Model M3LR RTD Transmitter

PC CONFIGURATOR SOFTWARE

Model: M3LRCFG

USERS MANUAL

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CONTENTS

1. GETTING STARTED

1.1. PC REQUIREMENTS

The following PC performance is required for adequate operation of the M3LRCFG.

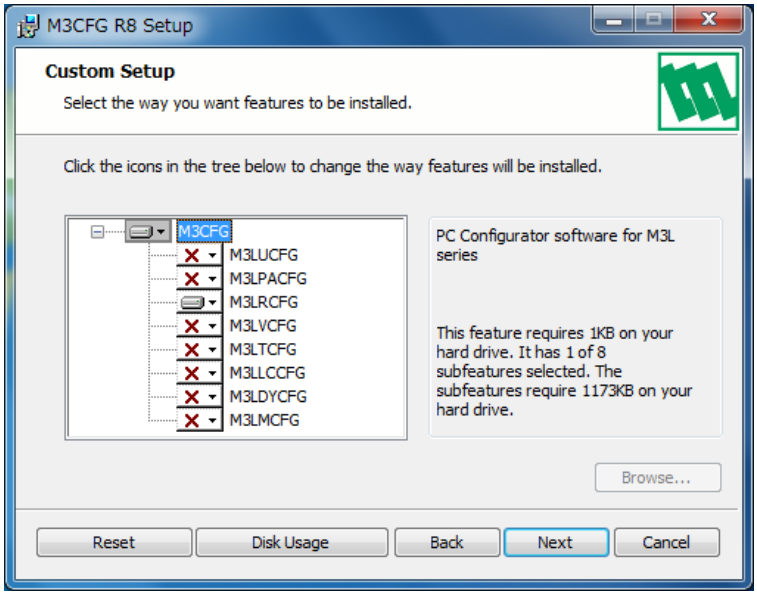
PC	IBM PC compatible
OS	Windows 7 (32-bit, 64-bit) Windows 10 (32-bit, 64-bit) The software may not operate adequately in certain conditions.
CPU/Memory	Must meet the relevant Windows' requirements.
Hard disk	10MB minimum free space
PC configurator cable	Model COP-US (USB) or MCN-CON (RS-232-C)

1.2. INSTALLING & DELETING THE PROGRAM

INSTALL

The program is provided as compressed archive. Decompress the archive and execute 'setup.msi' to start up the M3LRCFG installer program. Follow instructions on the Windows.

In the M3LRCFG installer program, all the software of the M3CFG series will be installed. If you would like to install only M3LRCFG, change to "X" for other software in the window appeared during the installation as shown below.



DELETE

Open Control Panel > Add/Remove Programs. Select the "M3CFG Rx" from the program list and click Delete button.

1.3. STARTING UP THE M3LRCFG

Connect the model M3LR RTD Transmitter to the PC via the PC configurator cable.

Press Start on the task bar and choose M3CFG > M3LRCFG from the Program menu.

1.4. OPTION /A & OPTION /B

The M3LR with Option /B is not designed for PC configuration but only for monitoring on the PC, while the Option /A version is fully programmable.

OPTION /B

When you connect the Option /B version to the PC and start up the M3LRCFG program, you can confirm the current setting but these buttons and fields used for configuring the module are greyed out and thus unavailable.

The M3LRCFG features available for the Option /B version are: monitoring, One Step Calibration, zero/span, loop test output and diagnostics.

OPTION /A

The Option /A version is fully programmable including the following: input sensor type, PV unit, and PV range, analog output type, range and custom RTD table.

This version of the M3LR can be programmed and calibrated even when the configuration mode switch (DIP switch SW2-8) is set to DIP SW mode, however, once the power supply to the M3LR is turned off and on, it restarts based on DIP switch configurations. It must be started up with the SW2-8 turned on so that it reads its EEPROM contents regardless of other DIP switch configurations.

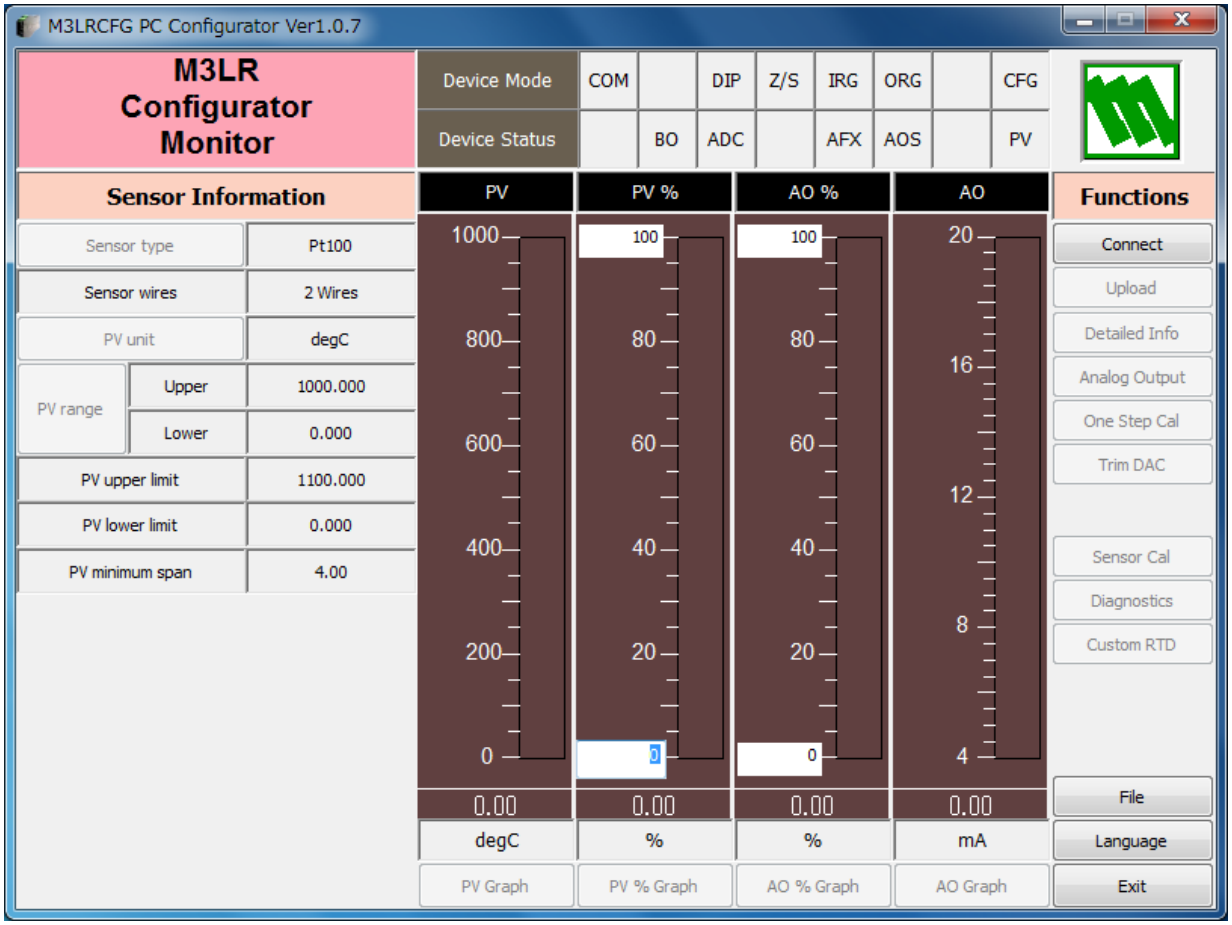
2. MONITOR

2.1. STARTING UP

Figure 1 shows the initial window of the M3LRCFG PC Configurator window.

In order to enable the tools shown on the screen, the model M3LR RTD Transmitter must be connected to the PC via the PC configurator cable.

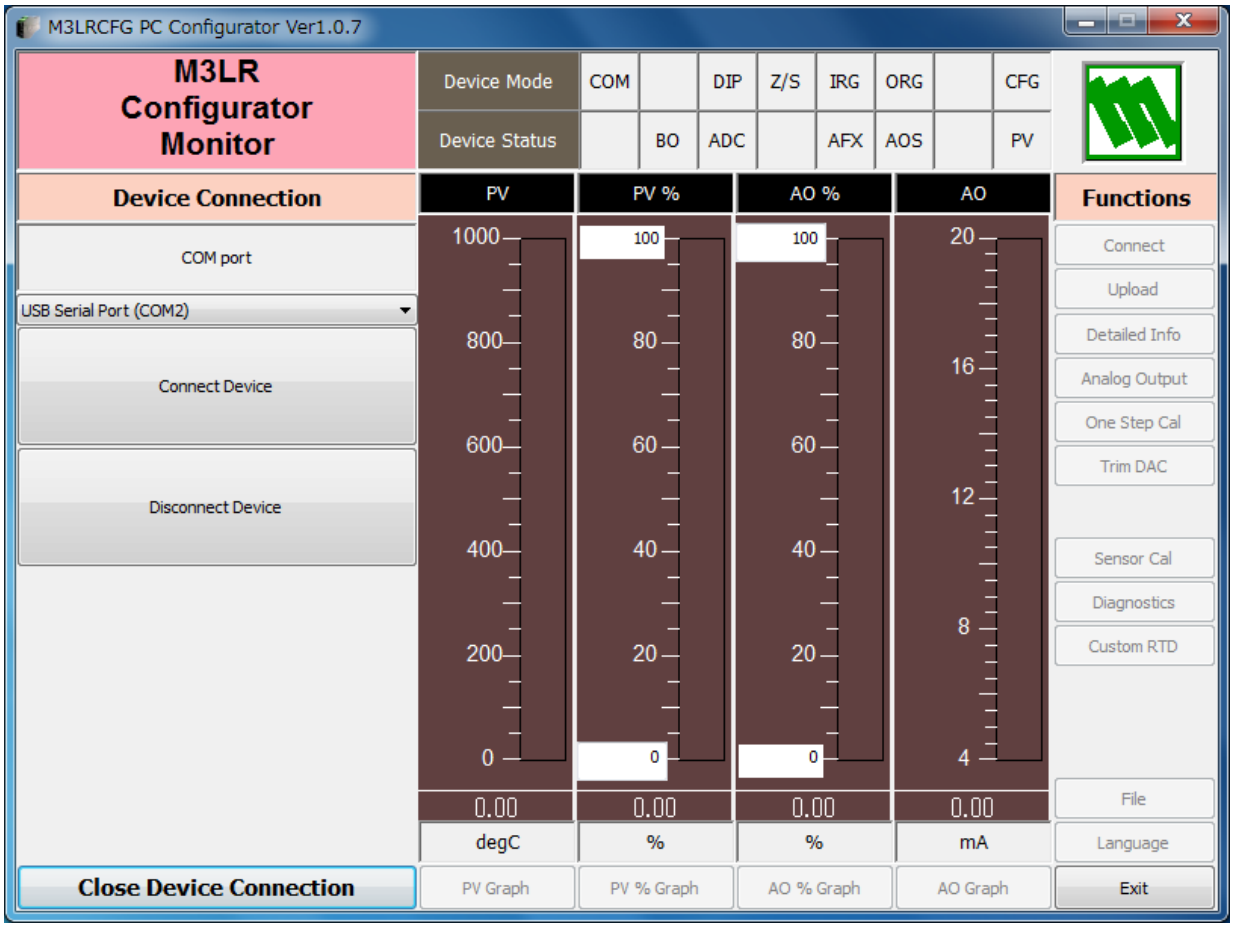
Figure 1. Initial Window



2.2. CONNECTING THE DEVICE

On the initial window, click [Connect] and the Device Connection menu appears on the screen.

Figure 2. Device Connection



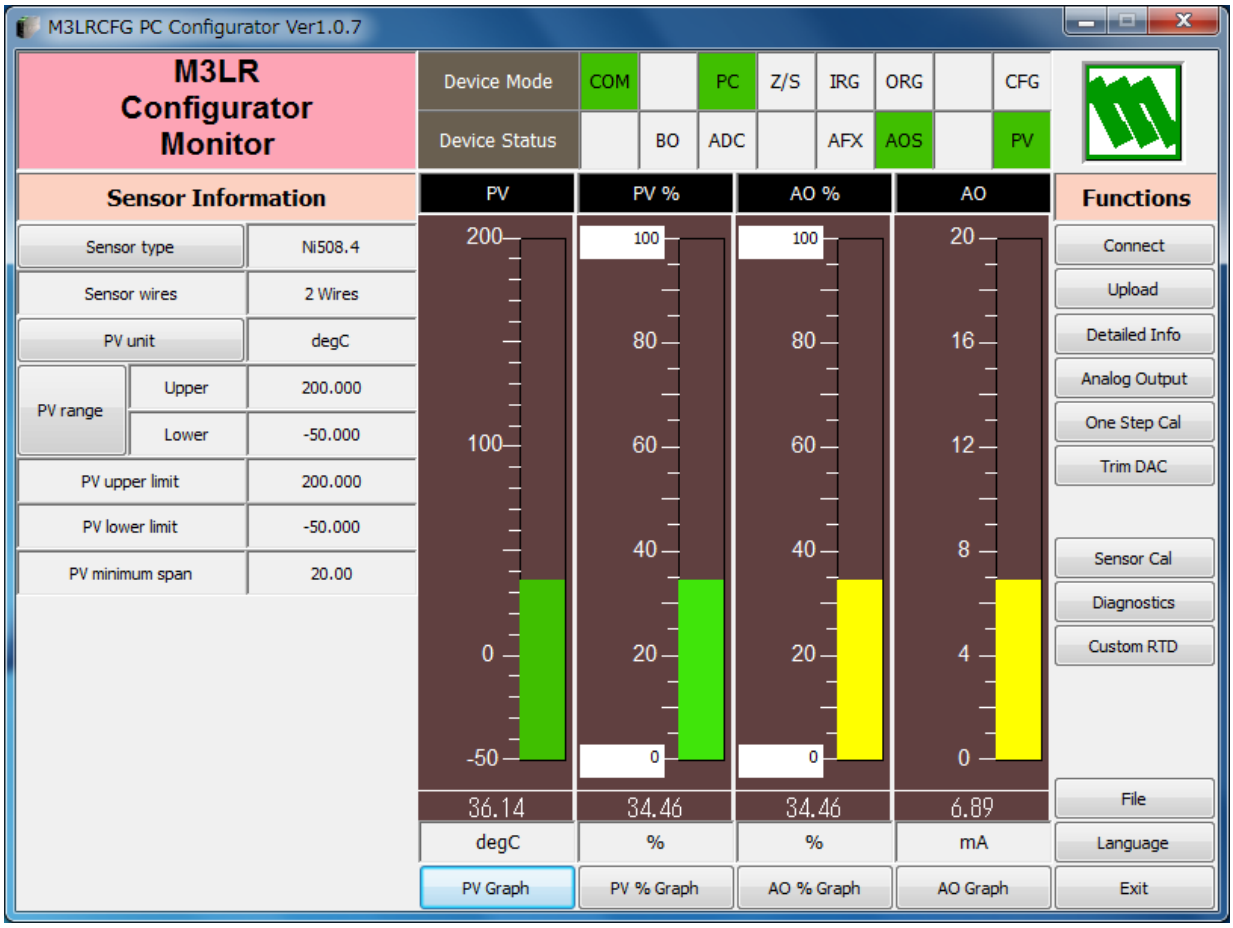
COM port	Choose an adequately configured COM port to be connected.
Connect Device	Connects the device. Once the connection is established, the program uploads the device's configuration information and automatically opens Sensor Information window. The window is the base for various operations to configure the M3LR.
Disconnect Device	Disconnects the currently connected device.
Close Device Connection	Close the Device Connection window.

2.3. MONITORING TRENDS

Once the device is connected, the Sensor Information menu and the trend monitors appears on the screen. The user can configure various parameters of the M3LR.

Use [Upload] button to re-load device information e.g. when you replace the module with a new one or when you make changes to M3LR's configuration without using this tool.

Figure 3. Sensor Information



2.3.1. DEVICE MODE

Device Mode summarizes the device's current operation status and communications status with the PC by lamps.

or

[COM] lamp	Blinks with the normal communications condition.
[DIP]/[PC] lamp	Shows the device's configuration mode: DIP switch or PC. For the M3LR version /B, only DIP switch mode is available.
[Z/S] lamp	Red light turns on when the device is in the DAC trimming mode.
[IRG] lamp	Red light turns on when the device is in the input one-step calibration mode.
[ORG] lamp	Red light turns on when the device is in the output one-step calibration mode.
[CFG] lamp	Red light turns on when data changes have been done on the configuration software since it was stored the last time. It turns off once the data has been stored into the nonvolatile memory.

2.3.2. DEVICE STATUS

Device Status summarizes the current device status by lamps.

[BO] lamp	Red light turns on with 'Input error' detected (ADC overrange or underrange).
[ADC] lamp	Red light turns on with ADC's hardware errors.
[AFX] lamp	Red light turns on when the analog output entered in Fixed AO mode.
[AOS] lamp	Green light turns on when the analog output is diagnosed to be normal. Red light turns on when the output is saturated upscale or downscale.
[PV] lamp	Green light turns on when the sensor input is in the specified range. Red light turns on when it is out of the range.

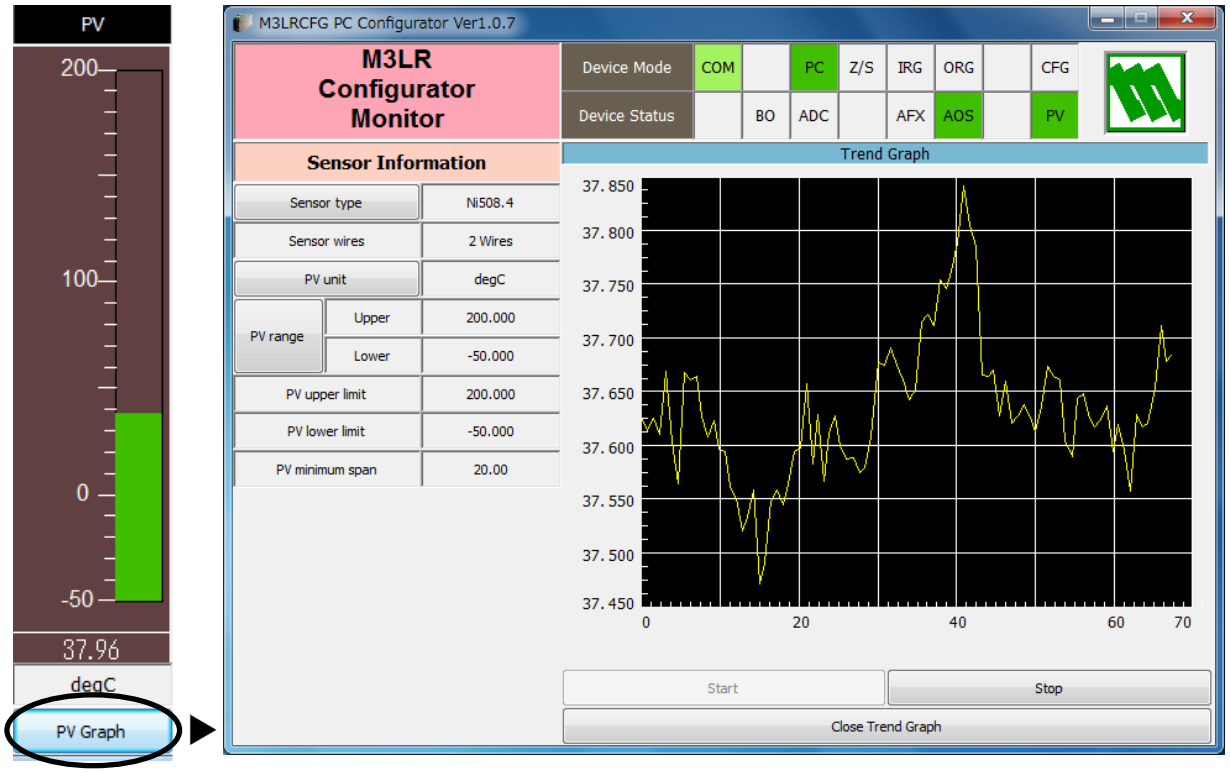
2.3.3. BARGRAPH & TREND GRAPH

Four bargraphs indicating PV (degC, degF or Kelvin), PV in % of the selected range, analog output in % which is calculated from PV in % by transfer function and analog output in engineering unit are available.

The graph scales for the PV in % and the analog output in % can be modified unlike the PV and the analog output in engineering unit of which the scales are automatically determined and fixed according to the selected range.

At the bottom of each bargraph is [Graph] button which opens a trend graph for the item. Use [Start] and [Stop] buttons to start/stop recording data, and click [Close Trend Graph] to close the graph window.

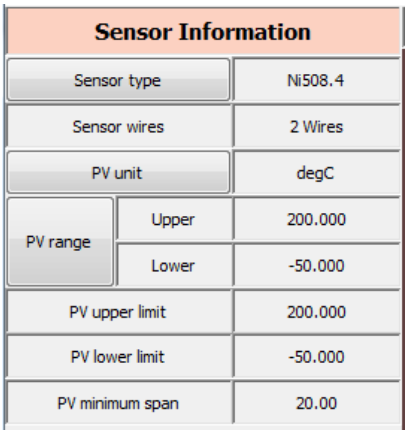
PV Bargraph **Figure 4. Trend Graph**



3. CONFIGURATION

3.1. INPUT CONFIGURATION

In Figure 3, the Sensor Information menu on the left shows basic configuration information of the connected device. When you need to change configurations, click the left button for the required parameter to modify its setting.

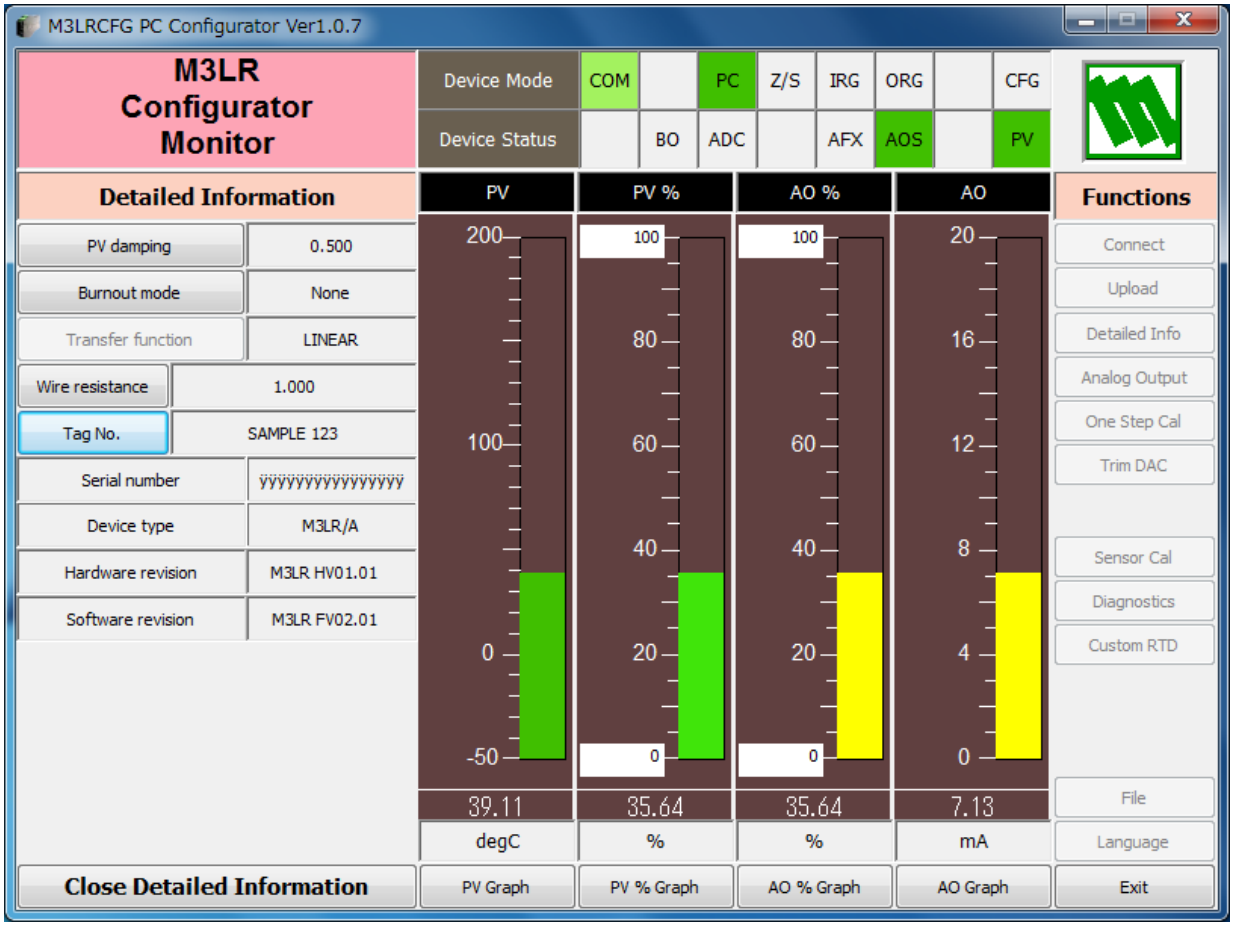


Sensor type	The input sensor type can be selected from the following 14 types. Pt100 Pt200 Pt300 Pt400 Pt500 Pt1000 Pt50(JIS81) JPt100(JIS89) Ni100 Ni120 Ni508.4 NiFe604 Cu10@25 Custom RTD Click [Sensor type] button to choose the input sensor type and the number of sensor wires. Choose with SW2-4, 2-5, 2-6, 2-7 in DIP SW mode.
Sensor wires	The number of wires can be selected from the following three types. 2 Wires 3 Wires 4 Wires Choose with SW3-3, 3-4 in DIP SW mode.
PV unit	PV and the terminal temperature in engineering unit are displayed. Choose from among this three choices. degC degF Kelvin Click [PV unit] button to choose unit type.
PV range (Upper / Lower)	Specifies input temperature range for 0% and 100%. Click the left button opens a dialog box to change the setting. The input temperature range can be also changed on One Step Calibration mode.
PV upper limit	Shows the usable range information for the selected type of sensor.
PV lower limit	
PV minimum span	

3.2. DETAILED INFORMATION

In Figure 3, click [Detailed Info] in Functions menu to the right opens the [Detailed Information] menu as shown in Figure 5.

Figure 5. Detailed Information

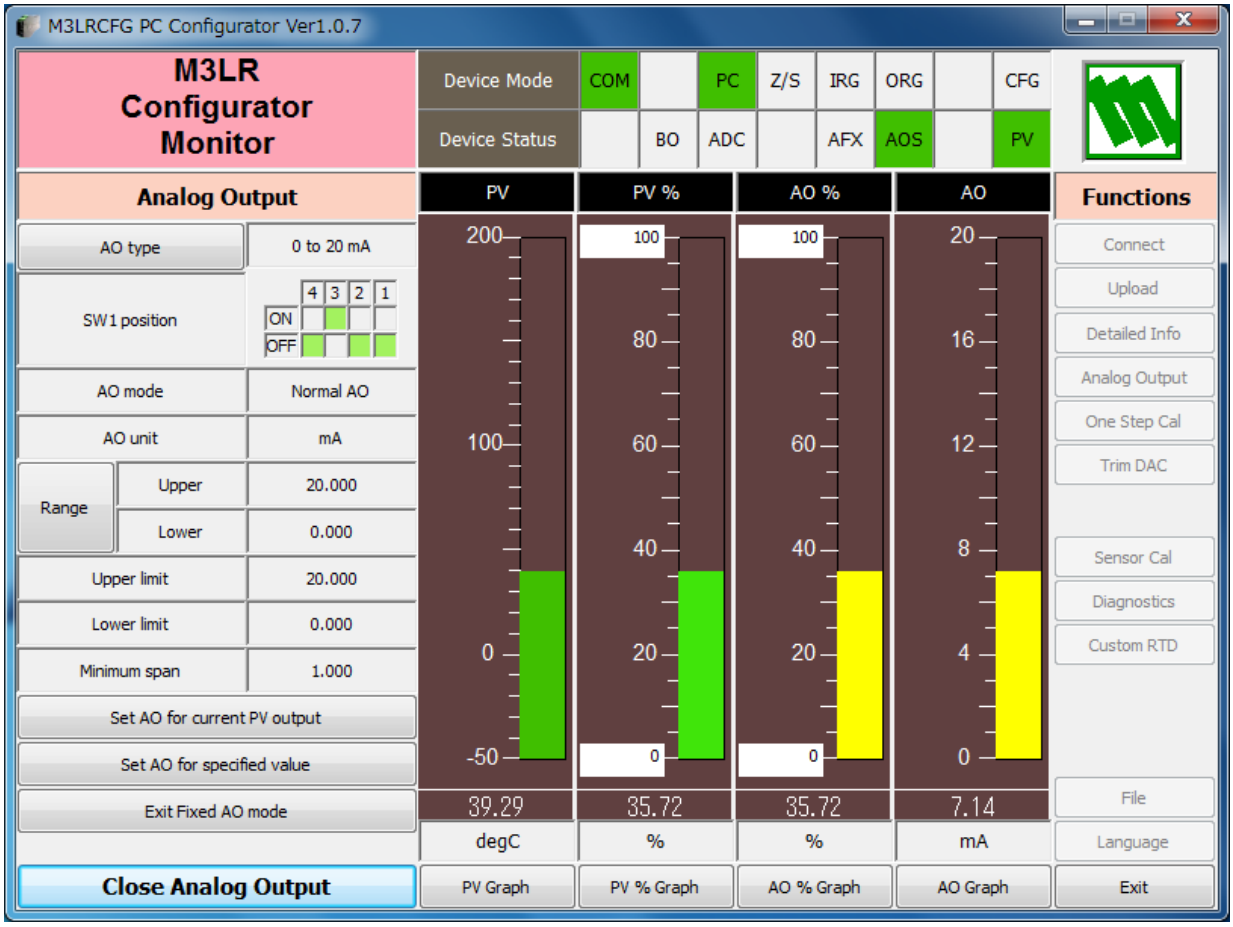


PV damping	Specifies the time constant for the primary input filter. Selectable range is from 0.5 sec. up to 30 sec. When you do not need a filtering, specify '0.'
Burnout mode	Specifies the burnout mode from among three choices. Upscale Downscale None Click [burnout mode] button to specify either the output should go upscale or downscale in case that a wire breakdown is detected.
Transfer function	Input-to-output transfer function is fixed at "LINEAR" and unchangeable.
Wire resistance	Click [Wire resistance] to specify the wire resistance value of the input sensor. The wire resistance value is used for two-wire RTD to compensate errors caused by wire resistance. Instead, errors can be calibrated using [Sensor Cal] Zero Calibration, but this setting will be automatically reset when you have changed the sensor type or the number of wires.
Tag No.	You can enter a tag name using up to 16 alphanumerical characters.
Serial number	Automatically displayed.
Device type	
Hardware revision	
Software revision	
Close Detailed Information	Close the window.

3.3. ANALOG OUTPUT

In Figure 3, click [Analog Output] in Functions menu to the right opens the [Analog Output] menu as shown in Figure 6.

Figure 6. Analog Output



The Analog Output menu on the left shows the output type and ranges. When you need to change configurations, click the left button for the required item to modify the setting.

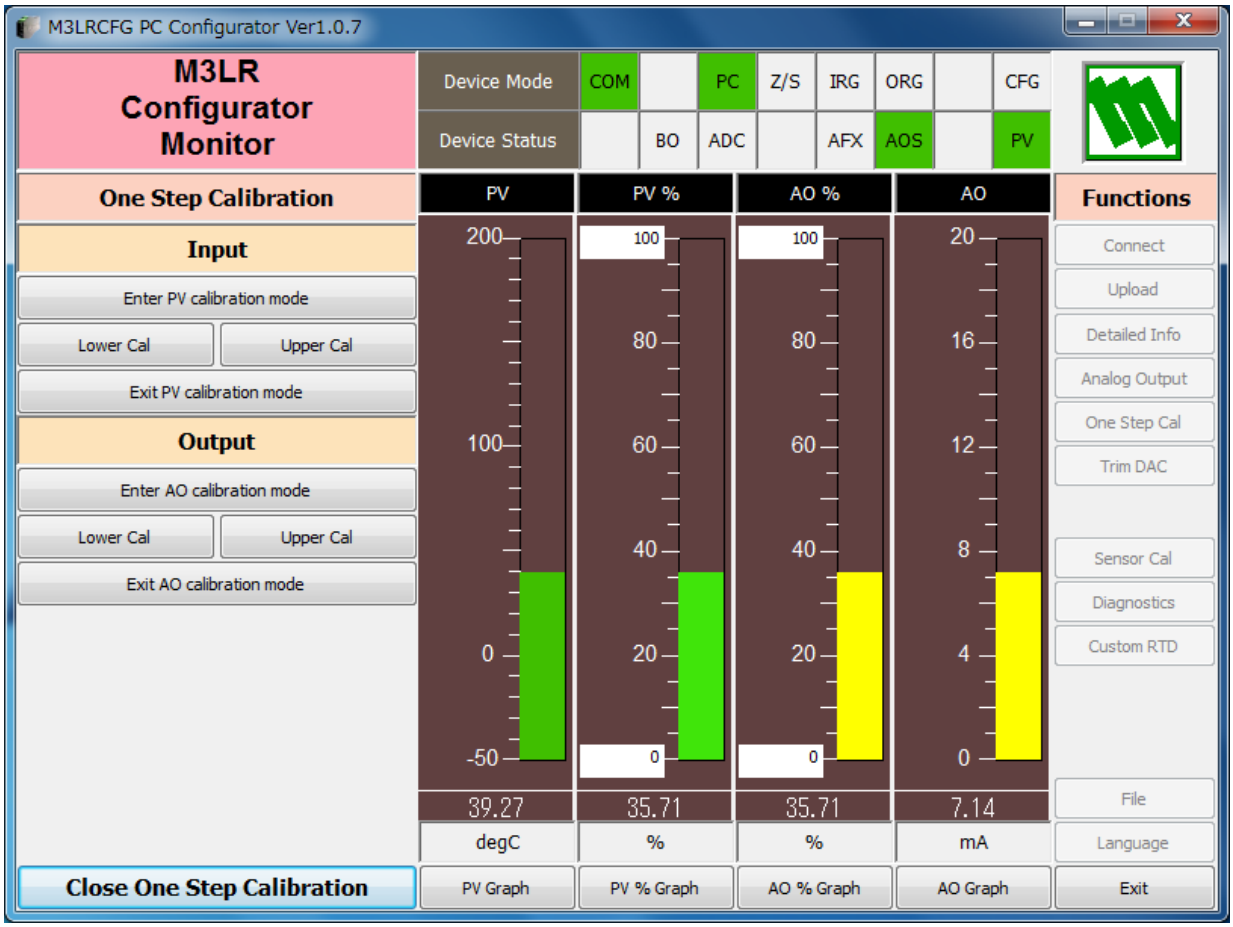
AO type	Specifies the Analog Output type from among three choices. 0 to 20 mA -2500 to +2500 mV -10 to +10 V Click [AO type] button to specify output type.
SW1 position	Shows DIP SW configuration (hardware setting) required for the selected output type. Confirm actual setting.
AO mode	Shows the output mode. 'Normal AO' is usually displayed.
AO unit	Shows engineering unit for the output signal.
Range (Upper / Lower)	Specifies the output range for 0% and 100%.
Upper limit	Show the usable range information for the selected output type.
Lower limit	
Minimum span	
Set AO for current PV output	The output signal is held at the current value.
Set AO for specified value	You can set a specific value to fix the output in order to perform an output loop simulation test.
Exit Fixed AO mode	Cancels the fixed output mode to return the device into normal output mode.
Close Analog Output	Close the window.

4. ONE STEP CALIBRATION

In Figure 3, click [One Step Cal] on the right control panel opens the One Step Calibration menu as shown in Figure 7.

The 'One Step Calibration' technique realizes automatic input and output ranging with a signal simulator connected to the module's input terminals.

Figure 7. One Step Calibration



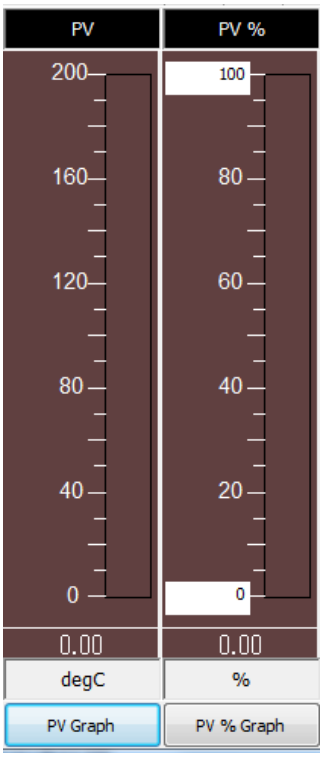
4.1. INPUT CALIBRATION MODE

(1) Connect the M3LR to a simulator as described in the M3LR instruction manual.

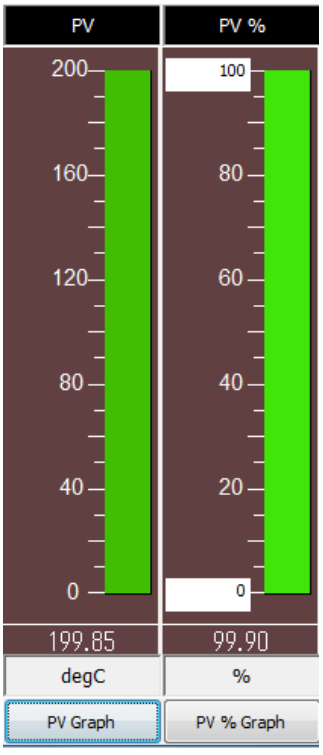
(2) Click [Enter PV calibration mode] in order to turn the module into the input calibration mode. The red [IRG] lamp in [Device Mode] panel at the top turns ON while the module is in this mode.

(3) Apply desired 0% and 100% signal levels and click [Lower Cal] and [Upper Cal] buttons respectively so that the input range is automatically set.

Input: 0.00 degC (Lower Cal)



Input: 200.00 degC (Upper Cal)



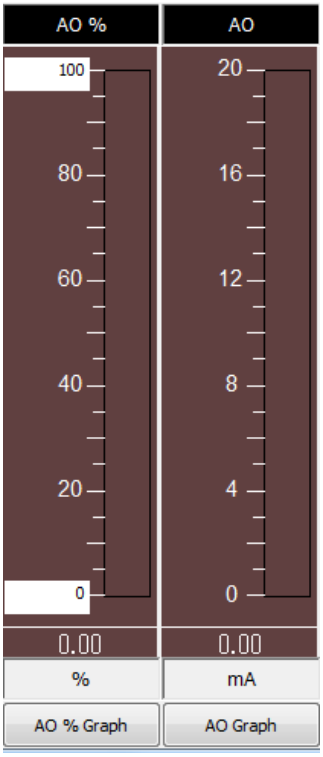
(4) Click [Exit PV calibration mode] when the calibration is complete.

4.2. OUTPUT CALIBRATION MODE

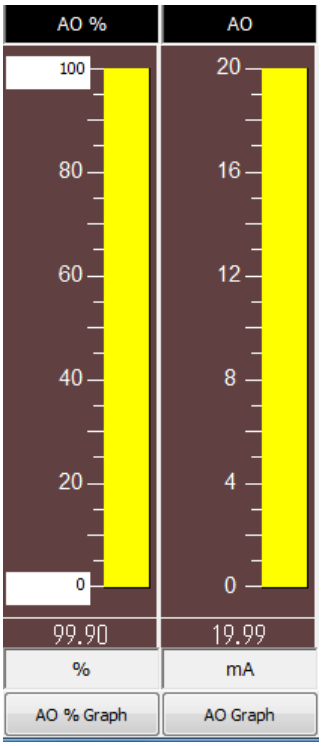
(1) Click [Enter AO calibration mode] in order to turn the module into the output calibration mode. The red [ORG] lamp in [Device Mode] panel at the top turns ON while the module is in this mode.

(2) Increase or decrease the simulated input until the output multimeter shows desired 0% and 100% signal levels and click [Lower Cal] and [Upper Cal] buttons respectively so that the output range is automatically set.

Apply the input so that output become 0%



Apply the input so that output become 100%



(3) Click [Exit AO calibration mode] when the calibration is complete.

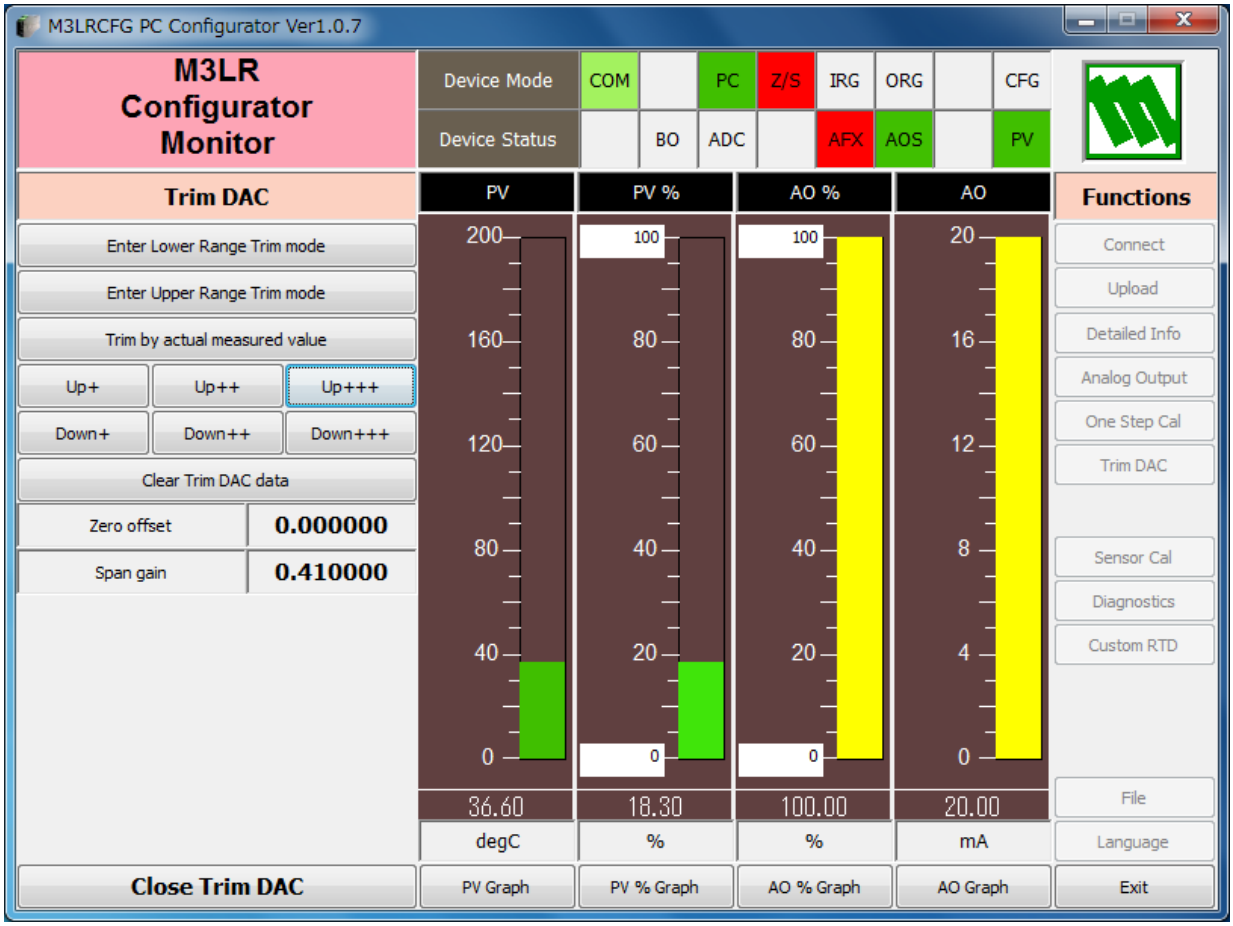
Click [Close One Step Calibration] to close the window.

5. INPUT / OUTPUT CALIBRATION

5.1. DAC TRIMMING

Click [Trim DAC] button to open the Trim DAC window as shown in Figure 8.

Figure 8. Trim DAC (e.g. Upper Range Trim Mode)



5.1.1. LOWER RANGE DAC TRIMMING

(1) Click [Enter Lower Range Trim mode]. The device outputs a fixed lower range signal level.

(2) Measure the actual output signal at the receiving instrument to which the device output should be matched.

(3) Click [Trim by actual measured value] to set the measured value.

(4) Repeat setting [Trim by actual measured value] until the measured output shows the desired level. Alternately, use [Up] or [Down] buttons. [+], [++] and [+++] have different increments. Deviation from the default value is shown in [Zero offset]. Lower range value is adjustable within ±15%.

5.1.2. UPPER RANGE DAC TRIMMING

(1) Click [Enter Upper Range Trim Mode]. The device outputs a fixed upper range signal level.

(2) Measure the actual output signal at the receiving instrument to which the device output should be matched.

(3) Click [Trim by actual measured value] to set the measured value.

(4) Repeat setting [Trim by actual measured value] until the measured output shows the desired level. Alternately, use [Up] or [Down] buttons. [+], [++] and [+++] have different increments. Deviation from the default value is shown in [Span gain]. Upper range value is adjustable within ±15%.

5.1.3. RESETTING TO THE DEFAULT

Click [Clear Trim DAC data] to return the device to the factory default trimming values (0.0 for both Zero offset and Span gain).

Click [Close Trim DAC] to close the window.

5.2. SENSOR CALIBRATION

The input sensor can be calibrated with Zero and Span: Zero is represented as offset at the calibration point, while Span is represented as gain against the zero point. The gain must be set from 0.1 to 10.0.

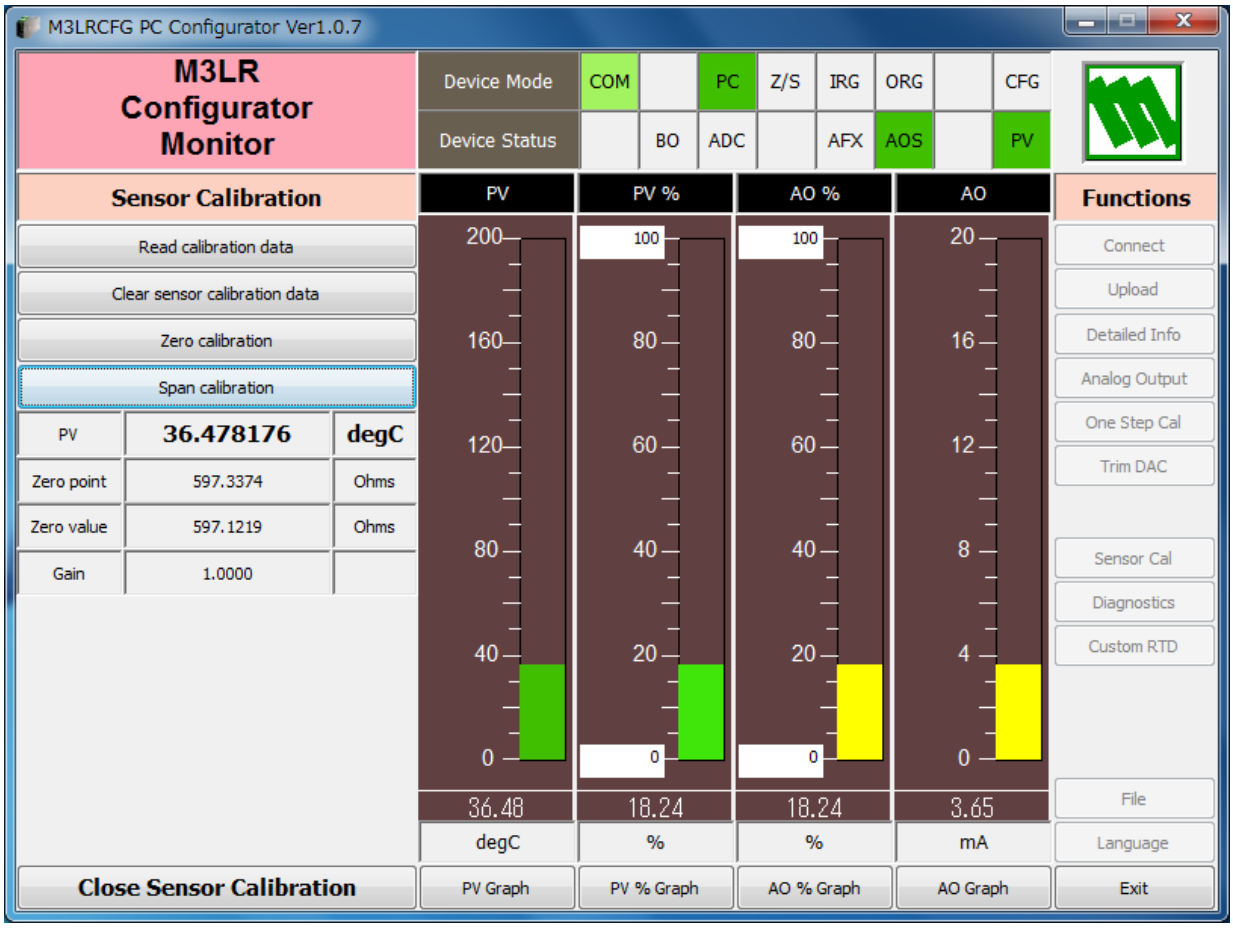
Calibration points can be specified to any point within the measuring range.

The calibration is applied to measured resistance. Therefore by using the Zero calibration, you can compensate errors caused by 2-wire RTD's wire resistance or 3-wire RTD's resistance unbalance.

However, this calibration value is automatically reset when sensor type or number of wires are changed.

Click [Sensor Cal] button to open the Sensor Calibration window as shown in Figure 9.

Figure 9. Sensor Calibration



The present measured value is indicated in the middle. Refer to this value when calibrating the sensor. It takes several seconds for the calibration result affects the measured value on the display.

Apply zero calibration point input signal and click [Zero calibration] to open the field where you can enter a target value. The result is shown in the PV display field. Data before calibration is shown in the Zero point field, while that after calibration is shown in the Zero value field.

Apply span calibration point input signal and click [Span calibration] to open the field where you can enter a target value. The result is shown in the PV display field. Span point gain against the zero point is shown in the Gain field.

[Read calibration data] calls up and display the present calibrated values in these fields.

Click [Clear sensor calibration data] to return the device to the factory default status.

Factory default settings are: Zero Point = Zero Value = Resistance (ohms) at 0°C, Gain = 1.0.

When the sensor type is changed, the calibration data are reset to these factory default values.

Click [Close Sensor Calibration] to close the window.

6. OFFLINE CONFIGURATION AND READ / WRITE FILES

6.1. CUSTOM RTD

The M3LR supports calibrated RTD and user-specific RTD table functions. In order to use these functions, RTD's characteristics data must be defined and registered.

CALIBRATED RTD

Callendar-Van Dusen approximation formula as shown below is used.

$Rt = R0 * (1 + A*T + V*T^2 + (T - 100)*C*T^3)$ (if $T \geq 0$, $C = 0$)

where Rt : Resistance at T°C (ohms)
R0 : Resistance at 0°C (ohms)
T : Temperature (°C)
A, B, C : Coefficient

Calibrate the RTD and determine the coefficients A, B, C and R0.

Click [Write calibrated RTD] button and enter these values to automatically create a sensor characteristic data.

The procedure to use user-specific RTD is as follows.

1. Create a user-specific table as following steps.
2. Click [Custom RTD] button to open the Custom RTD.
3. Click [Read table from file] button to read a characteristics data from a file stored in the PC. When uploaded, the file contents summery is indicated under Custom RTD Table Contents. If the number of points of the characteristic data exceeds 300. Excessive data is ignored.

   Instead, by clicking [Read table from device], RTD's characteristics data approximated using the Callendar-Van Dusen formula can be automatically created.
4. Click [Display custom RTD graph] button to show characteristics data in a graph.
5. Click [Write table to device] button to download currently displayed characteristics data to the M3LR.
6. When downloading is successfully complete, Status under Custom RTD Table Contents shows 'Configured.' Then the option 'RTD Spec (Custom RTD)' becomes available to choose. If 'RTD Spec' has been already selected before this setting is done, you can not download a particular data file.
7. Click [Read table from device] button to upload characteristics table registered in the M3LR. If there is no file registered, Status under Custom RTD Table Contents shows 'Non configured.'
8. Click [Close Custom RTD] button to close the window.

6.1.1. USER-SPECIFIC RTD TABLE

User-specific RTD data is defined in the format of texts. The file format is as following.

Define the minimum temperature value in Celsius (integer) at Minimum RTD Temperature.

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

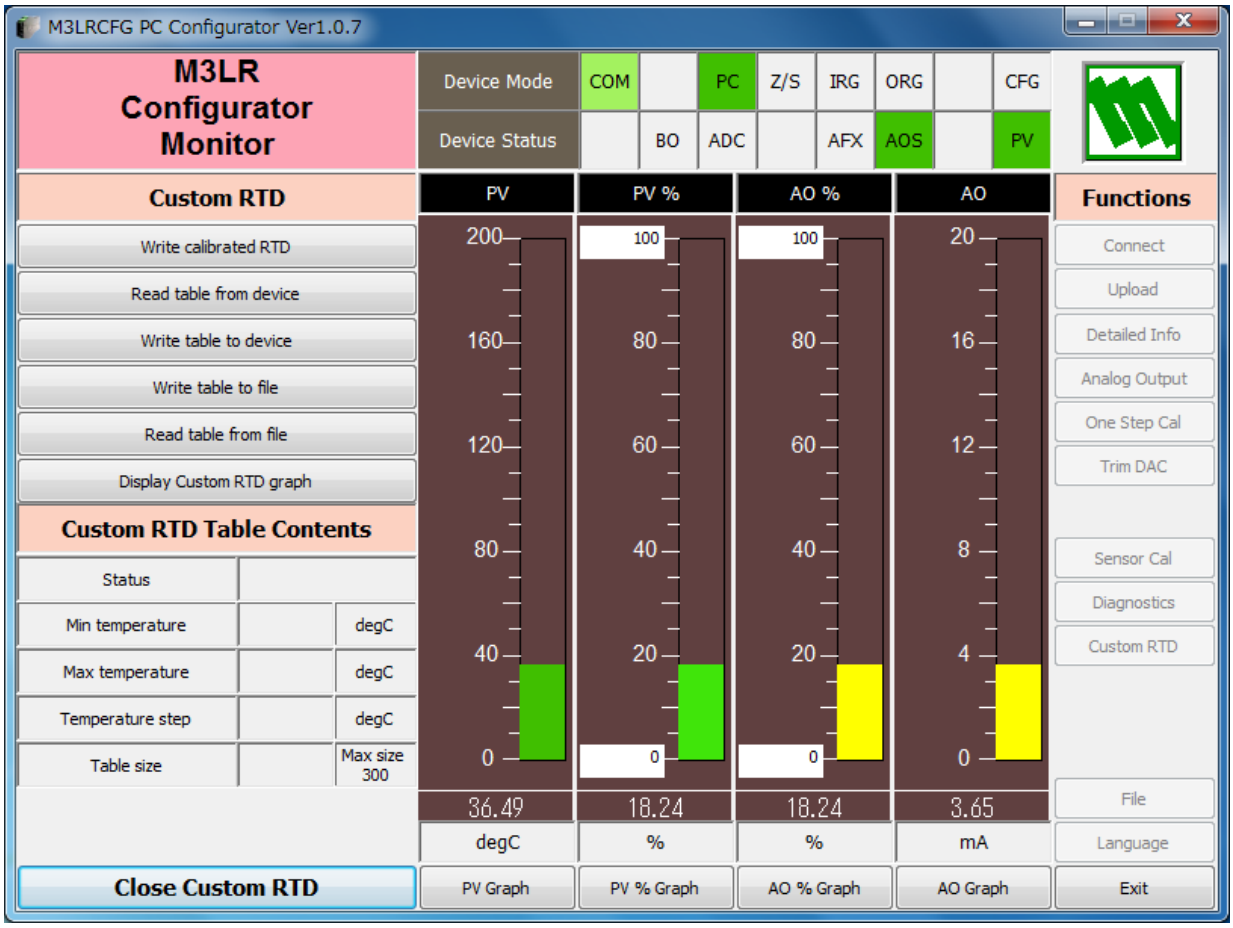
Describe characteristics data within { }. Data must be entered in ohms. Up to 300 points can be specified.

```
/*********************************************************
/* Custom RTD Table Definition
/* Ti = f(Xi) ( 0 <= i < Size )
/*    Temperature Step (1 to 50 degC)
/*    0 <= X(i)<= 30000 Ohm
/*    X(i) < X(i+1)
/*    2<= Size <= 300
/*********************************************************
Minimum RTD Temperature = 0          <-- Minimum temperature T0 (°C)
Step = 10                            <-- Temperature step (°C)
{
100.0000                             <-- Resistance value for T0 (Ω)
:
200.0000                             <-- Resistance for Tmax (Ω)
}
```

6.1.2. CUSTOM RTD WINDOW

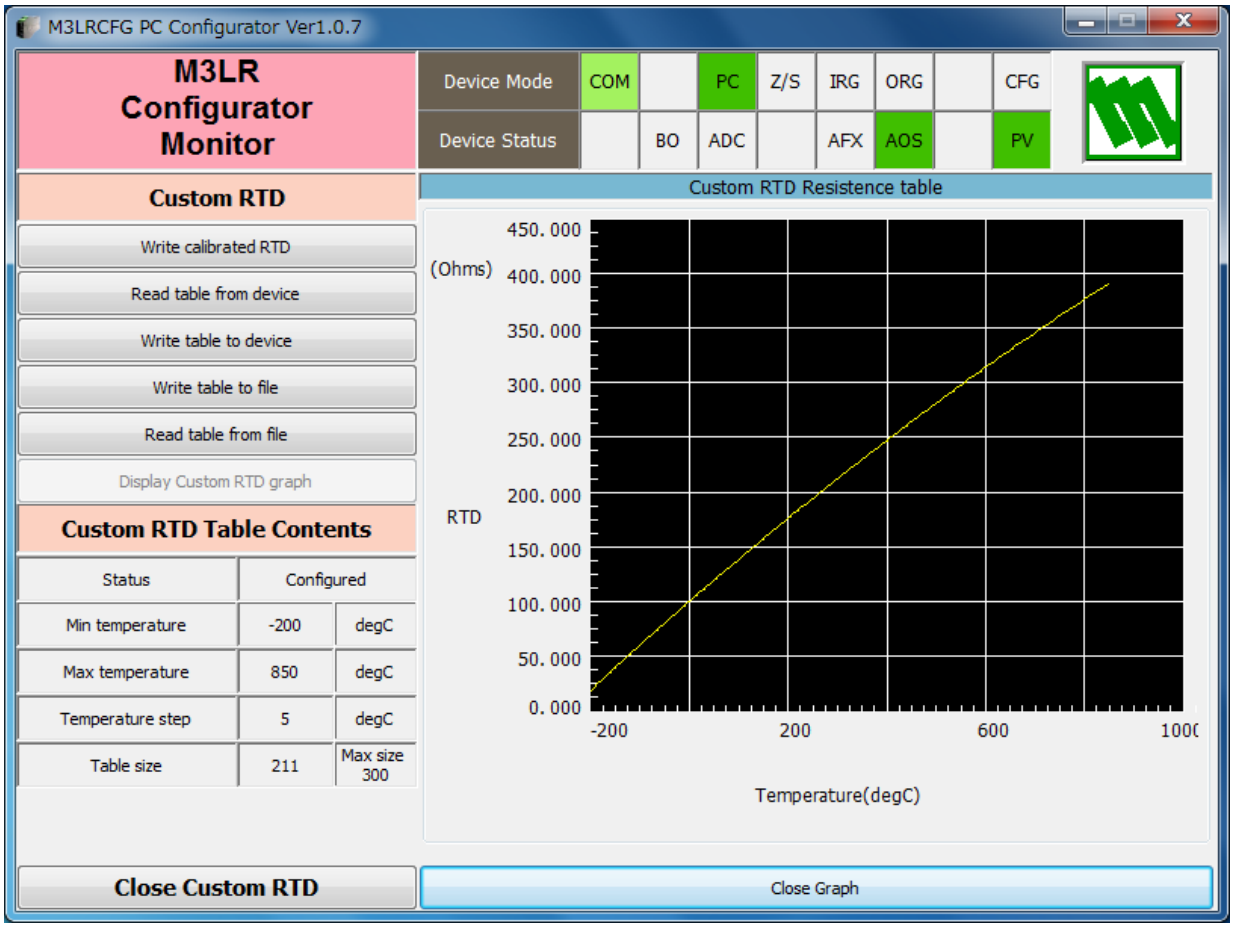
Click [Custom RTD] button to open the Custom RTD as shown in Figure 10.

Figure 10. Custom RTD



Write calibrated RTD	Enters the coefficients A, B, C and R0 defined by Callendar-Van Dusen approximation formula to automatically create approximated RTD's characteristic data.	
Read table from device	The program uploads characteristics table registered in the M3LR. If there is no file registered, Status under Custom RTD Table Contents shows 'Non configured.'	
Write table to device	The program downloads currently displayed characteristics to the M3LR. When downloading is successfully complete, Status under Custom RTD Table Contents shows 'Configured.'	
Write table to file	The program saves currently displayed characteristics data to a file. After reading the data from M3LR to the table in the PC with [Read table from device], save the data.	
Read table from file	The program uploads a file stored in the PC. When uploaded, the file contents summery is indicated under Custom RTD Table Contents.	
Display Custom RTD graph	Characteristics data can be shown in a graph. (figure 11)	
Custom RTD Table Contents	Show the summary of Custom RTD Table	
	Status	Show the status of Custom RTD Table.
	Min temperature	Minimum temperature in degC
	Max temperature	Maximum temperature in degC
	Temperature step	Temperature step in degC
	Table size	Defined number of point
Close Custom RTD	Close the window.	

Figure 11. Custom RTD graph: Temperature characteristics data of Pt 200 set by [Write calibrated RTD]



6.2. FILE MANAGEMENT

The M3LR's configurations can be saved in a file and then read out to be downloaded to multiple modules.

Click [File] button to open the File Management window as shown in Figure 12.

While this window is active, the device connection is severed, therefore the device can be connected and disconnected freely except during Upload or Download operations.

The window is divided in two sections: 'File Configuration' and 'Device Configuration.' 'File Configuration' shows data transfer (Read or Write) between the PC Configurator and the PC, while 'Device Configuration' shows data transfer (Upload or Download) between the configurator and the device.

Click [Exit] to complete the file management operations. The device will remain disconnected and must be 'Connected' to start monitoring.

NOTE

(1) Validity of the selected range values is not verified in this window. Please make sure to set them according to the described specifications.

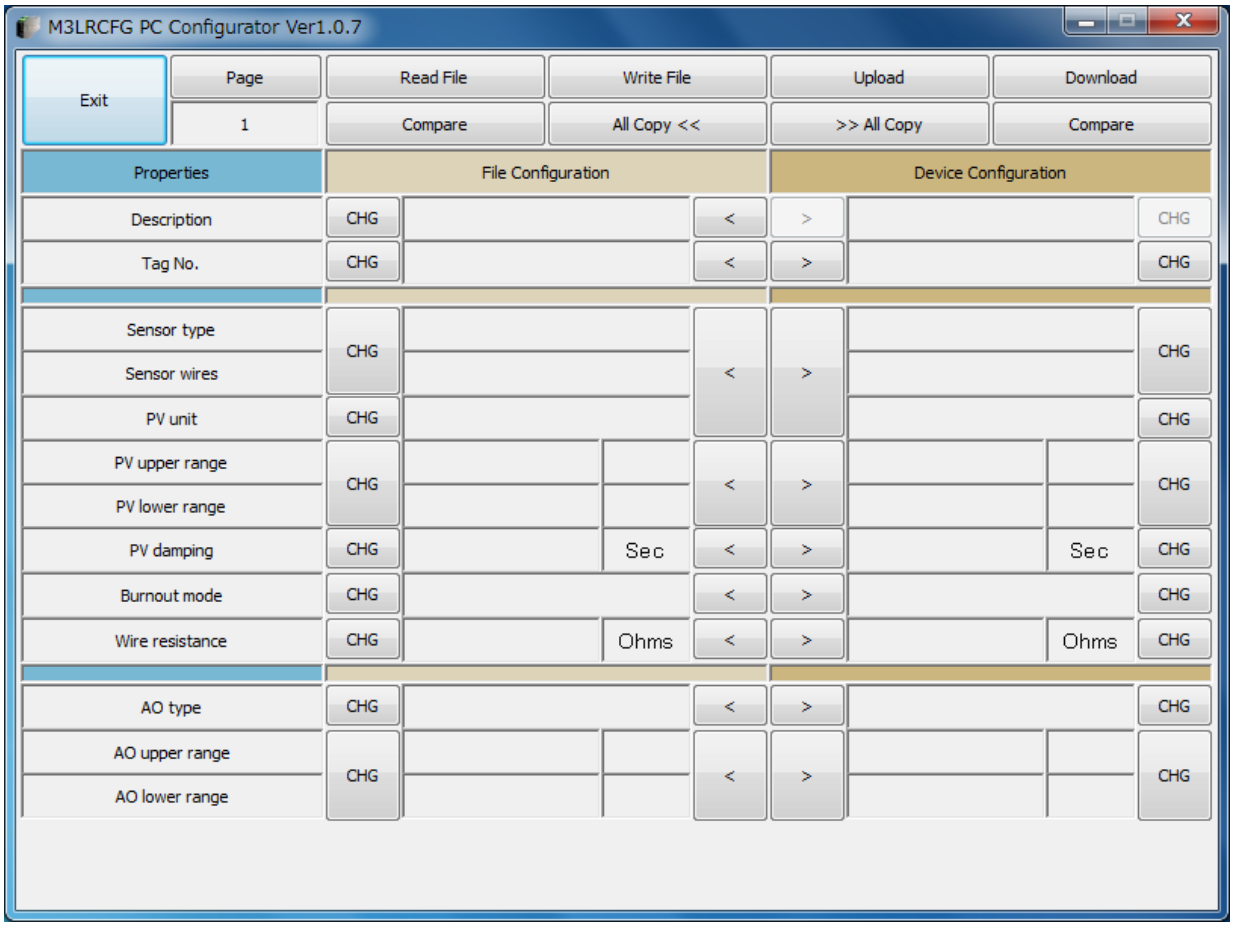
(2) Calibrated RTD parameters are handled in this window while Custom RTD table data is not.

(3) With the Option /B version, Download is unavailable. However, Upload is possible to save a configuration file, or to compare with other configurations.

(4) A comment can be entered in 'Description' in File Configuration section, which is saved in a configuration file. It cannot be written in the device. When a setting is uploaded from device, the relevant field in Device Configuration shows the device's serial number.

(5) It is unavailable to write the calibration data ([DAC Trim], [Sensor Trim]), which is read from configuration, to the device.

Figure 12. File



6.2.1. MODIFYING PARAMETERS

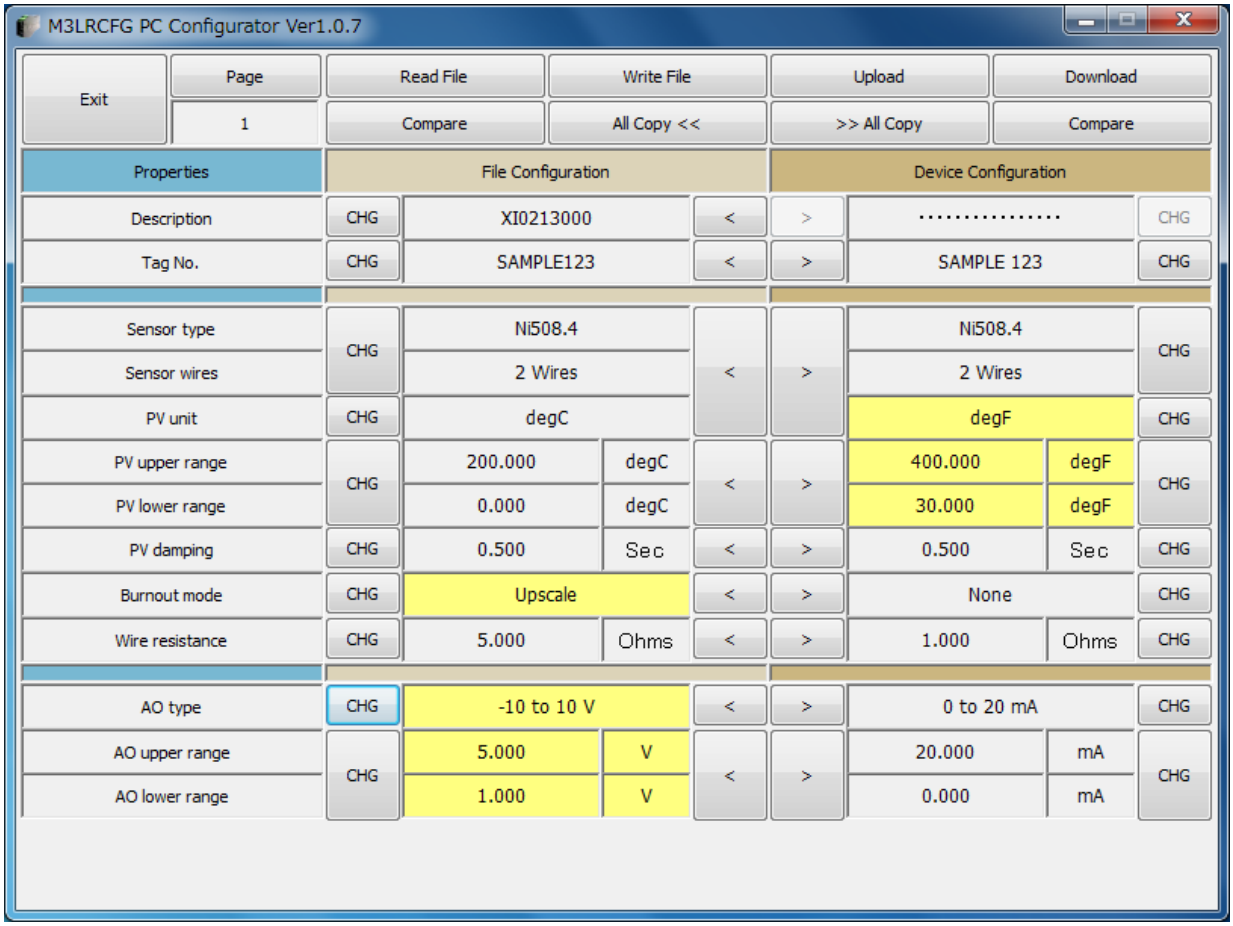
Click [CHG] button at the left of each field to modify the parameter. Fields in which the parameter has been changed will be highlighted in light yellow background color. [CHG] buttons placed across multiple fields indicate that these parameters can be modified in single sequence.

When one parameter has been changed, related fields may be also affected. For example, when 'Sensor type' is modified, 'PV range' may be automatically changed.

Parameters can be copied between 'File Configuration' and 'Device Configuration' using [<] and [>] buttons. Copied fields will be highlighted in light yellow background color.

Using [All Copy <<] or [All Copy >>] buttons enables transferring all parameters between the sections. Copied fields will be highlighted in light yellow background color.

Figure 13. Parameters Modified



6.2.2. TRANSFERRING DATA TO/FROM DEVICE

Click [Upload] button to connect to the device, to read out its configuration data and to show it in 'Device Configuration' section on the screen (Figure 14). All background colors are back to the initial state.

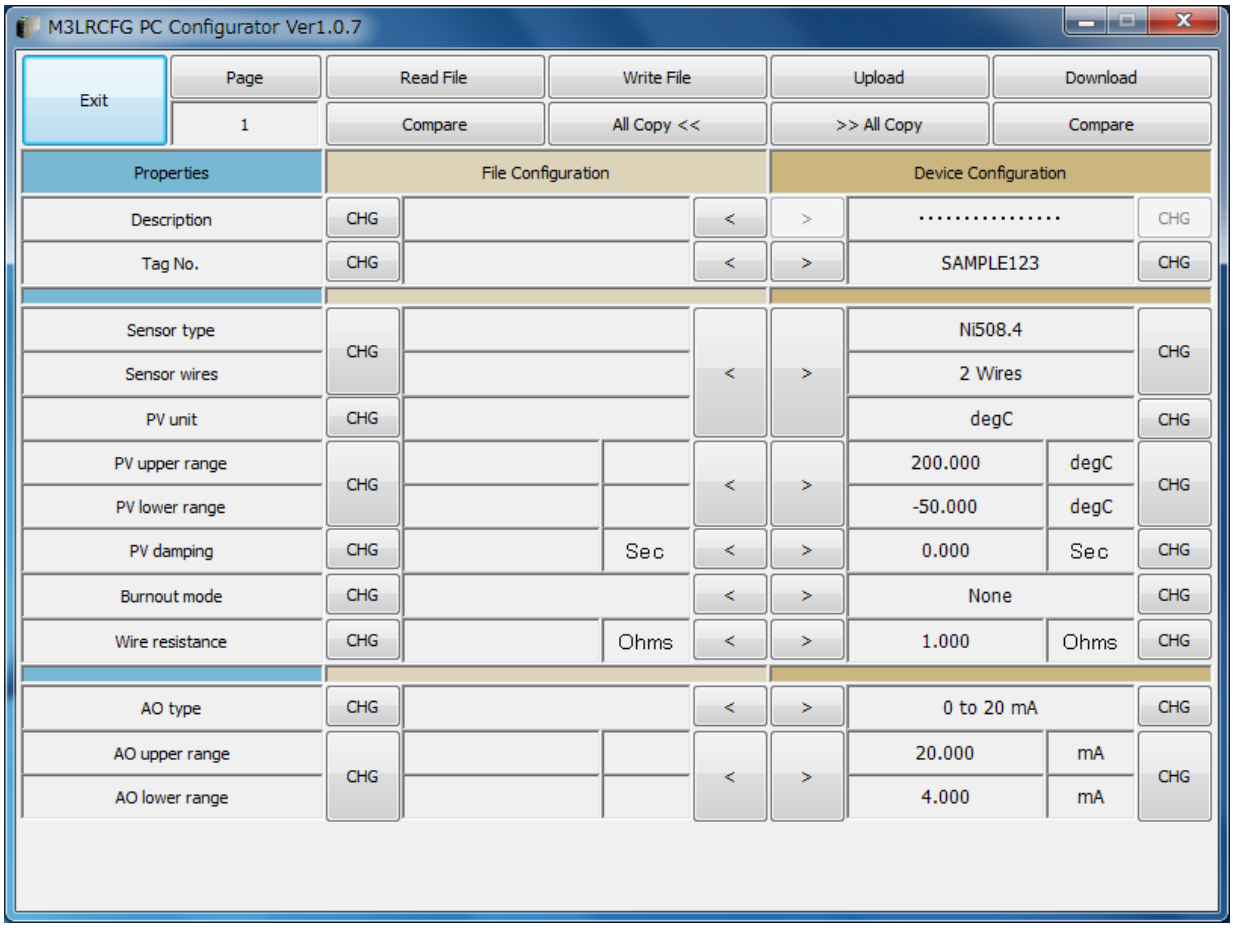
'Description' indicates the serial number of the product, which cannot be modified or copied from 'File Configuration' section.

Click [Download] button to connect and write the configuration data in 'Device Configuration' fields to the device.

If an error occurs and downloading is stopped during the process, erred data field is highlighted in med pale red background color.

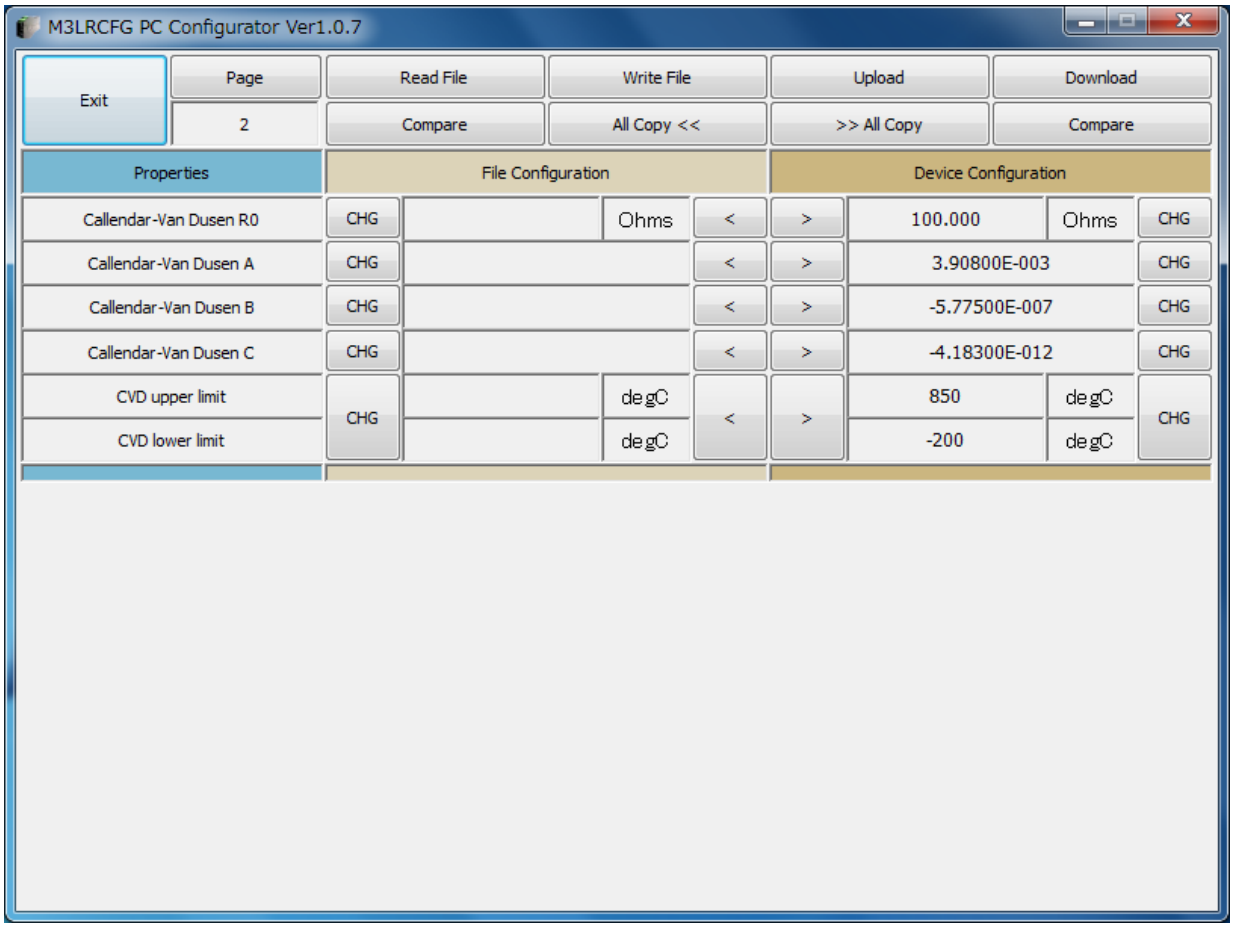
When the downloading is successfully complete, the configuration data is automatically uploaded and the background color returns to the initial state.

Figure 14. Data Uploaded, first page



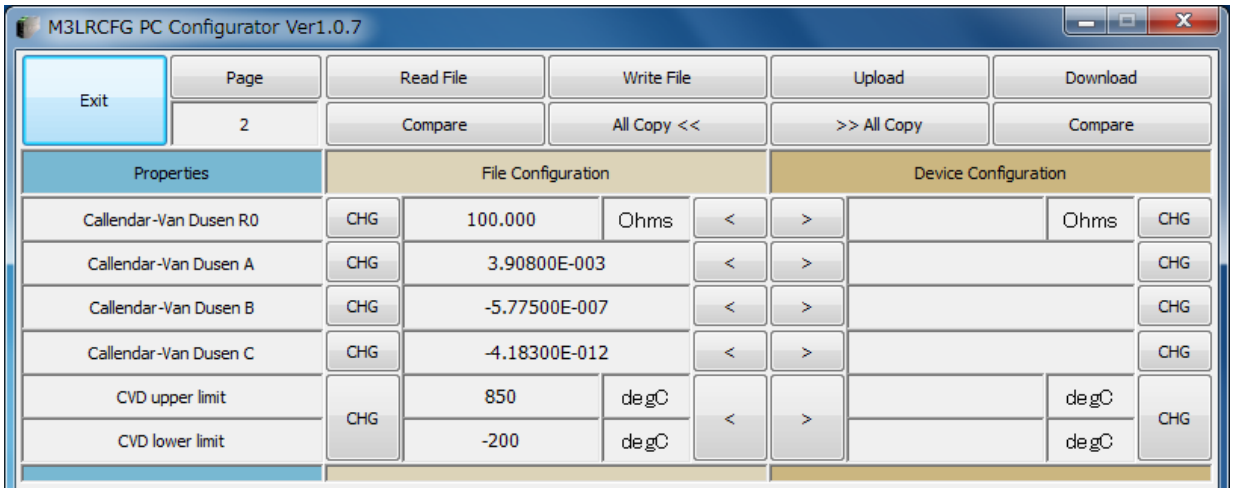
The M3LRCFG's configuration window consist of two pages. Click [Page] button to switch between pages. The second page appears as follows (Figure 15).

Figure 15. Data Uploaded, second page.



This page shows Calibrated RTD data. When downloading is performed with a calibrated RTD data file set, the table data is automatically overwritten. If you do not want to use Calibrated RTD, the fields must be blank. In order to delete data in these fields, set 0 ohm to Callendar-Van Dusen R0. All other fields are automatically reset to blank by this setting. When blank fields are downloaded, the Calibrated RTD data is set to Unused, thus creates no calibration data.

Figure 16. Device fields with no Callandar-Van Dusen R0 data.



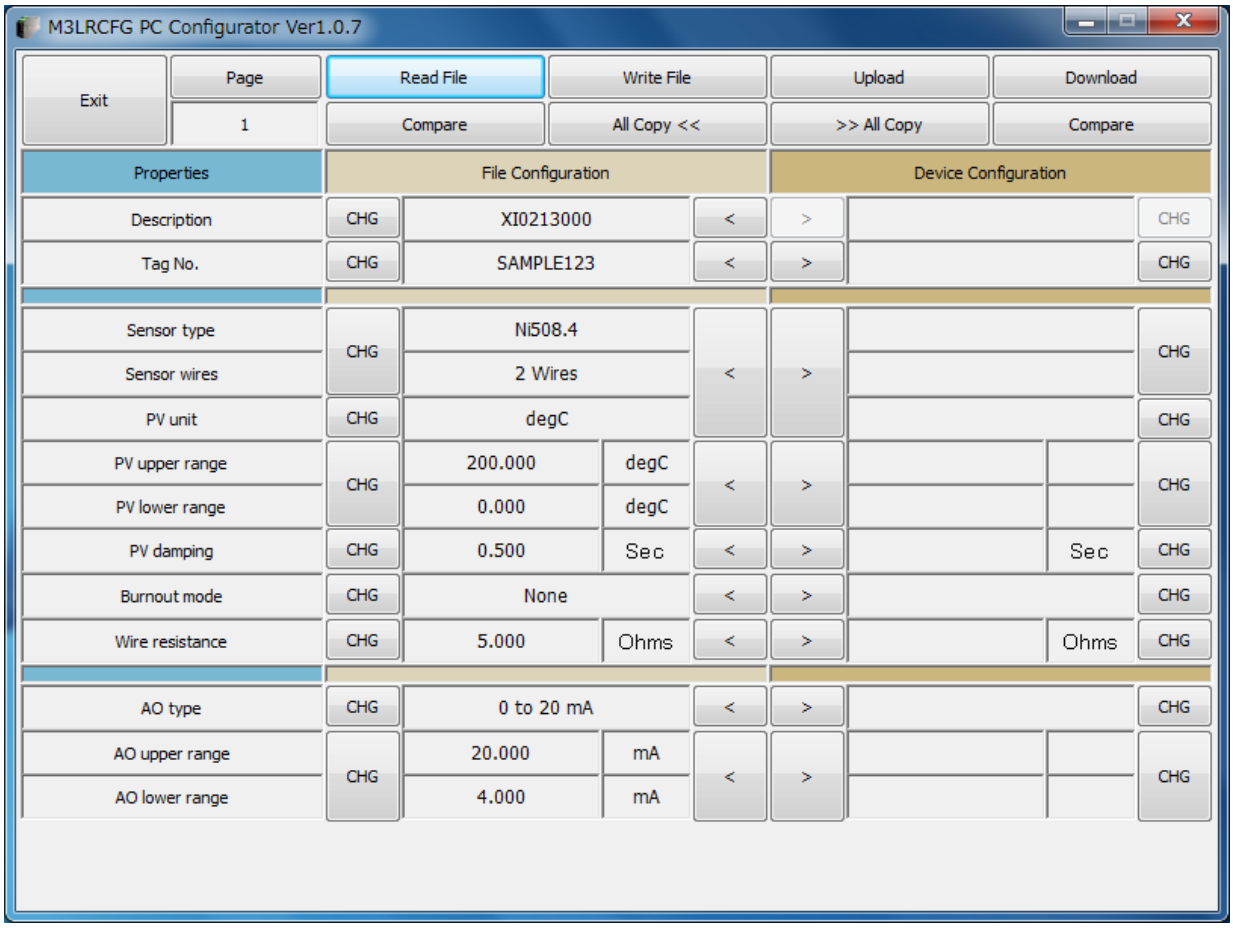
6.2.3. READING/WRITING FILES

Click [Read File] button to read the configuration data from a specified file and to show it in 'File Configuration' section on the screen (Figure 17). All background colors are back to the initial state.

Click [Write File] button to write the configuration data in 'File Configuration' section to a specified file.

A comment (max. 64 alphanumeric characters) can be entered in 'Description' in File Configuration section, which is saved in a configuration file. It cannot be written in the device. When a setting is uploaded from device, the relevant field in Device Configuration shows the device's serial number.

Figure 17. File Read Out



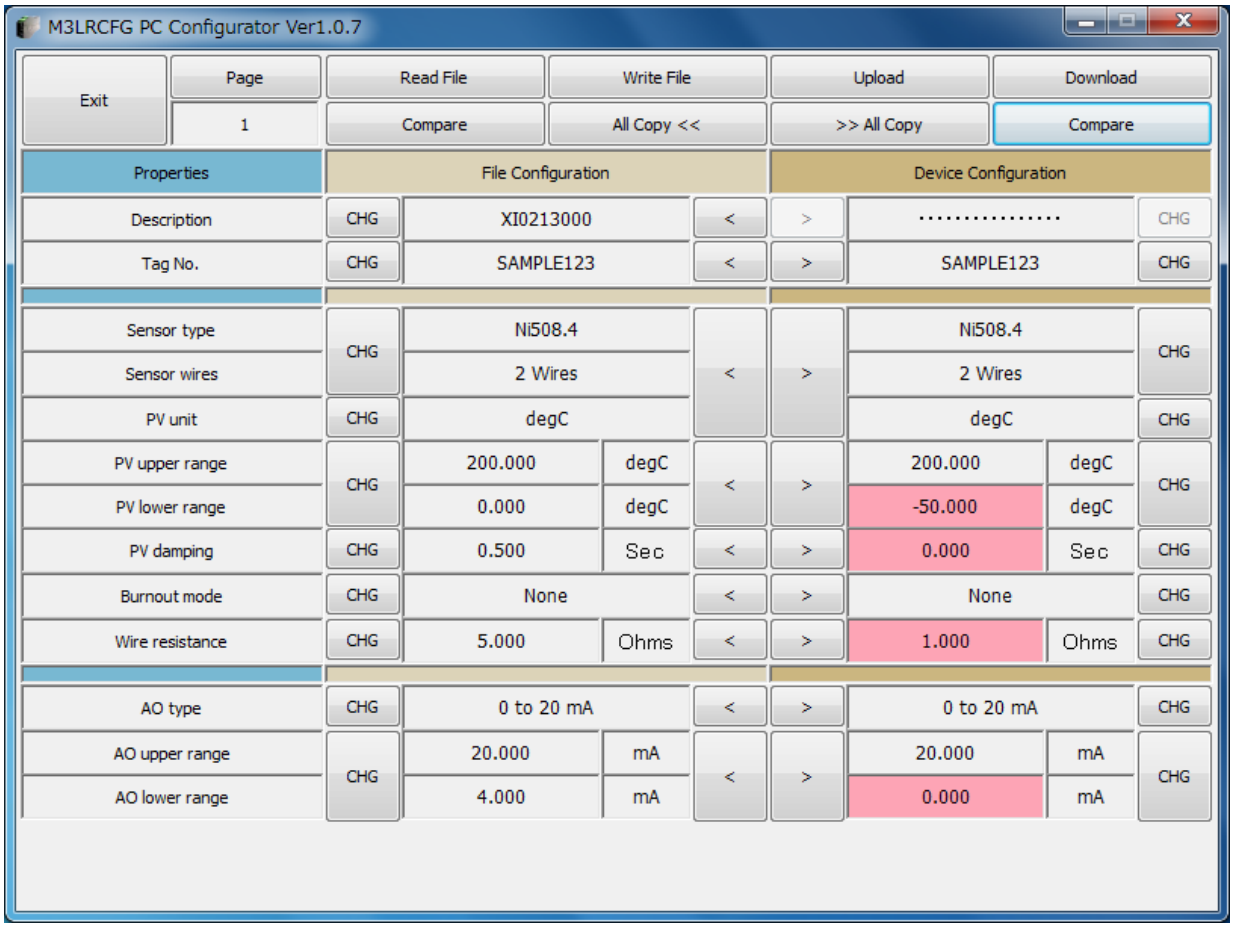
6.2.4. COMPARING FILE TO DEVICE

You can compare the configuration data in ‘File Configuration’ fields and ‘Device Configuration’ fields.

Click [Compare] button in ‘Device Configuration’ fields to compare its data to those in ‘File Configuration’ fields. Deviations will be highlighted in med pale red background color.

Click [Compare] button in ‘File Configuration’ fields to compare its data to those in ‘Device Configuration’ fields. Deviations will be highlighted in med pale red background color.

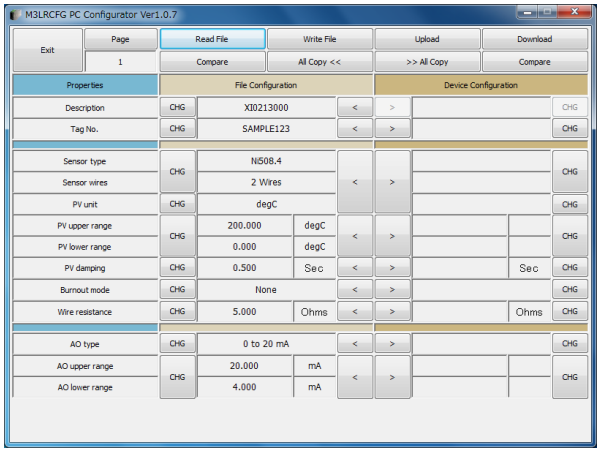
Figure 18. Parameters Compared



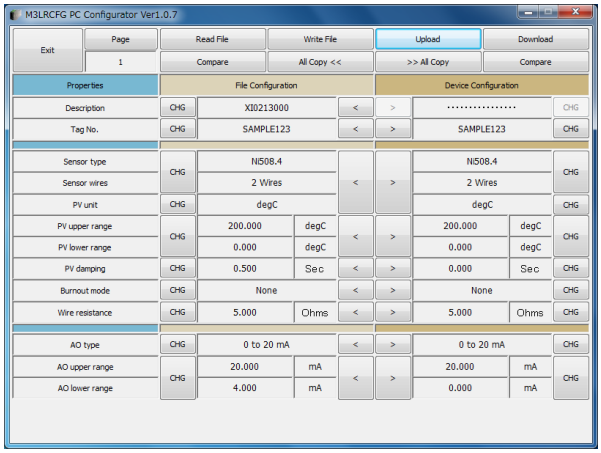
6.2.5. OPERATION EXAMPLE BY FILE MANAGEMENT

Operation procedure to change the configuration of the device with file management.

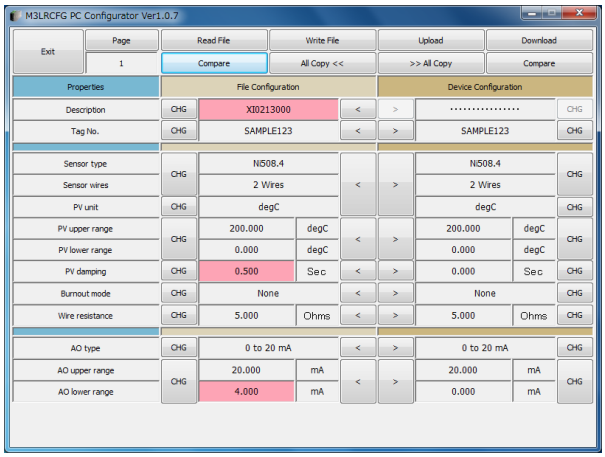
(1) Click [Read File] button to read the configuration data from a specified file



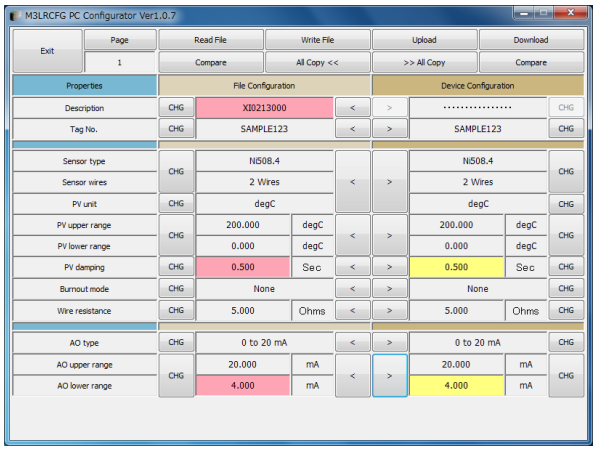
(2) Click [Upload] button to connect to the device, to read out its configuration data.



(3) Click [Compare] button in 'File Configuration' fields to compare the data in the file and the data in the device. Deviations will be highlighted in med pale red background color.

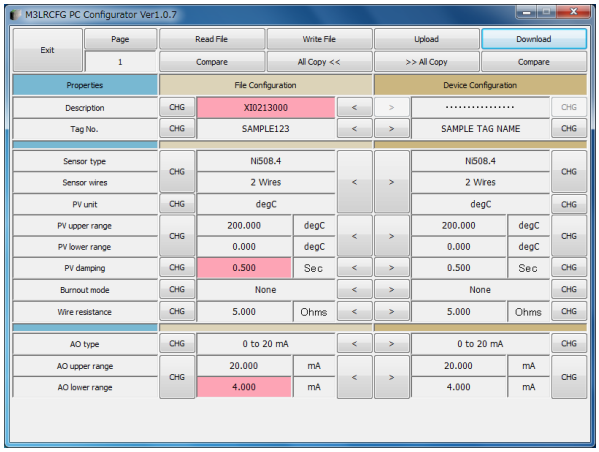


(4) Parameter can be copied from ‘File Configuration’ to ‘Device Configuration’ using [>] button. Copied fields will be highlighted in light yellow background color.



(5) Click [CHG] button at the left of each field to modify the parameter. Fields in which the parameter has been changed will be highlighted in light yellow background color.

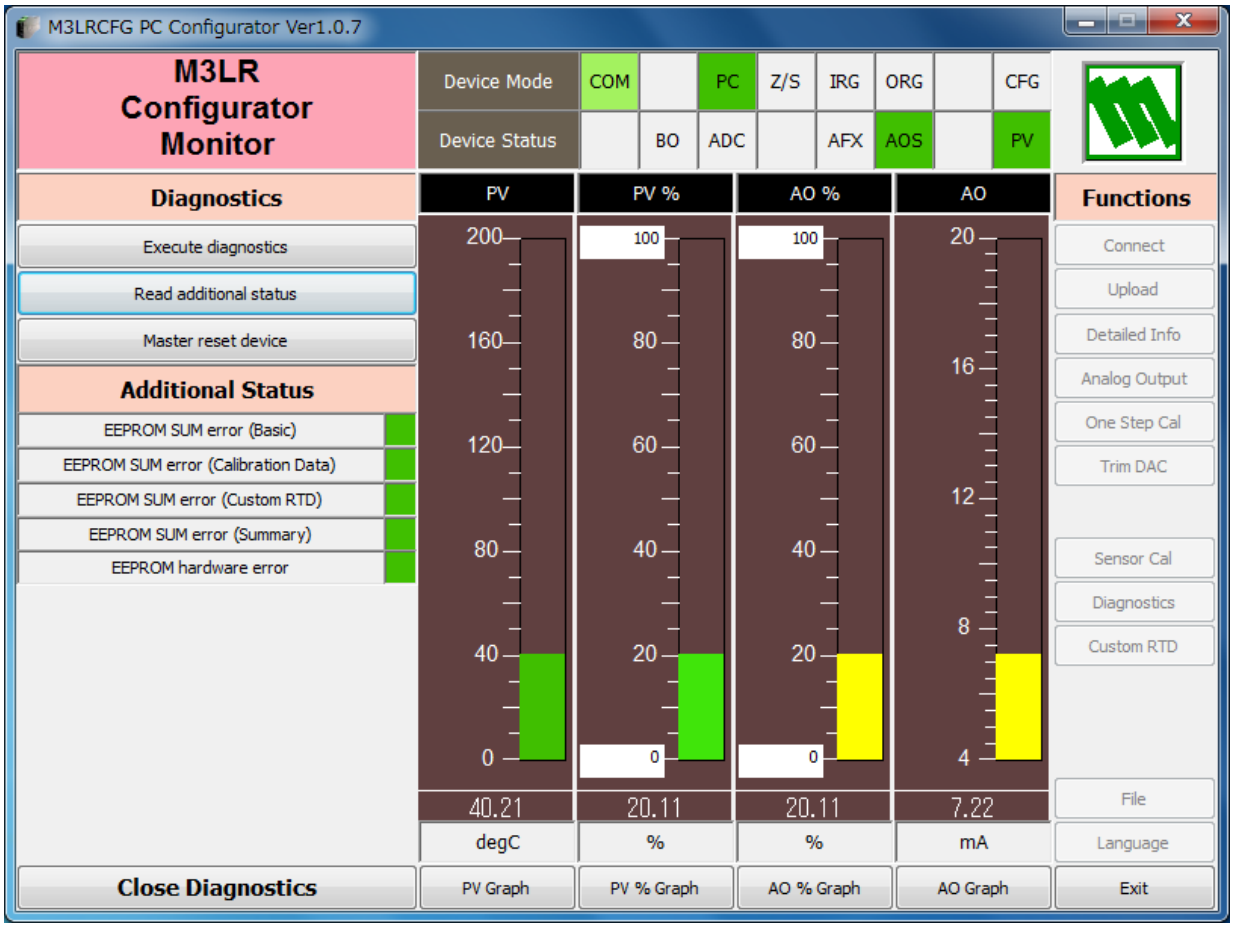
(6) Click [Download] button to write the configuration data in ‘Device Configuration’ fields to the connected device. When the downloading is successfully complete, the configuration data is automatically uploaded and the background color returns to the initial state.



7. DIAGNOSTICS

Click [Diagnostics] button to open the Diagnostics window as shown in Figure 19.

Figure 19. Diagnostics

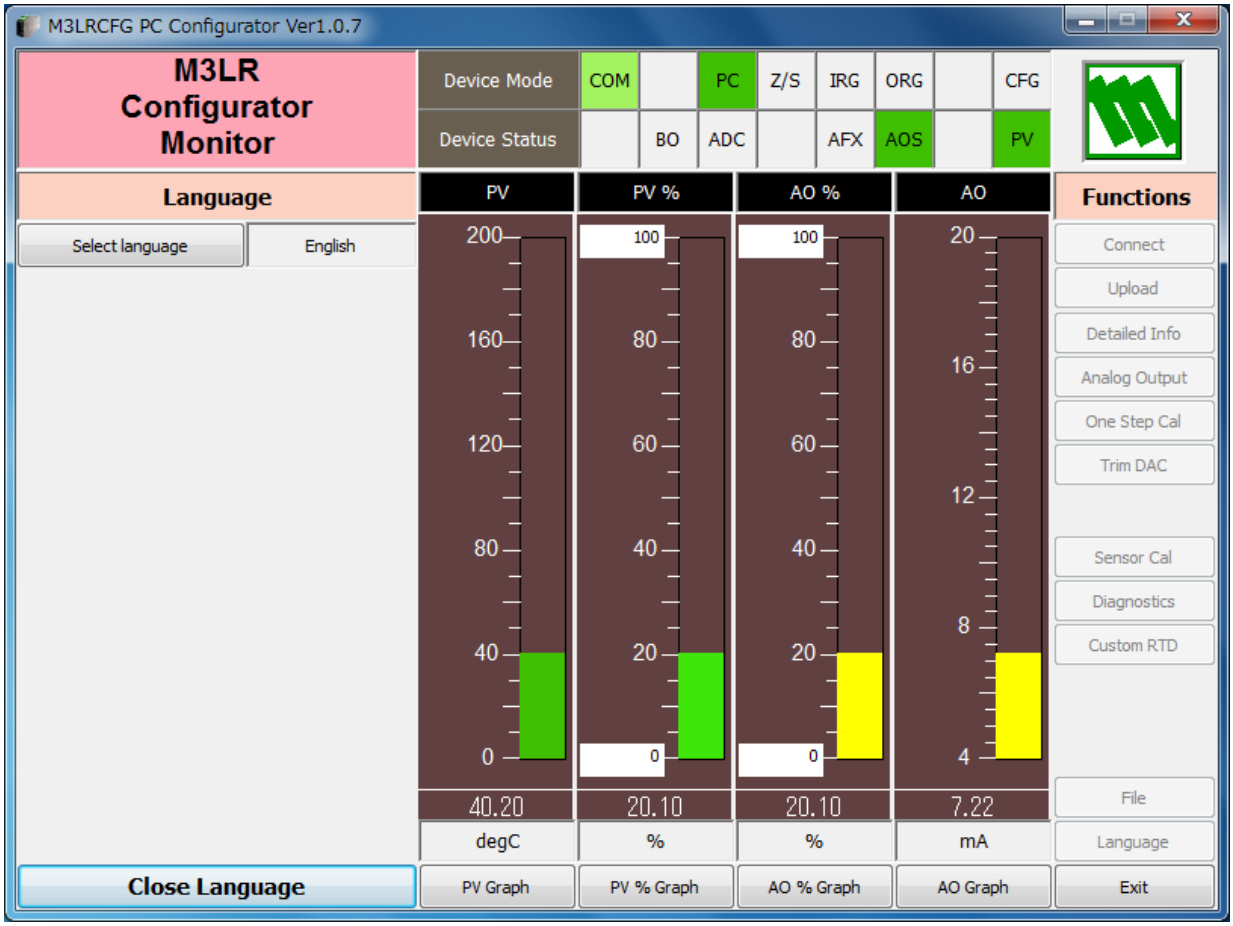


Execute diagnostics		Activates a diagnostics program and results are displayed in Additional Status.
Read additional status		Reads current contents of Additional Status from the device.
Master reset device		Reset and restart the device without actually turning OFF/ON the power supply.
Additional Status	EEPROM SUM error (Basic)	Status is displayed: green in normal status, while red in error.
	EEPROM SUM error (Calibration data)	
	EEPROM SUM error (Special Curve)	
	EEPROM SUM error (Summary)	
	EEPROM SUM hardware error	
Close Diagnostics		Close the window.

8. LANGUAGE

Click [Language] button to open the Language window as shown in Figure 20. The user can select the display language of the M3LRCFG.

Figure 20. Language



Click [Select language] to select the available language. The selected language is shown on the screen immediately.

English is available in each language version of Windows, while Windows in your PC must support other language in order to display it.

Click [Close Language] to close the window.