Instruction Manual

μR1800

Models 4370□□
μR1800 Recorder
/M1 Mathematical Functions

IM 4H3B1-20E

YOKOGAWA ◆
Yokogawa Electric Corporation

IM 4H3B1-20E
2nd Edition

INTRODUCTION

This Instruction Manual describes the Mathematical option for the μR1800 pen and dot printing recorder.
For details concerning the operation of the pen recorder, refer to IM 4H3B1-01E; for details concerning the operation of the dot printing model, refer to IM 4H3B4-01E.

NOTES

- 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.
- This manual is the second edition, October 1993.

Previous editions were released as follows:

January '93	first edition

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CONTENTS

1 OUTLINE

This chapter describes which computations can be used when your μR1800 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 <, >, =, ≠

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 μR1800 pen model has four extra channels (A, B, C, D) for computation available. The μR1800 dot printing model has twelve extra channels (A, B, C, D, E, F, G, J, K, M, N, P) for computation available.

However, in the case of arithmetic, SQR, ABS, LOG, EXP, relational and logical computation, you may also use a measurement channel for computation.
In the case of statistical computation, you can use only the extra channels for computation.

NOTE Channels must be entered using two digits; therefore, the correct way to enter channel numbers in case of the extra channels is 0A, 0B, 0C, 0D, 0E, etc.

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)
C	Used to enter digital data values (C01 to C04 for the pen model, C01 to C12 for the dot model)

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

2.1 Limitations of Settings

Channels with computational functions
The μR1800 pen model has four extra channels (A, B, C, D) for computation available. The μR1800 dot printing model has twelve extra channels (A, B, C, D, E, F, G, J, K, M, N, P) for computation available.

However, in the case of arithmetic, SQR, ABS, LOG, EXP, relational and logical computation, you may also use a measurement channel for computation.
In the case of statistical computation, 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 $\pm 3.4 \times 10^{\pm 38}$. 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:

{ 9.9999E+29 to 1.0000E–30
{ 0
{ –1.0000E–30 to –9.9999E+29

The number of significant digits is 5, while the rest will be truncated.
K02 stands for constant number 2.

Recording and display
The results of computations performed in the channels 1, 2, 3 etc. can be recorded on the chart both as analog and digital recording.
The results of computations performed in the channels A, B, C etc. can be digitally recorded on the chart.
Computed data will appear on the display and different kinds of displays can be selected. However, in case of ch. A, B, C etc. units will not appear on the display.

Recording and display ranges
The ranges of the recording and displays are: -19999 to 20000
In the case of computational channels(A~P): -9999999 to 99999999

Stacks
The μR1800 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.

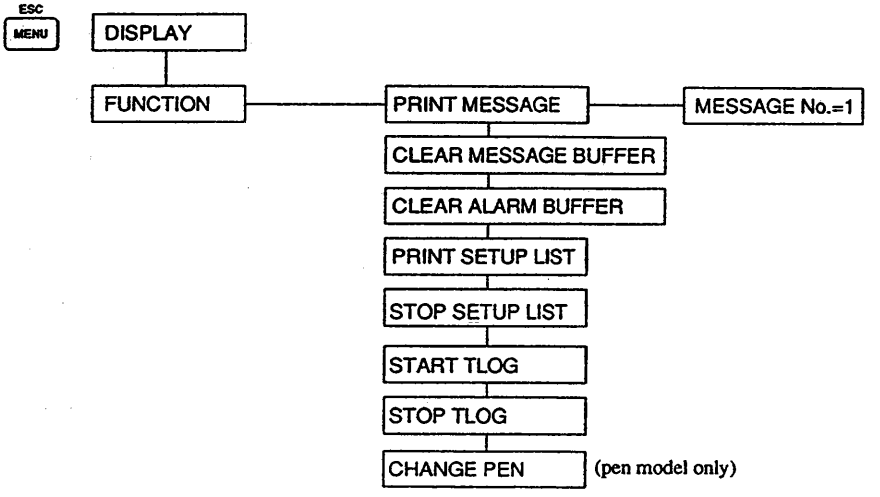
Errors
Errors will occur if any of the following is set:
- x/0, $\sqrt{(-x)}$ or LOG(–x);
- If SKIP channels are included in the computational expression.
The result will be + *****.

2.2 Flow Charts

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

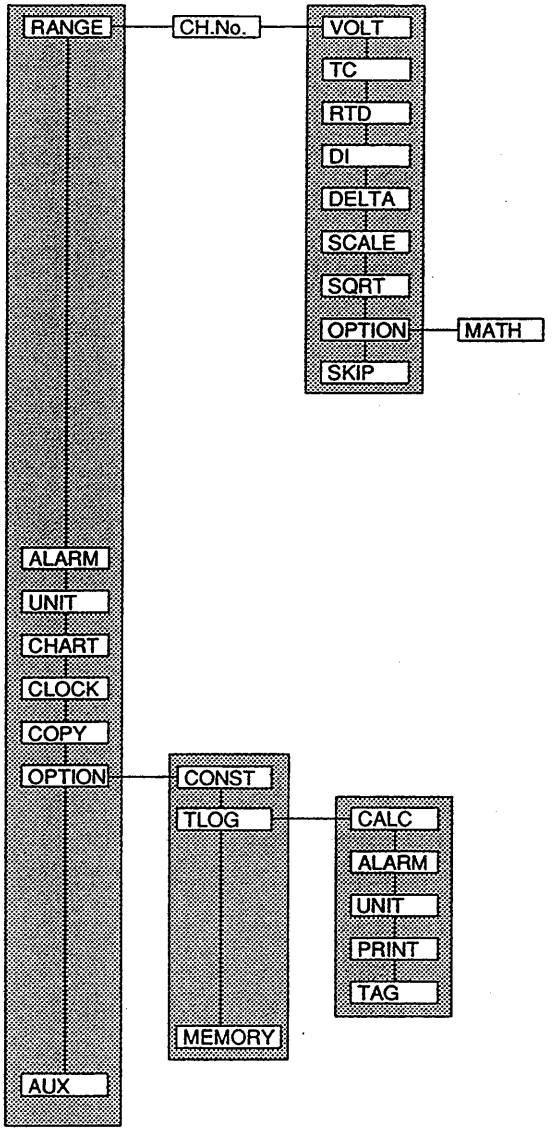
2.2.1 Flow Chart of Operation Mode

This flow can be entered by pressing the corresponding function key.



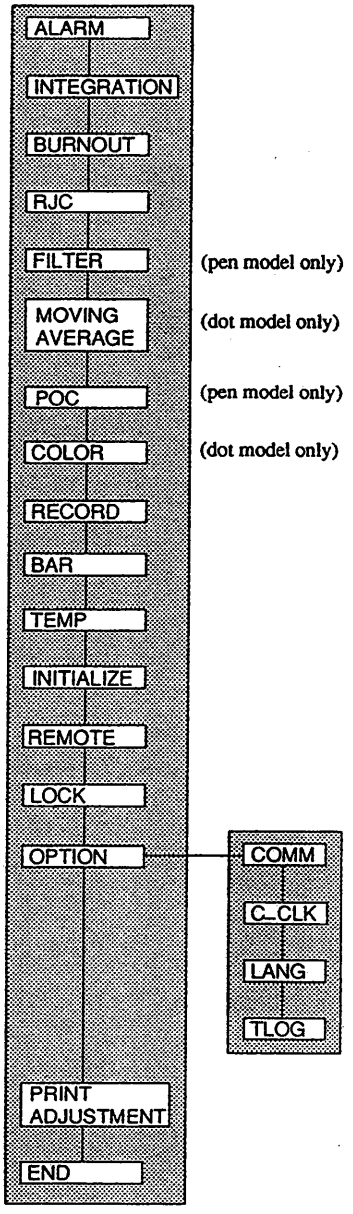
2.2.2 Flow Chart of SET Mode

This flow can be entered by pressing the MENU-key for three seconds.



2.2.3 Flow Chart of SET UP Mode

This flow can be entered by turning ON the power while pressing the ENT-key.



3 HOW TO SET COMPUTATIONS

This chapter describes the way to set the recorder to perform computations.
3.1 How to set constants
3.2 How to set arithmetic computations (+, –, /, *)
3.3 How to set SQR, ABS, LOG, EXP computations
3.4 How to set relational computations (<, >, =, ≠)
3.5 How to set logical computations (AND, OR, XOR, NOT)
3.6 How to set statistical computations (MAX, MIN, AVE, SUM)

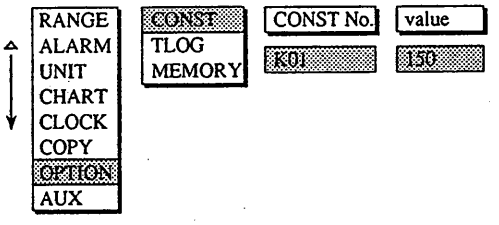
3.1 How to Set Constants

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:

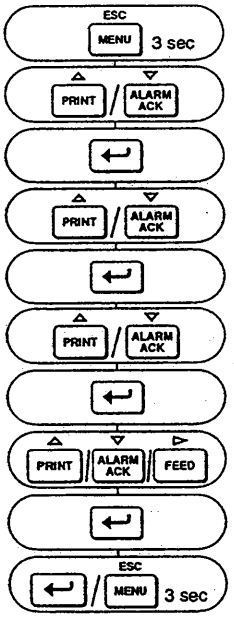
{ +9.9999E+29 to 1.0000E–30
{ 0
{ –1.0000E–30 to –9.9999E+30

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:



SETTING PROCEDURE:



SET=OPTION

Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=OPTION' display using the UP/DOWN-keys. Then press the ENT-key.

OPTION=CONST

Select the 'OPTION=CONST' display using the UP/DOWN-keys. Then press the ENT-key.

CONST=K01

Select the constant number you want to enter using the UP/DOWN-keys. Up to 10 constants can be entered (K01 to K10). Then press the ENT-key.

K01=150

Then enter the value of the constant using the UP/DOWN and RIGHT-keys. Up to 11 characters may be used.
Then press the ENT-key.

SET OK

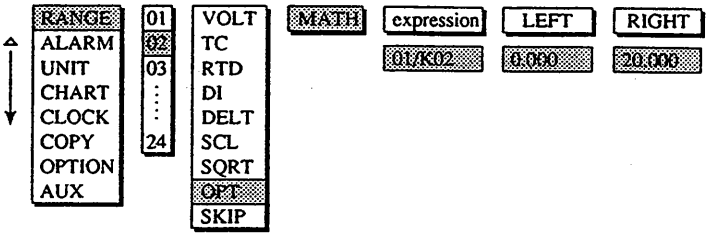
The setting is completed.
Press the ENT-key to return to the 'CONST=...' display; or press the ESC-key to return to go to the 'SET=OPTION' display; or press the MENU-key for three seconds to return to the Operation Mode.

3.2 How to Set Arithmetic Computations (+, –, /, *)

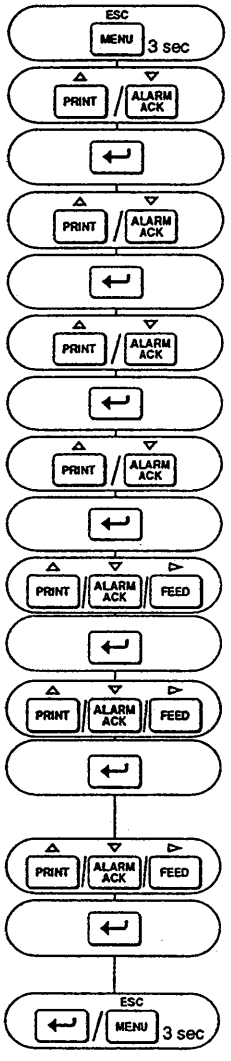
The following setting performs the setting of arithmetic computation as addition, subtraction, division and multiplication.

To set arithmetic computations, proceed as follows:

MENU:



SETTING PROCEDURE:



SET=RANGE

Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=RANGE' display using the UP/DOWN-keys. Then press the ENT-key.

02:MODE=

Use the UP/DOWN-keys to select the desired channel. Then press the ENT-key.

02:MODE=OPT

Use the UP/DOWN-keys to select 'OPT'. Then press the ENT-key.

02:OPTION MODE=MATH

Use the UP/DOWN-keys to select 'MATH'. Then press the ENT-key.

02:01/K02

Enter your expression using maximum 36 characters by the UP/DOWN and RIGHT-keys. Here you may use the preset constants. Then press the ENT-key.

02:LEFT=0.000

Enter the minimum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Then press the ENT-key.

02:RIGHT=20.000

Enter the maximum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Note that LEFT must be less than RIGHT. Then press the ENT-key.

SET OK

The setting is completed.
Press the ENT-key to return to the '02:MODE=OPT' display; or press the ESC-key to return to go to the 'SET=RANGE' display; or press the MENU-key for three seconds to return to the Operation Mode.

EXAMPLE:

Addition (+):	03=01+02
	Computes the value of channel 1 plus the value of channel 2
Subtraction (–):	03=01–02
	Computes the value of channel 1 minus the value of channel 2
Division (/):	02=01/K02
	Computes the value of channel 1 divided by constant number 2
Multiplication (*):	02=01*K03
	Computes the value of channel 1 multiplied by constant number 3

There is no restriction concerning the channel number on the left side of the equation and channel number(s) on the right side of the equation. Any channel number can be set.

NOTE When you set an expression as e.g. 03=03+02, channel 3 cannot accept any input anymore. But, as a result, the summation of channel number 2 will be displayed/ recorded in channel 3.

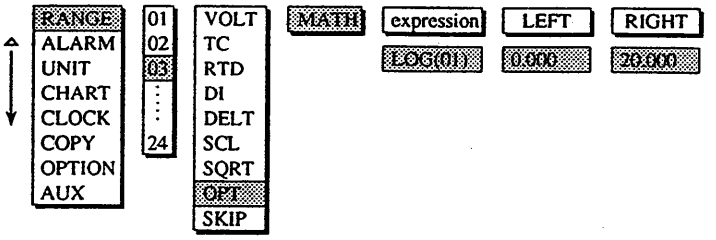
NOTE In the setting procedure described here, a measurement channel is used for computation. However, you can also use one of the extra channels for computation. Proceed as described in 3.6.1, where you can also enter an arithmetic expression.

3.3 How to Set SQR, ABS, LOG, EXP Computations

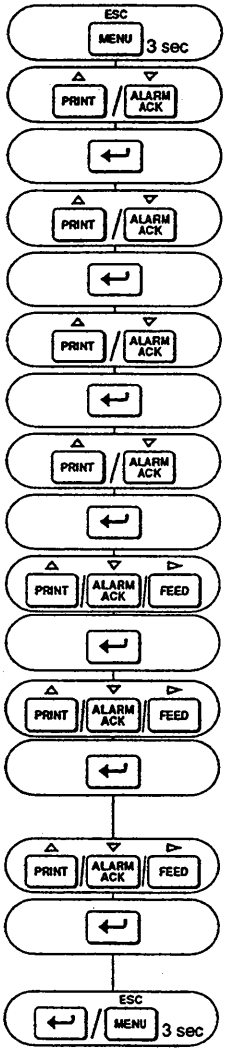
The following setting performs the setting of computations as square root, absolute value, common logarithm and exponent.

To set these computations, proceed as follows:

MENU:



SETTING PROCEDURE:



SET=RANGE

Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=RANGE' display using the UP/DOWN-keys. Then press the ENT-key.

03:MODE=

Use the UP/DOWN-keys to select the desired channel. Then press the ENT-key.

03:MODE=OPT

Use the UP/DOWN-keys to select 'OPT'. Then press the ENT-key.

03:OPTION MODE=MATH

Use the UP/DOWN-keys to select 'MATH'. Then press the ENT-key.

03:LOG(01)

Enter your expression using maximum 36 characters by the UP/DOWN and RIGHT-keys. Here you may use the preset constants. Then press the ENT-key.

03:LEFT=0.000

Enter the minimum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Then press the ENT-key.

3:RIGHT=20.000

Enter the maximum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Note that LEFT must be less than RIGHT. Then press the ENT-key.

SET OK

The setting is completed.
Press the ENT-key to return to the '03:MODE=OPT' display; or press the ESC-key to return to go to the 'SET=RANGE' display; or press the MENU-key for three seconds to return to the Operation Mode.

EXAMPLE:

Square root √:	02=SQR(01)
	Returns the square root of the measured value of channel 1
Absolute value:	02=ABS(01)
	Returns the absolute value of the measured value of channel 1
Logarithm:	03=LOG(01)
	Returns the common logarithm of the measured value of channel 1
Exponent:	04=EXP(01)
	Raises e to the power of the measured value of channel 1

There is no restriction concerning the channel number on the left side of the equation and channel number(s) on the right side of the equation. Any channel number can be set.

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 ln10=2.3025851.. Therefore, $10^x \approx \exp(x*2.3025851)$
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))

NOTE In the setting procedure described here, a measurement channel is used for computation. However, you can also use one of the extra channels for computation. Proceed as described in 3.6.1, where you can also enter an SQR, ABS, LOG, EXP expression.

3.4 How to Set Relational Computations (<, >, =, ≠)

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

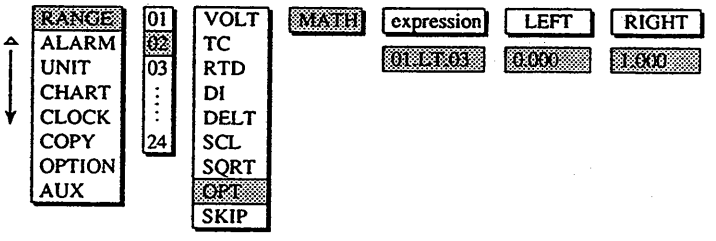
e1.LT.e2	e1 < e2
e1.GT.e2	e1 > e2
e1.EQ.e2	e1 = e2
e1.NE.e2	e1 ≠ e2

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

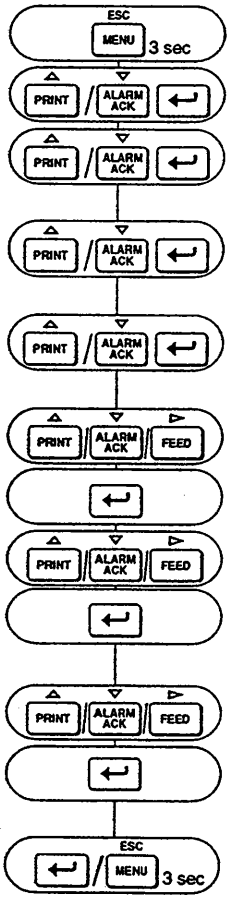
For e1 and e2, you can use:
- channels with measurement or computational functions
- channels with statistical (TLOG) functions
- constants (up to 10)

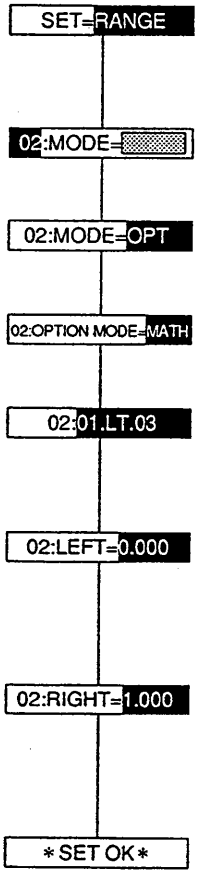
To set relational computations, proceed as follows:

MENU:



SETTING PROCEDURE:





Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=RANGE' display using the UP/DOWN-keys. Then press the ENT-key.

Use the UP/DOWN-keys to select the desired channel. Then press the ENT-key.

Use the UP/DOWN-keys to select 'OPT'. Then press the ENT-key.

Use the UP/DOWN-keys to select 'MATH'. Then press the ENT-key.

Enter your expression using maximum 36 characters by the UP/DOWN and RIGHT-keys. Then press the ENT-key.

Enter the minimum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Then press the ENT-key.

Enter the maximum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Note that LEFT must be less than RIGHT. Then press the ENT-key.

The setting is completed.
Press the ENT-key to return to the '02:MODE=OPT' display; or press the ESC-key to return to go to the 'SET=RANGE' display; or press the MENU-key for three seconds to return to the Operation Mode.

EXAMPLE: 01=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'. There is no restriction concerning the channel number on the left side of the equation and channel number(s) on the right side of the equation. Any channel number can be set.

NOTE In the setting procedure described here, a measurement channel is used for computation. However, you can also use one of the extra channels for computation. Proceed as described in 3.6.1, where you can also enter an relational expression.

3.5 How to Set Logical Computations (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:
e1=0, e2=0 } e1ANDe2=0
e1≠0, e2=0 } e1ANDe2=0
e1=0, e2≠0 } e1ANDe2=0
e1≠0, e2≠0 } e1ANDe2=1

OR Logical sum

Syntax: e1ORe2
Condition: If both e1 and e2 are '0', the operation results in '0', otherwise in '1'.
Status:
e1=0, e2=0 } e1ORe2=0
e1≠0, e2=0 } e1ORe2=1
e1=0, e2≠0 } e1ORe2=1
e1≠0, e2≠0 } e1ORe2=1

XOR Mutually exclusive logical sum

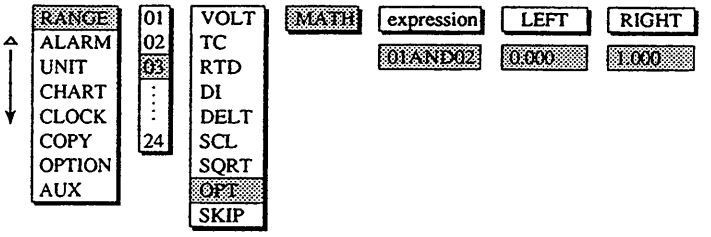
Syntax: e1XORe2
Condition: If e1 and e2 have different values, the operation results in '1', otherwise in '0'.
Status:
e1=0, e2=0 } e1XORe2=0
e1≠0, e2=0 } e1XORe2=1
e1=0, e2≠0 } e1XORe2=1
e1≠0, e2≠0 } e1XORe2=0

NOT Logical negation

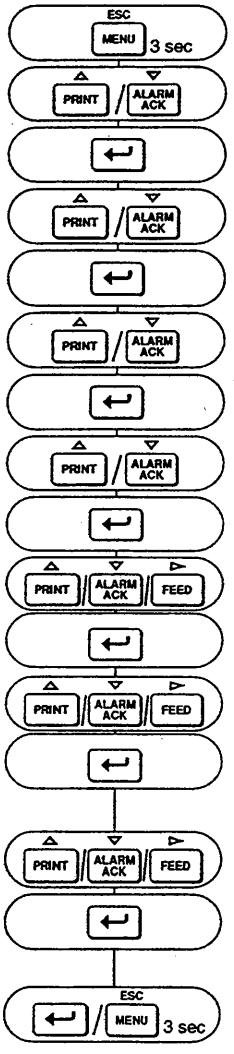
Syntax: NOTe1
Condition: Reverses the value of data e1
Status:
e1=0 NOTe1=1
e1≠0 NOTe1=0

To set relational computations, proceed as follows:

MENU:



SETTING PROCEDURE:



SET=RANGE

Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=RANGE' display using the UP/DOWN-keys. Then press the ENT-key.

03:MODE=

Use the UP/DOWN-keys to select the desired channel. Note that this channel can now only be used for computation. Then press the ENT-key.

03:MODE=OPT

Use the UP/DOWN-keys to select 'OPT'. Then press the ENT-key.

03:OPTION MODE=MATH

Use the UP/DOWN-keys to select 'MATH'. Then press the ENT-key.

03:01AND02

Enter your expression using maximum 36 characters by the UP/DOWN and RIGHT-keys. Then press the ENT-key.

03:LEFT=0.000

Enter the minimum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Then press the ENT-key.

03:RIGHT=1.000

Enter the maximum value of the recording span of the computation result using the UP/DOWN and RIGHT-keys. The number of significant digits is 5. The setting range is –20000 to 20000. Note that LEFT must be less than RIGHT. Then press the ENT-key.

SET OK

The setting is completed.
Press the ENT-key to return to the '03:MODE=OPT' display; or press the ESC-key to return to go to the 'SET=RANGE' display; or press the MENU-key for three seconds to return to the Operation Mode.

EXAMPLE: 03=01AND02

Channel 3 is set to compute the logical product of channel 1 and channel 2. There is no restriction concerning the channel number on the left side of the equation and channel number(s) on the right side of the equation. Any channel number can be set.

NOTE In the setting procedure described here, a measurement channel is used for computation. However, you can also use one of the extra channels for computation. Proceed as described in 3.6.1, where you can also enter an logical expression.

3.6 How to Set and Use Statistical Computations (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

The results of these computations can be recorded on the chart digitally.
The range of these computations is (digital recording & display):
–9999999 to 99999999

For e1, you can use:
- values of the channels 01 up to 04 in case of the pen model
- values of the channels 01 up to 24 in case of the dot model

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

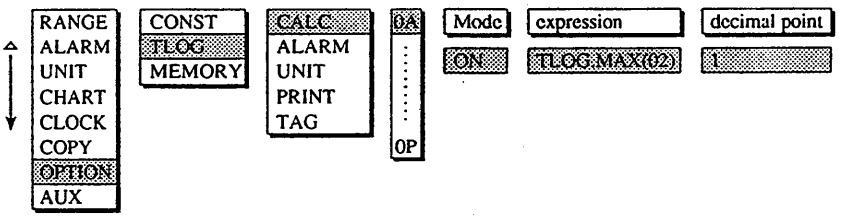
Syntax: TLOG.SUM(e1)
Result: Computes the summation of channel e1

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 Setting the initial TLOG settings
3.6.3 Start/stop the TLOG computation

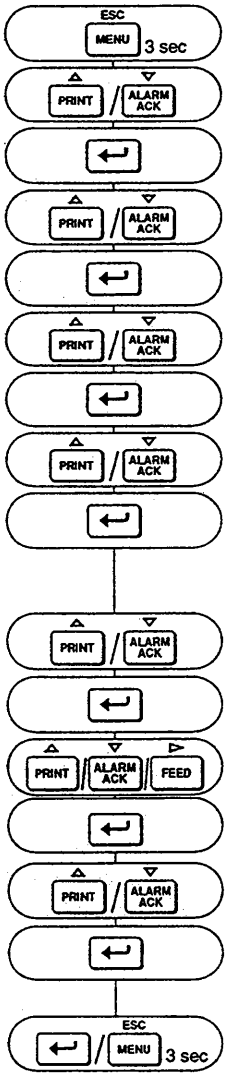
3.6.1 Entering the Expression

To enter the expression for statistical computation is described below. Up to 4 channels can be used for this computation in case of the pen model, and up to 12 channels in case of the dot printing model. Up to 36 characters can be entered for each expression.
Proceed as follows:

MENU:



SETTING PROCEDURE:



SET=OPTION

Press the MENU-key for three seconds to enter the SET Mode.
Select the 'SET=OPTION' display using the UP/DOWN-keys.
Then press the ENT-key.

OPTION=TLOG

Use the UP/DOWN-keys to select 'OPTION=TLOG'.
Then press the ENT-key.

TLOG=CALC

Use the UP/DOWN-keys to select 'TLOG=CALC'.
Then press the ENT-key.

0A:MODE=

Use the UP/DOWN-keys to select the desired channel (exclusive computational channel). You can select from A, B, C, D for the pen models or from A, B, C, D, E, F, G, H, J, K, L, M, N, or P for the dot models.
Then press the ENT-key.

0A:MODE=ON

Use the UP/DOWN-keys to select to use this channel (ON) or not (OFF). Initially all are set to OFF.
Then press the ENT-key.

0A:TLOG.MAX(02)

Enter your expression using maximum 36 characters by the UP/DOWN and RIGHT-keys. Preset constants may be used here.
Then press the ENT-key.

0A:DECIMAL POINT=1

Select the number of positions after the decimal point using the UP/DOWN-keys. This position is necessary for the display/recording of the results. Selectable from 0, 1, 2, 3 or 4.
Then press the ENT-key.

SET OK

The setting is completed.
Press the ENT-key to return to the '0A:MODE=...' display; or press the ESC-key to return to go to the 'SET=OPTION' display; or press the MENU-key for three seconds to return to the Operation Mode.

NOTE When you are using the exclusive computational channels (A, B...), any computation may be entered for the expression (as arithmetic expressions, etc.).
During computations in the channels A, B...etc. are in progress, range settings and expressions cannot be changed.

3.6.2 Setting the Initial TLOG Settings

The way to set the initial TLOG settings is described below. The settings consist of selecting:
- whether TLOG is triggered internally or by remote;
- whether reference time of the printout of computational results is of the absolute or relative type;
- the desired interval between printouts;
- the desired scale of the computed data;
- whether data should be reset when printouts start or not.

Proceed as follows:

SETTING PROCEDURE:

Enter the SET UP Mode by turning 'ON' the power while pressing and holding the ENT-key until the SET UP display appears.

Use the UP/DOWN-keys to select the display 'SETUP=OPT'. Press the ENT-key.

Use the UP/DOWN-keys to select the display 'OPT=TLOG'. Press the ENT-key.

Select if the TLOG computation should be triggered by key-board / RS-422-A communications (INT) or by remote (EXT). Then press the ENT-key. In the case of EXT, make sure to set this at the remote setting too (see 9.8 of IM4H3B1-01E/4H3B4-01E). Press the ENT-key. The initial value is INT.

Select the reference time of the printout of computational results to be absolute (ABS) or relative (RELTV). Press the ENT-key. The initial value is ABS.
Absolute means that as a reference time, the time entered at the periodic printout setting (see 9.4.6 of IM4H3B1-01E/4H3B4-01E) will be used. (In the case that the periodic printout is triggered by remote, only at times when the remote contact turns ON printouts will occur.) Note that the TLOG must be started (see 3.6.3) before printout occurs.
Relative means that as a reference time, the actual time when the TLOG computation starts, will be used.

Select the interval between two printouts of the computational results. Printouts will occur at the reference time (on condition that TLOG has been started in case of ABS), and each following time this interval has elapsed. Press the ENT-key. The initial value is 1 h.
In the case of ABS, the interval can be selected from 10 min to 24 hrs in 12 steps.
In the case of RELTV, the interval can be set from as small as one minute up to 24 hrs.

Select the scale for SUM computation. Data will be computed each sample for the dot model and each 125ms for the pen model. For data which have a scale like /s, /min or /h, (e.g. flow measurement), you may select a different scale to get the correct result. For other cases than SUM, OFF is also selectable. Press the ENT-key. The initial value is OFF.

Select if you want to have your calculated results reset when each printout starts (ON) or not (OFF). Press the ENT-key. The initial value is ON.

The display '*TLOG SET*' will appear.
The TLOG setting has been completed, but has not been stored yet. Press the ENT-key to return to the 'TLOG=...' display or the ESC-key to adjust other settings in the SET UP Mode.

Before leaving the SET UP Mode, you have to store your new settings. Press the ESC-key to return to the 'SETUP=OPT' display and then select the 'SETUP=END' display.
Press the ENT-key. Select 'END=STORE' to keep your new settings or 'END=ABORT' and press the ENT-key. After a few seconds, the Operation Mode will appear.

EXPLANATION

ABS vs. RELTV

In the case of ABS, the reference time for printouts of computational results will be the time entered at the periodic printout setting (see 9.4.6 of IM4H3B1-01E/4H3B4-01E).

ex1:
Suppose TIME=ABS and TLOG computation has started (see 3.6.3)
Suppose START=00:00, INTVL2=12h
Printouts of computational results will be done at 00:00 and at 12:00

ex2:
Suppose TIME=ABS and TLOG computation has started (see 3.6.3)
Suppose START=01:00, INTVL2=12h
Printouts of computational results will be done at 01:00 and at 13:00

ex3:
Suppose TIME=ABS and TLOG computation has started (see 3.6.3)
Suppose START=01:00, INTVL2=10min
Printouts of computational results will be done at 01:00, 01:10, 01:20 etc.

ex4:
Suppose TIME=ABS, but TLOG computation has not been started yet (see 3.6.3)
Suppose START=00:00, INTVL2=10min and TLOG starts at 0:05
Printouts of computational results will be done at 00:10, 00:20, etc. (NOT at 0:05, 0:15, because START time is reference; NOT at 00:00, because TLOG computation had not been started yet)

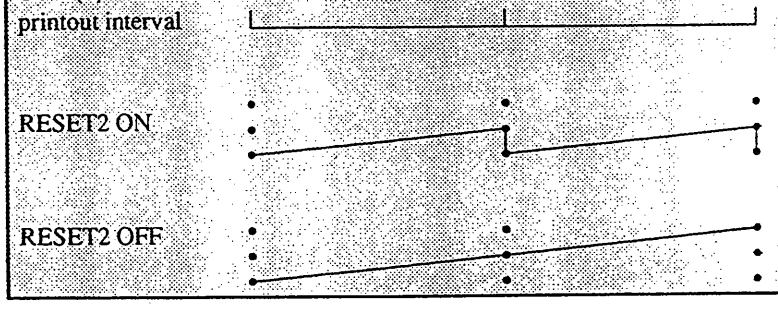
In the case of RELTV, the reference time for periodic printouts of computations will be the time when the TLOG computation is started.
ex1:
Suppose TIME=RELTV
Suppose INTVL2=00:13; From the time the TLOG computation starts, every 13 minutes a printout will occur.

SCALE

Let's assume a SUM-expresston, for the pen model. In that case, every 125ms a value will be added to the computational result.
Example:
Input: flow x m^3/s
Sampling interval: 125 ms (8 times each second)
scale2: /s
In this case the data which will be used for SUM computation will be 1/8 of the input.
This results in ($8xm^3/s$)/8, which leaves the correct result.

RESET

The computational results can be selected to be reset to 0 at each time the printout starts.
Example:



3.6.3 Start/Stop the TLOG Computation

The way to start/stop TLOG computation can be done by panel, by remote triggering or by RS-422-A communication. For remote triggering, refer to 9.8 of IM4H3B1-01E/ 4H3B4-01E. For communication by RS-422-A, refer to 9.3 of this manual.
The operation by panel keys is described below.

To start the TLOG computation, proceed as follows:
Press the MENU-key and select the 'MENU=SELECT_FUNCTION' display using the UP/DOWN- keys. Then press the ENT-key.
Select the 'START_TLOG' display using the UP/DOWN-keys. Press the ENT-key, and the TLOG computation will start.

To stop the TLOG computation, proceed as follows:
Press the MENU-key and select the 'MENU=SELECT_FUNCTION' display using the UP/DOWN- keys. Then press the ENT-key.
Select the 'STOP_TLOG' display using the UP/DOWN-keys. Press the ENT-key, and the TLOG computation will stop.
The μR1800 returns to the recording previously in progress.

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.

NOTE If the power is turned OFF while TLOG computation is in progress, the computation results will be kept for one hour (under normal operating conditions as specified on page 10-7 of the main IM). When the power is turned ON again within one hour, TLOG computation will start using the last values before the power turned OFF. If the power is turned OFF after the TLOG computation has finished, results will not be kept.

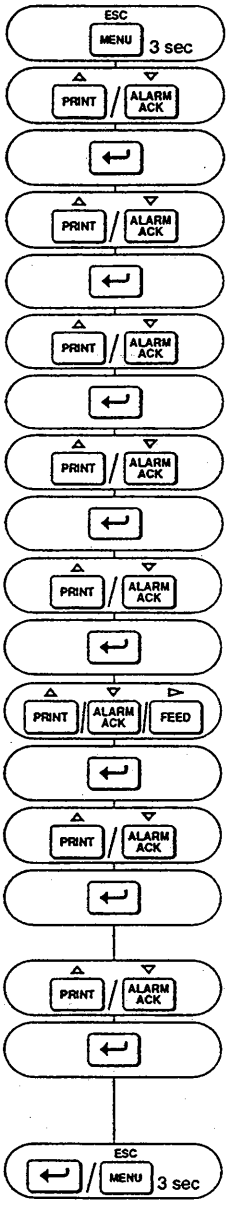
4 HOW TO SET AN ALARM

This chapter describes the way to set an alarm for channels used for computations.
4.1 How to set an alarm on a measurement channel used for computation
4.2 How to set an alarm on the extra computation channels

4.1 How to Set an Alarm on a Measurement Channel used for Computation

The way to set an alarm on a measurement channel used for computation (1 up to 4 for the pen model and 1 up to 24 for the dot model) is same as if the channel were used for measurement only. For details, refer to IM4H3B1-01E/4H3B4-01E, section 7.2.

SETTING PROCEDURE:



SET=ALARM

Press the MENU-key for three seconds to enter the SET mode. Select the 'SET=ALARM' display by using the UP/DOWN-keys. Then press the ENT-key.

01:ALARM LEVEL=

Specify the desired channel using the UP/DOWN-keys, and press the ENT-key.

01:ALARM LEVEL=1

Specify the desired level of the alarm using the UP/DOWN-keys. Up to four levels can be set. Then press the ENT-key.

01/1:ALARM=ON

Select the status of the alarm (ON or OFF) by using the UP/DOWN-keys. Initially all are set to OFF. Then press the ENT-key. When OFF is selected, setting is completed.

01/1:TYPE=H

Then enter the type of alarm. Six types are available. After selection by using the UP/DOWN-keys, press the ENT-key.

01/1: VALUE=2.000

Then enter the alarm value using the UP/DOWN and RIGHT-keys. After setting, press the ENT-key.

01/1:RELAY=ON

Specify whether an output relay should be activated (ON) or not (OFF). Note that output relays are optional (/A1, 2 or 3). If the option is not installed, data entry will be ignored. After selection, using the UP/DOWN-keys, press the ENT-key.

01/1:RELAY No.=I01

Then specify the output relay number using the UP/DOWN-keys. Up to 24 output relays I01 to I24 can be specified, depending on the option. Note that when you specify a relay, with which your μR1800 is not equipped, data entry will be ignored.
Then press the ENT-key.

SET OK

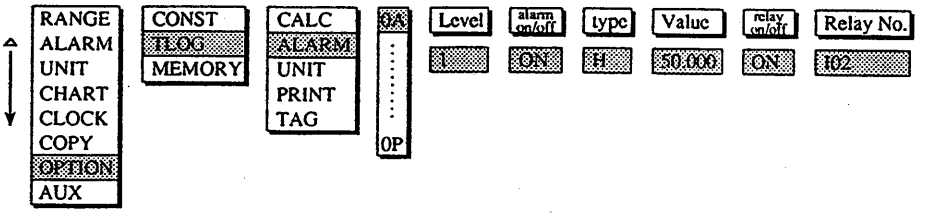
The setting is completed.
Press the ENT-key to return to the '01:ALARM LEVEL=1' display; or press the ESC-key to go to the 'SET=ALARM' display; or press the MENU-key for three seconds to return to the Operation mode.

4.2 How to Set an Alarm on the Extra Computation Channels

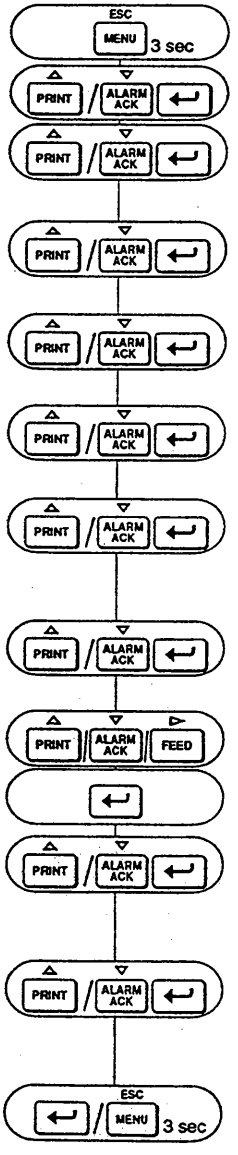
It is possible to set alarms on the extra channels used for computation (A to D for the pen model, A to P for the dot model). In this case only 2 types of alarms are selectable, namely High (H) and Low (L). Hysteresis for these alarms is always 0%. Alarms can not be set (or will be canceled) to computational 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:



SETTING PROCEDURE:



SET=OPTION

Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=OPTION' display using the UP/DOWN-keys. Then press the ENT-key.

OPTION=TLOG

Select the 'OPTION=TLOG' display using the UP/DOWN-keys. Then press the ENT-key.

TLOG=ALARM

Select the 'TLOG=ALARM' display using the UP/DOWN-keys. Then press the ENT-key.

0A:ALARM LEVEL=

Select the channel (character) using the UP/DOWN-keys for which you want to set an alarm. Press the ENT-key.

0A:ALARM LEVEL=1

Then select the alarm level using the UP/DOWN-keys. Up to 4 levels can be set. Then press the ENT-key.

0A/1:ALARM=ON

Select the status of the alarm (ON or OFF) by using the UP/DOWN-keys. Initially all are set to OFF. Then press the ENT-key. When OFF is selected, setting is completed.

0A/1:TYPE=H

Then enter the type of alarm. Two types are available. After selection by using the UP/DOWN-keys, press the ENT-key.

0A/1:VALUE=50.000

Then enter the alarm value using the UP/DOWN and RIGHT-keys. After setting, press the ENT-key. The range is –9999999 to 99999999.

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 UP/DOWN-keys, press the ENT-key.

0A/1:RELAY No.=I02

Then specify the output relay number using the UP/DOWN-keys. Up to 24 output relays I01 to I24 can be specified, depending on the option. Then press the ENT-key.

SET OK

The setting is completed.
Press the ENT-key to return to the '0A:ALARM LEVEL=...' display; or press the ESC-key to go to the 'SET=OPTION' display; or press the MENU-key for three seconds to return to the Operation mode.

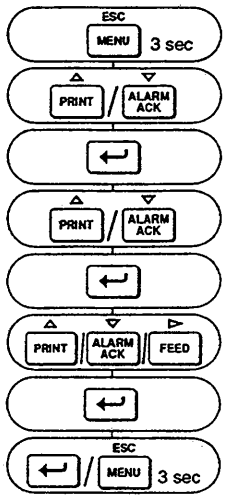
5 HOW TO APPEND UNITS

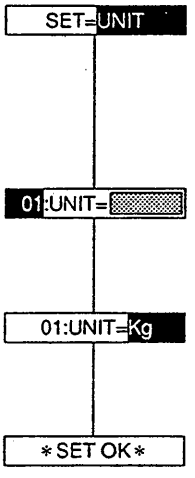
This chapter describes the way to append units to channels used for computations.
5.1 How to append units to a measurement channel used for computation
5.2 How to append units to the extra computation channels

5.1 How to Append Units to a Measurement Channel used for Computation

The way to append a unit to a measurement channel used for computation (1 up to 4 for the pen model, 1 up to 24 for the dot model) is same as if the channel were used for measurement only. For details, refer to IM4H3B1-01E/4H3B4-01E, section 7.3.

SETTING PROCEDURE:





Press the MENU-key for three seconds to enter the SET mode. Select the 'SET=UNIT' display by using the UP/DOWN-keys. Then press the ENT-key.

Specify the desired channel using the UP/DOWN-keys, and press the ENT-key.

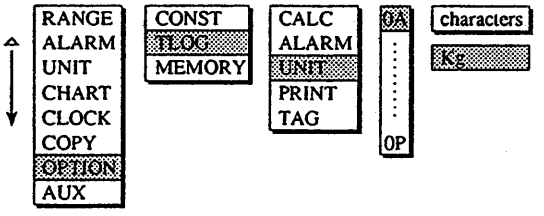
Type the desired unit (up to six characters) using the UP/DOWN and RIGHT-keys. Then press the ENT-key.

The setting is completed.
Press the ENT-key to return to the '01:UNIT=...' display; or press the ESC-key to go to the 'SET=UNIT' display; or press the MENU-key for three seconds to return to the Operation mode.

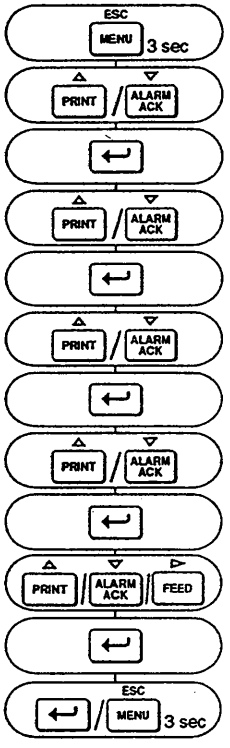
5.2 How to Append Units to the Extra Computation Channels

It is possible to append units to the extra channels used for computation (A to D for the pen model, A to P for the dot model).

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



SETTING PROCEDURE:



SET=OPTION

Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=OPTION' display using the UP/DOWN-keys. Then press the ENT-key.

OPTION=TLOG

Select the 'OPTION=TLOG' display using the UP/DOWN-keys. Then press the ENT-key.

TLOG=UNIT

Select the 'TLOG=UNIT' display using the UP/DOWN-keys. Then press the ENT-key.

0A:UNIT=

Select the channel (character) using the UP/DOWN-keys to which you want to append a unit. Press the ENT-key.

0A:UNIT=Kg

Type the desired unit (up to six characters) using the UP/DOWN and RIGHT-keys. Then press the ENT-key.

SET OK

The setting is completed.
Press the ENT-key to return to the '0A:UNIT=...' display; or press the ESC-key to go to the 'SET=OPTION' display; or press the MENU-key for three seconds to return to the Operation mode.

6 PRINTOUT OF COMPUTATIONAL RESULTS

This chapter describes the way to set a printout of computational results for channels used for computation.

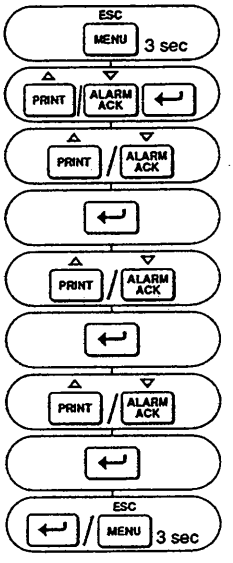
6.1 How to set a printout for a measurement channel used for computation

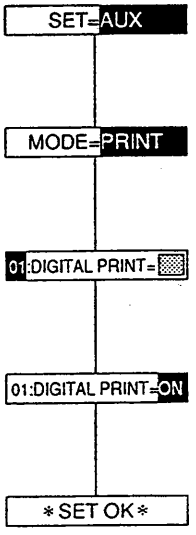
6.2 How to set a printout for the extra computation channels

6.1 How to Set a Printout for a Measurement Channel used for Computation

The way to set a printout of computational results for a measurement channel used for computation (1 up to 4 for the pen model, 1 up to 24 for the dot model) is same as if the channel were used for measurement only. For details, refer to IM4H3B1-01E/4H3B4-01E, section 8.2.1.

SETTING PROCEDURE:





Press the MENU-key for three seconds to enter the SET mode. Select the 'SET=AUX' display by using the UP/DOWN-keys. Then press the ENT-key.

Select the 'MODE=PRINT' display using the UP/DOWN-keys. Then press the ENT-key.

Specify the desired channel using the UP/DOWN-keys, and press the ENT-key.

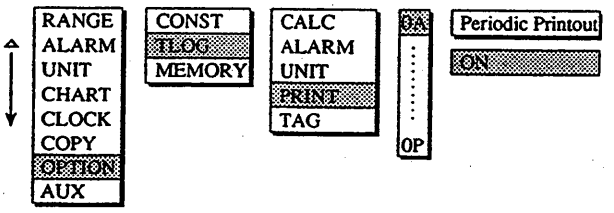
Then select ON or OFF using the UP/DOWN-keys. Then press the ENT-key.

The setting is completed.
Press the ENT-key to return to the '01:DIGITAL PRINT=...' display; or press the ESC-key to go to the 'SET=AUX' display; or press the MENU-key for three seconds to return to the Operation mode.

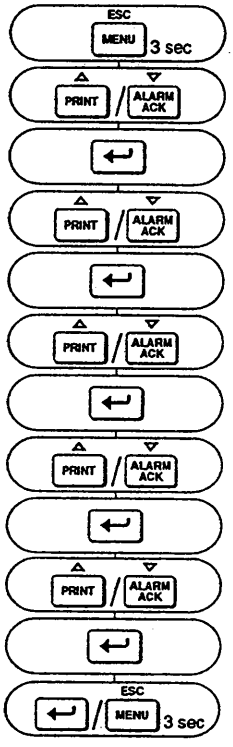
6.2 How to Set a Printout for the Extra Computation Channels

It is possible to set a printout for the extra channels used for computation (A to D for the pen model, A to P for the dot model).

To set a periodic printout for an extra computation channel, proceed as follows:
MENU:



SETTING PROCEDURE:



SET=OPTION

Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=OPTION' display using the UP/DOWN-keys. Then press the ENT-key.

OPTION=TLOG

Select the 'OPTION=TLOG' display using the UP/DOWN-keys. Then press the ENT-key.

TLOG=PRINT

Select the 'TLOG=PRINT' display using the UP/DOWN-keys. Then press the ENT-key.

0A:DIGITAL PRINT=

Select the channel (character) using the UP/DOWN-keys for which you want to set a periodic printout. Press the ENT-key.

0A:DIGITAL PRINT=ON

Select ON or OFF using the UP/DOWN and RIGHT-keys. Then press the ENT-key.

SET OK

The setting is completed.
Press the ENT-key to return to the '0A:DIGITAL PRINT=...' display; or press the ESC-key to go to the 'SET=OPTION' display; or press the MENU-key for three seconds to return to the Operation mode.

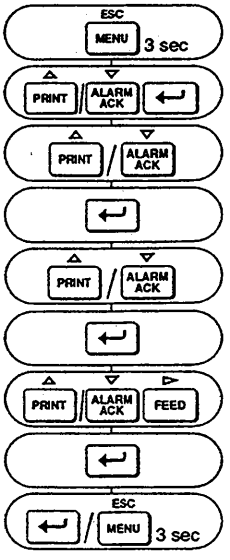
7 HOW TO SET A TAG

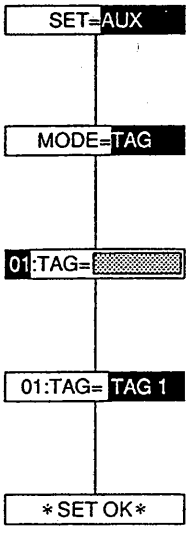
This chapter describes the way to set a tag for channels used for computation.
7.1 How to set a tag for a measurement channel used for computation
7.2 How to set a tag for the extra computation channels

7.1 How to Set a Tag for a Measurement Channel used for Computation

The way to set a tag for a measurement channel used for computation (1 up to 4 for the pen model, 1 up to 24 for the dot model) is same as if the channel were used for measurement only. For details, refer to IM4H3B1-01E/4H3B4-01E, section 8.2.2.

SETTING PROCEDURE:





Press the MENU-key for three seconds to enter the SET mode.
Select the 'SET=AUX' display by using the UP/DOWN-keys.
Then press the ENT-key.

Select the 'MODE=TAG' display using the UP/DOWN-keys.
Then press the ENT-key.

Specify the desired channel using the UP/DOWN-keys, and press the ENT-key.

Then enter the desired characters using the UP/DOWN and RIGHT-keys. The maximum length is seven characters.
Then press the ENT-key.

The setting is completed.
Press the ENT-key to return to the '01:TAG=...' display; or press the ESC-key to go to the 'SET=AUX' display; or press the MENU-key for three seconds to return to the Operation mode.

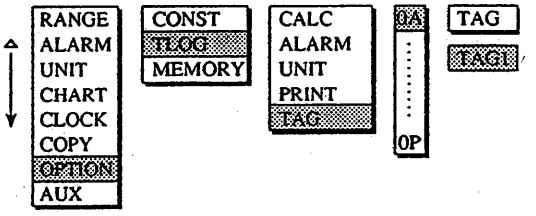
NOTE It is also necessary to set the CH/TAG-setting in the SET UP Mode to get the tag printout and display. See 9.4.1 of IM4H3B1-01E/4H3B4-01E.

7.2 How to Set a Tag for the Extra Computation Channels

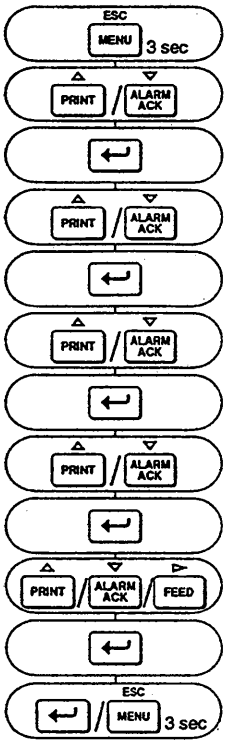
It is possible to set a tag for the extra channels used for computation (A to D for the pen model, A to P for the dot model).

To set a tag for an extra computation channel, proceed as follows:

MENU:



SETTING PROCEDURE:



SET=OPTION	Press the MENU-key for three seconds to enter the SET Mode. Select the 'SET=OPTION' display using the UP/DOWN-keys. Then press the ENT-key.
OPTION=TLOG	Select the 'OPTION=TLOG' display using the UP/DOWN-keys. Then press the ENT-key.
TLOG=TAG	Select the 'TLOG=TAG' display using the UP/DOWN-keys. Then press the ENT-key.
0A:TAG=	Select the channel (character) using the UP/DOWN-keys for which you want to set a periodic printout. Press the ENT-key.
0A:TAG=TAG1	Enter the desired characters using the UP/DOWN and RIGHT-keys. The maximum length is seven characters. Then press the ENT-key.
SET OK	The setting is completed. Press the ENT-key to return to the '0A:TAG=...' display; or press the ESC-key to go to the 'SET=OPTION' display; or press the MENU-key for three seconds to return to the Operation mode.

8 STATUS OF COMPUTATIONAL CHANNELS

This chapter describes the way to use the VIEW display which shows the status of the statistical operations.
8.1 Explanation of the VIEW display
8.2 How to select the VIEW display

8.1 Explanation of the VIEW Display

When watching the VIEW display, you can monitor the status of the computations performed in the channels A, B, C, etc.. This is the only way to certify on the display whether the computations in these channels are in progress or not (of course the results of the computations will be digitally printed on the chart as well).

When statistical computations (TLOG) are in progress, the capital 'S' can be seen on the VIEW display. Other capitals show the statuses of different options. Refer to specific option Manuals.

8.2 How to Select the VIEW Display

The way to select the VIEW Display is described below.

1 Starting from the basic operation display, press the MENU-key.

2 Select the display 'MENU=SELECT_DISPLAY' using the UP/DOWN-keys.

3 Press the ENT-key.
You have now entered the following flow:

DISPLAY_AUTO
DISPLAY_MANUAL
DISPLAY_CLOCK
DISPLAY_VIEW

4 Select the VIEW display using the UP/DOWN-keys.

5 Press the ENT-key.
After having pressed the ENT-key, the VIEW display will appear.

To change the VIEW display to another display, handle as described in steps 1 to 5 again, while selecting the desired display.

9 COMPUTATIONS BY RS-422-A

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

9.1 How to Set Constants by RS-422-A

For details concerning setting commands for RS-422-A, refer to IM4H3B1-10E, section 2.1.

The range of the constant must be within:

{ +9.9999E+29 to 1.0000E–30
{ 0
{ –1.000E–30 to –9.9999E+30

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.

9.2 How to Set Computations by RS-422-A

This paragraph describes the way to set computations by RS-422-A.
To enter the computational expression (and related settings) in a measurement channel (channel 1, 2, 3, etc.), refer to 9.2.1.
To enter the computational expression (and related settings) in an extra MATH-channel (channel A, B, C, etc.), refer to 9.2.2.
For details concerning the RS-422-A option, refer to IM 4H3B1-10E.

9.2.1 Setting Computations by RS-422-A in Measurement Channels

This paragraph describes the way to set computations by RS-422-A in a measurement channel which is used for computation. When set, this channel cannot be used for measurement anymore, but solely for computation.
The way to set the specific items is described below:

EXPRESSION

format: **SRp1, OPT, MATH, p2, p3, p4, p5**

- p1: channel number (01 to 24, depending on your model)
- p2: computational expression (up to 36 characters)
- p3: the minimum value of the recording span. The number of significant digits is 5. The setting range is -20000 to 20000.
- p4: the maximum value of the recording span. The number of significant digits is 5. The setting range is -20000 to 20000.
- p5: decimal point position (0 to 4, which stands for the number of digits after the decimal point)

example: **SR01, OPT, MATH, 02+K02, 0, 200, 1**

NOTE The parameters p3, p4 and p5 cannot be omitted in this setting

ALARM

The setting of alarms on measurement channels used for computations can be done the same way as if the channels were used for measurement only. See also IM 4H3B1-10E, section 2.1.3.

UNIT

The setting of units for measurement channels used for computations can be done the same way as if the channels were used for measurement only. See also IM 4H3B1-10E, section 2.1.4.

PRINTOUT of COMPUTATIONAL RESULTS

The setting of the a printout of computational results for measurement channels used for computations can be done the same way as if the channels were used for measurement only. See also IM 4H3B1-10E, section 2.1.11.

TAG

The setting of tags for measurement channels used for computations can be done the same way as if the channels were used for measurement only. See also IM 4H3B1-10E, section 2.1.12.

9.2.2 Setting Computations by RS-422-A in Extra MATH-Channels

This paragraph describes the way to set computations by RS-422-A in an extra MATH-channel. The pen model is equipped with 4 extra channels (A, B, C, D), where the dot model has 12 channels (A, B, C, D, E, F, G, J, K, M, N, P).
The way to set the specific items is described below:

EXPRESSION

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

- p1: channel number (0A to 0P, depending on your model)
- ON/OFF: set computational channel ON or OFF
- p2: computational expression (up to 36 characters)
- p3: 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 0P, 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 of OFF
- p6: specifying the alarm output relay number. Selectable from I01 to I24, according to your option.

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

UNIT

format: **SVp1, p2**

- p1: channel number (0A to 0P, depending on your model)
- p2: unit characters (up to 6)

example: **SV0A, kg**

PRINTOUT of COMPUTATIONAL RESULTS

format: **SIp1, p2**

- p1: channel number (0A to 0P, depending on your model)
- p2: ON or OFF

example: **SI0A, ON**

TAG

format: **SQp1, p2**

- p1: channel number (0A to 0P, depending on your model)
- p2: tag characters (up to 7)

example: **SQ0A, TAG 1**

9.3 How to Start/Stop the TLOG Computations by RS-422-A

This paragraph describes the way to start/stop the TLOG computations by RS-422-A. For details concerning Program Control Commands, refer to IM4H3B1-10E, 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.

9.4 Output Formats for Computations by RS-422-A

For details concerning output formats for computations, refer to IM4H3B1-10E, section 3.2.
The formats which can be used to output computed data:
- TS0 + ESC T + FM0 (2); outputs computed values in ASCII Mode, see 9.4.1.
- TS0 + ESC T + FM1 (3); outputs computed values in Binary Mode, see 9.4.2.

9.4.1 Output Format of Computed Values in the ASCII Mode

For details concerning output formats for computations in the ASCII Mode, refer to IM4H3B1-10E, section 3.2.1.
When the TS0, ESC T and FM0 (or 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
FM0, p1, p2	selects channel from which computed values are output in the ASCII mode, where p1 is the channel number (01, 02, 03, etc.) from where the output should start, and p2 is the channel number (01, 02, 03, etc.) where the output should end.
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 FM0, FM2:

DATEYYMMDD$C_R L_F$ (year, month, day)

TIMEHHMMSS$C_R L_F$ (hour, minute, second)

□□AAAAUUUUUUCC, ±DDDDDE±EE$C_R L_F$
1 2 3 4 1 2 3 4 5 6

- Data exponent
  E±2 digits
- Data mantissa
  ±5 digits (±8 digits in case of FM2)
- Channel number
  01 to 24
  (0A to 0P in case of FM2)
- Units
  mV□□□□ mV
  V□□□□□ V
  □C□□□□ °C
  □F□□□□ °F
  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
  h : Difference high limit alarm (in case of FM0 only)
  l : Difference low limit alarm (in case of FM0 only)
  R : Rate-of-change limit on increase (in case of FM0 only)
  r : Rate-of-change limit on decrease (in case of FM0 only)
  □ : No alarm
- Data status
  □ space : middle and other data
  E : end of data
- Data status
  N : normal
  D : differential data (DELT) (in case of FM0 only)
  O : overrange; data ± 99999 (± 99999999 in case of FM2)
  S : skip

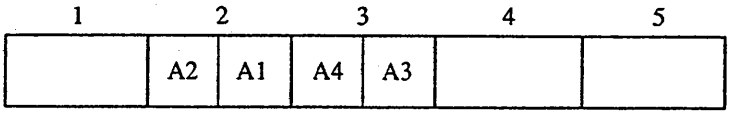
9.4.2 Output Format of Computed Values in the Binary Mode

For details concerning output formats for computations in the Binary Mode, refer to IM4H3B1-10E, section 3.2.2.

When the TS0, ESC T and FM1 (or FM3) commands are received, the measured value and computed result are output in the Binary mode.

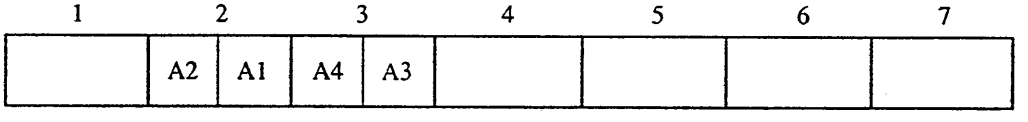
Command	Function
FM1, p1, p2	selects channel from which computed values are output in the Binary mode, where p1 is the channel number (01, 02, 03, etc.) from where the output should start, and p2 is the channel number (01, 02, 03, etc.) where the output should end.
FM3, p1, p2	selects channel from which 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 FM1:



- 1: channel number (1 to 24)
- 2, 3: Alarm status
  - An=1: H
  - An=2: L
  - An=3: h
  - An=4: l
  - An=5: R
  - An=6: r
  - An=0: No alarm or set to OFF
  - Outputs for each level:
  - A1 = level 1
  - |
  - A4 = level 4
- 4, 5: measured value (order of output byte can be selected, using BO command)
  - data + over: 7E7E is output
  - data – over: 8181 is output
  - skip: 8080 is output

Output format for FM3:



- 1: channel number
  - ACH=61
  - |
  - PCH=72
- 2, 3: Alarm status
  - An=1: H
  - An=2: L
  - An=0: No alarm or set to OFF
  - Outputs for each level:
  - A1 = level 1
  - |
  - A4 = level 4
- 4, 5, 6, 7: 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

9.5 How to Enter Digital Data Values by RS-422-A

Using both the computation channel and the communication function, digital data values can be entered to the μR1800 from a personal computer. This is useful in case you want to send values, which are to be used for computations, from the personal computer to the μR1800.
Digital data values can be used in both measurement channels used for computations and in the extra channels provided for computations. The values will be recorded accordingly.

9.5.1 Limitations of Digital Data Values Entry

- In order to be able to enter digital data values from a personal computer to the μR1800, your μR1800 must be equipped with the /M1 (Mathematical functions) option and the /C3 (RS-422-A interface) option.
- Digital data entries: Up to 4 for the pen models (C01 to C04)
  Up to 12 for the dot model (C01 to C12)
- Format: ASCII entry only (Binary entry is not allowed)
- Digital data range: -20000 to 20000 (integer)
- Data accepting period: The period of accepting digital data by the μR1800 is the sample interval (125ms for the pen model, refer to the following table for the dot model).

Table 9.1

A/D Frequency	100ms	50/60Hz
6 dot model	2.5s	2.5s
12 dot model	5s	2.5s
18 dot model	10s	2.5s
24 dot model	10s	2.5s

Therefore, when digital data are frequently sent, be sure to synchronize the sending period with the measuring interval (SAMPLE interval) of the recorder. Since the data specified by each measuring interval are updated, the data values of C01 to C12 are not synchronized.

9.5.2 Setting Procedure at the μR1800 to Receive Digital Data

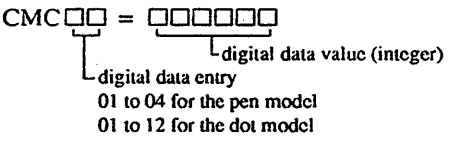
Digital data values can be used in both measurement channels used for computations and in the extra channels provided for computations. Therefore, you can set expressions like 01=C01+... and
like 0A=C01+... .

For settings in measurement channels used for computations (01, 02, etc.), follow the setting procedure as described in 3.2 to 3.5.
For settings in the extra channels used for computations (A, B, etc.), follow the setting procedure as described in 3.6.1.

NOTE C01, C02 etc. cannot be used as a parameter in the TLOG function.

9.5.3 Setting Procedure at the Personal Computer to Send Digital Data

Use the following format to send digital data:



The position of the decimal point will be the same as specified in the channel where the digital data will be used.
For example:
CMC01=10000

0A=C01 (and in channel 0A, the number of digits after the decimal point is set to 2), the value of C01 will become 100.00

03=C01 (and in channel 03, the number of digits after the decimal point is set to 3), the value of C01 willl become 10.000

NOTE When the power supply is turned ON, the initial values of C01 to C12 will be set to 1. If a decimal point is entered in this setting, the digits after the decimal point will be truncated.

10 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 range or expression while TLOG is in progress	stop TLOG computation before changing the range or expression
ERROR 149	Tried to start/stop TLOG by panel, while TLOG is set to be triggered externally (EXT)	change TLOG setting to INT in SET UP Mode

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