PT1 Auto Calibration and Data Logger

PT1 is RTD temperature measurement module, with seven channel RTD-to-digital converters, designs specific for Auto Calibration Application.

- 7 channel platinum RTD temperature measurement and data logger
- Works with PT100 RTD temperature sensors
- Compatible with 4-wire sensors
- 15-Bit ADC Resolution
- Temperature and Calibration report
- Stand-alone application with Micro SD Card data logger
- IEEE Standard 488.2 Communications
- Powered by USB port or DC adaptor

Auto Calibration eliminates human errors and inaccuracies from manual calibration. PT1 uses a resistance-to-digital converter which optimizes for platinum resistance temperature detectors. An external resistor and delta-sigma ADC are used to convert RTD resistance to a digital value. PT1 has seven resistance-to-digital converters that mean PT1 can measure temperature from multiple sensors at the same time, so it was time-saving and better sensor data. Calibration Value is calculated automatically when a stable condition is met, then PT1 will update all the values immediately. PT1 uses GPIB (General Purpose Interface Bus) IEEE Standard 488.2 for data transfer and Calibration function. Temperature value, Calibration value and Calibration time, all this information is saved to Micro SD Card, so data can be analyzed when needed.

Specifications

Sensor Type	RTD PT100
PT1 Measurement Ranges	-200 to 800 °C * depending on external PT100 sensor
Accuracy	0.5 °C (0.05% full scale) max
Resolution	0.03125 °C
Overvoltage Protection	+/- 45V
ADC Resolution	15 bits
Conversion Time	91ms per channel
Communication	IEEE Standard 488.2
Sensor Inputs	7
Sensor Connectors	Mini DIN 4-Pin
I/O Ports	GPIB, USB
Power Supply	USB or DC 12V
Dimensions	219.9 x 217.9 x 50.5mm

PT1 Auto Calibration

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PT1 Auto Calibration and Data Logger

User's Guide

Important Information

Do not use PT1 near the high frequency or electrical noise area. High frequency or electrical noise results in inaccurate measurement.

Do not connect the sensor or any of the PT1 parts to dangerous equipment. The hazardous voltage on the equipment can damage the A/D converter circuit and anything that connects with PT1.

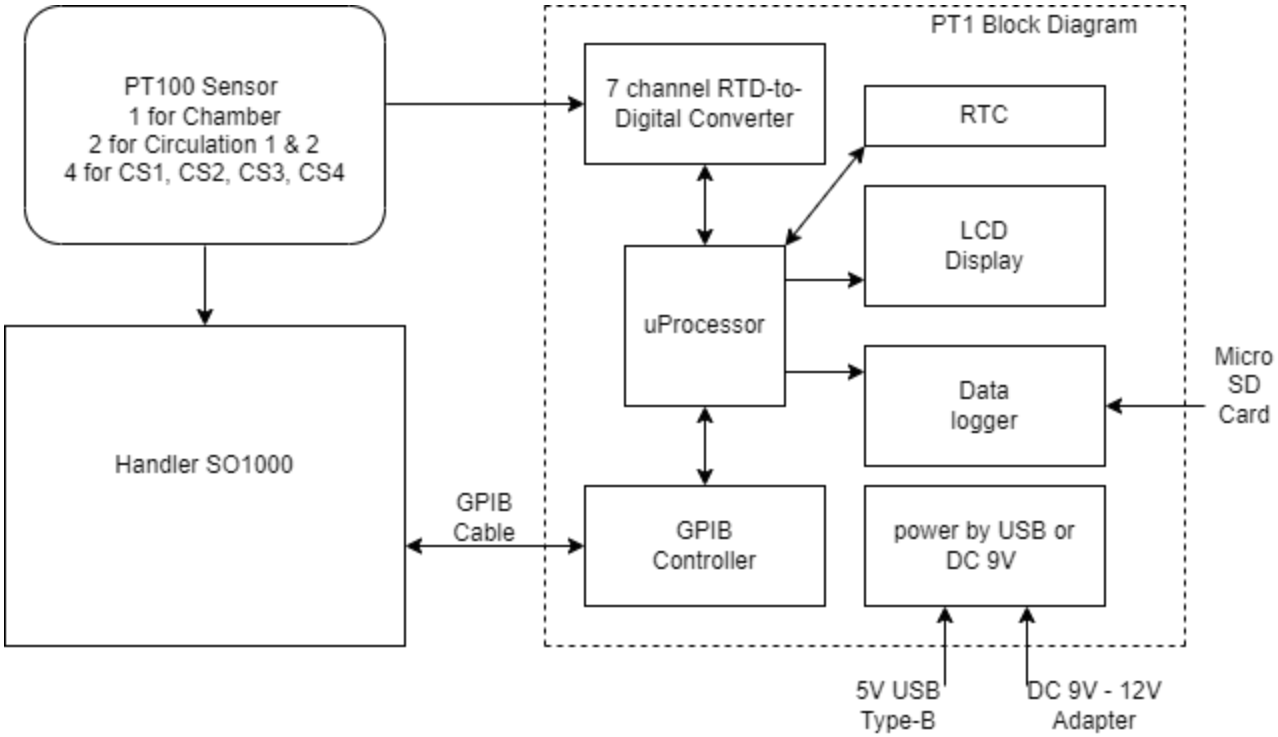
PT1 is protected by copyright law, attempting to replace or modify PT1 electronic components and/or any part including the enclosure is not allowed.

All accompanying documents, especially this datasheet/user's guide, must be passed to and acknowledged by PT1 users.

Redistribution of PT1 documents, this datasheet, must retain all copyright notices that are currently in place, and the conditions in this page without modification.

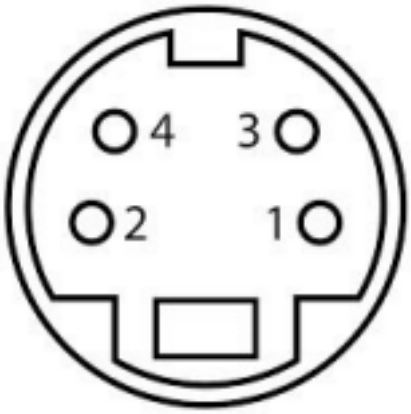
PT1 owners shall not be responsible or liable for any loss, damage or injury, however caused, related to the use of PT1.

PT1 Block Diagram



RTD Sensor wiring

Use a multimeter to determine which RTD wires connect together directly (2 ohms) and which connect through RTD.



Connect RTD wires that connect together to mini-DIN 4 pin no. 1 and 4, and connect other pairs to mini-DIN 4 pin no. 2 and 3

PT1 Channel: Handler External Sensor Position

Ch1: Chamber
Ch2: CS1&3 Circulation Contact Area 1
Ch3: CS2 & CS4 Circulation Contact Area 2
Ch4: CS3 Nozzle
Ch5: CS4 Nozzle
Ch6: CS1 Nozzle
Ch7: CS2 Nozzle

PT1 on-screen menu and navigation

There is an on-screen menu on the LCD display and 6 BUTTON to help navigate to each setting or selection. Users can go to the next page by pressing the [NEXT/RIGHT] button or go back to the previous page by pressing the [BACK/LEFT] button. Use [UP/+] button or [DOWN/-] button to increase or decrease the value or navigate up/down on the sub-menu. [START] button, press this button when ready to begin calibration or start to measure temperature. [RESET] button, use this button to reset PT1.

Calibration Setup

* see calibration procedure section for more details

1. Place RTD sensor at Handler specific location and connect RTD sensors connector to PT1 channel inputs
2. Connect GPIB cable between Handler and PT1
3. Connect power supply to PT1, use one of power source options
    a. USB connector
    b. AC-to-DC adapter 7 - 12 volts
4. Insert Micro SD Card into Card Slot
5. On Handler goto Settings > Tester Interface
    a. IEEE Interface > Protocol: RASCO
    b. IEEE Interface > IEEE Address: 5
    c. Termination: CR / LF
6. goto Settings > Temperature
    a. Calibration > Enable [Table Enabled]
    b. Calibration > press [Edit Table]
    c. Edit Table > Temperature Calibration: select Calibration_x (x=table number) d. For new calibration enter new Main Setpoint and Measure Value (setpoint and value must be equal) for each channel or use the previous value
    e. Save and Exit
    f. enable [Auto Calibration]
7. on PT1 select menu Calibration and press [NEXT]
8. set Internal Sensor Stability and External Sensor Stability
9. when ready press PT1 [START] button to begin calibration

While in the calibration process the LCD screen will show current setpoint value, calibration table number (T) and number of update count (U). PT1 will start calibrating at a lowest setpoint first. It will take some time until all sensors get into stability range (setpoint +/- stability value) and stable time. Then PT1 will update Handler Calibration Table Value. The update can occur many times until the current calibration setpoint is complete and then PT1 will calibrate the next setpoint. “Calibration at setpoint xx xx completed.” will be shown when all calibration is completed. Stable time is 2 to 30 minutes (default is 2 minutes) depending on the user-specified. Stability starts to count when all sensors reach stable condition. Usually it takes around 30 minutes or more to complete one setpoint. If temperature cannot be stable within 90 minutes, users can press and hold PT1 [BACK]+[UP] button for 5 sec to adjust stability settings. Abort time is 120 minutes.

After calibration complete

1. reset PT1 or view summary data on the LCD screen and then reset PT1 2. Disable Handler Auto Calibration by Press Handler [Auto Calibration] button 3. Message display "do you really want to exit autocal" press “yes”
4. Press [Save and Exit] to save new Calibration Value or [Exit] exit without save
5. restart or shutdown Handler

SD Card

DATAxx.CSV (xx = 00 - 99) this file saves all data every program cycle. SUMMxx (xx = 00 - 99) this is a summary data file. TEMPxx (xx = 00 - 99) is a temperature measurement data file which is saved when PT1 is in “Temperature Measurement” Mode.

The filename will increase by 1 from number 00 to 99. When filename reaches 99, all files should be deleted, otherwise it will be an error.

Handler Defrost

If the first setpoint is <= 0 °C or in cold setpoint and the second setpoint is >= 40 °C and < 70°C, Handler will go to defrost mode for 1 hour. When the defrost finishes Handler will automatically return to normal mode.

*** from SO1000 manual

1. set point was -55°C, new set point is >/= 40°C but below 70°C then

- The Handler requires defrost, and goes into defrost mode automatically which is 70°C. - If the new set point is > 40°C but </= 70°C, the Handler will go to 70°C for 1 hour, as soon it reaches the 70°C then it turns on the air nozzles for all contact sites and after 1h it drops to the set point which was entered.

- If the new set point is > 70°C, the Handler will be in defrost mode and will go up to the set temperature until it reaches the guardband of the new set point. Then Handler will switch on the nozzles and will stay there for 1h. Afterwards the Handler will be in normal handling mode automatically and will start handling again if the Start button was pressed.

2. setpoint was -55°C (or other cold set point.) the new set point is < 40°C - Defrost cycle does not turn on. Handler warms up to a new set point. Make sure LN2 is still provided to the Handler. Set points below +41°C required LN2 in general.

PT1 Application

There are two applications, first is Auto Calibration which is the main application of PT1, second is Temperature Measurement for measuring internal temperature, external temperature or measures internal and external temperature. OFFSET is used to adjust PT1 temperature measurement to be close to the reference system.

Main Menu

- Calibration: enter this menu for Calibration Application
    - Calibration Settings
        - Internal Sensor Stability
        - External Sensor Stability
        - RTD Wire Settings
        - Calibration Mode
- Temperature Measurement: use this menu to measure RTD temperature -
    Internal Sensor Measurement
    - External Sensor Measurement
    - Internal and External Sensor measurement
    - OFFSET (set temperature offset)
    - OFFSET: Enable/Disable

Calibration Settings

Stability Setting is used to filter temperature and determine if the temperature is in stable condition. After changing the stability value, press [BACK] will automatically save the value. The internal sensor is the default sensor inside the Handler, the external sensor is the PT100 RTD sensor that is placed at a specific location on the Handler. Internal sensor stability is used with internal sensors, external sensor stability is used with external sensors.

Internal Sensor Stability: min = 0.1, max = 0.5

External Sensor Stability: min = 0.1, max = 3

RTD Wire setting

The default value is set to 4-wire which is recommended for accuracy, but 2-wire or 3-wire can be used. If 2-wire or 3-wire is used, the jumper on PCB must be changed to the correct position.

Calibration Mode

Auto: this is the default mode in which PT1 will perform an auto-calibration from start to finish.

Temperature Measurement

- Internal Sensor Measurement: PT1 use IEEE 488 to read internal sensor from each position (chamber, Circulation 1, Circulation 2, CS1, CS2, CS3 , CS4) and display on the LCD screen
- External Sensor Measurement: PT1 read external sensor via 7 channel inputs and display on the LCD screen
- Internal and External Sensor Measurement: PT1 read internal and external sensor at the same time and display on the LCD screen
- Temperature Offset Enable/Disable: enable or disable temperature offset - Temperature Offset: Temperature measurement can be adjusted to nearly or close to the reference system by using the offset. Use this menu to set offset values.

OFFSET1

An example of how to use offset 1

1. select Temperature Measurement menu
2. set desire setpoint -e.g., -55, 0, 100, 155 on reference system
3. get sample data (read temperature value, 20 or 30 samples for each setpoint) at specific setpoint (sample data also save to sd card)
4. calculate average temperature value from sample data
5. calculate offset for current setpoint
6. go to step 2. and set next setpoint, repeat each step until completed all setpoint then go to step 7
7. to get an offset, calculate an average value from step 5
8. goto Temperature Measurement menu and enable offset1
9. goto offset menu and select channel
10. set offset value for the current channel
11. press [BACK] to save and set next channel offset or go back to Temperature Measurement

PT1 Data Logger

Date Time	INT0	INT2	INT3	INT4	INT5	INT6	INT7	EXT0	EXT2	EXT3	EXT4	EXT5	EXT6	EXT7	DIF0	DIF2	DIF3	DIF4	DIF5	DIF6	DIF7
2017/12/4-15:2:57	84.9	85	85	84.9	84.9	84.9	84.9	85	84.7	84.8	84.9	84.6	84.8	84.8	0	0.3	0.2	0.1	0.4	0.2	0.2
2017/12/4-15:3:1	84.9	85	85	84.9	85	84.9	84.9	84.9	84.7	84.8	84.9	84.7	84.8	84.8	0.1	0.3	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:4	84.9	85	85	85	85	84.9	84.9	84.9	84.6	84.8	84.9	84.7	84.8	84.8	0.1	0.4	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:6	84.9	85	85	85	85	84.9	84.9	85	84.7	84.8	84.9	84.6	84.8	84.8	0	0.3	0.2	0.1	0.4	0.2	0.2
2017/12/4-15:3:10	84.9	85	85	85	85	84.9	84.9	84.9	84.6	84.8	84.9	84.7	84.8	84.8	0.1	0.4	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:13	84.9	85	85	85	85	84.9	84.9	84.9	84.7	84.8	84.9	84.7	84.8	84.8	0.1	0.3	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:16	84.9	85	85	85	85	84.9	84.9	84.9	84.7	84.8	84.9	84.7	84.8	84.8	0.1	0.3	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:20	84.9	85	85	85	85	84.9	84.9	84.9	84.7	84.8	84.9	84.7	84.8	84.8	0.1	0.3	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:22	84.9	85	85	85	85	84.9	84.9	84.9	84.7	84.8	84.9	84.7	84.8	84.8	0.1	0.3	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:25	84.9	85	85	85	85	84.9	84.9	84.9	84.7	84.8	84.9	84.8	84.8	84.8	0.1	0.3	0.2	0.1	0.2	0.2	0.2
2017/12/4-15:3:29	84.9	85	85	85	85	84.9	84.9	84.9	84.7	84.8	84.9	84.7	84.8	84.8	0.1	0.3	0.2	0.1	0.3	0.2	0.2
2017/12/4-15:3:32	84.9	85	85	85	85	84.9	84.9	85	84.7	84.8	84.9	84.6	84.8	84.8	0	0.3	0.2	0.1	0.4	0.2	0.2

Each program cycle, many information are generated: DateTime, internal sensor value (INTx), external sensor value (EXTx), DIFx (the difference between the setpoint and external sensor), old calibration value, new calibration value, information or error message, update calibration count, update calibration time, internal-to-stable condition time. Update CAL Count is a number of update calibration counts, Update CAL Time is elapsed time between each update, INT_to_STB is elapsed time an internal sensor reaches a stable condition.

Each complete Setpoint, PT1 will generate summary information which contains information: Handler ID, Start Time, Finish Time, Setpoint, External Value, Calibration Value, Update CAL Count and Calibration Time. PT1 saved this information to Micro SD Card.

log data description

When auto calibration was completed calibration data was also saved to the Micro SD Card. Analysts can take the SD Card and view the calibration data with the PC. There are 3 files for each application, DATAxx.CSV, SUMMxx.CSV and TEMPxx.CSV each file has a .csv extension which can be opened with spreadsheet software like Microsoft excel. The xx character in the file name is the number that starts at 00 to 99, e.g. DATA00.CSV - DATA99.CSV. This is the auto generated file name and the number is incremented by 1. When the number is reached 99 all files should be deleted.

When PT1 Temperature Measurement mode is used data is saved to TEMPxx.CSV. While the auto calibration is in process data is saved to file DATAxx.CSV and when calibration completed summary data is saved to file SUMMxx.CSV. The xx of these two files (DATAxx and SUMMxx) will have the same number, calibration data file name DATA00 has summary data file name SUMM00.

Each handler must have a unique Handler ID because when PT1 performs auto calibration it saves the handler id to the log data file so analysts know which handler belongs to the log data file.

SUMMxx.CSV file is a summary file and easy to read. There is only one line for each setpoint. Each of this line has the data that was saved when calibration at the setpoint completed. So if auto calibration has three setpoints this file will have only three lines.

DATAxx.CSV file has more details and more lines of data, it can have thousands or more lines of data. Analysts can view data changed at the second when data was saved. This file combined with a summary file shows analysis of complete auto calibration.

DATAxx.CSV

Column name	*Description*
Datetime	Time when data was saved, yyyy/mm/dd hh:mm:ss
INT0 to INT7	Temperature of internal sensor inside handler
EXT0 to EXT7	Temperature of external sensor RTD PT100 EXT0 = chamber EXT2 = CS1&3 Circulation Contact Area 1 EXT3 = CS2 & CS4 Circulation Contact Area 2 EXT4 = CS3 Nozzle EXT5 = CS4 Nozzle EXT6 = CS1 Nozzle EXT7 = CS2 Nozzle
DIFF0 to DIFF7	Difference between setpoint and external sensor (setpoint - external sensor)
NEWCAL0 to NEWCAL7	New calculate calibration value
OLDCAL0 to OLDCAL7	Old calibration value
Info Message	Information, e.g. handler id, status or error message
Update CAL Count	The number of count when PT1 update handler calibration value
Update CAL Time	Elapsed time of each time PT1 update handler calibration value
INT_to_STB(sec)	Elapsed time when internal sensor reach temperature stable condition
INT STB	Internal temperature stability value
EXT STB	external temperature stability value
Setpoint	Calibration Setpoint

SUMMxx.CSV

Column name	*Description*
Handler ID	Handler id number
Start Time	Start calibration time, yyyy/mm/dd hh:mm:ss
Finish Time	Finish calibration time, yyyy/mm/dd hh:mm:ss
Setpoint	Calibration setpoint
EXT0 to EXT7	Temperature of external sensor RTD PT100 EXT0 = chamber EXT2 = CS1&3 Circulation Contact Area 1 EXT3 = CS2 & CS4 Circulation Contact Area 2 EXT4 = CS3 Nozzle EXT5 = CS4 Nozzle EXT6 = CS1 Nozzle EXT7 = CS2 Nozzle
CAL0 to CAL7	Calibration value
Update CAL Count	Total update count when calibration completed.
Calibration Time	Time when calibration completed.

TEMPxx.CSV

Column name	*Description*
Datetime	Date and time, yyyy/mm/dd hh:mm:ss
INT0 to INT7	Temperature of internal sensor inside handler
EXT1 to EXT7	Temperature of RTD PT100 channel 1 - 7

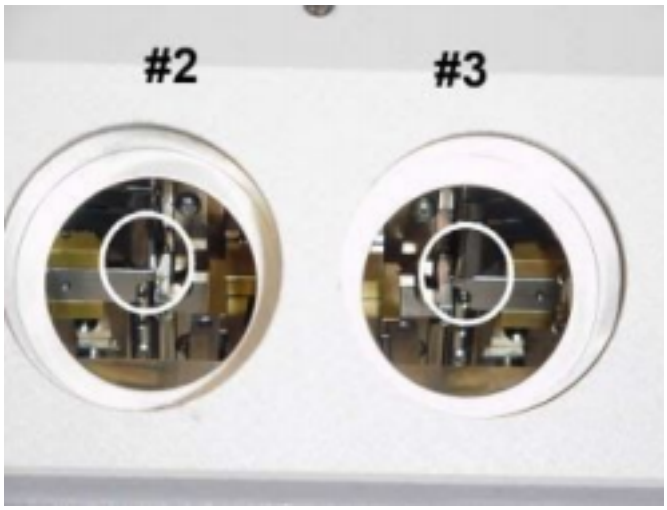
PT1 Calibration Procedure

1. Sensor connection
    a. Place RTD sensor at Handler specific location and connect RTD sensors mini-din 4 pin connector to PT1 channel inputs
    b. PT1 channel mini-din 4 pin connector

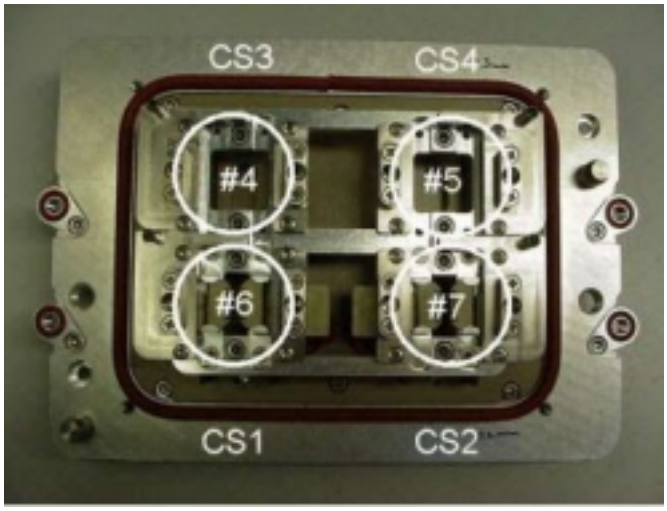
    c. PT1 CH1 to Chamber Circulation (#0)

    d. PT1 CH2 to CS1 & CS3 Circulation (#2)

e. PT1 CH3 to CS2 & CS4 Circulation (#3)



f. PT1 CH4 to CS3 (#4)
g. PT1 CH5 to CS4 (#5)
h. PT1 CH6 to CS1 (#6)
i. PT1 CH7 to CS2 (#7)

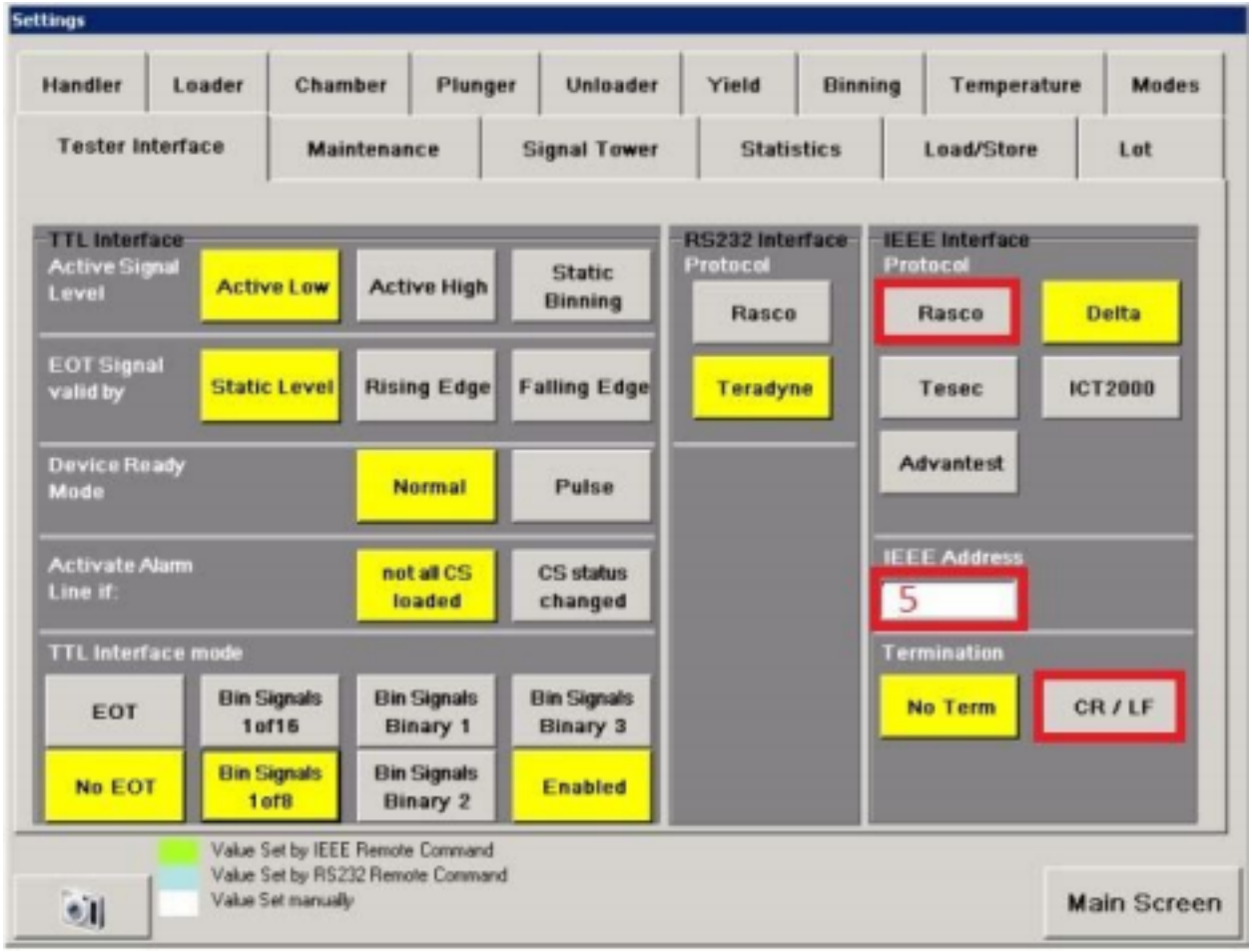


2. Connect GPIB cable between Handler and PT1

3. Connect power supply to PT1. DC Adapter and USB cable is included with PT1 (GPIB cable is not included). PT1 can get power from the Handler by connecting the USB cable from the Handler to PT1. Only one power source can be used, if USB is used for power source disconnect DC Adapter, if used DC Adapter disconnect USB cable. use one of power source options
    a. USB connector
    b. AC-to-DC adapter 7 - 12 volts

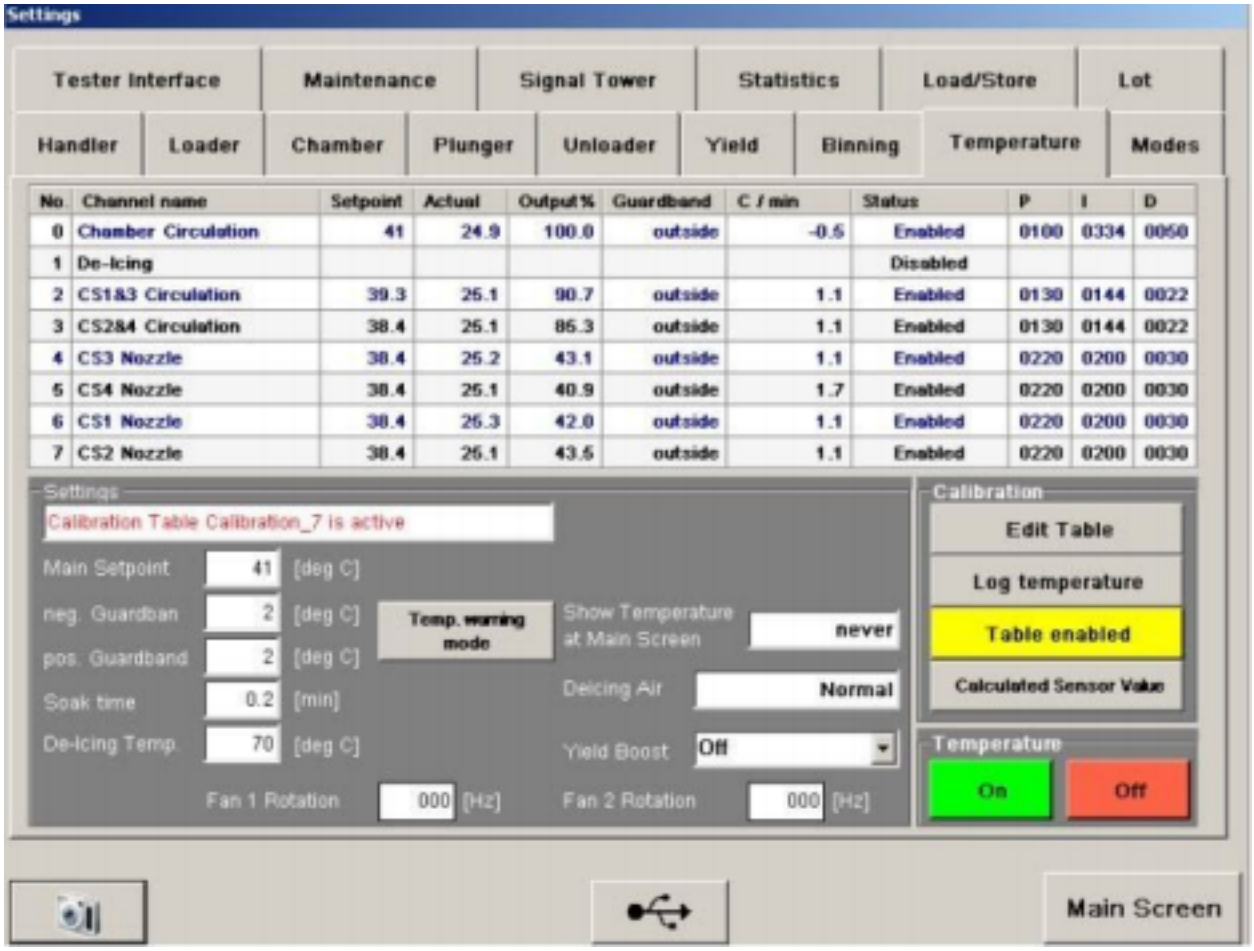
4. Prepare for data logging
    a. Insert Micro SD Card into Card Slot
    b. If no micro sd card PT1 still able to perform normal calibration but there will be no data logger information
    c. PT1 log data to Micro SD Card, file format is .csv
    d. DATAxx.CSV (xx = 00 - 99) this file saves all data every program cycle. SUMMxx (xx = 00 - 99) this is a summary data file. TEMPxx (xx = 00 - 99) is a temperature measurement data file.
    e. The filename will increase by 1 from number 00 to 99. When filename reaches 99, all files should be deleted, otherwise it will be an error

5. Set IEEE Interface



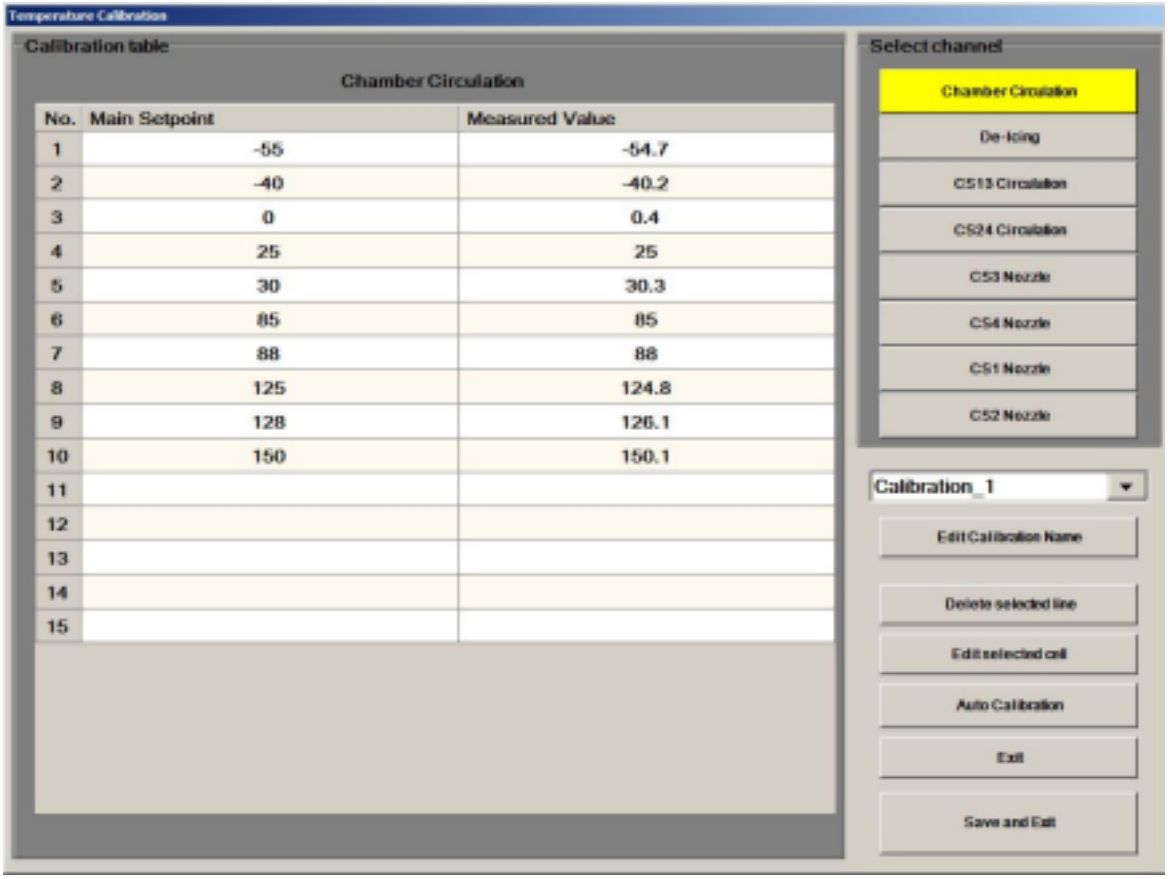
a. On Handler goto Settings > Tester Interface
b. IEEE Interface > Protocol: RASCO
c. IEEE Interface > IEEE Address: 5
d. IEEE Interface > Termination: CR / LF

6. Activate Table enabled



a. goto Settings > Temperature
b. Calibration > [Table Enabled] button must be activate (yellow background)

7. Input Main Setpoint and Measured Value

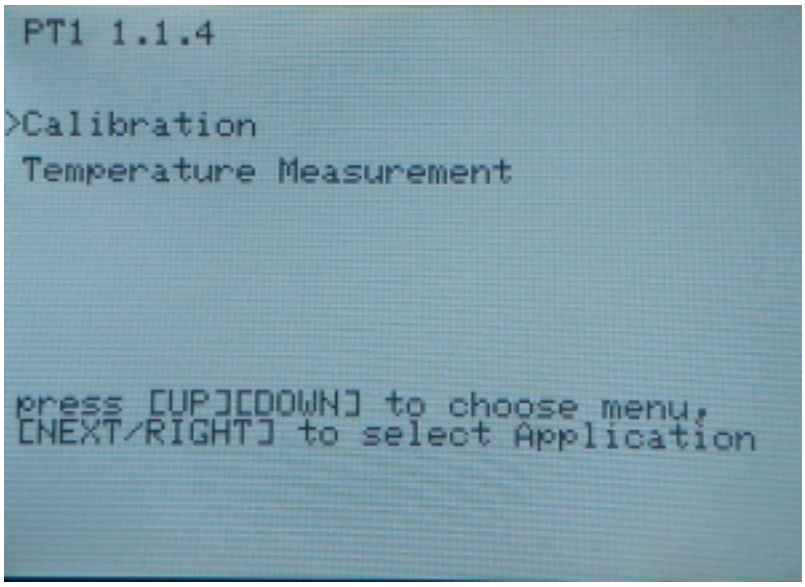


a. goto Settings > Temperature > Edit Table > Temperature Calibration
b. For new calibration
    i. choose calibration table (Calibration_x, x=table number 1 to 10) to use for calibrate and select channel
    ii. enter Main Setpoint and Measured Value (Main Setpoint and Measured Value must be equal)
        1. If selected Table has value delete old value (old Main Setpoint and old Measured Value) and enter new value (Main Setpoint and new Measured Value)
        2. PT1 can calibrate up to 20 Setpoint Value
c. If use old calibration value
    i. choose calibration table to use for calibrate
    ii. Check and ensure that there is no missing setpoint and measure value otherwise PT1 will error
d. for each setpoint PT1 will calibrate from lower setpoint value to higher setpoint value
e. Save and Exit

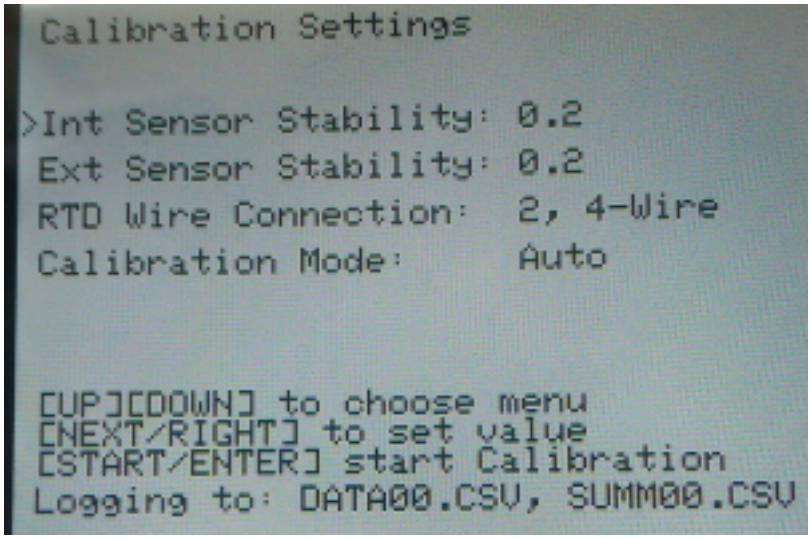
i. Handler does not automatically save the new value (value appears on the screen) to the calibration table (actual calibration database file) unless the [Save and Exit] button is pressed.

8. Enable Auto Calibration
    a. Settings > Temperature > Calibration > press [Edit Table]
    b. Temperature Calibration: enable Auto Calibration by pressed [Auto Calibration] button (make button yellow background color)
    c. After enabled Auto Calibration OPI will display as below screen and during this time the other button will not be function unless terminate auto calibration

9. on PT1 select menu Calibration and press [NEXT]



10. set Internal Sensor Stability and External Sensor Stability

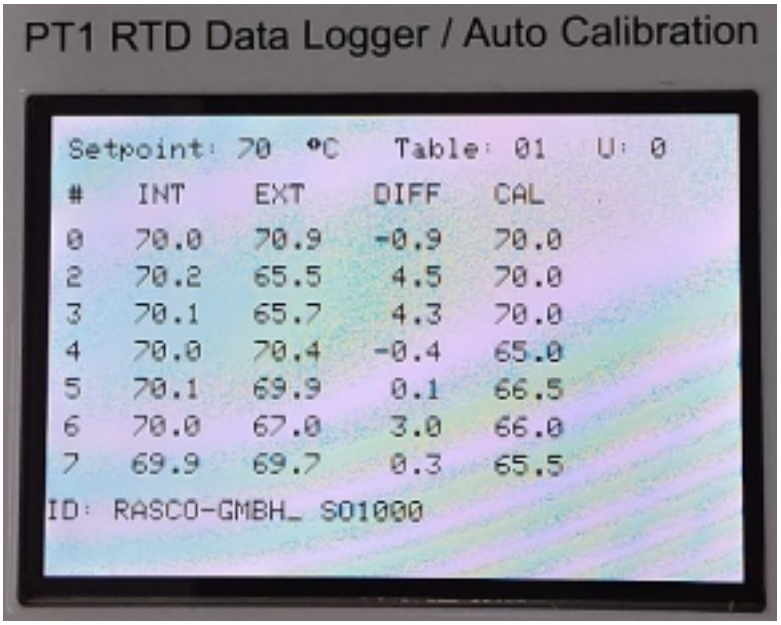


a. Use Stability with setpoint value, e.g. if setpoint is 100 degree and the desired stable state of temperature value is in between 99.8 degree to 100.2 degree use stability value 0.2

b. RTD Wire Connection: 2, 4-wire is default, 4-wire RTD better for accuracy

c. Calibration Mode: Auto (leave as default)

11. When ready press PT1 [START] button to begin calibration



While in the calibration process the LCD screen will show current setpoint value, calibration table number (T), number of update count (U), internal sensor value (INT), external sensor value (EXT), difference between setpoint and external sensor value (DIFF), current calibration value (CAL).

#
0: Chamber Circulation
2: CS1 & CS3 Circulation
3: CS2 & CS4 Circulation
4: CS3 Nozzle
5: CS4 Nozzle
6: CS1 Nozzle
7: CS2 Nozzle

Calibration process

1. PT1 reads all internal sensors which is the default sensor that is inside the Handle and then reads all external sensors that the user places at each position.
2. PT1 checks if the internal sensor reaches temperature stable condition: temperature stable condition = all temperature of internal sensor (sensor inside Handler) reaches setpoint +/- internal stability
    a. If the internal sensor is within stable condition goto 3.
    b. If the internal sensor is not stable goto 1.
3. If all the internal sensors reach temperature stable condition PT1 waits for stable time (default is stable time is 2 minutes, stable time can be valued from 2 minutes to 30 minutes).
    a. During stable time If there is some internal sensor deviating from stable condition goto 1.
    b. If all internal sensors stay within temperature stable condition and stable time has passed goto 4.
4. PT1 calculates the new calibration value and updates the Handler calibration table. The update can occur many times until the current calibration setpoint is complete.
    a. New calibration value = current calibration value (value in Handler calibration table) - (current setpoint - external sensor temperature)
    b. After PT1 update Handler calibration table. Handler will adjust the internal sensor value according to new calibration value
5. PT1 checks if the internal sensor and external sensor are met with stable conditions. If all sensors are in temperature stable condition and stable time has passed the current setpoint is complete then PT1 will calibrate the next setpoint. The time to complete each setpoint is depending on the Handler physical state, usually it takes 30 to 60 minutes.
    a. If not all sensors are stable goto 1.
    b. If current setpoint is complete calibrate next setpoint
6. “Calibration at setpoint xx xx completed.” (xx=setpoint value) will be shown when all calibration setpoints are completed.

Stable time is 2 to 30 minutes (default is 2 minutes) depending on the user-specified. Stable time starts to count after the temperature value of all sensors reach the temperature stable condition (setpoint +/- stability).

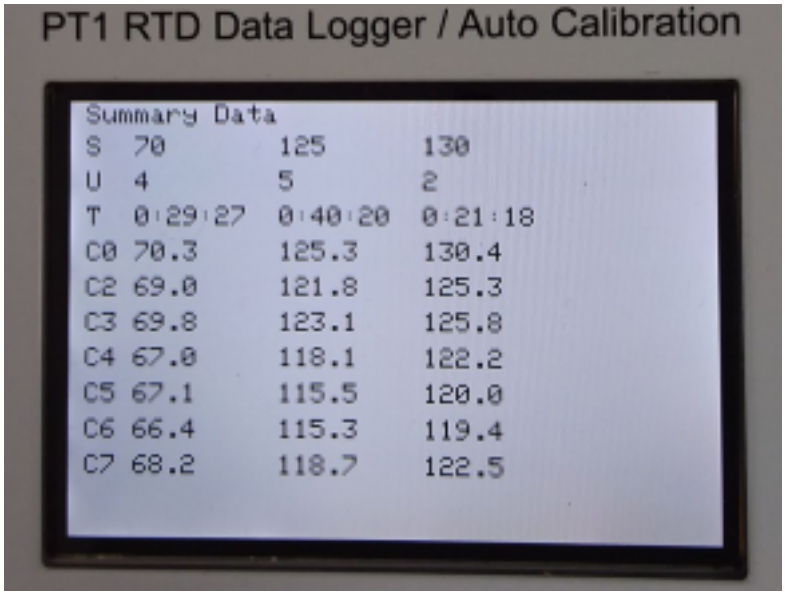
The time to complete a single setpoint is depending on the Handler physical condition (sensor placement, heat controller, LN2, fan speed etc.). Normally it takes 30 to 60 minutes to complete one setpoint but it can be more or less, e.g. when consecutive setpoint values are close together in this case calibration can be complete in less than 30 minutes.

If temperature cannot be stable within 90 minutes, users can adjust the temperature stability by press-and-hold PT1 [BACK]+[UP] button for 5 sec then PT1 will show the stability settings

screen. If all sensors cannot be stable within abort time the Auto Calibration process will terminate. Abort time is 120 minutes.

After calibration complete

1. reset PT1 or view summary data on the LCD screen and then reset PT1
    a. reset PT1
        i. press [RESET] button on PT1
    b. View summary data
        i. After calibration completed do not reset PT1
        ii. press [NEXT] button
        iii. Summary data, setpoint (S), update count (U), calibration time (T), calibration value (Cx)

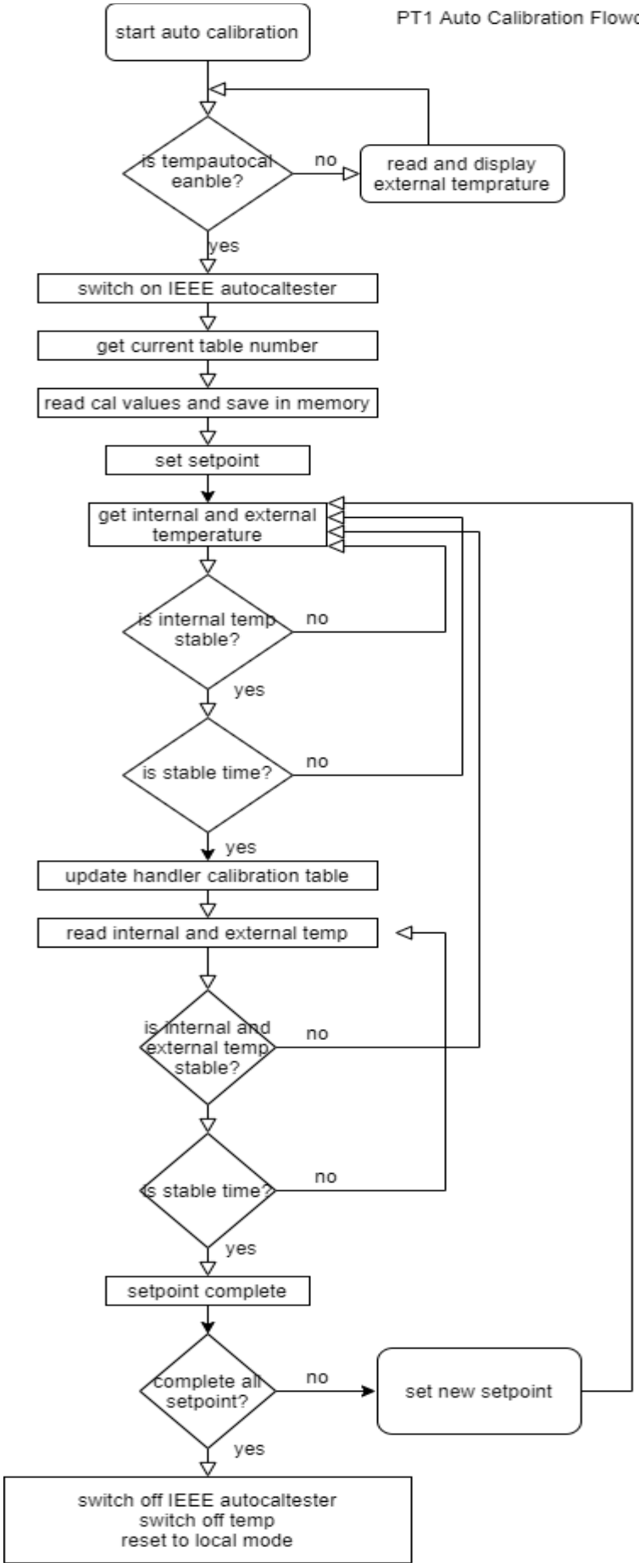


2. Disable Auto Calibration
    a. on Handler press [Auto Calibration] button (no yellow background color)
3. Message display "do you really want to exit autocal" press “yes”
4. Exit or Save and Exit
    a. Press [Exit] button to reset to the old calibration value in database table
    b. press [Save and Exit] to save a new calibration value to database table
5. restart or shutdown Handler

*** If Auto Calibration is terminated while all setpoints are still not completed, Handler must be reset to Local Mode. On the PT1 Application Selection menu select the “Calibration” menu and press [NEXT] this will automatically reset Handler to Local Mode.

PT1 Auto Calibration Flowchart

PT1 Auto Calibration Flowchart



RTC (Real-time Clock) Date and Time Settings

PT1 has an RTC (real-time clock) which maintains the date and time of the system. RTC devices operate at 3v and use batteries to keep date-time running even if there is no power supply connected to the system. The accuracy of RTC remains at +/-3.5ppm (+/-0.3024 seconds/day). Normally the battery life is about 3 - 5 years but in some cases users may need to reprogram RTC. RTC date and time can be reprogram by do the following:

run PT1 in debug mode

1. connect USB type B connector to PT1 and connect USB type A to PC
2. on PC open Terminal Software (any Terminal Software can be use)
3. on Terminal software:
    a. select port
    b. setting baud rate to 150200 bps and use 8 N 1 settings
4. connect Terminal Software to PT1
5. wait and watch stream of text flow on Terminal screen
6. When text " Off State " is shown, it means initialization is complete.

reprogram date-time of RTC module

a. run PT1 in debug mode from Step 1. to 6.
b. input command into Terminal Software
   date-time command: "#T yyyy, mm, dd, hh, mm, ss"
   * yyyy = year, mm = month, dd = day, hh = hour, mm = minute, ss = second
c. restart
d. verify date and time is correct

Version history

Version	Date	Description
1.9c	2020/05/04	Added calibration procedure section
2.0	2020/05/05	Added calibration process details Added flowchart
2.1	2020/05/13	Added log data description
2.2	2023/08/30	Added TOC
2.2a	2023/09/03	Added RTC Settings

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