



7929 SW Burns Way
Suite B
Wilsonville, OR

Phone: 503 344-5085
Fax: 503 682-9014
sales@rinehartmotion.com

RMS RTD Calibration Process

Revision 0.4



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Revision History

Version	Description of Versions / Changes	Updated by	Date
0.1	Initial version	Azam Khan	8/3/2012
0.2	Replaced 100 Ohms and 1000 Ohms resistors with PT100 and PT1000.	Chris Brune	8/5/2012
0.3	Updated Calibration Process (section 2.3) with information regarding the difference between temperature units used in GUI versus the spreadsheet.	Azam Khan	8/7/2012
0.4	Updated document to include calibration for Gen-2 boards also.	Azam Khan	9/18/2012



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1 Introduction

1.1 Purpose

The purpose of this user manual is to provide a calibration process for the sensor in the controller that reads the RTDs.

Generally the sensors are already calibrated at the RMS factory. However, there are some instances when the calibration data could inadvertently be erased or lost.

The intended audience of this document is primarily customers and end users of PM controller.

1.2 Scope

This document describes the calibration process for RTD1 through RTD5. Gen-3 controllers use only RTD1 and RTD2. Gen-2 controllers use all five RTDs, RTD1 through RTD5.

1.3 Definitions, Acronyms, and Abbreviations

Terms	Definitions
Gen-2	Generation 2 boards (All old PM100 units have Gen-2 boards. None of PM150 units are Gen-2 boards).
Gen-3	Generation 3 boards (All PM150 units have Gen-3 boards. Some newer PM100 units also have Gen-3 boards)
PT100 or PT1000	PT100 and PT1000 are the two common types of platinum RTD sensors. PT100 is 100 ohms at 0°C and PT1000 is 1000 ohms at 0°C.
RTD	Resistance Temperature Detectors
UUT	Unit under testing

1.4 References

- RTD Calibration Worksheet.xlsx
- defsyms_rtd_cal.txt
- PM150 Additional Features Description.pdf



2 RTD Calibration

2.1 RTD Selection (Gen-3 Boards Only)

The two available RTDs are RTD1 and RTD2. These RTDs are configurable to select either a 100 Ohms RTD or a 1000 Ohms RTD through the GUI parameter, RTD_Select_Command_(BITS_1_0).

The final selection can be saved by programming the value in RTD_Select_Command_(BITS_1_0) into the EEPROM parameter, RTD_Selection_EEPROM_(BITS_1_0).

2.2 RTD Selection Parameters (Gen-3 Boards Only)

Following GUI parameters can be used to configure and confirm the setup of RTD1 and RTD2:

Parameter	Description
RTD_Select_Command_(BITS_1_0)	<p>This parameter is used to select values for the two RTDs as follows:</p> <ul style="list-style-type: none">• Bit 0: Configures RTD1• Bit 1: Configures RTD2 <p>Set this parameter to one of the following values to select the desired configuration for RTD1 and RTD2:</p> <p>0: RTD1 = PT1000 RTD2 = PT1000</p> <p>1: RTD1 = PT100 RTD2 = PT1000</p> <p>2: RTD1 = PT1000 RTD2 = PT100</p> <p>3: RTD1 = PT100 (default) RTD2 = PT100 (default)</p>
RTD_1_Select_Output_Status	<p>This is the hardware output pin that shows the status of RTD1 configuration.</p> <p>0: RTD1 is selected for PT1000 1: RTD1 is selected for PT100</p>



RTD_2_Select_Output_Status	This is the hardware output pin that shows the status of RTD2 configuration. 0: RTD2 is selected for PT1000 1: RTD2 is selected for PT100
RTD_1_Selected_Value_(Ohms)	This parameter can be used for additional confirmation of RTD1 selection. This shows the value of RTD1 as either 100 or 1000 based on the chosen configuration.
RTD_2_Selected_Value_(Ohms)	This parameter can be used for additional confirmation of RTD2 selection. This shows the value of RTD2 as either 100 or 1000 based on the chosen configuration.

2.3 Calibration Process (Gen-2 & Gen-3 Boards)

Each RTD calibration requires two known values of resistors that can be plugged into the RTD inputs instead of the RTD sensors. RMS uses 120 ohms and 150 ohms. The calculation in the spreadsheet is also based on these two values.

NOTE: Please pay attention to the units and multiplier factors when entering data in the spreadsheet and in the GUI. Temperature readings in the spreadsheet are in °C, while those in the GUI are in °C x 10.

1. Power up the UUT and load the default symbols file defsyms_rtd_cal.txt. It should contain only parameters relevant to RTD calibration.
2. Open RMS GUI and monitor the following parameters from the 'Memory View':

Parameter	Address	Comment
RTD1_Temp_(C)_x_10	0x00A8	Shows the current value of RTD sensor as degrees C x 10 for both Gen-2 and Gen-3 boards.
RTD2_Temp_(C)_x_10	0x00A9	
RTD3_Temp_(C)_x_10	0x00AA	Shows the current value of RTD sensor as degrees C x 10 for Gen-2 boards only.
RTD4_Temp_(C)_x_10	0x00AB	
RTD5_Temp_(C)_x_10	0x00AC	



3. Please note that each RTD is listed with both 100 ohms and 1000 ohms gain and offset parameters. Change only those parameters that are relevant to the RTD value being used by the controller. For example, if RTD1 = 100 ohms, then only values in the first row in the table below need to update.

To calibrate	use EEPROM parameters
RTD1 = 100 Ohms	G3_RTD1_100_Ohm_Gain_EEPROM_x_10000 G3_RTD1_100_Ohm_Offset_EEPROM_x_100
RTD2 = 100 Ohms	G3_RTD2_100_Ohm_Gain_EEPROM_x_10000 G3_RTD2_100_Ohm_Offset_EEPROM_x_100
RTD1 = 1000 Ohms	G3_RTD1_1K_Ohm_Gain_EEPROM_x_10000 G3_RTD1_1K_Ohm_Offset_EEPROM_x_100
RTD2 = 1000 Ohms	G3_RTD2_1K_Ohm_Gain_EEPROM_x_10000 G3_RTD2_1K_Ohm_Offset_EEPROM_x_100

Table 1: RTD Parameters for Gen-3 Board (Mostly PM150)

To calibrate	use EEPROM parameters
RTD1 = 1000 Ohms	G2_RTD1_1K_Ohm_Gain_EEPROM_x_10000 G2_RTD1_1K_Ohm_Offset_EEPROM_x_100
RTD2 = 1000 Ohms	G2_RTD2_1K_Ohm_Gain_EEPROM_x_10000 G2_RTD2_1K_Ohm_Offset_EEPROM_x_100
RTD3 = 1000 Ohms	G2_RTD3_1K_Ohm_Gain_EEPROM_x_10000 G2_RTD3_1K_Ohm_Offset_EEPROM_x_100
RTD4 = 100 Ohms	G2_RTD4_100_Ohm_Gain_EEPROM_x_10000 G2_RTD4_100_Ohm_Offset_EEPROM_x_100
RTD5 = 100 Ohms	G2_RTD5_100_Ohm_Gain_EEPROM_x_10000 G2_RTD5_100_Ohm_Offset_EEPROM_x_100

Table 2: RTD Parameters for Gen-2 Board (PM100)

4. Read the 120 Ohms resistor with an ohm-meter and enter the value from the RTD data sheet into the Excel spread sheet labeled, 'Worksheet'. This spread sheet is provided by RMS with this document. Also included with this package is defsyms_rtd_cal.txt file used by the GUI. In the spreadsheet, this value should be entered as °C instead of (°C x 10) as shown in the GUI.



5. Read the 150 Ohms resistor with an ohm-meter and enter the value from the RTD data sheet into 'Worksheet' in the same manner as above.
6. Connect 120 Ohms in place of the sensor and enter the value read by the GUI parameter, RTD1_Temp_(C)_x_10 in 'Memory View'.
7. Connect 150 Ohms in place of the sensor and enter the value read by the GUI parameter, RTD1_Temp_(C)_x_10 from 'Memory View' into the spreadsheet.
8. Enter the current value of G3_RTD1_100_Ohm_Gain_EEPROM_x_10000 from the "EEPROM View" of the GUI into the spreadsheet.
9. Enter the current value of G3_RTD1_100_Ohm_Offset_EEPROM_x_100 from the "EEPROM View" of the GUI into the spreadsheet.
10. From the 'Worksheet', program the value RTD1 EEPROM Gain (Auto-calc) into G3_RTD1_100_Ohm_Gain_EEPROM_x_10000 of the "EEPROM View" of the GUI display. This is the new gain for RTD1.
11. From the 'Worksheet', program the value RTD1 EEPROM Offset (Auto-calc) into G3_RTD1_100_Ohm_Offset_EEPROM_x_100 of the "EEPROM View" of the GUI display. This is the new Offset for RTD1.

The above calibration process is for RTD1 with 100 Ohms value on a Gen-3 board. The same process can be repeated for RTD2 with 100 Ohms value.

A separate calibration must be performed if PT1000 sensors are going to be used. The calibration resistors should be 1.2K Ohms and 1.5K Ohms, respectively. Repeat the same process.

Once the calibration process is completed successfully, RTD values from the GUI should read exactly the same as the values from RTD data sheets.