User's Manual

Model GX10/GX20/GP10/GP20/GM10

Log Scale (/LG)
User's Manual

Introduction

Thank you for purchasing the SMARTDAC+ Series GX10/GX20/GP10/GP20/GM10 (hereafter referred to as the recorder, GX, GP, or GM).
This manual explains the Log scale (/LG option) function of the GX, GP, and GM.
Although the display of GX20 is used in this manual, GX10/GP10/GP20 can be operated similarly. Moreover, for the GM10, the same content can be displayed on a Web browser.
To ensure correct use, please read this manual thoroughly before beginning operation.
For details on other settings, procedures, and communication features, read also the following user's manuals.
- Model GX10/GX20/GP10/GP20 Paperless Recorder User's Manual (IM 04L51B01-01EN)
- Data Acquisition System GM User's Manual (IM 04L55B01-01EN)
- Model GX10/GX20/GP10/GP20/GM10 Communication Command User's Manual (IM 04L51B01-17EN)

The following manuals are provided for the GX/GP.

• Paper Manuals

Manual Title	Manual No.	Description
Model GX10/GX20/GP10/GP20 Paperless Recorder First Step Guide	IM 04L51B01-02EN	Explains the basic operations of the GX/GP.

• Downloadable Electronic Manuals

You can download the latest manuals from the following website.
www.smartdacplus.com/manual/en/

Model	Manual Title	Manual No.	Description
GX/GP	Model GX10/GX20/GP10/GP20 Paperless Recorder First Step Guide	IM 04L51B01-02EN	This is the electronic version of the paper manual.
	Model GX10/GX20/GP10/GP20 Paperless Recorder User's Manual	IM 04L51B01-01EN	Describes how to use the GX/GP. The communication control commands and some of the options are excluded.
	Model GX10/GX20/GP10/GP20 Advanced Security Function (/AS) User's Manual	IM 04L51B01-05EN	Describes how to use the advanced security function (/AS option).
GM	GM Data Acquisition System First Step Guide	IM 04L55B01-02EN	This is the electronic version of the paper manual.
	GM Data Acquisition System User's Manual	IM 04L55B01-01EN	Describes how to use the GM. The communication control commands and some of the options are excluded.
	GM Data Acquisition System Advanced Security Function (/AS) User's Manual	IM 04L55B01-05EN	Describes how to use the advanced security function (/AS option).
GX/GP GM	Model GX10/GX20/GP10/GP20/GM10 Communication Commands User's Manual	IM 04L51B01-17EN	Describes how to use command control communication functions.
	SMARTDAC+ STANDARD Universal Viewer User's Manual	IM 04L61B01-01EN	Describes how to use Universal Viewer, which is a software that displays GX/GP/GM measurement data files.
	SMARTDAC+ STANDARD Hardware Configurator User's Manual	IM 04L61B01-02EN	Describes how to use the PC software for creating setting parameters for various GX/GP/GM functions.
	Model GX10/GX20/GP10/GP20/GM10 Multi-batch Function (/BT) User's Manual	IM 04L51B01-03EN	Describes how to use the multi-batch function (/BT option).
	Model GX10/GX20/GP10/GP20/GM10 Log Scale (/LG) User's Manual	IM 04L51B01-06EN	Describes how to use the log scale (/LG option).
	Model GX10/GX20/GP10/GP20/GM10 EtherNet/IP Communication (/E1) User's Manual	IM 04L51B01-18EN	Describes how to use the communication functions through the EtherNet/IP (/E1 option).
	Model GX10/GX20/GP10/GP20/GM10 WT Communication (/E2) User's Manual	IM 04L51B01-19EN	Describes how to use WT communication (/E2 option).
	Model GX10/GX20/GP10/GP20/GM10 OPC-UA Server (/E3) User's Manual	IM 04L51B01-20EN	Describes how to use the OPC-UA server function (/E3 option).
	Model GX10/GX20/GP10/GP20/GM10 SLMP Communication (/E4) User's Manual	IM 04L51B01-21EN	Describes how to use SLMP communication function (/E4 option).
	Model GX10/GX20/GP10/GP20/GM10 Loop Control Function, Program Control Function (/PG Option) User's Manual	IM 04L51B01-31EN	Describes how to use the Loop Control Function, Program Control Function (/PG Option).

Model	Manual Title	Manual No.	Description
GX/GP	DXA170 DAQStudio User's Manual	IM 04L41B01-62EN	Describes how to create custom displays (/CG option).

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
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This product uses open source software.
For details on using open source software, see *Regarding the Downloading and Installing for the Software, Manuals and Labels* (IM 04L61B01-11EN).

Revisions

May 2014   1st Edition
December 2014   2nd Edition
June 2017   3rd Edition

Recorder Versions Described in This Manual

The contents of this manual correspond to the GX/GP with release number 4 (see the STYLE S number) and style number 2 (see the STYLE H number) and the GM10 with release number 4 (see the STYLE S number) and style number 1 (see the STYLE H number).

Edition	Product	Explanation
1	GX/GP: Version 2.01 and later	—
2	GX/GP: Version 2.01 and later GM: Version 2.02 and later	Describes the GM.
3	GX/GP: Version 4.01 and later GM: Version 4.01 and later	Support for Release number 4.

Conventions Used in This Manual

Unit

K	Denotes 1024. Example: 768K (file size)
k	Denotes 1000.

Markings

⚠ **CAUTION**

Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING   Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION   Calls attention to actions or conditions that could cause light injury to the user or cause damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

Note   Calls attention to information that is important for the proper operation of the instrument.

Reference Item

▶   Reference to related operation or explanation is indicated after this mark.
Example: ▶ section 4.1

Conventions Used in the Procedural Explanations

Bold characters   Denotes key or character strings that appear on the screen.
Example: **Volt**

Ⓐⓐ#1   Indicates the character types that can be used.

   Ⓐ uppercase alphabet,   ⓐ lowercase alphabet,   # symbol,

   1 numbers

Procedure

Explanation

Carry out the procedure according to the step numbers. All procedures are written with inexperienced users in mind; depending on the operation, not all steps need to be taken.
Explanation gives information such as limitations related the procedure.

Path

Description

Indicates the setup screen and explains the settings.

Module Notation

When necessary, the following notations are used to distinguish the GX90XA analog input modules by type.

Type Suffix Code	Notation
-U2	Universal
-C1	Current (mA)
-L1	Low withstand voltage relay
-T1	Electromagnetic relay
-H0	High-speed universal or High speed AI
-R1	4-wire RTD/resistance

Contents

**Blank**

Using the Log scale Function

Log Scale Display Function

You can apply a logarithmic voltage that has been converted from a physical value to the recorder, and then use the log scale (logarithmic scale) to display and record the physical value. The recorder supports three types of input signals.

- Logarithmic Input
  This is referred to as "Log input". Log input is input in which the voltage corresponds to logarithmic values of physical values.
- Pseudo Log Input
  This is referred to as "Pseud-log input." This input supports pseudo logs.
  A pseudo log signal is a voltage obtained by summing the one's digit of the voltage representing the exponent of the logarithmic data and the decimal digits of the voltage representing the mantissa.
- Input That Is Linear on a Logarithmic Scale
  This is referred to as "Linear-Log input." Linear log input is input in which the voltage values correspond to the logarithmic values of physical values at each decade division (for example, 1×10^2) and in which, within each decade, the voltage values correspond linearly to physical values.

On the trend display, the recorder displays waveforms with the log scale. Digital values are displayed as exponents (for example, 1.2E+03).

Display example on the GX/GP main unit
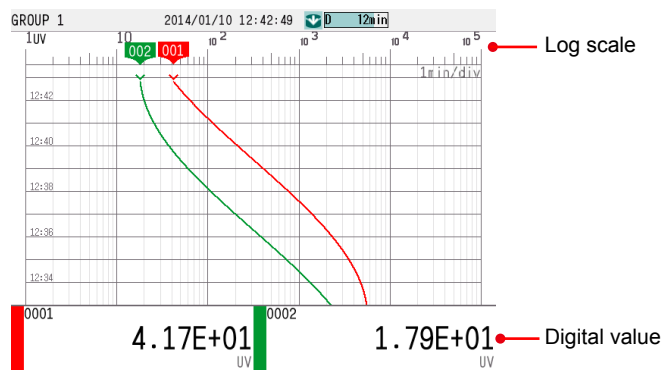
Trend display example on a Web application (GM)
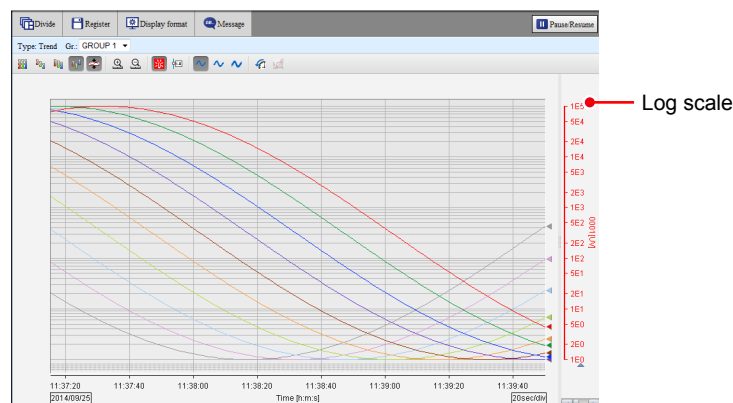
Restrictions

Partial

You cannot set the partial display on a channel that is set to log scale.

Differential Computation between Channels

If you set the reference channel of a differential computation between channels to a channel that is set to log scale, an error will be returned as the measured result of the differential computation between channels.

Computation Channels (/MT option)

Do not include channels that are set to log scale in a computation channel expression.
If you include these channels, an error will be returned as the measured result.

Report Function (/MT option)

You cannot create reports for channels that are set to log scale. An error will be returned as the result of report computations on channels that are set to log scale.

Manual Sampled Data

For channels that are set to log scale, the data is stored using the "mantissa + exponent" format, the same format as that of digital values on the recorder.

Number of Channels Set to Log Scale

Keep the number of channels set to log scale no greater than 300.
When there are many channels set to log scale, log scale processing may not finish within the scan interval and may cause computation data dropouts.

Setting the Log scale

AI channel settings

Log input computation cannot be specified on current (mA), 4-wire RTD/resistance modules.

Range settings

Description

Setup Item	Selectable Range or Options	Default Value
First-CH	AI channel	—
Last-CH	AI channel	—

First-CH, Last-CH

Set the target channels. The channels that you can specify appear depending on the module configuration.

Range

Setup Item	Selectable Range or Options	Default Value
Type	Skip, Volt, GS (general signal), TC (thermocouple), RTD (resistance temperature detector)[1], DI (contact, voltage level)	Volt
Range	See "Range Details."	See "Range Details."
Span Lower	Numeric value (depends on the range)	–2.0000
Span Upper	Numeric value (depends on the range)	2.0000
Calculation	Off, Delta, Linear scaling, Square root, Log input, Pseudo-Log input, Linear-Log input	Off

1 Cannot be specified for the electromagnetic relay type analog input module and low withstand voltage relay type.

Type

Set the type to **Volt**. You cannot use the log scale display for any other type.

Note

For the channels in which you are not using an electromagnetic relay type module, set the range type to Skip.

Range

Set the input type range.

Range Details

Type	Range	Selectable Range	Default Value
Volt	20mV	–20.000 mV to 20.000 mV	2V
	60mV	–60.00 mV to 60.00 mV	
	200mV	–200.00 mV to 200.00 mV	
	1V	–1.0000 V to 1.0000 V	
	2V	–2.0000 V to 2.0000 V	
	6V	–6.000 V to 6.000 V	
	20V	–20.000 V to 20.000 V	
	50V	–50.00 V to 50.00 V	
	100V[1]	–100.00 V to 100.00 V	

1 For high-speed universal type.

Span Lower, Span Upper

Set the input range. The selectable range varies depending on the range setting.
For the selectable ranges, see "Range Details."

> *Note*
>
> You cannot set the same value to **Span Lower** and **Span Upper**.

Calculation

Set the log scale type to **Log input**, **Pseudo-log input**, or **Linear-log input**.

Scale[1]

Setup Item	Selectable Range or Options	Default Value
Decimal place	1, 2	2
Scale Lower	Log input: 1.00E–15 to 1.00E+14 Linear-Log, Pseudo-Log: 1.00E–15 to 1.00E+15	1.00E+00
Scale Upper	Log input: 1.00E–14 to 1.00E+15 Linear-Log, Pseudo-Log; 1.00E–15 to 1.00E+15	1.00E+15
Unit	Character string (up to 6 characters, A a # 1)	—

1 Appears when the range calculation is set to **Log input**, **Pseudo-log input**, or **Linear-log input**.

Decimal Place

Set the decimal place for scale lower and scale upper.
This value is also applied to the lower and upper limits of the displayed point of color scale band as well as alarm values.

Scale Lower, Scale Upper

Set the Scale Lower and Scale Upper.

- **When Calculation is Log input**

Set the settings so that **Scale Lower** is less than **Scale Upper**.
The mantissas of scale lower and scale upper can be set to different values.

Mantissa of Scale Lower	Setting Range			
1.00	1.00E–15 to 1.00E+15. However, the difference between the exponents must be at least 1. The scale width must be 15 decades or less.			
		Scale Lower	Scale Upper	Notes
	Example	1.00E+01	1.00E+02	
	Examples of invalid settings	1.00E+01	2.00E+01	The difference between the exponents is less than 1.
		1.00E–01	1.00E+15	The scale width is greater than 15 decades.
A value other than 1.00	1.01E–15 to 1.00E+15. However, the difference between the exponents must be at least 2. The scale width must be 15 decades or less.			
		Scale Lower	Scale Upper	Notes
	Example	2.00E+01	1.00E+03	
		2.00E+00	5.00E+14	
	Examples of invalid settings	2.00E+01	7.00E+02	The difference between the exponents is less than 2.
		2.00E–01	1.00E+15	The scale width is greater than 15 decades.
		2.00E+03	2.00E+15	The upper limit is greater than 1.00E+15.

- **Pseudo-Log, Linear-Log**

You can set the settings so that Scale Lower is less than Scale Upper or so that Scale Lower is greater than Scale Upper.
The mantissa that you set for Scale Lower is automatically set as the mantissa of Scale Upper.

The scale is referred to as the positive scale or reverse scale depending on the scale value settings.

Scale	Span value (Input voltage)	Scale value
Positive scale	[Span Lower] < [Span Upper]	[Scale Lower] < [Scale Upper]
Reverse scale		[Scale Lower] > [Scale Upper]

Mantissa of Scale Lower	Setting Range			
1.00	1.00E–15 to 1.00E+15. However, the difference between the exponents must be at least 1. The scale width must be 15 decades or less.			
		Scale Lower	Scale Upper	Notes
	Example	1.00E+01	1.00E+02	
		1.00E+15	1.00E+00	
	Examples of invalid settings	1.00E–01	1.00E+15	The scale width is greater than 15 decades.
A value other than 1.00	1.00E–15 to 9.99E+14. However, the difference between the exponents must be at least 1. The scale width must be 14 decades or less			
		Scale Lower	Scale Upper	Notes
	Example	1.33E+01	1.33E+02	
		1.33E+00	1.33E+13	
		1.33E+13	1.33E+00	
	Examples of invalid settings	1.33E–15	1.33E+00	The scale width is greater than 14 decades.
		1.33E+03	1.33E+15	The upper limit is greater than 9.99E+14.

The scale displayed on the recorder is zoomed in until the value that is less than the lower scale limit and whose mantissa is 1.00 and the value that is greater than the upper scale limit and whose mantissa is 1.00 are displayed. See Example 4 under Scale Examples.

Unit
Set the unit.

Moving average

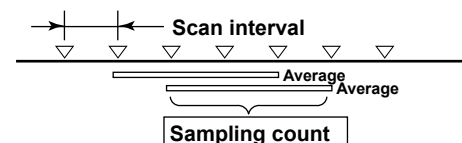| Setup Item	Selectable Range or Options	Default Value
On/Off	Off, On	Off
Count[1]	2 to 100 2 to 500 (High-speed AI)	2

1 Appears when On/Off is set to **On**.

On/Off
Set this to **On** to perform moving average.

Count
Set the number of data points to take the moving average of.

First-order lag filter (high-speed AI module only)

Setup Item	Selectable Range or Options	Default Value
On/Off	Off, On	Off
Filter coefficient[1]	3 to 300	3

1 Appears when On/Off is set to **On**.

On/Off

Set this to **On** to use the first-order lag filter.
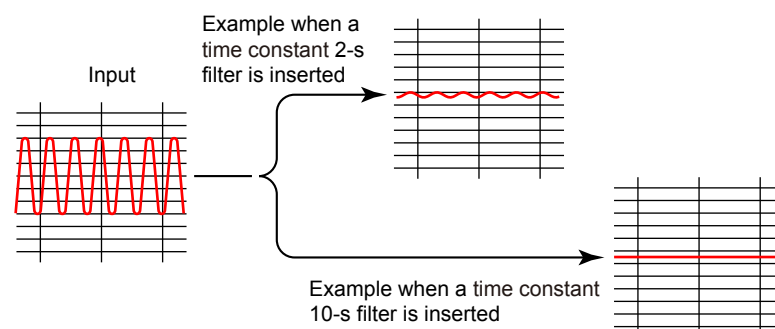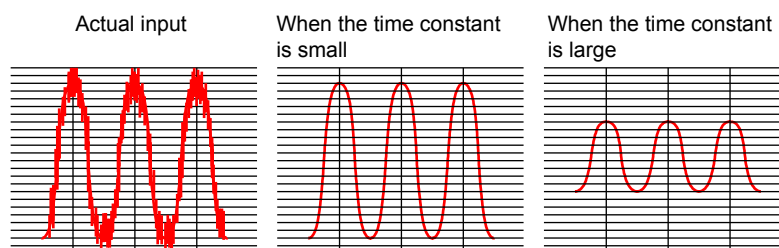
Filter coefficient

Filter time constant = scan interval × filter coefficient N

The following table shows the relationship between filter coefficient N of the first-order lag filter, scan interval, and time constant for filter coefficient N = 3, 10, 30, 100, and 300.

Scan interval	Time constant (s)				
	N = 3	N = 10	N = 30	N = 100	N = 300
1ms	0.003	0.01	0.03	0.1	0.3
2ms	0.006	0.02	0.06	0.2	0.6
5ms	0.015	0.05	0.15	0.5	1.5
10ms	0.03	0.1	0.3	1	3
20ms	0.06	0.2	0.6	2	6
50ms	0.15	0.5	1.5	5	15
100ms	0.3	1	3	10	30
200ms	0.6	2	6	20	60
500ms	1.5	5	15	50	150
1s	3	10	30	100	300
2s	6	20	60	200	600
5s	15	50	150	500	1500

Description

When there is noise riding on the input signal, inserting a first-order lag filter has the effect of rejecting noise. The larger the filter coefficient (time constant), the higher the noise rejection effect. However, setting the filter coefficient too large will distort the waveform.

Actual input   When the time constant is small   When the time constant is large

Input   Example when a time constant 2-s filter is inserted

Example when a time constant 10-s filter is inserted

Bias

Setup Item	Selectable Range or Options	Default Value
Value	Numeric value (–999999 to 999999)	0

Value

Set the bias to add to input values or linear scaling values (input calculation).

Channel on which bias is added

Input value → ○ → Measured value

+

Bias (a constant value)
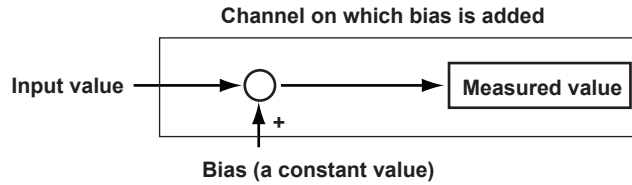
Scale Examples

Below are scale examples in which the trend direction is set to vertical on the GX/GP main unit. With the GM, the measurement data is displayed on a Web application, so the following items are different.

- The trend is displayed with the time plotted on the horizontal axis. Therefore, the scale is displayed vertically.
- For example, a scale value of $1×10^3$ is displayed as "1E3."
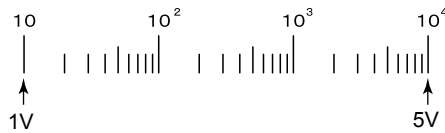- Scale marks other than decades (e.g., 1E3) are displayed only when there is space.
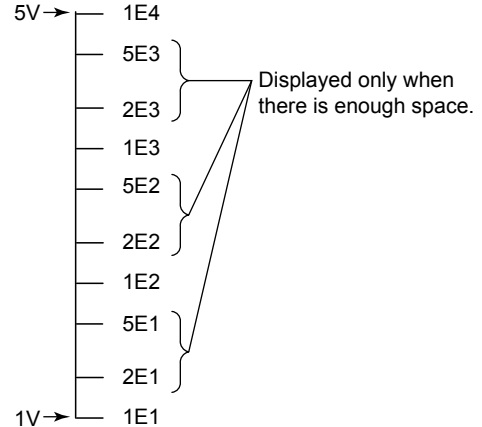
Log input

Example 1

In this example, the mantissa of the scale lower limit and the mantissa of the scale upper limit are both 1.

	Lower	Upper
Span value (Input voltage)	1V	5V
Scale value	1.00E+01	1.00E+04

Display example on the GX/GP main unit

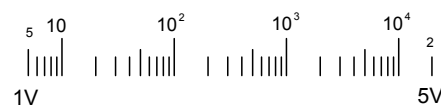**Display example on a Web application (GM)**

Example 2

In this example, the mantissa of the scale lower limit and the mantissa of the scale upper limit are both a value other than 1.

	Lower	Upper
Span value (Input voltage)	1V	5V
Scale value	5×1.00E+00	2×1.00E+04

The end points of the scale are displayed using single digits if there is space to display them.

Pseudo-Log input, Linear-Log input

Example 3

Positive scale in which the mantissa of the scale lower limit and the mantissa of the scale upper limits are 1

This is the same as when the mantissa of the scale lower limit and the mantissa of the scale upper limit are both 1 in log input example 1.
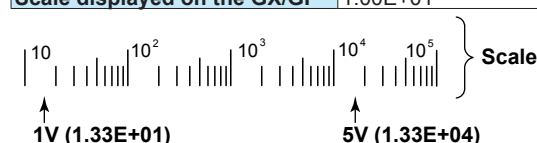
Example 4

Positive scale in which the mantissa of the scale lower limit and the mantissa of the scale upper limits are not 1

The scale displayed on the recorder is zoomed in until the value that is less than the lower scale limit and whose mantissa is 1.00 and the value that is greater than the upper scale limit and whose mantissa is 1.00 are displayed. Only the scale is zoomed in.

Span Lower equals Scale Lower, and Span Upper equals Scale Upper.

|	Lower	Upper
Span value (Input voltage)	1V	5V
Scale value	1.33E+01	1.33E+04
Scale displayed on the GX/GP	1.00E+01	1.00E+05

1V (1.33E+01)   5V (1.33E+04)

Example 5

Reverse scale in which the mantissa of the scale lower limit and the mantissa of the scale upper limits are 1

On the reverse scale of a vertical waveform display, the left side is always the minimum scale value and the right side the maximum.

	Lower	Upper
Span value (Input voltage)	1V	5V
Scale value	1.00E+04	1.00E+01

5V   1V
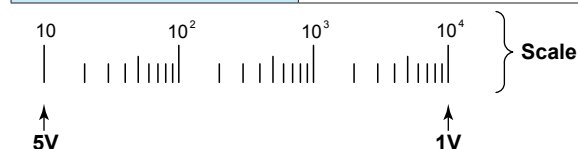
The scale image shows 10^{-1} as 0.1, 10^{0} as 1, and 10^{1} as 10.

Note

Regarding Log Scale Over-range

A value less than –5% of the voltage span is a negative over-range, and a value greater than 105% of the scale is a positive over-range. They are displayed as –Over and +Over. The "Value on over-range" setting (see section 1.11.2, "Setting the Over-range Detection Method" in the user's manual (IM 04L51B01-01EN) or section 2.12.2, "Setting the Over-range Detection Method" in the user's manual (IM04L55B01-01EN)) is not applied to channels that are set to log scale.

Example: If the span lower limit is set to 0 V and the span upper limit is set to 10 V, a value less than –0.5 V will result in "–Over" being displayed. A value greater than 10.5 V will result in "+Over" being displayed.

Alarm settings

GX/GP: **MENU** key > **Browse** tab > **Setting** > Setting menu **AI channel settings** > **Alarm**
Web application: **Config.** tab > **AI channel settings** > Channel range (display example: 0001-0010) > **Alarm**
Hardware configurator: **AI channel settings** > Channel range (display example: 0001-0010) > **Alarm**

Description

Setup Item	Selectable Range or Options	Default Value
First-CH	AI channel	—
Last-CH	AI channel	—

First-CH, Last-CH

Set the target channels. The channels that you can specify appear depending on the module configuration.

Level 1, Level 2, Level 3, Level 4

Setup Item	Selectable Range or Options	Default Value
On/Off	Off, On	Off
Type[1]	H: High limit, L: Low limit, T: Delay high limit, t: Delay low limit	H: High limit
Value[1]	Log scale range that corresponds to –5% to 105% of the span width	1.00E+00
Logging[1]	Off, On	On
Output type[1]	Off, Relay[3], Internal switch[4]	Off
Output No.[2]	DO channel or internal switch	—

1 Appears when Level (1 to 4) is set to **On**.
2 Appears when Output type is not set to **Off**.
3 Appears when the range type of any of the DO channels is set to Alarm.
4 Appears when any of the internal switch type is set to Alarm.

On/Off

To use an alarm level (1 to 4), set this to **On**.

Type

Set the alarm type.

Options	Description
H: High limit	An alarm is activated when the measured value is greater than or equal to the alarm value.
L: Low limit	An alarm is activated when the measured value is less than or equal to the alarm value.
T: Delay high limit	An alarm is activated if measured values remain greater than or equal to the alarm value for a specified time period (delay period).
t: Delay low limit	An alarm is activated if measured values remain less than or equal to the alarm value for a specified time period (delay period).

Value

Set the alarm value for the specified alarm type.
The selectable range is the Log scale range that corresponds to –5% to 105% of the span width. The mantissa range is 1.00 to 9.99 or 1.0 to 9.9 (depending on the decimal place setting).
If the alarm value is set outside the selectable scale range of the range setting, the alarm mark will be displayed at the lower or upper limit position of the scale setting.

| Options	Value	Examples of Alarm Value Range
H, L	Log scale range that corresponds to –5% to 105% of the span width	For 6 V range (span lower: 1.000 V, span upper: 6.000V), LOG input (decimal place: 2, scale lower: 1.00E+01, scale upper: 1.00E+04), 7.08E+00 to 1.41E+04
T, t	Same as H and L	Same as H and L

Logging

Set this **On** to display an alarm (notify you) when an alarm occurs. If set to **Off**, when an alarm occurs, the recorder outputs signals to alarm output DO channels or internal switches but does not display the alarm. Alarms are also not recorded in the alarm summary.

Output type

Set the alarm output destination.

Alarm status can be output to the relay (DO channel) or internal switches (100 software switches). Internal switch values are shown below. Like the DO output relay, you can specify AND/OR operation.
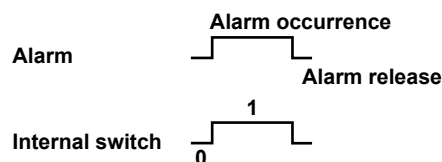
Internal switches can be used as events of the event action function (See section 1.19, "Configuring the Event Action Function" in the GX/GP user's manual or section 2.20, "Configuring the Event Action Function" in the GM user's manual (IM 04L55B01-01EN)). In addition, they can also be written in calculation expressions of math channels (/MT option).

Output No.

Set the number of the relay (DO channel) or internal switch to output alarms to.

Note

- The decimal place of the alarm setting is the same as the decimal place of the scale. You cannot specify a value using more than the number of significant digits.
- The alarm hysteresis on channels that are set to log scale is fixed to 0%.
- The "lower and upper limits of available range" shown on the alarm setting screen are guidelines.

Color scale band settings (Display settings)

GX/GP: **MENU** key > **Browse** tab > **Setting** > Setting menu **AI channel settings** > **Display settings**

Web application: **Config.** tab > **AI channel settings** > Channel range (display example: 0001-0010) > **Display settings**

Hardware configurator: **AI channel settings** > Channel range (display example: 0001-0010) > **Display settings**

Description

Color scale band

Setup Item	Selectable Range or Options	Default Value
Band area	Off, In, Out	Off
Color	24 colors (red, green, blue, blue violet, brown, orange, yellow-green, light blue, violet, gray, lime, cyan, dark blue, yellow, light gray, purple, black, pink, light brown, light green, dark gray, olive, dark cyan, and spring green) and a user-defined color (1 color)	—
Display position Lower	Scale lower limit to scale upper limit	1.00E+00
Display position Upper	Scale lower limit to scale upper limit	1.00E+15

Band area

Displays a specified section of the measurement range using a color band on the scale. This setting is shared with the bar graph display.

Options	Description
Off	Disables the function.
In	Displays the area inside using the color band.
Out	Displays the area outside using the color band.

Color

Set the display color.

▶ For instructions on how to set the user-defined color, see section 1.2.3, "Setting the Display" in the GX/GP user's manual (IM 04L51B01-01EN) or section 2.3.3, "Setting the Display" in the GM user's manual (IM 04L55B01-01EN).

Display position Lower and Display position Upper

Set a value within the selectable scale range. (The selectable range is 1.00E–15 to 1.00E+15. Set the mantissa to a value in the range of 1.00 to 9.99.)

Setup Examples

pseudo-Log input and Log input (nonlinear log) setup examples are shown below.

Setting the Pseudo-Log Range

This setting is for logging the pseudo log output (see the table below) of a vacuum gauge.

Pressure Reading [Pa]	Output Voltage [V]	Pressure Reading [Pa]	Output Voltage [V]
1.30×10^{-7}	0.13	5.00×10^{-4}	3.50
5.00×10^{-7}	0.50	1.00×10^{-3}	4.10
1.00×10^{-6}	1.10	5.00×10^{-3}	4.50
5.00×10^{-6}	1.50	1.00×10^{-2}	5.10
1.00×10^{-5}	2.10	5.00×10^{-2}	5.50
5.00×10^{-5}	2.50	1.00×10^{-1}	6.10
1.00×10^{-4}	3.10	9.90×10^{-1}	6.99

GX/GP main unit: Press **MENU** key, Tap the **Brows** tab > **Setting** > **AI channel settings** > **Range**.

Web application: Click the **Setting** tab > **AI channel settings** > **Channel range (0001-0010)** > **Range**

Hardware configurator: Click **AI channel settings** > **Channel range (0001-0010)** > **Range**

Set the channel 0001 range as shown below.

Range
Type: Volt
Range: 20V
Span: Span Lower 0.000, Span Upper 7.000
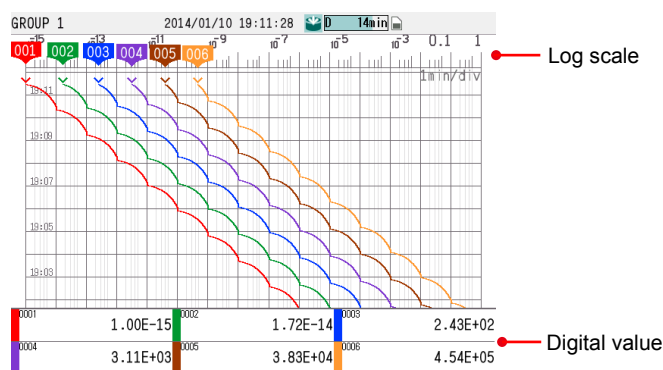Calculation: Pseudo-Log input

Scale:
Decimal place: 2
Scale: Scale Lower 1.00E–07, Scale Upper 1.00E+00
Unit: Pa

Display Example
Below is a screen example in which the trend direction is set to vertical on the GX/GP main unit.


— Log scale
— Digital value

Note

- Set the mantissa to 1.00.
- The output voltage for pressure reading whose mantissa is 1.00 has a certain deviation. For example, if the pressure reading is 1.00E–07, the output voltage is 0.00 to 0.10 V. In this situation, set the range (Span Lower) to the minimum value (0.00 V).

Setting the Log input (Nonlinear Log)

In this example, pressure is measured by applying calibration correction to linearly approximate the nonlinear output of a vacuum gauge.

Calculating linearizer Input and linearizer output

The following figure is an example of a nonlinear output of a vacuum gauge. The 10 red dots in the figure are the set points for the linearizer approximation. Their values are shown under ① and ② in the table below. Keep the number of set points to no more than 12.
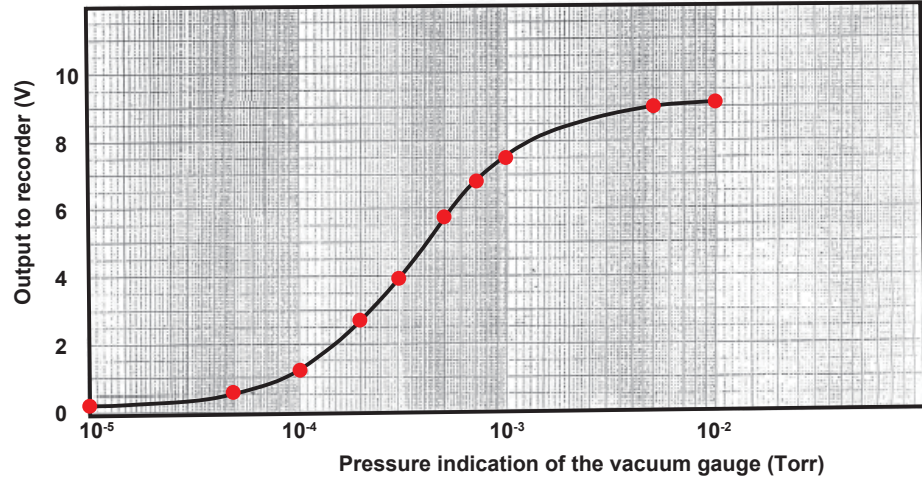
No.	① Pressure indication [Torr]	② Output to recorder [V]
1	1.00E-05	0.2
2	5.00E-05	0.55
3	1.00E-04	1.25
4	2.00E-04	2.7
5	3.00E-04	3.95
6	5.00E-04	5.7
7	7.00E-04	6.75
8	1.00E-03	7.5
9	5.00E-03	8.8
10	1.00E-02	9.1

Calculate the output (④, linearizer output) that correspond to the recorder input (②, linearizer input) in the following manner.

- ③: Take a log of the pressure indication values (①).
- ④: Linearly scale the value of each row of ③ using the ② span. The calculation formula is shown below.

$$④ = \frac{(③ - (\text{minimum of } ③))}{(\text{maximum of } ③ - \text{minimum of } ③)} \times (\text{maximum of } ② - \text{minimum of } ②) + \text{minimum of } ②$$

$$= \frac{(③ - (-5))}{((-2) - (-5))} \times (9.1 - 0.2) + 0.2 \quad = \quad \frac{③ + 5}{3} \times 8.9 + 0.2$$

The combination of ② and ④ is the set point.

③ log(①)	④ Linearly scale ③ using ②.
-5	0.2
-4.301029996	2.273611013
-4	3.166666667
-3.698970004	4.05972232
-3.522878745	4.582126389
-3.301029996	5.24027768
-3.15490196	5.673790852
-3	6.133333333
-2.301029996	8.206944346
-2	9.1

→

Set point	② Linearizer input [V]	④ Linearizer output [V]
1	0.200	0.200
2	0.550	2.274
3	1.250	3.167
4	2.700	4.060
5	3.950	4.582
6	5.700	5.240
7	6.750	5.674
8	7.500	6.133
9	8.800	8.207
10	9.100	9.100

Setting the Channels to Use

Set the channels that you want to use as follows.
Setting the Range
GX/GP main unit: Press the **MENU** key, tap the **Browse** tab > **Setting** > **AI channel settings** > **Range**
Web application: Click the **Setting** tab > **AI channel settings** > **Channel range (0001-0010)** > **Range**
Hardware configurator: Click **AI channel settings** > **Channel range (0001-0010)** > **Range**

Item	Description	Explanation
Mode	Log input	It is an input in which voltages correspond to logarithmic values of physical values.
Range	20V	Range that can cover the output to recorder (②)
Span	0.200 to 9.100	Minimum to the maximum of the output to recorder (②)
Scale	1.00E-5 to 1.00E-2	Minimum to the maximum of the pressure indication (①) of the vacuum gauge
Decimal place	2	Decimal place of mantissa
Unit	Torr	Unit of the pressure indication (①) of the vacuum gauge

Configuring calibration correction
GX/GP main unit: Press the **MENU** key, tap the **Browse** tab > **Setting** > **AI channel settings** > **Calibration correction**
Web application: Click the **Setting** tab > **AI channel settings > Channel range (0001-0010)** > **Calibration correction**
Hardware configurator: Click **AI channel settings** > **Channel range (0001-0010)** > **Calibration correction**

Item	Description	Explanation
Mode	Linearizer approximation	Correction type
Number of set points	10	The number of rows of ② and ④. If the number exceeds 12, decimate to no more than 12 while maintaining appropriate approximation.
Linearizer input	(Value)	Value of ②
Linearizer output	(Value)	Value of ④

Blank