel to use.
5.1 Display Color (COLOR) Setting
5.2 Setting the Number of Channels to be use

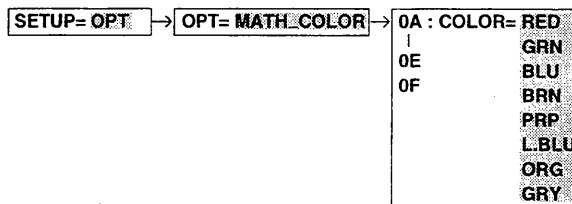## 5.1 Display Color (COLOR) Setting

CAUTION

- Selecting the 'SETUP=END' and then 'END&INIT. DATA=STORE' display and pressing the [↵] key at the end of each procedure (described in this chapter) initializes the data memory and information file. If necessary, save the data memory contents (e.g., measured data) to a floppy disk before setting.
- Do not turn off the power before switching back to the operation mode after executing 'SETUP=END' and 'END&INIT.DATA=STORE,' otherwise the calibration data in the recorder may be destroyed.

Follow the procedure below to set the colors of recording traces on the screen. The available colors are as follows.

Recording trace colors: Select for each channel from red (RED), green (GRN), blue (BLU), brown (BRN), or red-purple (PRP), light blue (L.BLU), orange (ORG), or gray (GRY). Light blue, orange, and gray are available only for the VR206. The initial settings are:

        Channel 1: red
        Channel 2: green
        Channel 3: blue
        Channel 4: red-purple
        Channel 5: orange
        Channel 6: light blue

MENU:

SETUP= OPT	→	OPT= MATH_COLOR	→	0A : COLOR= RED
				GRN
			0E	BLU
			0F	BRN
				PRP
				L.BLU
				ORG
				GRY

PROCEDURE:

	Key Sequence	Display	
1	[DISP] ↵		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	[ACK]△/[◄]▽ [DISP]↵	SETUP=**OPT**	Select the display 'SETUP=OPT' display using the [△]/[▽] keys. Then press the [↵] key.
3	[ACK]△/[◄]▽ [DISP]↵	OPT=**MATH_COLOR**	Select the 'OPT=MATH_COLOR' display using the [△]/[▽] keys. Then press the [↵] key.
4	[ACK]△/[◄]▽ [DISP]↵	**0A**:COLOR= RED	Select the channel for which you want to set the trace color using the [△]/[▽] keys. Then press the [↵] key.
5	[ACK]△/[◄]▽ [DISP]↵	0A :COLOR=**PRP**	The entry cursor then moves to the color entry field. Use the [△]/[▽] keys to select the trace color from among 'RED,' 'GRN,' 'BLU,' 'BRN,' 'PRP', 'L.BLU,' 'ORG,' or 'GRY', then press the [↵] key.

`* MATH COLOR SET *`	The setting is completed. To continue setting the color for another channel, press the [↵] key to return to the display 'COLOR:☐.' Pressing the **ESC** key in this step enables you to proceed to other settings in the SETUP mode.

6 ⟮ MENU ESC ACK △/◄ ▽ DISP ↵ ⟯ `SETUP=`**`END`**

Before leaving the SETUP mode, you must store the new setting in the internal memory.
Press the **ESC** key to return to the 'SETUP=OPT' display, then select the 'SETUP=END' display using the [△]/[▽] keys. Then press the [↵] key.
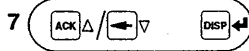
7 ⟮ ACK △/◄ ▽ DISP ↵ ⟯ `END&INIT.DATA=`**`STORE`**

Finally,
* to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [△]/[▽] keys, then press the [↵] key; or
* to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [△]/[▽] keys, then press the [↵] key.
The mode is then released from SETUP to operation.

5.2 Setting the Number of Channels to be use

> **CAUTION**
>
> - Selecting the 'SETUP=END' and then 'END&INIT. DATA=STORE' display and pressing the [↵] key at the end of each procedure (described in this chapter) initializes the data memory and information file. If necessary, save the data memory contents (e.g., measured data) to a floppy disk before setting.
> - Do not turn off the power before switching back to the operation mode after executing 'SETUP=END' and 'END&INIT.DATA=STORE,' otherwise the calibration data in the recorder may be destroyed.

Define the number of channels for computation to be used. Set this to the minimum required number for effective use of memory. The default setting is four (for the VR204) or six (for the VR206).

SETUP= OPT	→	OPT= MATH_CHQTY	→	CH_QTY= 4

PROCEDURE:

|	Key Sequence	Display	
1	([DISP]↵)		While pressing the [↵] key, turn on the power to enter the SETUP mode.
2	([ACK]△/[◄]▽ [DISP]↵)	SETUP=OPT	Select the 'SETUP=OPT' display using the [△]/[▽] keys. Then press the [↵] key.
3	([ACK]△/[◄]▽ [DISP]↵)	OPT=MATH_CHQTY	Select the 'OPT=MATH_CHQTY' display using the [△]/[▽] keys. Then press the [↵] key.
4	([ACK]△/[◄]▽ [DISP]↵)	CH_QTY=4	Select the number of channels for computation using the [△]/[▽] keys. Then press the [↵] key.
		* MATH CH_QTY SET *	The setting is completed. To continue setting the color for another channel, press the [↵] key to return to the display 'CHQTY:□.' Pressing the **ESC** key in this step enables you to proceed to other settings in the SETUP mode.
5	([MENU] ESC [ACK]△/[◄]▽[DISP]↵)	SETUP=END	Before leaving the SETUP mode, you must store the new setting in the internal memory. Press the **ESC** key to return to the 'SETUP=OPT' display, then select the 'SETUP=END' display using the [△]/[▽] keys, then press the [↵] key.
6	([ACK]△/[◄]▽ [DISP]↵)	END&INIT.DATA=STORE	Finally, - to store and make the new settings take effect, select the 'END&INIT.DATA=STORE' display using the [△]/[▽] keys, then press the [↵] key; or - to discard the new settings, select the 'END&INIT.DATA=ABORT' display using the [△]/[▽] keys, then press the [↵] key. The mode is then released from SETUP to operation.

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HOW TO SET DISPLAY COLORS AND NUMBER OF CHANNEL TO USE

6 COMPUTATIONS BY RS-422-A

This chapter explains how to perform computations by RS-422-A interface.

6.1 Setting a Constant by RS-422-A
6.2 Setting a Equation by RS-422-A in Extra MATH-Channel
6.3 Output Formats for Computations by RS-422-A
6.4 Start/Stop the TLOG Computations by RS-422-A

6.1 Setting a Constant by RS-422-A

For details concerning setting commands for RS-422-A.
The range of the constant must be within:

$$\begin{cases} +9.9999E+29 \text{ to } 1.0000E-30 \\ 0 \\ -1.000E-30 \text{ to } -9.9999E+30 \end{cases}$$

format: **SKp1, p2**

p1:   constant number (K01 to K10)
p2:   constant value (up to 11 characters)

example: **SKK01, 150**

This example assigns the value of 150 to constant number 01.

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COMPUTATIONS BY RS-422-A

6.2   Setting a Equation by RS-422-A in Extra MATH-Channels

This paragraph describes the way to set equations by RS-422-A in an extra MATH-channel. The VR202 and VR204 are equipped with 4 extra channels (A, B, C, D), where the VR206 has 6 channels (A, B, C, D, E, F).
The way to set the specific items is described below:

EXPRESSION

format: **SOp1, ON/OFF, p2, p3, p4, p5**

    p1:   channel number (0A to 0F, depending on your m]odel)

    ON/OFF: set computational channel ON or OFF

    p2:   computational expression (up to 36 characters)

    p3:   the minimum value of the display span. The setting range is -9999999 to 99999999.

    p4:   the maximum value of the display span. The setting range is -9999999 to 99999999.

    p5:   decimal point position (0 to 4, which stands for the number of digits after the decimal point)

example: **SO0A, ON, TLOG.MAX(01), 1**

ALARM

format: **SBp1, p2, ON/OFF, p3, p4, p5, p6**

    p1:   channel number (0A to 0F, depending on your model)

    p2:   alarm level number (1 to 4)

    ON/OFF: set alarm ON or OFF

    p3:   the type of alarm (H or L)

    p4:   the alarm set point. Range is from –9999999 to 99999999 without decimal point

    p5:   activating the alarm output relay ON or OFF ,

    p6:   specifying the alarm output relay number. Selectable from I01 to I06, according to your option.

example: **SB0A, 1, ON, L, 1500, ON, I05**

UNIT

format: **SVp1, p2**

    p1:   channel number (0A to 0F, depending on your model)

    p2:   unit characters (up to 6)

example: **SV0A, kg**

TAG

format: **SQp1, p2**

    p1:   channel number (0A to 0F, depending on your model)

    p2:   tag characters (up to 7)

example: **SQ0A, TAG 1**

Setting the Discrete (ZONE) Display

format:	**MZp1, p2, p3**

p1:   channel number (CC)
p2:   Lower display boundary value (0 to 95)
p3:   Upper display boundary value (5 to 100)

example:	**SZ0A, 30, 50**

This example results in the display for 0 to 100% of channel A in the band from 30 to 50% of the scale.

Note
* The display bandwidth cannnot be set to 5% or less.
* The lower display boundary must be less than the upper boundary.

Setting the Partial Expanded Display

format:	**SPp1, p2, p3, p4**

p1:   channel number (CC)
p2:   Partial expanded display ON/OFF
p3:   Percentage of the full display span which will be compressed (1 to 99%)
p4:   Boundary value (lower display span +1 to upper display span -1). Enter a numeric value excluding the decimal point.

Note
The display bandwidth cannnot be set to 5% or less.

example:	**SP0A, ON, 25, 0000**

This example results in partial expanded display for channel A where the value at 25% of the display scale corresponds with 0.000 V.

Setting the Waveform and Scale Value Indication On/Off

format:	**SKp1, p2, p3**

p1:   channel number (CC)
p2:   Whether to display the waveform.
         Enter ON or OFF
p3:   Whether to display the scale values.
         Enter ON or OFF

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COMPUTATIONS BY RS-422-A

6.3 Output Formats for Computations by RS-422-A

For details concerning output formats for computations, refer to IM4N1A1-11E, section 3.2.
The formats which can be used to output computed data:
• TS0 + ESC T + FM2; outputs computed values in ASCII Mode, see 6.3.1.
• TS0 + ESC T + FM3; outputs computed values in Binary Mode, see 6.3.2.

6.3.1 Output Format of Computed Values in the ASCII Mode

When the TS0, ESC T and FM2 commands are received, the measured value and computed result are output in ASCII mode. When the ESC T command is received immediately after the TS0 command, the recorder data will be transferred to a buffer.

Command	Function
FM2, p1, p2	selects channel from which computed values are output in the ASCII mode, where p1 is the channel number (0A, 0B, 0C, etc.) from where the output should start, and p2 is the channel number (0A, 0B, 0C, etc.) where the output should end.

Output format for FM2:
$DATEYYMMDDC_R L_F$ (year, month, day)

$TIMEHHMMSSC_R L_F$ (hour, minute, second)

$$\square\,\square\,AAAAUUUUUUCC,\ \pm DDDDDDDDE\pm EEC_R\ L_F$$

```
  AAAA      UUUUUU
  1 2 3 4   1 2 3 4 5 6
```

— Data exponent
  E±2 digits
— Data mantissa (8 digits)
— Channel number
— Units
  U U U U U U Arbitrary
  1 2 3 4 5 6
— Alarm status (place corresponds to level)
  H: High alarm
  L: Low alarm
  □: No alarm
— Data status
  □ space: middle and other data
  E: end of data
— Data status
  N: nomal
  O: overrange; data ±99999999
  S: skip
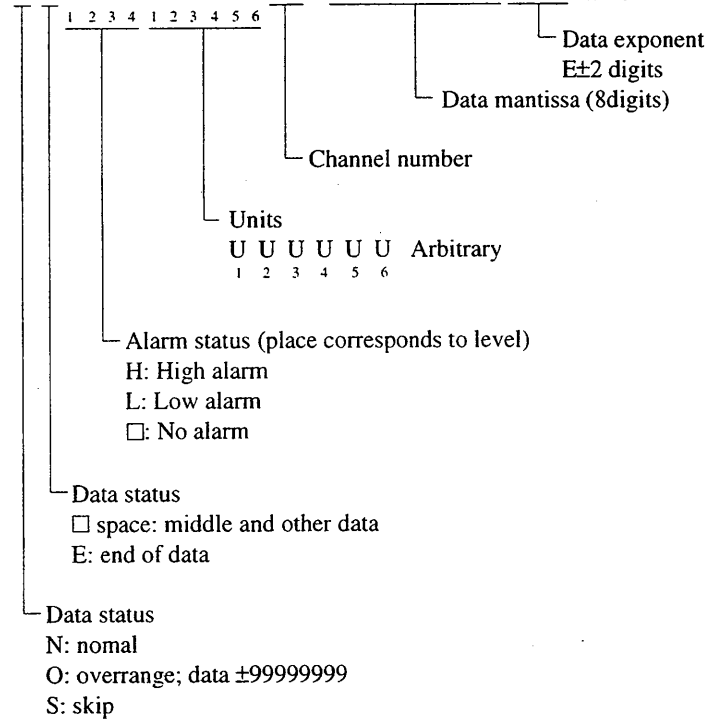
6.3.2 Output Format of Computed Values in the Binary Mode

When the TS0, ESC T and FM3 commands are received, the measured value and computed result are output in the Binary mode.

Command	Function
FM3, p1, p2	selects channel from which computed values are output in the Binary mode, where p1 is the channel number (0A, 0B, 0C, etc.) from where the output should start, and p2 is the channel number (0A, 0B, 0C, etc.) where the output should end.

Output format for FM3:

1	2	3	4	5	6	7
	A_2	A_1	A_4	A_3		

channel
number
ACH=61
l
FCH=66

Alarm status
A_n=1:H
A_n=2:L
A_n=0:No alarm or set to OFF
Outputs for each level:
A1=level 1
l
A4=level 4

measured value (order of output byte can be selected using BO command)
data + over: 7E7E7E7E is output
data - over: 81818181 is output
skip: 80808080 is output
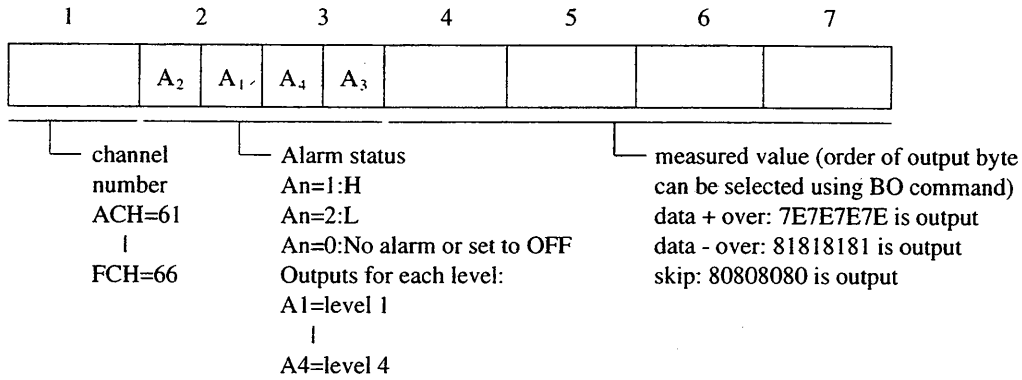
6.4 Start/Stop the TLOG Computations by RS-422-A

This paragraph describes the way to start/stop the computations by RS-422-A. For details concerning Program Control Commands, refer to IM4N1A1-11E, section 2.2.

Command	Function
TL0	Results in starting the TLOG computation
TL1	Results in interrupting the TLOG computation.

Note

When starting the TLOG computations, the value of the computations will be reset.
When stopping the TLOG computations, the value of the computations will be kept, so you can still obtain these values at the display, in the (manual) printout and by communication. However, the alarm relays (corresponding to channels A, B, C etc.) and indicators will be reset.

7 ERROR MESSAGES

This chapter describes the error messages which may occur and the countermeasures which should be taken in such cases.

Error Message (on display)	Error Description	Countermeasure
ERROR 091	Syntax error in constant setting	enter constant correctly
ERROR 092	Constant setting is out of range	enter constant correctly
ERROR 140	Tried to use an unidentified code	enter setting correctly
ERROR 141	Parentheses do not match	enter parentheses correctly
ERROR 142	Tried to set more than one TLOG function in a TLOG expression e.g. TLOG.MAX(01)+TLOG.MIN(02)	set only one TLOG function in a TLOG expression
ERROR 143	Invalid relation between parameters e.g. 01*+02	enter correct expression
ERROR 144	Cannot compute this TLOG expression e.g. TLOG.AVE(K01)	constants cannot be used as in this example
ERROR 147	Tried to change the expression while TLOG is in progress	stop TLOG computation before changing the expression

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ERROR MESSAGES

APPENDIX

Strange Time Span

Strage Time Span of VR204 with Math Option
E1+D
Event file (aprrox. 240 K byte)

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.)		
			Sampling Speed 125ms	Sampling Speed 250ms	Sampling Speed 1s
1	0	120000	125 minutes	500 minutes	33.3 hours
2	0	60000	250 minutes	250 minutes	16.6 hours
3	0	40000	83 minutes	166 minutes	11.1 hours
4	0	30000	62 minutes	125 minutes	8.3 hours
1	1	40000	————	166 minutes	11.1 hours
2	1	30000	————	125 minutes	8.3 hours
3	1	24000	————	100 minutes	6.6 hours
4	1	20000	————	83 minutes	5.5 hours
1	2	24000	————	100 minutes	6.6 hours
2	2	20000	————	83 minutes	5.5 hours
3	2	17000	————	70 minutes	4.7 hours
4	2	15000	————	62 minutes	4.1 hours
1	3	17000	————	70 minutes	4.7 hours
2	3	15000	————	62 minutes	4.1 hours
3	3	13200	————	55 minutes	3.6 hours
4	3	11800	————	49 minutes	3.3 hours
1	4	13200	————	55 minutes	3.6 hours
2	4	11800	————	49 minutes	3.3 hours
3	4	10600	————	44 minutes	2.9 hours
4	4	9600	————	40 minutes	2.6 hours

E1 only
Event file (aprrox. 960 K byte)

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.)		
			Sampling Speed 125ms	Sampling Speed 250ms	Sampling Speed 1s
1	0	480000	16.6 hours	33.3 hours	133.3 hours
2	0	240000	8.3 hours	16.6 hours	66.6 hours
3	0	160000	5.5 hours	11.1 hours	44.4 hours
4	0	120000	4.1 hours	8.3 hours	33.3 hours
1	1	160000	————	11.1 hours	44.4 hours
2	1	120000	————	8.3 hours	33.3 hours
3	1	96000	————	6.6 hours	26.6 hours
4	1	80000	————	5.5 hours	22.2 hours
1	2	96000	————	6.6 hours	26.6 hours
2	2	80000	————	5.5 hours	22.2 hours
3	2	68500	————	4.7 hours	19.0 hours
4	2	60000	————	4.1 hours	16.6 hours
1	3	68500	————	4.7 hours	19.0 hours
2	3	60000	————	4.1 hours	16.6 hours
3	3	53000	————	3.6 hours	14.7 hours
4	3	47500	————	3.2 hours	13.1 hours
1	4	53000	————	3.6 hours	14.7 hours
2	4	47500	————	3.2 hours	13.1 hours
3	4	43000	————	2.9 hours	11.9 hours
4	4	39500	————	2.7 hours	10.9 hours

App

APPENDIX

E16+D
Event file (aprrox. 240 K byte/16 blocks)
Number of data value in one block

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.)		
			Sampling Speed 125ms	Sampling Speed 250ms	Sampling Speed 1s
1	0	8000	16.6 minutes	33.3 minutes	133.3 minutes
2	0	4000	8.3 minutes	16.6 minutes	66.6 minutes
3	0	2600	5.5 minutes	11.1 minutes	44.4 minutes
4	0	2000	4.1 minutes	8.3 minutes	33.3 minutes
1	1	2600	——	11.1 minutes	44.4 minutes
2	1	2000	——	8.3 minutes	33.3 minutes
3	1	1600	——	6.6 minutes	26.6 minutes
4	1	1330	——	5.5 minutes	22.1 minutes
1	2	1600	——	6.6 minutes	26.6 minutes
2	2	1330	——	5.5 minutes	22.1 minutes
3	2	1130	——	4.7 minutes	18.8 minutes
4	2	990	——	4.1 minutes	16.5 minutes
1	3	1130	——	4.7 minutes	18.8 minutes
2	3	990	——	4.1 minutes	16.5 minutes
3	3	870	——	3.6 minutes	14.5 minutes
4	3	780	——	3.2 minutes	13.0 minutes
1	4	870	——	3.6 minutes	14.5 minutes
2	4	780	——	3.2 minutes	13.0 minutes
3	4	710	——	2.9 minutes	11.8 minutes
4	4	650	——	2.7 minutes	10.8 minutes

Strage Time Span of VR206 with Math Option
E1+D
Event file (aprrox. 240 K byte)

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.) Sample Speed 1s
1	0	120000	33.3 hours
2	0	60000	16.6 hours
3	0	40000	11.1 hours
4	0	30000	8.3 hours
6	0	20000	5.5 hours
1	1	40000	11.1 hours
2	1	30000	8.3 hours
3	1	24000	6.6 hours
4	1	20000	5.5 hours
6	1	15000	4.1 hours
1	2	24000	6.6 hours
2	2	20000	5.5 hours
3	2	17000	4.7 hours
4	2	15000	4.1 hours
6	2	12000	3.3 hours
1	3	17000	4.7 hours
2	3	15000	4.1 hours
3	3	13200	3.6 hours
4	3	12000	3.3 hours
6	3	10000	2.7 hours
1	4	13200	3.6 hours
2	4	12000	3.3 hours
3	4	10900	3.0 hours
4	4	10000	2.7 hours
6	4	8500	2.3 hours
1	6	9200	2.5 hours
2	6	8500	2.3 hours
3	6	8000	2.2 hours
4	6	7500	2.0 hours
6	6	6600	1.8 hours

E1 only
Event file (aprrox. 1344 K byte)

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.) Sample Speed 1s
1	0	672000	186.6 hours
2	0	336000	93.3 hours
3	0	224000	62.2 hours
4	0	168000	46.6 hours
6	0	112000	31.1 hours
1	1	207300	57.5 hours
2	1	155500	43.1 hours
3	1	124400	34.5 hours
4	1	103600	28.7 hours
6	1	77700	21.5 hours
1	2	124400	34.5 hours
2	2	103600	28.7 hours
3	2	88800	24.6 hours
4	2	77700	21.5 hours
6	2	62200	17.2 hours
1	3	88800	24.6 hours
2	3	77700	21.5 hours
3	3	69100	19.1 hours
4	3	62200	17.2 hours
6	3	51800	14.3 hours
1	4	69100	19.1 hours
2	4	62200	17.2 hours
3	4	56500	15.6 hours
4	4	51800	14.3 hours
6	4	44400	12.3 hours
1	6	47800	13.2 hours
2	6	44400	12.3 hours
3	6	41400	11.5 hours
4	6	38800	10.7 hours
6	6	34500	9.5 hours

App

APPENDIX

E16+D

Event file (aprrox. 240 K byte/16 blocks)

Number of data value in one block

Number of measurement channels	Number of computation channels	Number of data values (aprrox.)	Strage Time Span (aprrox.) Sample Speed 1s
1	0	8000	133.3 minutes
2	0	4000	66.6 minutes
3	0	2600	43.3 minutes
4	0	2000	33.3 minutes
6	0	1300	21.6 minutes
1	1	2600	43.3 minutes
2	1	2000	33.3 minutes
3	1	1600	26.6 minutes
4	1	1330	22.1 minutes
6	1	990	16.5 minutes
1	2	1600	26.6 minutes
2	2	1330	22.1 minutes
3	2	1130	18.8 minutes
4	2	990	16.5 minutes
6	2	780	13.0 minutes
1	3	1130	18.8 minutes
2	3	990	16.5 minutes
3	3	870	14.5 minutes
4	3	780	13.0 minutes
6	3	650	10.8 minutes
1	4	870	14.5 minutes
2	4	780	13.0 minutes
3	4	710	11.8 minutes
4	4	650	10.8 minutes
6	4	550	9.1 minutes
1	6	590	9.8 minutes
2	6	550	9.1 minutes
3	6	510	8.5 minutes
4	6	480	8.0 minutes
6	6	420	7.0 minutes