

M6xX Series
Ultra-Slim Signal Conditioners
PC CONFIGURATOR SOFTWARE
Model: M6CFG

Users Manual

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1. INTRODUCTION

1.1 GENERAL DESCRIPTION

The M6CFG is used to program parameters for M6xX Series Ultra-Slim Signal Conditioners (referred hereunder as 'device'). The following major functions are available:

- Edit parameters online (connected to the device) in real time
- Edit parameters offline (not connected to the device)
- Download parameters to the device, upload parameters from the device
- Save parameters as files, read parameters from files
- Compare parameters edited on the screen with the ones stored in the device

1.2 APPLICABLE DEVICES

The M6CFG is applicable to the following products:

Function	M6xX Model	Symbol	Version
Signal Transmitter	M6xXV	V	1.00
Thermocouple Transmitter	M6xXT	T	1.00
RTD Transmitter	M6xXR	R	1.00
Potentiometer Transmitter	M6xXM	M	1.00
DC Alarm	M6xXAS	AS	1.10
Function Module	M6xXF1	F1	1.20
2-input Function Module	M6xXF2	F2	1.30
Hold Function Module	M6xXF3	F3	1.40
Thermocouple Alarm	M6xXAT	AT	1.50
RTD Alarm	M6xXAR	AR	1.50
Universal Transmitter	M6xXU	U	1.50
DC/ Frequency converter	M6xXAP	AP	1.60

The lowest software version applicable to each hardware model is indicated in the above table. Confirm that the software you have is compatible with the hardware you have.

The latest version of the M6CFG is downloadable at our web site if you need higher version software.

In this manual, descriptions given with the above symbols are applied only to the models those symbols are assigned to. Other descriptions with no specific symbol are applied to all models.

1.3 PC REQUIREMENTS

The following PC performance is required for adequate operation of the M6CFG.

PC	IBM PC compatible
OS	Windows Windows 8.1 (32-bit/ 64-bit), 10 (32-bit/ 64-bit) The software may not operate adequately in certain conditions.
CPU	Must meet the relevant Windows' requirements.
Memory	Must meet the relevant Windows' requirements.
Network port	COM port (RS-232-C) or USB port (COM1 through COM16)

One of the dedicated cables as listed below is also required to connect the transmitter device to the PC.

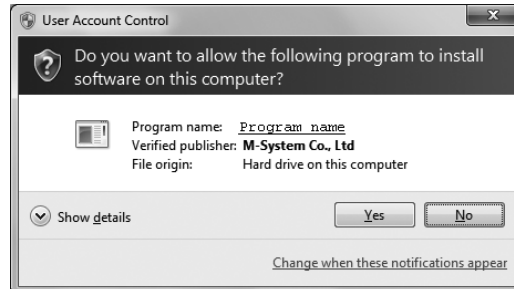
Port	PC Configurator Cable Model No.
RS-232-C	MCN-CON
USB	COP-US

1.4 INSTALLING & DELETING THE PROGRAM

INSTALL

The program is provided as compressed archive. Decompress the archive and execute 'setup.exe' to start up the M6CFG installer program. Follow instructions on the Windows.

For Windows 8.1, 10 log on as administrator but you still need to clarify your administrative right before proceeding. When User Account Control window appears, choose 'Continue' or 'Yes'.



For 'Program name,' M6CFG is shown.

DELETE

The procedure to delete program differs according to your OS.

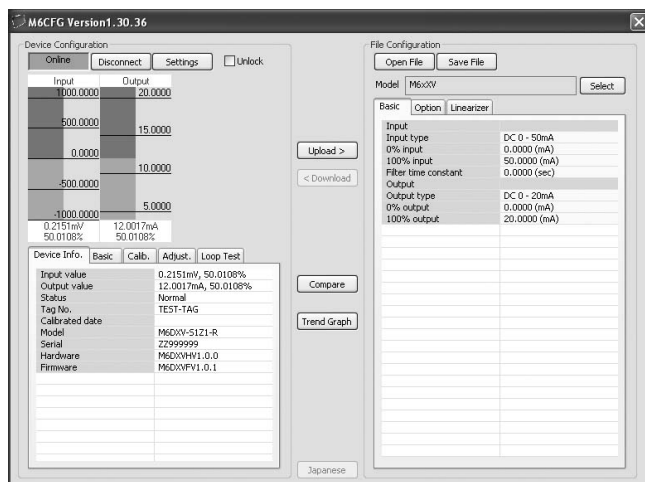
For Windows 8.1, choose Control Panel from Charms bar, uninstall with [Uninstall a program] in the Control Panel. Choose the M6CFG from [Uninstall or change a program] list, click [Uninstall].

For Windows 10, choose Settings of Start menu, choose System from Settings menu, uninstall with [Apps & features] in the System. Choose the M6CFG from [Apps & features] list, click [Uninstall].

2. GETTING STARTED

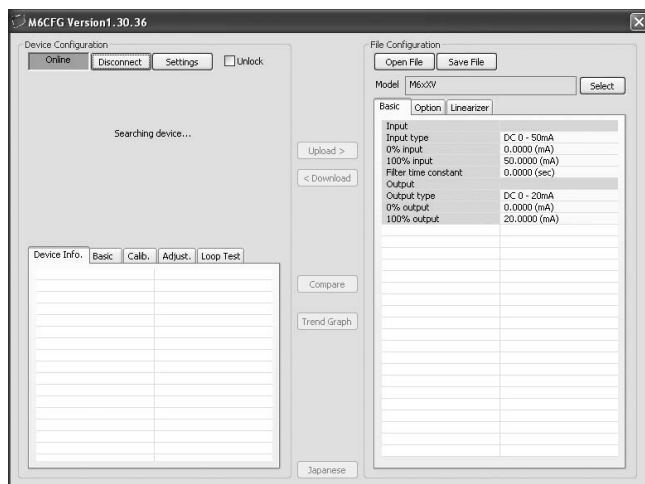
2.1 STARTING THE M6CFG

In order to start the M6CFG, on the PC installed with the M6CFG, for Windows 8.1, select All apps => M-System => M6CFG in the Start view. For Windows 10, select All apps => M-System => M6CFG in the Start menu.



2.2 CONNECTING TO THE DEVICE

- 1) Click [Settings] button at the left top of the screen.
- 2) Choose the COM port number to which the device is to be connected. Once one of the COM port is specified after the PC Configurator has been installed and started, you do not need to repeat the setting procedure until you want to change the COM port setting.
- 3) Click [Connect] button and connect the device to the PC's COM port with the PC Configurator Cable.



- 4) The device's present parameters are uploaded and shown on the screen. (See the figure in Section 2.1.)

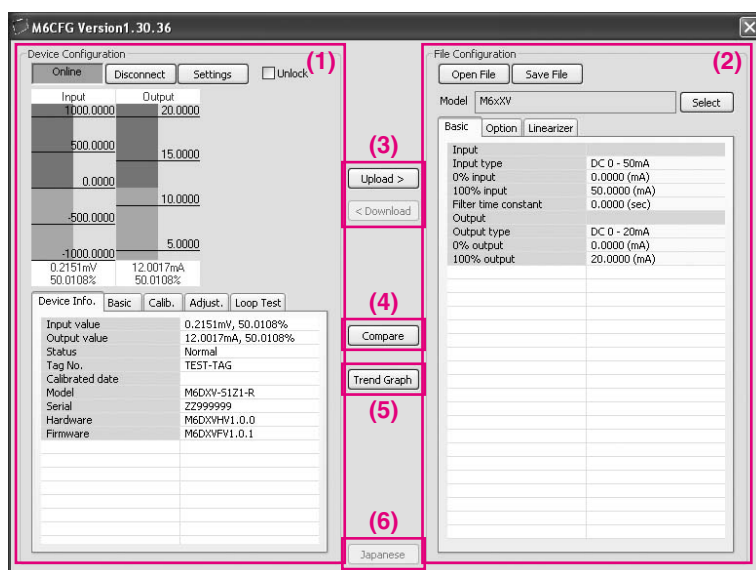
[Connect] button is now replaced with [Disconnect] button.

The bargraphs on the screen show real time I/O status of the device, and you can now access to the menu tabs such as Device Info, Basic, Calibration, Adjustments, and Loop Test.

When the cable is disconnected, the device info returns to blank status and the PC Configurator is ready to be connected to another device. In order to continue, just connect a new device. You do not need to click [Connect] button.

2.3 BASIC OPERATIONS

2.3.1 SCREEN COMPONENT IDENTIFICATION



(1) Device Configuration

Shows the parameters of the device presently connected online. You can edit these parameters in real time.

(2) File Configuration

Used to create and edit parameter sets on the PC. You can upload a parameter set from a device, edit it and download it to the device again.

(3) Upload / Download

Used to read parameter setting in the device and to write one to the device.

(4) Compare

Opens Compare window to compare edited parameters from actual setting.

(5) Trend Graph

Opens Trend Graph window to show a trend graph for the connected device.

(6) English / Japanese

Switches the display language. Clicking the button switches between English and Japanese.

The program starts up in English mode as initial state when the OS is other than Japanese version. You can switch to Japanese only when the OS supports Japanese language.

2.3.2 DEVICE INFO – DEVICE INFORMATION

Shows the present I/O data and status, last calibration date, model number and other information.

Device Info.	Basic	Calib.	Adjust.	Loop Test
Input value	0.0000deg C, 16.6667%			
Output value	20.3978mA, 102.0000%			
Status	Burnout			
RTD resistance	0.0000 (Ohm)			
Tag No.	TESTTAG0001			
Calibrated date				
Model	M6DXR-1Z1-R			
Serial	M6DXR-1Z1-R			
Hardware	M6DXRHV1.00			
Firmware	M6DXRFV1.00			

Name	Explanations
Input value v m r t a s f l f b a t a r u a P	Shows the current input value in engineering unit and in percent.
Input 1 value F2	Shows the current input 1 value in engineering unit and in percent.
Input 2 value F2	Shows the current input 2 value in engineering unit and in percent.
Output value	Shows the current output value in engineering unit and in percent.
Status	Shows the current device status. Normal The device is operating in normal parameters. Saturation The output is saturated at -2% or at +102%. Burnout M P T a t a r u The input wire is broken. Fixed output The device in the loop test mode, supplying a fixed output. Alarm A S a t a r The alarm relay is in the tripped status.
Cold junction temp. T a t u	Shows the temperature measured at the CJC Sensor (CJM).
Terminal temperature T a t u	Shows the emf voltage measured at the thermocouple sensor.
RTD resistance R a r u	Shows the resistance measured at the RTD sensor.
Tag No.	Shows the device's tag name. When 'Unlock' box located above Device Info tab is checked, the tag can be modified. Enter at the maximum of 16 alphanumeric characters among the following: 0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ !"#\$%&'()*=+*^~ @`[]{};:<>?_.,/
Calibrated date	Shows the date when the last calibration was conducted.
Model	Model number of the device This is the original model number at our factory. Actual model suffix codes may differ if the device setting has been changed at site.
Serial	Serial number of the device
Hardware	Hardware revision number of the device
Firmware	Firmware revision number of the device

2.3.3 BASIC – BASIC SETTING

Shows basic I/O setting of the device. Parameter items on the screen may change depending upon models.

When 'Unlock' box located above Device Info tab is checked, modifiable parameters are highlighted on the light orange background. Click one of such parameters and to show a pull-down list or an edit box to modify it.

For example, the Input Type is selected on a pull-down list (See the example below – left). Another example for an edit box is given by Filter Time Constant (See the example below – right). Enter an appropriate value and press Enter key.

Figure: Pull-down list.

Figure: Edit box.

Model specific parameter items are explained in Section 4.

2.3.4 CALIB – CALIBRATION

The device's calibration ranges (actual input and output ranges such as 4 to 20mA or 1 to 5V) can be setup using a simulated input signals.

Input Calibration

- 1) Click [Start Calib.] button under Input Calibration. The maximum usable range of the selected input type is read into the value fields.
- 2) Apply a simulated 0% input signal and click [0% Calib.] button. The simulated input is read in.
- 3) Apply a simulated 100% input signal and click [100% Calib.] button. The simulated input is read in.

Figure: Start input calibration.

Figure: Max. usable range $\pm 10V$.

Figure: Calibrated range set to 1 to 5V.

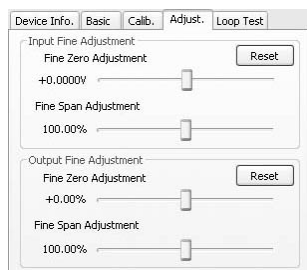
- 4) Click [Set] button to apply the calibration range to the device.

Output Calibration

- 1) Click [Start Calib.] button under Output Calibration.
- 2) Vary the simulated input signal levels until the monitored output shows a desired 0% output. Click [0% Calib.] button. The simulated output is read in.
- 3) Vary the simulated input signal levels until the monitored output shows a desired 100% output. Click [100% Calib.] button. The simulated output is read in.
- 4) Click [Set] button to apply the calibration range to the device.

2.3.5 ADJUST – FINE ADJUSTMENTS

Fine adjustments can be conducted independently for the input and the output. Zero is adjusted by offset adjustment, while Span is adjusted by gain adjustment.



Input Fine Adjustment

- 1) Apply 0% input signal.
- 2) Adjust the sliding potentiometer until the monitored input signal shows 0% input.
- 3) Apply 100% input signal.
- 4) Adjust the sliding potentiometer until the monitored input signal shows 100% input.

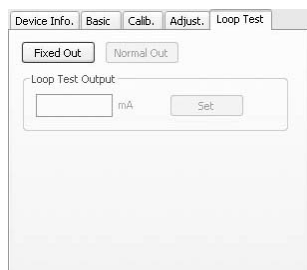
Output Fine Adjustment

- 1) Apply 0% input signal.
- 2) Adjust the sliding potentiometer until the monitored output signal shows 0% output.
- 3) Apply 100% input signal.
- 4) Adjust the sliding potentiometer until the monitored output signal shows 100% output.

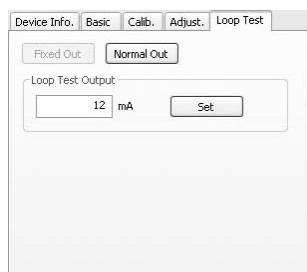
2.3.6 LOOP TEST

The device output signal can be simulated without actual input signals to conduct a loop test.

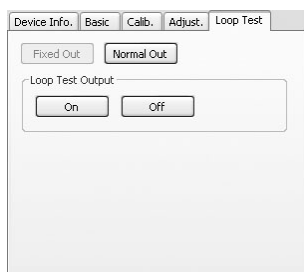
- 1) Click [Fixed Out] button.



- 2) Enter a desired output value and click [Set] (analog), or click [On] or [Off] button (discrete).



Analog output device



Discrete (Contact) output device

- 3) Click [Normal Out] button to cancel the loop test mode.

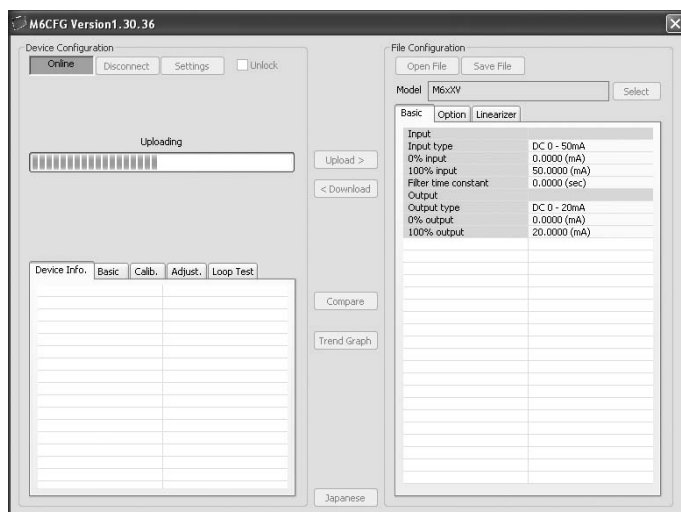
Caution !

Be sure not to forget to return the device to the normal output mode after the loop test. The loop test mode is not cancelled until the power supply to the device is turned off.

2.4 READING/Writing PARAMETERS

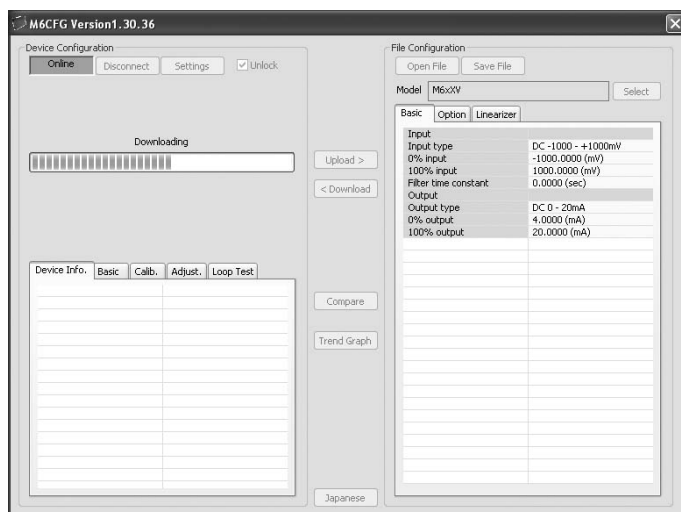
2.4.1 READING PARAMETERS FROM DEVICE (UPLOAD)

Confirm the device connection (cable and software link) and click [Upload] to start reading parameters stored in the connected device. A progress bar is indicated on the screen and when the uploading is complete, the parameters are shown on File Configuration field.



2.4.2 WRITING PARAMETERS TO DEVICE (DOWNLOAD)

Confirm the device connection (cable and software link) and click [Download] to start writing parameters edited on the screen to the connected device. A progress bar is indicated on the screen until the downloading is complete.



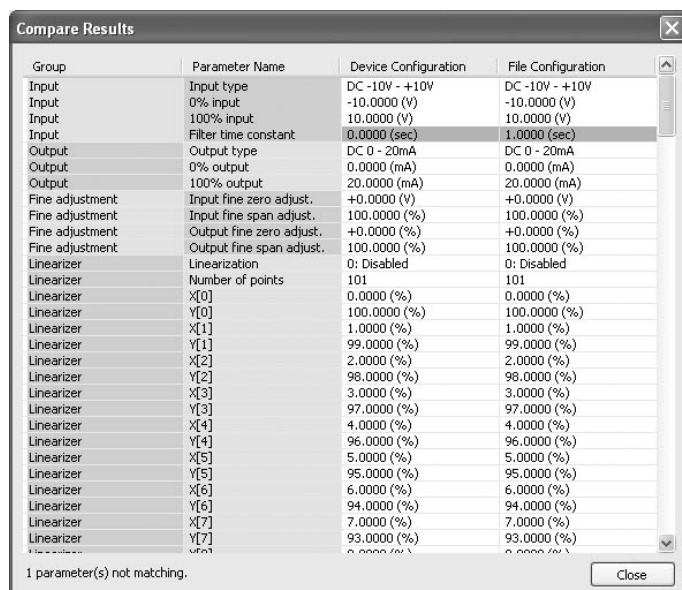
Caution !

DO NOT turn off the power supply to the device or disconnect the cable while downloading. The device setting may not be complete as expected.

2.5 COMPARING PARAMETERS

Parameters presently edited on the screen and those stored in the connected device can be compared side by side. Edited parameters could be from a file if you open one in advance, or another device if you uploaded one in advance.

Clicking [Compare] button starts reading parameters from the connected device. Parameters are compared and listed on the screen side by side. The rows showing differences between two sets of parameters are highlighted in red background. The total number of non-matching cases is mentioned at the bottom.



Group	Parameter Name	Device Configuration	File Configuration
Input	Input type	DC -10V - +10V	DC -10V - +10V
Input	0% input	-10.0000 (V)	-10.0000 (V)
Input	100% input	10.0000 (V)	10.0000 (V)
Input	Filter time constant	0.0000 (sec)	1.0000 (sec)
Output	Output type	DC 0 - 20mA	DC 0 - 20mA
Output	0% output	0.0000 (mA)	0.0000 (mA)
Output	100% output	20.0000 (mA)	20.0000 (mA)
Fine adjustment	Input fine zero adjust.	+0.0000 (V)	+0.0000 (V)
Fine adjustment	Input fine span adjust.	100.0000 (%)	100.0000 (%)
Fine adjustment	Output fine zero adjust.	+0.0000 (%)	+0.0000 (%)
Fine adjustment	Output fine span adjust.	100.0000 (%)	100.0000 (%)
Linearizer	Linearization	0: Disabled	0: Disabled
Linearizer	Number of points	101	101
Linearizer	X[0]	0.0000 (%)	0.0000 (%)
Linearizer	Y[0]	100.0000 (%)	100.0000 (%)
Linearizer	X[1]	1.0000 (%)	1.0000 (%)
Linearizer	Y[1]	99.0000 (%)	99.0000 (%)
Linearizer	X[2]	2.0000 (%)	2.0000 (%)
Linearizer	Y[2]	98.0000 (%)	98.0000 (%)
Linearizer	X[3]	3.0000 (%)	3.0000 (%)
Linearizer	Y[3]	97.0000 (%)	97.0000 (%)
Linearizer	X[4]	4.0000 (%)	4.0000 (%)
Linearizer	Y[4]	96.0000 (%)	96.0000 (%)
Linearizer	X[5]	5.0000 (%)	5.0000 (%)
Linearizer	Y[5]	95.0000 (%)	95.0000 (%)
Linearizer	X[6]	6.0000 (%)	6.0000 (%)
Linearizer	Y[6]	94.0000 (%)	94.0000 (%)
Linearizer	X[7]	7.0000 (%)	7.0000 (%)
Linearizer	Y[7]	93.0000 (%)	93.0000 (%)

1 parameter(s) not matching.

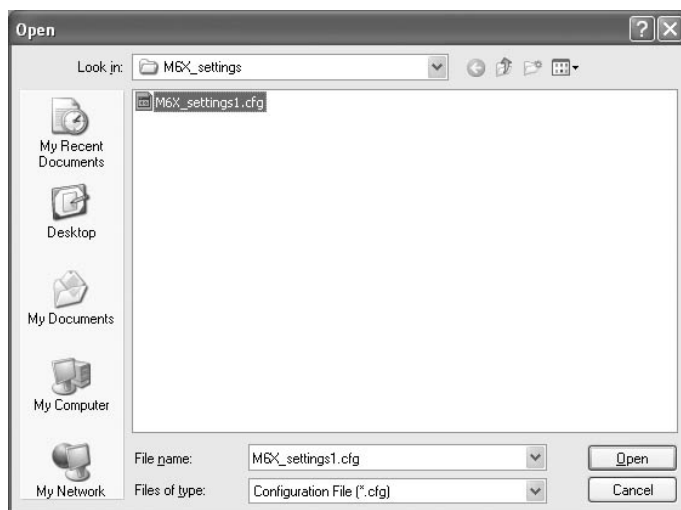
Close

2.6 FILES

2.6.1 READING PARAMETERS SAVED AS FILE

Clicking [Open File] calls up the Windows-standard Open dialog box. Select a parameter file to show a stored parameter setting.

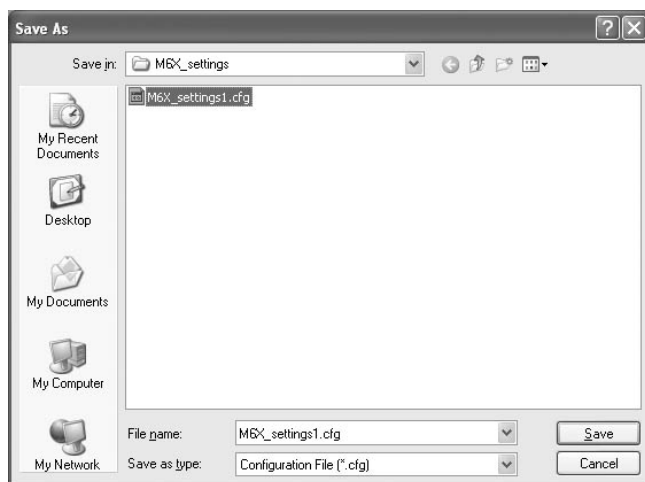
In order to download the parameters to the connected device, click [Download] button.



2.6.2 SAVING PARAMETERS IN A FILE

Clicking [Save File] calls up the Windows-standard Save As dialog box. Enter a desired file name to File Name field and click [Save] to store a parameter setting.

In order to save the parameters of the connected device, click [Upload] first and then save them as a file.



2.6.3 OFFLINE OPERATION

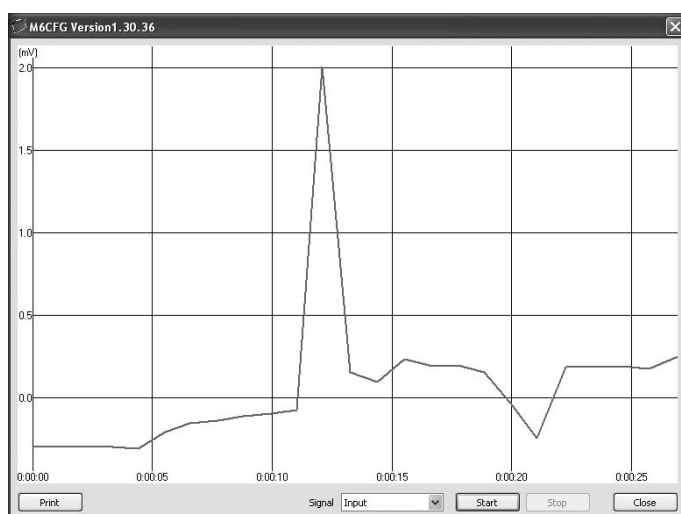
The parameters under File Configuration on the right side of the window can be edited freely regardless of the status of the connection or the connected device.

With a device connected online, only the parameters under Basic tab under Device Configuration can be edited in real time. In the offline state, all parameters under File Configuration including Linearizer and Option setting can be edited.

If you want to modify setting for the connected device, first upload the parameters from the device, edit them and then download them to the device.

2.7 TREND GRAPH

I/O signal of the device can be monitored on a trend graph. The trend is recorded and displayed in 1 second intervals.



Choose the signal you want to record and click [Start] to start recording and displaying in real time.

Click [Stop] to stop monitoring, and the recorded trend graph can be studied more closely by scrolling and enlarging the screen:

Mouse	Screen
Press left mouse button and drag	Scrolls the screen to all directions.
Press right mouse button and drag	Forms an area on the screen to enlarge and fit it to the full-screen area when the mouse button is released.
Double-click left mouse button	Display range is reduced by half (trend curve is zoomed in).
Double-click right mouse button	Display range is doubled (trend curve is zoomed out).

[Print] is available only when the monitoring is stopped by [Stop] button.

Click [Print] to print the trend graph presently displayed on the screen.

3. HOW TO SETUP I/O (EXAMPLE)

Basic input/output range setting is as in the following.

The input range of the M6DXV is to be configured to 4 to 20 mA_{dc} and output range to 1 to 5 V_{dc} in the below example.

3.1 CONNECTING TO THE DEVICE

Start up the M6CFG software. Choose the COM port to which the device is connected and click [Connect]. Present parameter setting is uploaded and displayed under Device Configuration on the screen. Check 'Unlock' box so that you can now change the parameters.

3.2 INPUT RANGE

- 1) Click [Input type] field. Choose an input type adequate for the desired range from the list below.

DC 0 – 50mA

DC -1000 – +1000mV

DC -10 – +10V

For 4 – 20 mA input, choose the input type 'DC 0 – 50mA.'

- 2) Click [0% input] field. The input range is automatically set to the full-scale of the selected input type. Enter the scaled 0% input value (4.0000). Use the same engineering unit as for the type.
- 3) Click [100% input] field. Enter the scaled 100% input value (20.0000).

3.3 OUTPUT RANGE

- 1) Click [Output type] field. Choose an output type adequate for the desired range from the list below.

DC 0 – 20mA

DC -5 – +5V

DC -10 – +10V

For 1 – 5 V DC input, choose the input type 'DC -5 – +5V.'

- 2) Click [0% output] field. The output range is automatically set to the full-scale of the selected output type. Enter the scaled 0% output value (1.0000). Use the same engineering unit as for the type.
- 3) Click [100% output] field. Enter the scaled 100% output value (5.0000).

3.4 OTHER SETTING

The M6DXV has more variety of functions than explained in the previous sections, including filter time constant setting and linearization. Basic procedure is mostly the same as the above example.

Linearizer and Option setting must be edited offline. Upload the present setting to the PC (See 2.4.1), edit the file and then download the new setting (See 2.4.2).

For detailed explanations, please refer to Section 4. PARAMETER DETAILS.

4. PARAMETER DETAILS

4.1 PARAMETERS LIST

Supported parameters depend upon model types. Supported ones are marked with 'X' in the following table.

		M6xxV	M6xxT	M6xxR	M6xxM	M6xxAS	M6xxF1	M6xxF2	M6xxF3	M6xxAT	M6xxAR	M6xxU	M6xxAP					
BASIC SETTING	Input type	X	X	X	X	X	X	X	X	X	X	X	X					
	0% input / 100% input	X	X	X	X	X	X	X	X	X	X	X	X					
	Low-end cutout point						X	X										
	Input high limit / low limit							X										
	Input type (input 2)							X										
	0% input / 100% input (input 2)							X										
	Low-end cutout point (input 2)							X										
	Input high limit / low limit (input 2)							X										
	Equation / K0...K2 / A0...A2							X										
	Burnout		X	X	X					X	X	X						
	Sensor wires			X							X	X						
	Temperature unit		X	X						X	X	X						
	Cold junction compensation		X							X		X						
	Response Characteristics	X	X	X	X	X	X	X	X	X	X	X	X					
	Filter type						X											
	Filter time constant	X	X	X	X	X	X	X	X	X	X	X	X					
	Sampling cycle						X											
	Filter samples						X											
	High-cut / Low-cut samples						X											
	Max. positive / negative rate						X											
	Linearization						X											
	Hold								X									
	Control logic								X									
	Output type	X	X	X	X		X	X	X			X						
	Output period												X					
	0% output / 100% output	X	X	X	X		X	X	X			X						
	Alarm value					X				X	X							
	Hysteresis (deadband)					X				X	X							
	Alarm trip operation					X				X	X							
	Coil at alarm					X				X	X							
	Alarm ON delay timer					X				X	X							
	Power ON delay timer					X				X	X							
	Output low limit / high limit						X											
OPTIONS	Fine input adjustments	X	X	X	X	X	X	X	X	X	X	X	X					
	Fine input adjustments (input 2)							X										
	Fine output adjustments	X	X	X	X		X	X	X			X						
LINEARIZER	User's table linearization	X			X	X	X	X	X			X	X					
	Number of points	X			X	X	X	X	X			X	X					
	X[0], Y[0] ... X[100], Y[100]	X			X	X	X	X	X			X	X					
	Custom TC start		X							X		X						
	Custom TC step		X							X		X						
	Custom TC points		X							X		X						
	Custom TC V[0] ... V[299]		X							X		X						
	Custom RTD type			X							X	X						
	Coefficient R0 / A / B / C			X							X	X						
	Custom RTD start			X							X	X						
	Custom RTD step			X							X	X						
	Custom RTD points			X							X	X						
	Custom RTD R[0] ... R[299]			X							X	X						

4.2 BASIC SETTING

4.2.1 INPUT TYPE

Selectable input types depend upon model numbers.

Symbol	Selection	Applicable Models
VAS F1	DC 0 – 50mA	M6xXV, M6xXAS, M6xXF1, M6xXF2, M6xXF3, M6xXU, M6xXAP, all suffix codes
F2 F3 u	DC -1000 – +1000mV	
AD	DC -10 – +10V	
Tatu	TC (PR)	M6xXT, M6xXAT, M6xXU all suffix codes except the input code 0
	TC K (CA)	
	TC E (CRC)	
	TC J (IC)	
	TC T (CC)	
	TC B (RH)	
	TC R	
	TC S	
	TC N	
	TC Custom TC	
Paru	RTD JPt 100 (JIS '89)	M6xXR, M6xXAR, M6xXU all suffix codes except the input codes 7, 0
	RTD Pt 100 (JIS '89)	
	RTD Pt 100 (JIS '97, IEC)	
	RTD Pt 50 (JIS '81)	
	RTD Cu 10 (25 deg C)	
	RTD Pt 1000	M6xXR, M6xXAR, M6xXU the input code 7
	RTD Custom RTD	M6xXR, M6xXAR, M6xXU all suffix codes
Mu	POT 0 – 5kOhm	M6xXM, M6xXU all suffix codes
	POT 0 – 2.5kOhm	
	POT 0 – 1.2kOhm	
	POT 0 – 600Ohm	
	POT 0 – 300Ohm	
	POT 0 – 100Ohm	

4.2.2 0% INPUT, 100% INPUT

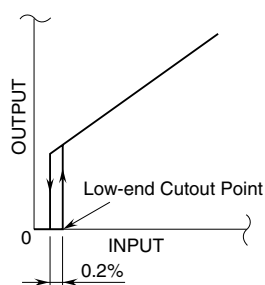
Calibrated (scaled) input range. Unit depends upon the models.

4.2.3 LOW-END CUTOFF POINT F1 F2

The input signals below the low-end cutoff point are handled as 0%.

The point has 0.2% hysteresis (deadband). The low-end cutoff is applied exactly at the point when an increasing signal passes through the point, while it is applied at -0.2% of the point when a decreasing signal passes through it.

Set between 0.0000% and 99.9999%. With 0.0000% setting, the low-end cutoff function is cancelled.



When the output low limit is set to a value higher than 0%, the input below the low-end cutoff point is forced to the value, not 0%.

4.2.4 INPUT HIGH LIMIT, INPUT LOW LIMIT **F2**

The output signal is limited within the range between the high limit and the low limit.

For example, when the high limit is set to 90% and the low limit to 10%, the input signal between 90% and 102% is converted as 90%, while the input between -2% and 10% is converted as 10%.

4.2.5 EQUATION / K0...K2 / A0...A2 **F2**

The following functions and parameters are selectable for the two-input function module. Input 1 (X₁) and Input 2 (X₂) are applied with the selected function and converted into Output (X₀).

Gains K₀, K₁ and K₂ are selectable within -29.9999 to 29.9999, while biases A₀, A₁ and A₂ are selectable within -299.9999 and 299.9999%.

Function	Equation
1 Temperature compensation	$X_0 = \frac{K_1 X_1}{\sqrt{K_2 X_2 + A_2}}$ <p>when $\sqrt{K_2 X_2 + A_2} = 0$, $X_0 = +102$ with $K_1 X_1 > 0$ $X_0 = 0$ with $K_1 X_1 = 0$ $X_0 = -2$ with $K_1 X_1 < 0$</p>
2 Temperature compensation (square root)	$X_0 = \frac{K_1 \sqrt{X_1}}{\sqrt{K_2 X_2 + A_2}}$ <p>when $\sqrt{K_2 X_2 + A_2} = 0$, $X_0 = +102$ with $K_1 X_1 > 0$ $X_0 = 0$ with $K_1 X_1 = 0$ $X_0 = -2$ with $K_1 X_1 < 0$</p>
3 Pressure compensation	$X_0 = K_1 X_1 \sqrt{K_2 X_2 + A_2}$
4 Pressure compensation (square root)	$X_0 = K_1 \sqrt{X_1} \sqrt{K_2 X_2 + A_2}$
5 Addition / Subtraction	$X_0 = K_0 \{K_1 (X_1 + A_1) + K_2 (X_2 + A_2)\} + A_0$
6 Multiplication	$X_0 = K_0 (K_1 X_1 + A_1) (K_2 X_2 + A_2) + A_0$
7 Division	$X_0 = \frac{K_0 (K_1 X_1 + A_1)}{K_2 X_2 + A_2} + A_0$ <p>when $K_2 X_2 + A_2 = 0$, $X_0 = +102$ with $K_0 (K_1 X_1 + A_1) > 0$ $X_0 = 0$ with $K_0 (K_1 X_1 + A_1) = 0$ $X_0 = -2$ with $K_0 (K_1 X_1 + A_1) < 0$</p>
8 High selector	$X_0 = X_1 \text{ when } X_1 \geq X_2$ $X_0 = X_2 \text{ when } X_1 < X_2$
9 Low selector	$X_0 = X_2 \text{ when } X_1 \geq X_2$ $X_0 = X_1 \text{ when } X_1 < X_2$

n is applied without root extraction with $n < 0$ in $\sqrt[n]{n}$.

4.2.6 BURNOUT TERMINAL **U**

Specifies either the output should go upscale (+102%) or downscale (-2%) in case that a burnout is detected. Choose among the following:

- None
- Upscale
- Downscale

4.2.7 SENSOR WIRES **RARDU**

Choose either 2 wires, 3 wires or 4 wires.

“4 wires” is not selectable for **ARD**

4.2.8 TEMPERATURE UNIT T R A T A R U

Choose among the following:

deg C
deg F
K

The device internally processes temperature in Celsius, and converts the value into Fahrenheit (°F) or Absolute Temperature (K) to show on the screen.

This means certain Fahrenheit values cannot be set and displayed exactly down to the limit of fractions.

When you enter a value in Fahrenheit, fractions of values converted into Celsius are rounded to four (4) decimal places before it is internally processed, then converted again into Fahrenheit to be displayed on the screen, its result's fractions rounded again.

For example:

Entering 96 [°F] is converted internally into $(96 - 32) / 1.8 = 35.5555\dots$, rounded to 35.5556. Then it is converted again into $35.5556 \times 1.8 + 32 = 96.00008$, rounded to 96.0001 [°F] on the screen.

4.2.9 COLD JUNCTION COMPENSATION T A T U

Specifies either the CJC sensor (model: CJM) incorporated to the device is used to measure the cold junction temperature or a preset fixed terminal temperature is used for cold junction compensation.

4.2.10 RESPONSE CHARACTERISTICS

Choose input response characteristic among the following:

Standard

Normal response of signal conditioners. For normal input signal, the fluctuation in the output is small and the output stabilizes. On the other hand, the output may not respond to small variation in the input signal.

High sensitivity

The response time to very small variation in input signal will be short. On the other hand, the fluctuation in the output may be large for normal input signal.

High sensitivity is available with the versions shown below or later. For the models not shown in the table, high sensitivity is available with all versions.

MODEL	VERSION
M6xXV, M6xXM, M6xXR, M6xXT, M6xXAS	1.30
M6xXF1, M6xXF2, M6xXF3	1.20
M6xXAT, M6xXAR, M6xXU	1.10

4.2.11 FILTER TYPE F1

Choose among the following:

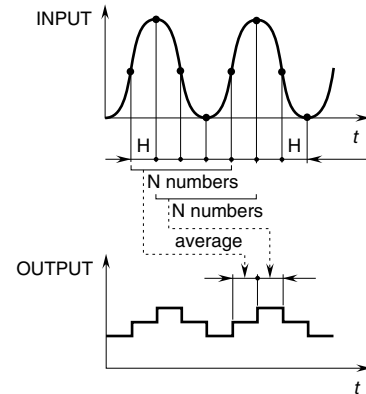
Disable

No filter function is used.

Moving Average

The module samples input signals every H seconds and, excluding U numbers of highest-value samples and L numbers of lowest-value samples, outputs proportionally to the average of the rest $[N \times (U + L)]$ of sampled data. When a new input is sampled after another H seconds, it gives up the oldest sample and calculates a new average including the latest sample and outputs proportionally.

When the number of samples to be calculated equals 0 or less, it outputs an error.



Parameter	Selection or Programmable Range
Sampling cycle H	0.1000 to 100.0000 seconds
Filter samples N	1 to 128
High-cut samples U	$([\text{High-cut samples}] + [\text{Low-cut samples}] + 1) \leq 128$
Low-cut samples L	$([\text{High-cut samples}] + [\text{Low-cut samples}] + 1) \leq 128$

Dead-time Computing

The module does not respond to an input signal for a preset dead-time* duration. In addition, with adjusting a time constant T, it generates a first order lag output after the dead-time. Set 0.0000 for the time constant when the first order lag is not needed.

$$X_0(s) = \frac{e^{-HNs}}{1 + Ts} X_1(s)$$

where X_1 : Input
 X_0 : Output

Dead time = $H \times N$ (s)

Parameter	Selection or Programmable Range
Sampling cycle H	0.1000 to 100.0000 seconds
Filter samples N	1 to 128
Filter time constant T	0.5000 to 100.0000 seconds

*Output is refreshed every sampling cycle. The response time may be delayed by 1 cycle at the maximum.

Delay Buffer

The module generates a first order lag output.

$$X_0(s) = \frac{1}{1 + Ts} X_1(s)$$

where X_1 : Input
 X_0 : Output

Parameter	Selection or Programmable Range
Filter time constant T	0.5000 to 100.0000 seconds

Lead-time Computing

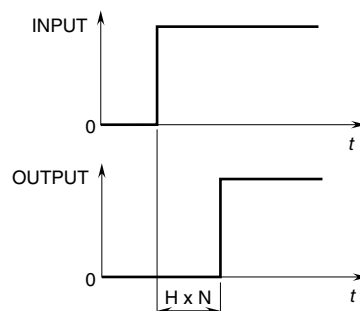
The module operates a lead-time equation.

$$X_0(s) = (1 + Ts) X_1(s)$$

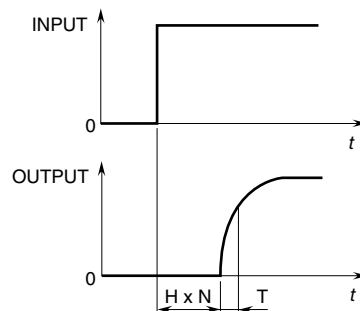
where X_1 : Input
 X_0 : Output

Parameter	Selection or Programmable Range
Filter time constant T	0.5000 to 100.0000 seconds

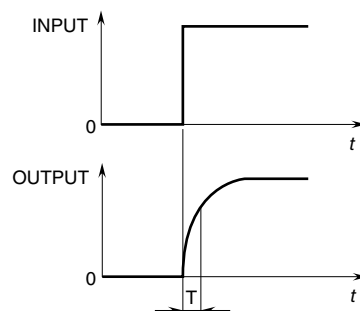
• Step input with dead-time



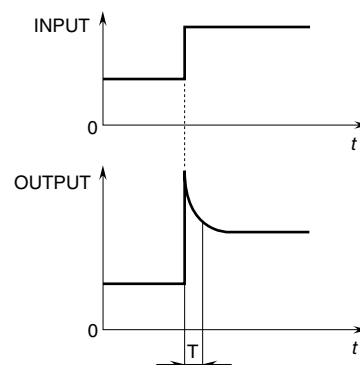
• Step input with dead-time plus time constant



• Step input with time constant



• Step input with lead-time constant



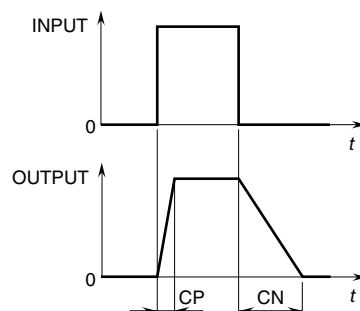
Ramp Buffer

The module's output does not change faster than a preset maximum rate, positive CP and negative CN, no matter how fast its input changes.

Setting 0.0000 cancels the filter.

Parameter	Selection or Programmable Range
Max. positive rate CP	0.0000 to 200.0000 %/second
Max. negative rate CN	0.0000 to 200.0000 %/second

• Step input with rate-of-change limits



4.2.12 FILTER TIME CONSTANT

First order lag filter used other than for the M6xXF1. Time constant, time required for an step input to track and reach approx. 63% of the full-scale, is selectable from 0.5 to 30 seconds. No filter is applied when set to 0.

For the M6xXF1, this parameter is used with specific filter functions. Refer to respective filter types for more information.

4.2.13 SAMPLING CYCLE F1

4.2.14 FILTER SAMPLES F1

4.2.15 HIGH-CUT SAMPLES, LOW-CUT SAMPLES F1

4.2.16 MAX. POSITIVE RATE, MAX. NEGATIVE RATE F1

Sampling, cycle, Filter samples, High-cut samples, Low-cut samples, Max. positive rate and Max. negative rate are parameters specifically used with the M6xXF1 filter functions. Refer to respective filter types for more information.

4.2.17 LINEARIZATION F1

Choose among the following:

User's Table Linearization

The input is converted into a linearized output according to the user specified segment data table, defined with pairs of X (input) and Y (output) values.

2 to 101 segment points can be specified.

Inverted Output

The output is inversely proportional to the input.

$$X_0 = 100 - X_1$$

where X_1 : Input
 X_0 : Output

Square Root Extraction (orifice, venturi)

The output is inversely proportional to the input.

$$X_0 = 10 \sqrt{X_1}$$

where X_1 : Input
 X_0 : Output

X^2 Output (Palmer-Bowlus flume, Parshall flume)

$$X_0 = X_1^2 / 100$$

where X_1 : Input
 X_0 : Output

X^{5/2} Output (triangular or V-notch weir)

$$X_0 = X_1^{5/2} / 1000$$

where X_1 : Input
 X_0 : Output

X^{3/2} Output (rectangular weir)

$$X_0 = X_1^{3/2} / 10$$

where X_1 : Input
 X_0 : Output

4.2.18 HOLD FUNCTION F3

Choose among the following:

Hold type	Function
Sampling hold	The output is held at the value of when CONTROL turns to HOLD.
Peak hold	The output is held at the maximum input value during HOLD. If the maximum input is updated, the output changes to that value. When CONTROL turns to TRACK, the maximum value is reset.
Valley hold	The output is held at the minimum input value during HOLD. If the minimum input is updated, the output changes to that value. When CONTROL turns to TRACK, the minimum value is reset.
Peak-to-peak hold	The output is held at the difference between the maximum and minimum input value during HOLD. If the maximum or minimum input is updated, the output changes to that value. When CONTROL turns to TRACK, the difference value is reset.

4.2.19 CONTROL LOGIC **F3**

Choose among the following:

Control Logic	Function
Hold at open	When CONTROL is open, Hold Function is available.
(Track at close)	When CONTROL is close, Hold Function is unavailable and the OUTPUT tracks the INPUT.
Hold at close	When CONTROL is close, Hold Function is available.
(Track at open)	When CONTROL is open, Hold Function is unavailable and the OUTPUT tracks the INPUT.

4.2.20 OUTPUT TYPE **VTRMF1F2F3UAD**

Choose among the following:

DC 0 – 20mA
DC -5 – +5V
DC -10 – +10V

For AP choose among the following:

Frequency
Duty

Caution !

The DIP switches on the device must be appropriately set to the selected output type. If both settings do not match, the device output may be an unexpected one.

4.2.21 OUTPUT PERIOD **AD**

When duty is chosen for the output type, choose the period of pulse between 0.0080 and 1 000.0000 (Hz).

4.2.22 0% OUTPUT, 100% OUTPUT **VTRMF1F2F3UAD**

Calibrated (scaled) output range. Unit depends upon the output type.

4.2.23 ALARM VALUE **ASATAD**

Threshold value to trip an alarm. Choose between -2.0000 and +102.0000%.

4.2.24 HYSTERESIS (DEADBAND) **ASATAD**

Once an alarm is tripped, it is not reset until the input signal goes across and past the setpoint by the hysteresis (deadband). Choose between 0 and 99.9999%.

4.2.25 ALARM TRIP OPERATION **ASATAD**

Choose either High or Low alarm.

4.2.26 COIL AT ALARM AS AT AR

You can specify either the relay coil is to be energized or de-energized at an alarm condition.

The table below shows how this setting affects the relay contact status across each set of terminals depending upon alarm conditions.

Coil	Set to 'Energized'		Set to 'De-energized'	
	COM - NO	COM - NC	COM - NO	COM - NC
Alarm tripped	ON	OFF	OFF	ON
Alarm Not tripped	OFF	ON	ON	OFF
Power OFF	OFF	ON	OFF	ON

4.2.27 ALARM ON DELAY TIMER AS AT AR

Alarm contact does not trip unless an alarm condition remains true for the alarm on delay time. If the input signal goes out of the alarm zone within the preset time, the delay time is reset so that when it comes into the zone again, the delay time is newly applied.

Choose between 0 and 999 seconds.

4.2.28 POWER ON DELAY TIMER AS AT AR

Alarm is disregarded for the preset power on delay time after the power supply to the device is turned on.

Choose between 0 and 999 seconds.

4.2.29 OUTPUT HIGH LIMIT, OUTPUT LOW LIMIT FI

The output does not go above the preset high limit or below the preset low limit.

High and Low limits are independently selectable within -2.0000 and 102.0000%.

4.3 OPTIONS

4.3.1 FINE INPUT ADJUSTMENTS

The following equation is applied to finely adjust the input signal.

$$\text{Adjusted value} = \text{Input} \times \text{Input Span Fine Adj.} + \text{Input Zero Fine Adj.}$$

Unit depends upon the input type. Adjustable ranges for Input Zero Fine Adj. are as follows:

Symbol	Input type	Unit	Adjustable range
VAS F1	DC 0 – 50mA	mA	-7.5 to 7.5
F2 F3	DC -1000 – +1000mV	mV	-300 to 300
UAD	DC -10 – +10V	V	-3 to 3
TATU	Thermocouple	mV	-15 to 15
RARU	RTD	Ω	-40 to 40
MU	Potentiometer	%	-15 to 15

Adjustable range for Input Span Fine Adj. is 85 to 115%.

4.3.2 FINE OUTPUT ADJUSTMENTS **VTRM F1 F2 F3 U**

The following equation is applied to adjust the output signal finely.

$$\text{Adjusted value} = \text{Output} \times \text{Output Span Fine Adj.} + \text{Output Span} \times \text{Output Zero Fine Adj.}$$

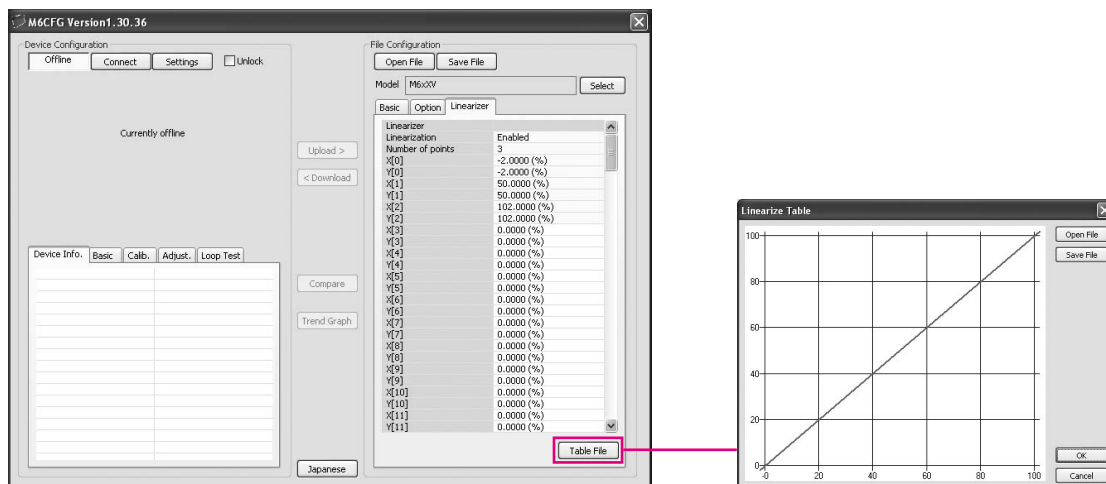
Adjustable range for Output Zero Fine Adj. is -2 to 2%, Span Fine Adj. is 98 to 102%.

4.4 LINEARIZER

Different types of linearization are used depending upon models as shown below:

Symbol	Input type	Linearizer
VMA S F1 F2 F3 U AD	DC mV, V and mA Potentiometer	User Table Specified by a segment linearization table with calibration points defined with multiple sets of input (X) and output (Y) values.
TATU	Thermocouple	Custom TC Calibration points defined with a starting point, calibration step and calibration points. An EMF value is given to each point.
RARU	RTD	Custom RTD Calibration points defined with a starting point, calibration step and calibration points. A resistance value is given to each point.

A linearization table created on the screen can be saved as a text file, while those saved as text files can be also imported. Click [Table] to read or save a file. Refer to Appendices for detailed table format



Note

[Table] button is available when 'Linearization' is 'Enabled' with User Table, or when 'Table' is selected with Custom RTD.

4.4.1 USER TABLE ∇ M A S F1 F2 F3 U

Linearization

Choose among the following:

- 0 : Disable
- 1 : Enable

With '0 : Disable' selected, the output % is proportional to the input %.

With '1 : Enable' selected, the input % is converted into the output % according to a user specified table.

For the model M6xF1, the linearization setting is also available in the Basic Setting, including specifying other specific I/O characteristics. For more information, refer to Section 4.2.16.

Number of points

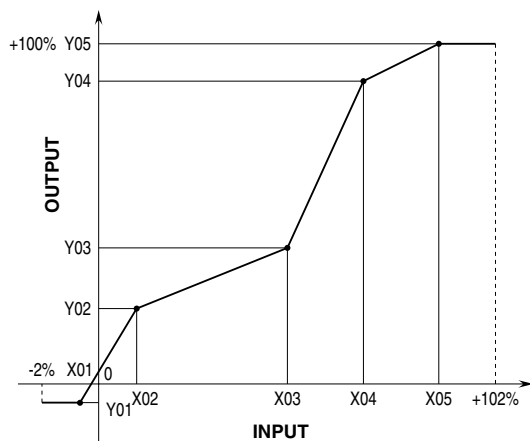
Specify the number of calibration points in the linearization table (2 through 101).

X[0], Y[0] ... X[100], Y[100]

Enter pairs of X (input %) and Y (output %) within the range of -2 to 102% of the full-scale. Arrange in order from the smallest X value. Non-specified Xs and Ys, i.e. the range between two calibration points are approximated by a linear line.

When the input value is out of the defined range, the closest Y value is applied.

When the calibrated output value is lower than -2% or higher than +102%, -2% and +102% is output respectively.



4.4.2 CUSTOM TC T A T U

Custom TC start

Specify the minimum temperature value from -300 to 1000°C.

Custom TC step

Specify the temperature step in which the resistance values are given in the table, from 1 to 50°C.

Custom TC points

Specify how many calibration points are given in the table, from 2 to 300 points.

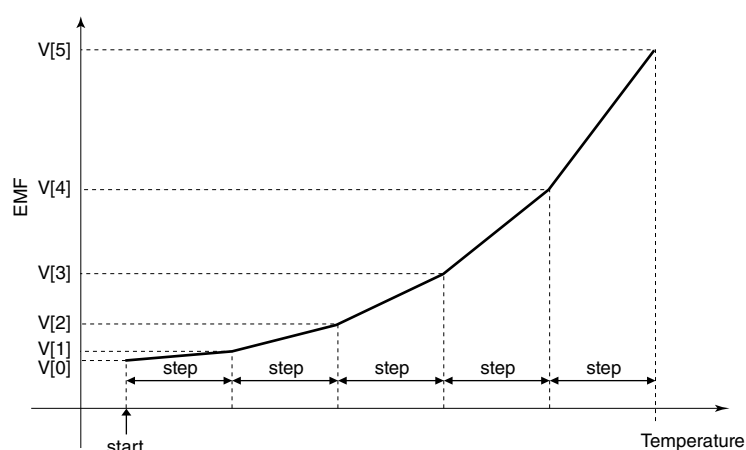
V[0] through V[299]

Specify the resistance values for each calibration point in the temperature range which is determined by Custom TC start, step and points.

The range of input selectable emf value is specified below.

INPUT SELECTABLE EMF VALUE	INPUT CONVERSION ACCURACY
-1000 – +1000mV	<p>±0.1% of the absolute value of emf at 0% or 100%, whichever greater.</p> <p>(e.g.) In case that the emf is -50mV at 0% and +25mV at 100%, the absolute value of -50mV is greater than 25mV. Therefore, the accuracy is ±0.05mV as $50 \times 0.001 = 0.05\text{mV}$.</p>

Start at V[0], in consecutive, ascending order or in consecutive, descending order. Mixing ascending and descending orders is not possible.



4.4.3 CUSTOM RTD R A R U

Custom RTD type

Choose either Table or CVD Coefficient (Callendar-Van Dusen approximation formula).

For Table type calibration, temperature and resistance values are described in a table format, and the input resistance value is converted into temperature referring to it.

For Callendar-Van Dusen approximation formula, the CVD coefficients R0, A, B, and C in the following equation are specified.

$$r [\Omega] = R_0 \times (1 + A \times t + B \times t^2) \quad (t [^{\circ}\text{C}] \geq 0)$$

$$r [\Omega] = R_0 \times (1 + A \times t + B \times t^2 - 100 \times C \times t^3 + C \times t^4) \quad (t [^{\circ}\text{C}] < 0)$$

Resistance range depends upon model suffix codes. For Table type calibration, resistance values are checked when the data is downloaded. However, for CVD formula, no checking is performed.

RESISTANCE RANGE	MODEL NUMBER	CONVERSION ACCURACY
0 – 500 Ω	M6xXR-1x-R, M6xXR-3x-R, M6xXR-4x-R, M6xXR-5x-R, M6xXR-9x-R, M6xXAR-1x-R, M6xXAR-3x-R, M6xXAR-4x-R, M6xXAR-5x-R, M6xXAR-9x-R	$\pm 0.1\%$ of resistance at 100% or $\pm 0.038\Omega$, whichever greater
0 – 5 k Ω	M6xXR-7x-R, M6xXAR-7x-R	$\pm 0.1\%$ of resistance at 100% or $\pm 0.435\Omega$, whichever greater
0 – 20 k Ω	M6xXU-R1x-x, M6xXU-R3x-x, M6xXU-R4x-x, M6xXU-R5x-x, M6xXU-R7x-x, M6xXU-R9x-x	$\pm 0.1\%$ of resistance at 100% or $\pm 0.038\Omega$, whichever greater

Coefficient R0, A, B, C

Specify Coefficients in Callendar-Van Dusen formula.

Custom RTD start

Specify the minimum temperature value from -300 to 1000°C.

Custom RTD step

Specify the temperature step in which the resistance values are given in the table, from 1 to 50°C.

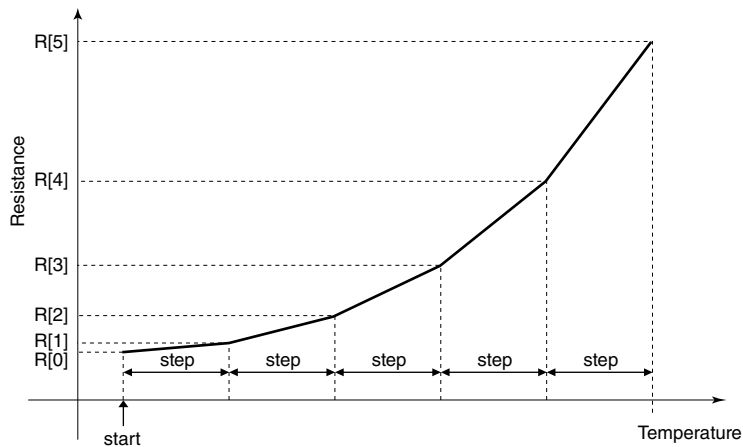
Custom RTD points

Specify how many calibration points are given in the table, from 2 to 300 points.

R[0] through R[299]

Specify the resistance values for each calibration point in the temperature range which is determined by Custom RTD start, step and points.

Start at R[0], in consecutive, ascending order for RTDs or in consecutive, descending order for thermistors. Mixing ascending and descending orders is not possible.



APPENDIX - 1. CUSTOM TC/RTD FORMAT

TC/RTD table data can be stored in a simple text format, created by Windows application software such as 'note pad'. This table can be imported as a predetermined linearization table.

User-specific TC/RTD data are defined in .text format with components as indicated below.

```
/* Custom table comment */

Minimum Temperature = 0.0000
Step = 1
{
    100.0000
    100.3900
    100.7800
    101.1700
    101.5600
}
```

The row starting with '/' is recognized as a comment.

The bracket '{' in the second row indicates the beginning of the table, while the '}' in the last row indicated the end.

Define the minimum temperature value in Celsius at Minimum Temperature, from -300 to 1000°C.

Specify the Temperature Step used in the table, from 1°C to 50°C.

°F or K cannot be used to define a custom table.

Describe the characteristics data within { }. Data must be entered in mV (TC) or ohms (RTD). Max. 4 decimal places. Up to 300 points can be specified.

APPENDIX - 2. USER TABLE FORMAT

Linearization data is saved in text format with components as indicated below. This table can be imported as a predetermined linearization table.

```
/* User linearization table comment */
{
    -2.000,    -2.000
    0.000,     1.000
    50.000,    49.000
    102.000,   102.000
}
```

The row starting with '/' is recognized as a comment.

The bracket '{' in the second row indicates the beginning of the table, while the '}' in the last row indicated the end.

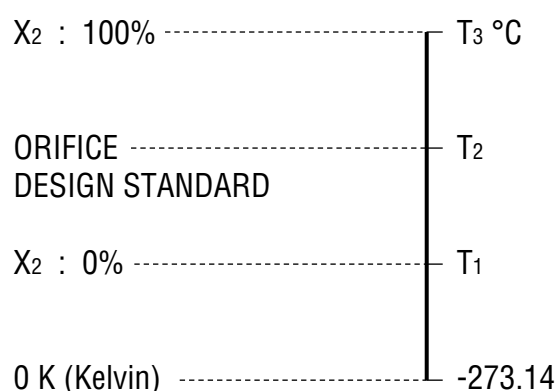
Each row contains Xn and Yn represented in %, paired and separated by comma.

Data must be arranged in order from the smallest Xn.

Max. 101 pairs of 'Xn, Yn' can be described.

APPENDIX - 3. HOW TO CALCULATE GAIN/BIAS FOR TEMP. & PRESS. COMPENSATION

TEMPERATURE COMPENSATION FOR DP FLOWMETER



K_1 = I/O range scaling factor

K_1 = 1 when input & output ranges are identical.

$$K_2 = \frac{T_3 - T_1}{T_2 + 273.14} \quad A_2 = \frac{T_1 + 273.14}{T_2 + 273.14}$$

[EXAMPLE]

Temp. range of DP flowmeter: 0 – 400°C

Design standard of orifice: 300°C

$$K_1 = 1$$

$$K_2 = \frac{400 - 0}{300 + 273.14} = 0.698$$

$$A_2 = \frac{0 + 273.14}{300 + 273.14} = 0.4766 = 47.66\%$$

PRESSURE COMPENSATION FOR DP FLOWMETER

Atmospheric pressure = 101.3 kPa (abs)

	Absolute Pressure kPa (abs)	Gauge Pressure kPa (G)
X ₂ : 100% -----	B ₃	G ₃
ORIFICE DESIGN STANDARD -----	B ₂	G ₂
X ₂ : 0% -----	B ₁	G ₁
0 kPa (abs) -----	0	-101.3

• Absolute Pressure

$$K_2 = \frac{B_3 - B_1}{B_2} \quad A_2 = \frac{B_1}{B_2}$$

• Gauge Pressure

$$K_2 = \frac{G_3 - G_1}{G_2 + 101.3} \quad A_2 = \frac{G_1 + 101.3}{G_2 + 101.3}$$

[EXAMPLE]

Press. range of DP flowmeter: 0 – 980 kPa (G)

Design standard of orifice: 686 kPa (G)

$$K_1 = 1$$

$$K_2 = \frac{980}{686 + 101.3} = 1.245$$

$$A_2 = \frac{101.3}{686 + 101.3} = 0.1287 = 12.87\%$$