Rheonics Density & Viscosity DVM Accessory

DTCM-BB Operator Manual

DVM Thermal Control Module Bath Based

Doc. ID: DTCM-BB-OP-2412

rheonics

GLOBAL SUPPORT

For Support, visit: https://support.rheonics.com

EUROPE HEADQUARTERS
Rheonics GmbH
Winterthur, Switzerland
Tel: +41 52 511 32 00

US HEADQUARTERS
Rheonics, Inc.
Sugar Land, TX, USA
Tel: +1 713 364 5427

Website: https://rheonics.com
Support Portal: https://support.rheonics.com
Sales E-Mail: info@rheonics.com
Support E-Mail: support@rheonics.com

© COPYRIGHT RHEONICS 2024

No part of this publication may be copied or distributed, transmitted, transcribed, stored in a retrieval system, or translated into any human or computer language, in any form or by any means, electronic, mechanical, manual, or otherwise, or disclosed to third parties without the express written permission of Rheonics. The information contained in this manual is subject to change without notice.

TRADEMARKS

Rheonics is a trademark of Rheonics, Inc. Other product and company names listed in this manual are trademarks or trade names of their respective manufacturers.

Contents

1 Before you begin 4
1.1 About the manual 4
1.2 Contact 4
1.3 Who should use this document? 4
1.4 Warning 4
1.5 Nomenclature 4
1.6 Related Documentation 5
2 Technical Specifications 6
2.1 E4: SME-BOX 6
2.2 DTCM-BB 8
3 Packing list 10
4 Quick Start 11
4.1 Installation of the thermostat 11
4.2 Bath fluids 15
4.3 Installation of the DTCM-BB 16
4.4 DTCM-BB Configurations 17
4.5 How to Start and Finish a run 20
4.6 Post-Processing 21
4.7 DVM Cleaning 22
5 Notes/Errata: 23
6 Revision and Approvals 24

©Rheonics. Rheonics confidential and proprietary information.

1 Before you begin

1.1 About the manual

This manual provides information and a quick guide for operating Rheonics Rheonics DTCM-BB-
This manual refers to external articles from Rheonics knowledge base, if any article link is not working, the user should refer to the main web page or contact Rheonics Support Team.

1.2 Contact

Contact the Rheonics team to help you with any inquiry.
For sales and delivery-related questions contact the Sales Team at info@rheonics.com
For installation, integration, and troubleshooting contact the Support Team at support@rheonics.com

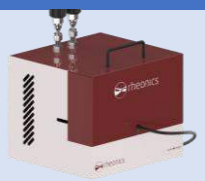
1.3 Who should use this document?

Users of Rheonics DTCM Bath Based.

1.4 Warning

The users should be trained in government and corporate safety standards that apply for their installation and use.
This installation manual is strictly for non-explosive atmospheres.

1.5 Nomenclature

Item	Abbreviation (short form)	Full-term	Meaning	Reference Image
1	**DTCM-BB**	DVM Thermal Control Module - Bath Based	Thermal Chamber for DVM	
2	**DVM**	Density Viscosity Module	High-pressure and temperature Density and Viscosity Sensor Module	
3	**SME-BOX-E4**	Smart Module Electronics – BOX – E4 variant	Sensor electronics with integrated industrial PC with display	

©Rheonics. Rheonics confidential and proprietary information.

1.6 Related Documentation

You can find all product documentation on the USB storage device shipped with the sensors. You can also find them on the website: https://rheonics.com/resources
For more information on the DTCM accessory, refer to the following documents on Rheonics website. Contact Rheonics Support Team if you cannot find a document online.

Title	Code	Description
DTCM-BB Operator Manual	**DTCM-BB-OP**	**DTCM Bath-Based Operator Manual**
DVM Operator Manual	DVM-OP	DVM Sensor Operator Manual
SME Operator Manual	SME-OP	Sensor Electronics (all variants) Operator Manual
RCP Software Manual	RCP-OM	Rheonics Software Installation and User Manual
DVM Datasheet	DVM-DS	Rheonics DVM Datasheet

©Rheonics. Rheonics confidential and proprietary information.

2 Technical Specifications

2.1 E4: SME-BOX

SME-BOX is Rheonics electronics variant especially suited for the TCM-units, namely the STCM and DTCM. This device is designed for tabletop, desktop, or laboratory setups. It contains the sensor electronics, the TCM-control system, and an industrial PC with Rheonics standard softwares.

Power the SME-BOX with either 110VAC or 220VAC. Once the system has power, the computer will boot automatically and is operational.
Connect the sensor cable to the “SENSOR” for operation.
In case you need to access the industrial PC, use the USB/Ethernet or HDMI connections.
Note: The RS485 is not enabled in the standard version.

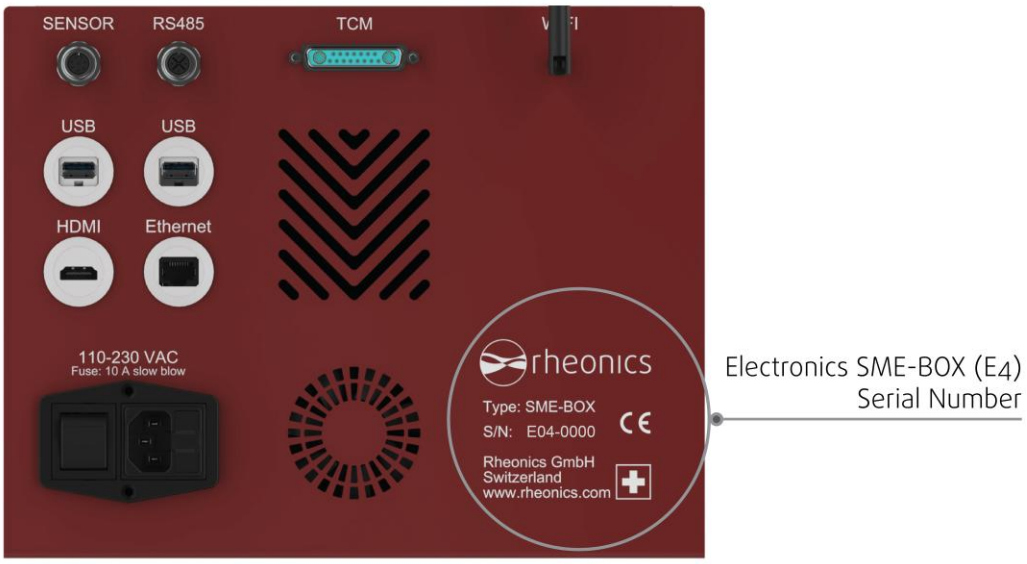
Parameter	Value
Dimensions	365 x 280 x 220 (mm) 14.4 x 11 x 8.7 (inch)
Power Input	110 / 220 V AC
Power consumption	max. 700W
Total Weight	9,500 g (21 lb)
Operating temperature	Max 65°C/150°F ambient
Communication interface	2x USB 1x Ethernet 1x HDMI 1x RS485 1x Wi-Fi
Sensor Connection	M12
Computer OS	Windows 10 IoT

©Rheonics. Rheonics confidential and proprietary information.

2.1.1 User and Password

To access the SME-BOX-E4 a user and password are required.

User: administrator
Password: rheonics[SN] e.g. for serial number E04-0000, password is: rheonicsE04-0000



©Rheonics. Rheonics confidential and proprietary information.

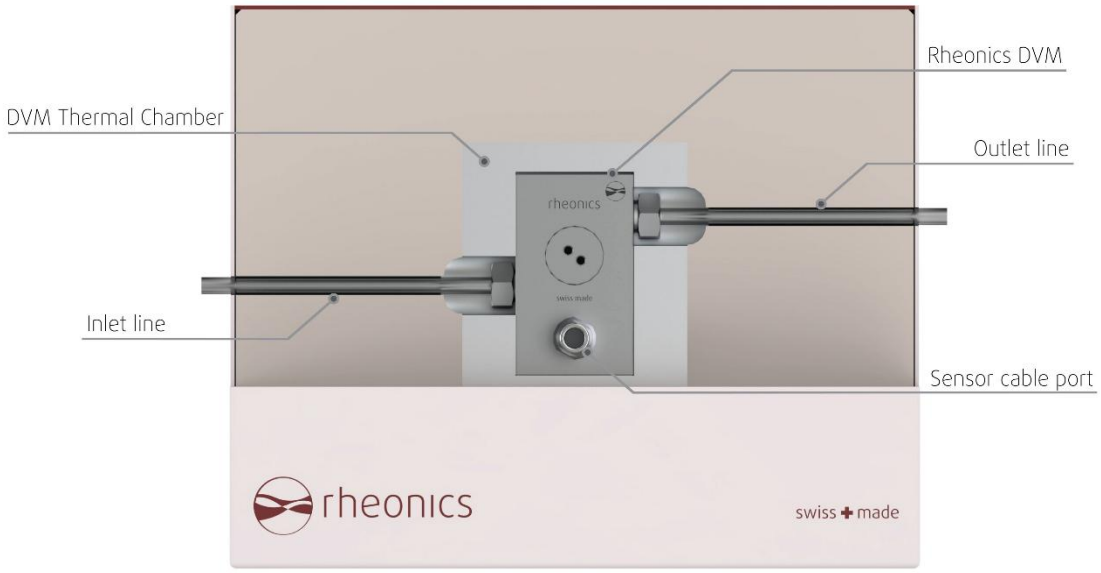
2.2 DTCM-BB

Rheonics DTCM is custom designed to ensure uniform temperature distribution across DVM even when installed in a flow loop. Heating and cooling are achieved through an external bath.

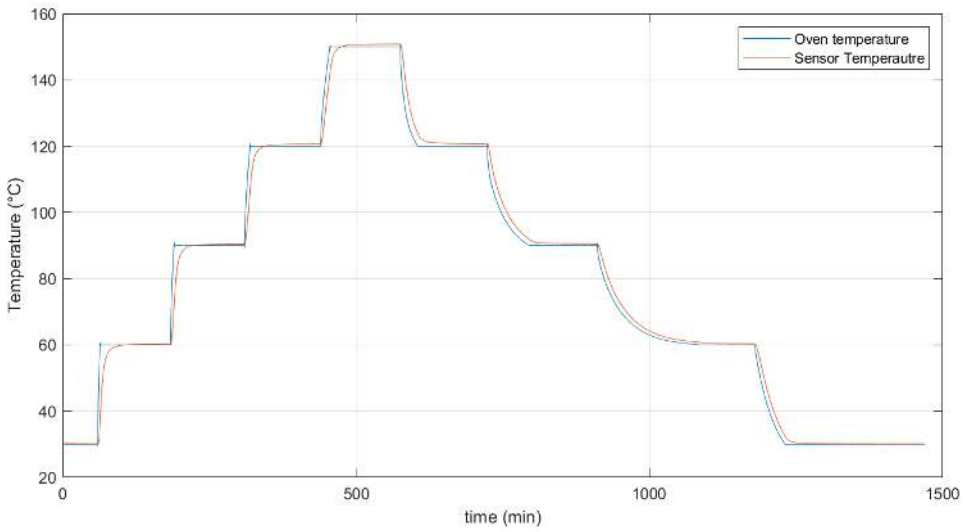
Parameter	Value
Dimensions	240 x 260 x 260 (mm) 9.5 x 10 x 10 (inch)
Total Weight	8.6 kg (19 lb)
Temperature stability	0.005°C
Temperature accuracy	Dependent on the bath
Operating temperature	-40 to 200°C
Compatible Sensor type	DVM

During operation, the DVM is placed in a thermally uniform aluminum block. This thermal cell is built such that the inlet- and outlet line can be connected while the DVM is within the DTCM stage, allowing the DVM to be part of a flow loop. For a stable measurement, the flow rate must be zero i.e. fluid should be static, otherwise, the fluid temperature can't be controlled properly.

©Rheonics. Rheonics confidential and proprietary information.



Rheonics Control Panel Software controls the temperature (see RCP Manual for details). Therein, temperature profiles can be defined to scan viscosity and density over a broad range of temperatures. Once the desired temperature is reached, additional time will be needed to achieve a thermally uniform state around the DVM, this is the so-called time-delay or dwell time between oven temperature and sensor temperature.



Accurate measurements require that the sensor temperature does not change over time, i.e. the sensor temperature is close to its thermal equilibrium which will be reached after a sufficiently long dwell time. Accurate measurements can be conducted after approx. 3600s. For high-accuracy measurements, Rheonics recommends a dwell time of 7200s.

©Rheonics. Rheonics confidential and proprietary information.

3 Packing list

Item	Name	Quantity	Reference Image
1	E4: SME-BOX	1	
2	DTCM-BB	1	
3	Julabo DYNEO DD-200F (If ordered)	1	
4	Adapter Swagelok 8mm to M16x1.5 Note: is already installed	2	
5	High-Temperature Hose	2	
6	Power cable for E04-BOX	1	
7	USB-A to USB-B	1	

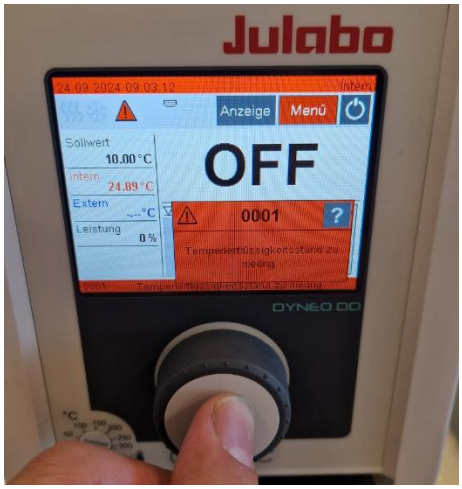
©Rheonics. Rheonics confidential and proprietary information.

4 Quick Start

4.1 Installation of the thermostat

Rheonics standard thermostat is the Julabo DYNEO DD-200F. The thermostat needs to be installed according to Julabo's instructions.
To connect to the SME-BOX, proceed as follows:
Note: This can be done before the bath has been filled with fluid. The error message regarding the unfilled bath may be ignored.

1. Click on "Menü" (use the large bottom)



2. Click on "Einstellungen"

©Rheonics. Rheonics confidential and proprietary information.

3. Click on “Sprache”

4. Set the desired language e.g. English

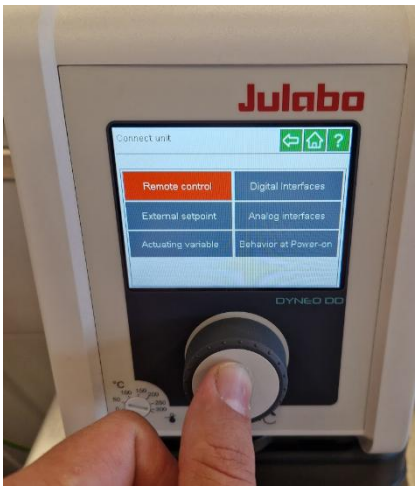
5. Go back to the home

©Rheonics. Rheonics confidential and proprietary information.

6. Click on “Menu”

7. Click on “Connect Unit”

8. Click on “Remote control”

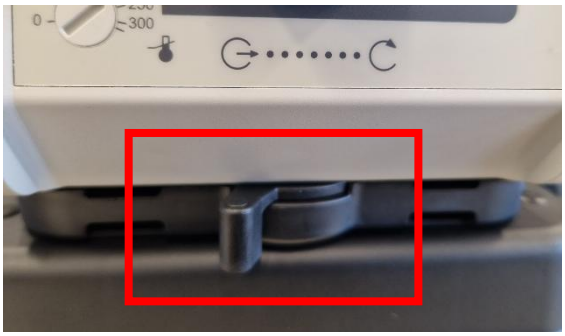


©Rheonics. Rheonics confidential and proprietary information.

9. Select “USB” and go back to home

10. The display should say R-OFF, indicating the remote-control state.
    Set the temperature limit to the proper value. Turn the wheel in the bottom left to the maximum temperature that is safe for operation. This will depend on the fluid you fill in the bath. It is the responsibility of the operator to ensure the temperature limit is set correctly.

11. Move the lever to the left. This will set the bath to “external circulation” as is needed to operate the DCM-BB.



©Rheonics. Rheonics confidential and proprietary information.

4.2 Bath fluids

Rheonics does not provide bath fluids. It's the responsibility of the operator to choose the correct fluid with the proper temperature range. For operation with the DTCM-BB, the fluid must also be compatible with the following materials:

- FKM
- Aluminium (AW-6060)
- Stainless steel 304/316L (1.4301, 1.4404)

The fluid's viscosity should be below 20 cP for proper heat transport to the DTCM-BB.

©Rheonics. Rheonics confidential and proprietary information.

4.3 Installation of the DTCM-BB

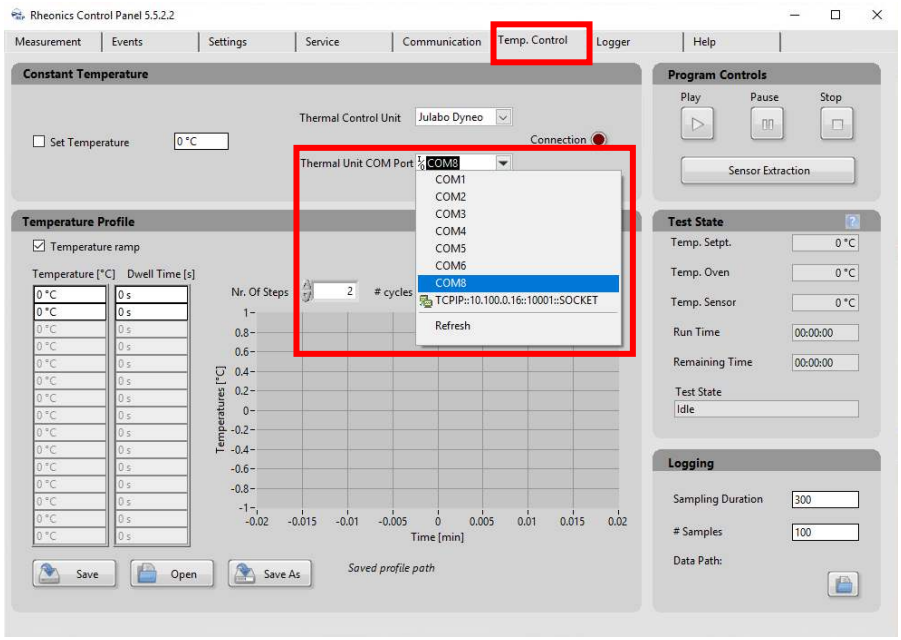
1. Connect the hose from the DTCM-BB to the Julabo bath.

Note: Inlet and outlet are irrelevant.

Dyneo DD-200F

DTCM-BB

2. Connect the Dyneo DD-200F to the E4 box with the supplied USB-Cable. Open RCP in the E4-Box, go to the Temp. Control Tab and select the COM Port for the Julabo.
   Note: COM Ports 1-6 are always visible. The Julabo will be on the additionally appearing COM Port.



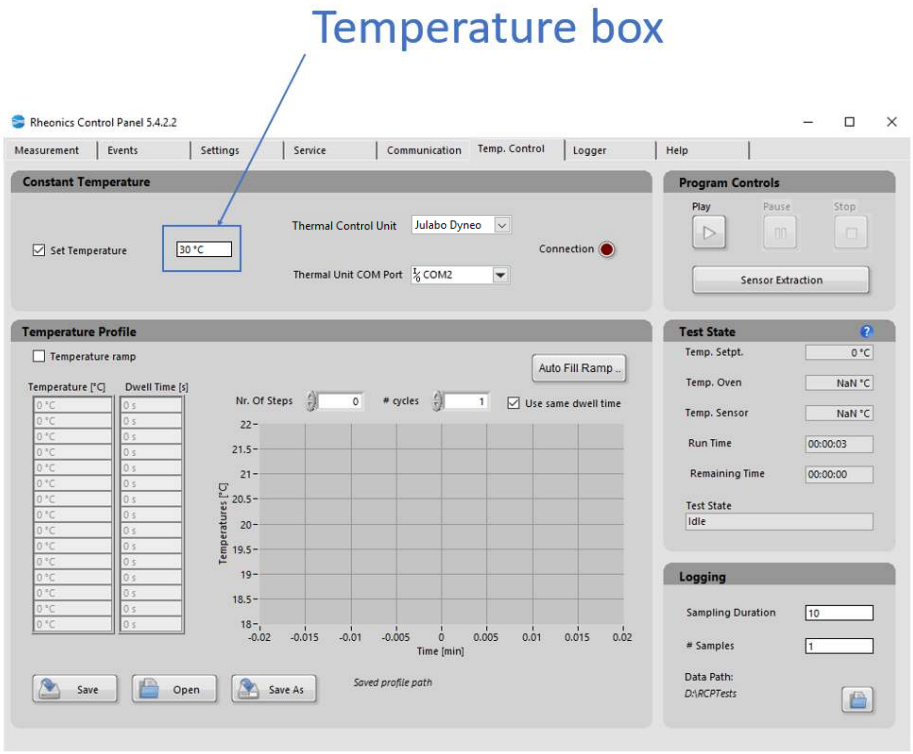
For additional information, consult the RCP Manual (Help Tab).

©Rheonics. Rheonics confidential and proprietary information.

4.4 DTCM-BB Configurations

1. Open Rheonics Control Panel and Go to “Temp. Control” tab
2. Configure the Temperature mode, the temperature control has two modes:
    a. **Mode 1: Constant temperature**

    To use a constant temperature, check the “set temperature” box, and the Bath will heat or cool the DVM to reach the set temperature.



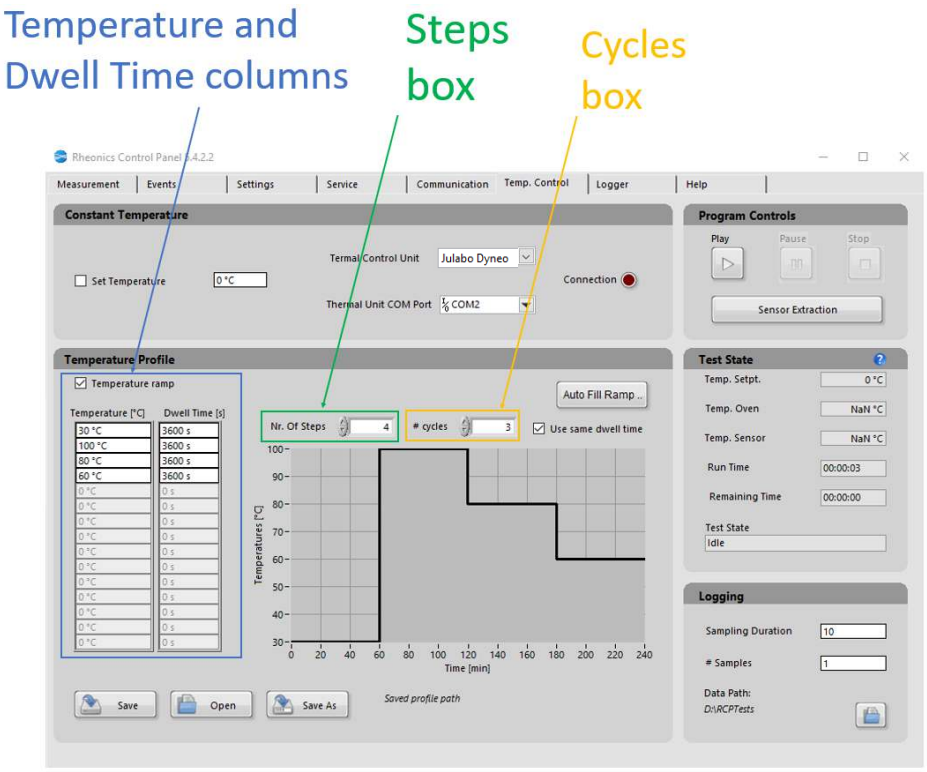
    b. **Mode 2: Temperature profile**

    User can set a time-based temperature profile, filling the temperature ramp manually or using the “Auto Fill Ramp” button.

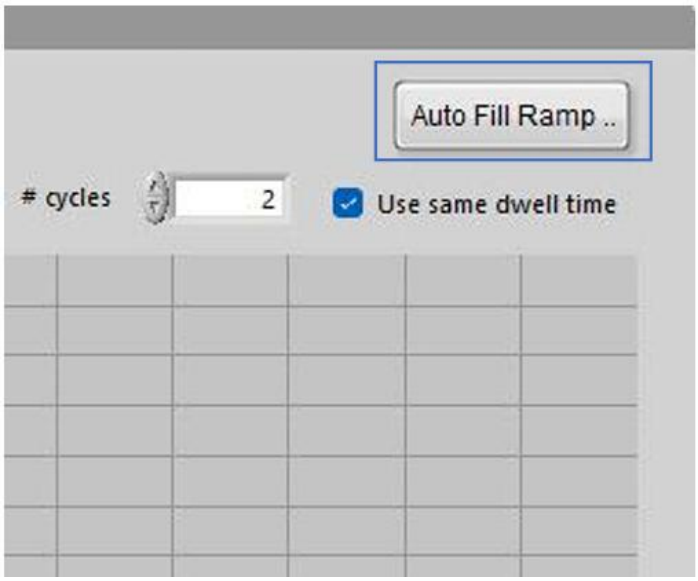
    Manual Fill:

    First, check the “Temperature ramp” box and define the temperature ramp using steps box and cycles box. After that, enter temperature and dwell time for each setpoint using the columns.

©Rheonics. Rheonics confidential and proprietary information.

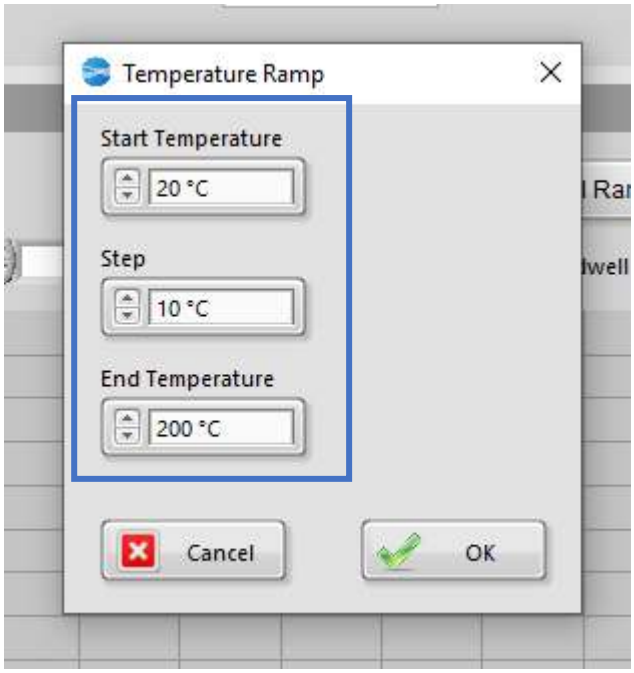


Auto Fill Ramp:
To use the Auto fill ramp, first click on the Auto Fill Ramp button.

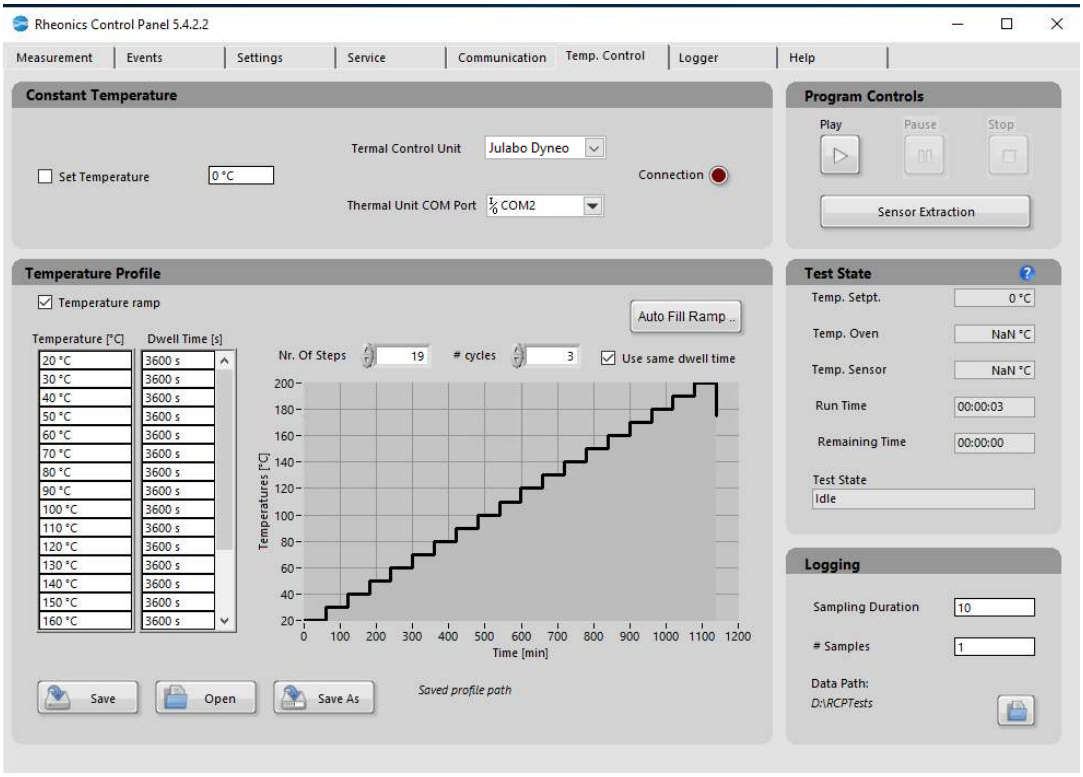


©Rheonics. Rheonics confidential and proprietary information.

Then, set the “start temperature”, the “step” and the “end temperature” values and click “OK” to create the temperature ramp.

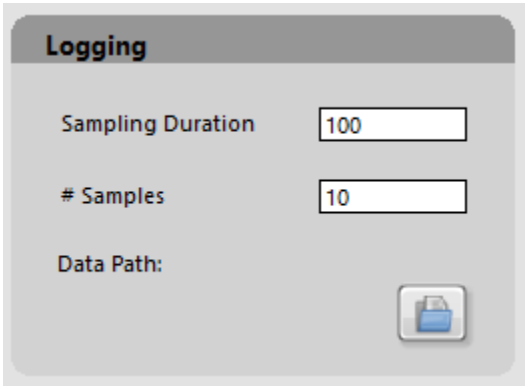


Finally, a new ramp with your parameters will be created.



©Rheonics. Rheonics confidential and proprietary information.

3. Configure how often DTCM logs the data in seconds and how many samples will be taken. The data starts logging when the DTCM reaches the established temperature. User can also change the path where data will be stored.

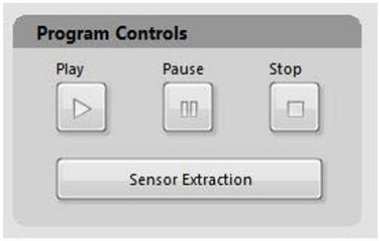


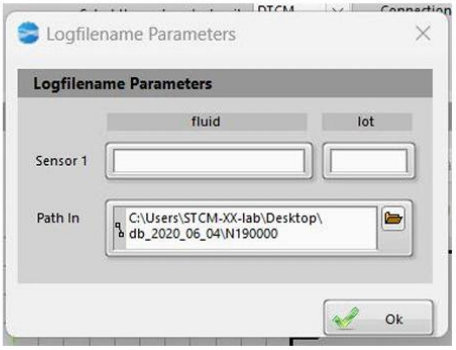
4.5 How to Start and Finish a run

Once all the parameters are configured you can start the process with “Play” button. Additionally, user may define a fluid and lot number for tracing the measured fluid.

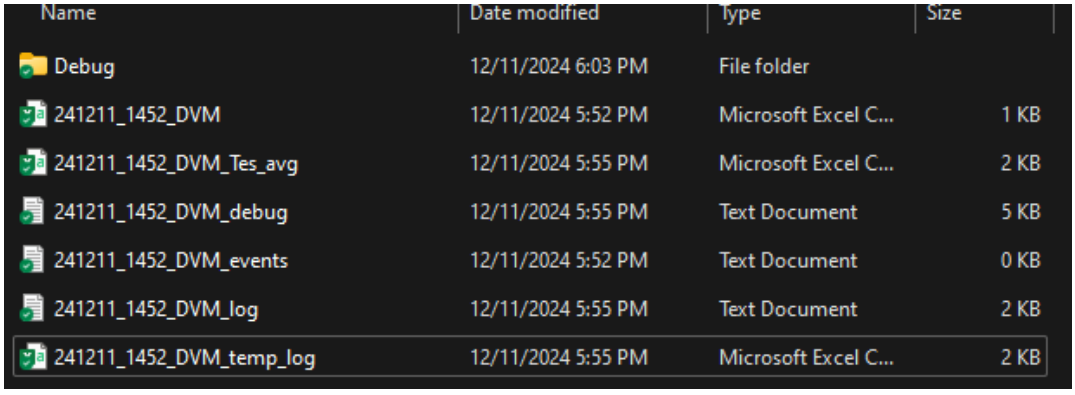
To finish the run, you have to click on the Stop button and the Bath stops heating

Note: User can pause the Bath operation at any temperature step using the pause button.





When the run finishes the log files of your test will be in the path that you used previously.



©Rheonics. Rheonics confidential and proprietary information.

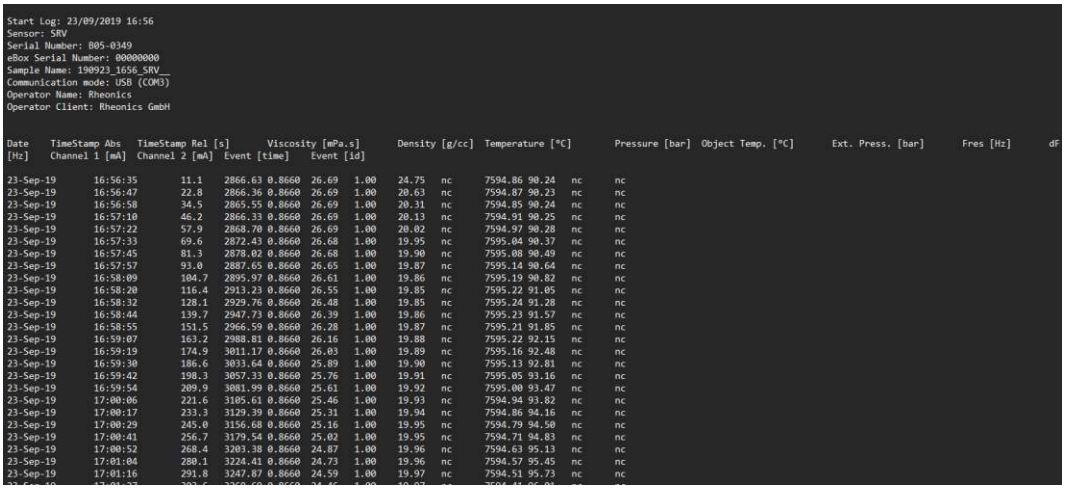
4.6 Post-Processing

After performing the test, the user can find 6 files and 1 folder in the selected path, here are all the information about the test, where the two most important are the “DVM_log” and “Tes_avg” which will show the following:

DVM_log File:

This file shows all the data that the DTCM records along the test whether it has reached the temperature set point or not, the sampling duration is defined by the user using the logging tab mentioned before.

Here each column represents a measurement which are Date, TimeStamp Abs, TimeStamp Rel [s], Viscosity [mPa.s], Density [g/cc], Temperature [°C], Pressure [bar], Object Temp. [°C], Ext. Press. [bar], Fres [Hz], dF [Hz], Channel 1 [mA], Channel 2 [mA], Event [time], Event [id] consecutively.



```
Start Log: 23/09/2019 16:56
Sensor: SRV
Serial Number: 805-0349
eBox Serial Number: 00000000
Sample Name: 190923_1656_SRV__
Communication mode: USB (COM3)
Operator Name: Rheonics
Operator Client: Rheonics GmbH

Date    TimeStamp Abs   TimeStamp Rel [s]       Viscosity [mPa.s]       Density [g/cc]  Temperature [°C]        Pressure [bar]  Object Temp. [°C]       Ext. Press. [bar]       Fres [Hz]       dF
[Hz]    Channel 1 [mA]  Channel 2 [mA]  Event [time]    Event [id]

23-Sep-19       16:56:35        11.1    2866.63 0.8660  26.69   1.00    24.75   nc      7594.86 90.24   nc      nc
23-Sep-19       16:56:47        22.8    2866.36 0.8660  26.69   1.00    20.63   nc      7594.87 90.23   nc      nc
23-Sep-19       16:56:58        34.5    2865.55 0.8660  26.69   1.00    20.31   nc      7594.85 90.24   nc      nc
23-Sep-19       16:57:10        46.2    2866.33 0.8660  26.69   1.00    20.13   nc      7594.91 90.25   nc      nc
23-Sep-19       16:57:22        57.9    2868.70 0.8660  26.69   1.00    20.02   nc      7594.97 90.28   nc      nc
23-Sep-19       16:57:33        69.6    2872.43 0.8660  26.68   1.00    19.95   nc      7595.04 90.37   nc      nc
23-Sep-19       16:57:45        81.3    2878.02 0.8660  26.68   1.00    19.90   nc      7595.08 90.49   nc      nc
23-Sep-19       16:57:57        93.0    2887.65 0.8660  26.65   1.00    19.87   nc      7595.14 90.64   nc      nc
23-Sep-19       16:58:09        104.7   2895.97 0.8660  26.61   1.00    19.86   nc      7595.19 90.82   nc      nc
23-Sep-19       16:58:20        116.4   2913.23 0.8660  26.55   1.00    19.85   nc      7595.22 91.05   nc      nc
23-Sep-19       16:58:32        128.1   2929.76 0.8660  26.48   1.00    19.85   nc      7595.24 91.28   nc      nc
23-Sep-19       16:58:44        139.7   2947.73 0.8660  26.39   1.00    19.86   nc      7595.23 91.57   nc      nc
23-Sep-19       16:58:55        151.5   2966.59 0.8660  26.28   1.00    19.87   nc      7595.21 91.85   nc      nc
23-Sep-19       16:59:07        163.2   2988.81 0.8660  26.16   1.00    19.88   nc      7595.22 92.15   nc      nc
23-Sep-19       16:59:19        174.9   3011.17 0.8660  26.03   1.00    19.89   nc      7595.16 92.48   nc      nc
23-Sep-19       16:59:30        186.6   3033.64 0.8660  25.89   1.00    19.90   nc      7595.13 92.81   nc      nc
23-Sep-19       16:59:42        198.3   3057.33 0.8660  25.76   1.00    19.91   nc      7595.05 93.16   nc      nc
23-Sep-19       16:59:54        209.9   3081.99 0.8660  25.61   1.00    19.92   nc      7595.00 93.47   nc      nc
23-Sep-19       17:00:06        221.6   3105.61 0.8660  25.46   1.00    19.93   nc      7594.94 93.82   nc      nc
23-Sep-19       17:00:17        233.3   3129.39 0.8660  25.31   1.00    19.94   nc      7594.86 94.16   nc      nc
23-Sep-19       17:00:29        245.0   3156.68 0.8660  25.16   1.00    19.95   nc      7594.79 94.50   nc      nc
23-Sep-19       17:00:41        256.7   3179.54 0.8660  25.02   1.00    19.95   nc      7594.71 94.83   nc      nc
23-Sep-19       17:00:52        268.4   3203.38 0.8660  24.87   1.00    19.96   nc      7594.63 95.13   nc      nc
23-Sep-19       17:01:04        280.1   3224.41 0.8660  24.73   1.00    19.96   nc      7594.57 95.45   nc      nc
23-Sep-19       17:01:16        291.8   3247.87 0.8660  24.59   1.00    19.97   nc      7594.51 95.73   nc      nc
```

Tes_avg File:

This file shows the average of the measurements that the DTCM records when the temperature set point is reached. The most important values here are the Viscosity (Column I), Density (Column J), and Temperature (Column F), which the customer can use to analyze the fluid behavior and test results.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Start Log:	23/09/2019 16:56														
Test Configuration File:															
Temperat	20	30	20	30											
Wait Time	3600	3600	3600	3600											
Environm	TEC 1089														
Number o	1														
SN Sensor	B05-0349														
TimeStam	TimeStam	Temperature	Temperat	Temperat	Temperature Mean [°	F Mean [H	dF Mean [	Viscosity I	Density M	Coil Temp	Error Cour	Temperature Std D	F Std Dev	dF Std Dev	Viscosity S
17:56:52	3628.3	19.995865	49.94	nc	19.997999	7592.634	106.6055	4132.316	0.866	NaN	0	NaN	NaN	NaN	NaN
18:57:43	7279.7	30.001236	27.37164	nc	30.006001	7595.27	83.34766	2416.448	0.866	NaN	0	NaN	NaN	NaN	NaN
19:58:59	10955.5	20.002062	48.01688	nc	19.975	7593.027	106.8008	4149.027	0.866	NaN	0	NaN	NaN	NaN	NaN
20:59:50	14606.6	29.999218	26.65402	nc	30.01	7595.312	83.375	2416.909	0.866	NaN	0	NaN	NaN	NaN	NaN
22:01:06	18282.8	19.995766	47.49713	nc	19.975	7593.016	106.8242	4149.036	0.866	NaN	0	NaN	NaN	NaN	NaN
23:01:57	21933.6	30.000381	26.23901	nc	30.007999	7595.305	83.34766	2417.145	0.866	NaN	0	NaN	NaN	NaN	NaN
0:03:26	25621.8	20.000263	48.02737	nc	19.987	7593.016	106.7969	4148.022	0.866	NaN	0	NaN	NaN	NaN	NaN
1:04:16	29272.6	30.000557	25.85465	nc	30.007999	7595.325	83.31641	2415.689	0.866	NaN	0	NaN	NaN	NaN	NaN

©Rheonics. Rheonics confidential and proprietary information.

4.7 DVM Cleaning

DVM Cleaning can be done by two ways:

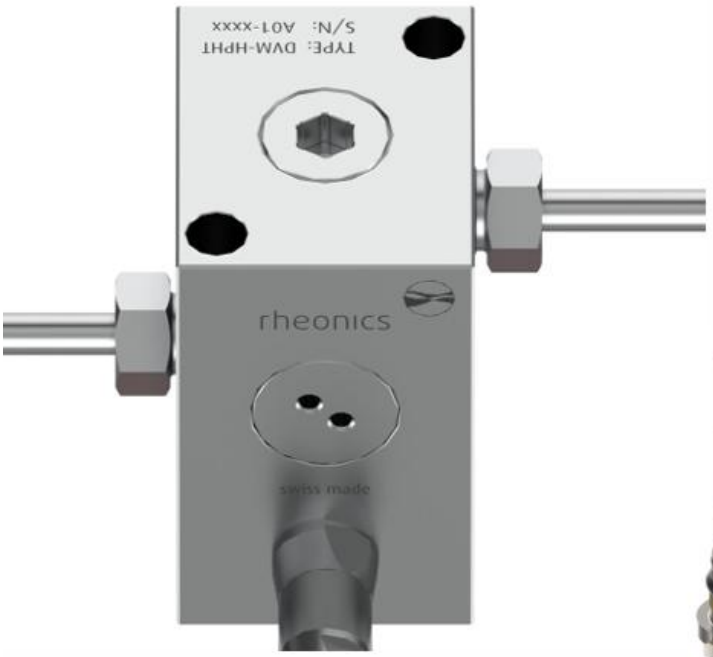
1. Clean in place (CIP):

Rheonics DVM can be cleaned in place by flushing it with solvent or cleaning fluid through the inlet/outlet lines. In-situ cleaning is recommended when process fluid does not tend to leave deposits or adhere to the sensing element.

2. Manual Cleaning:

Manual cleaning is possible by dismantling the DV Sensing element from the DVM module (See how to do that https://youtu.be/Eo5IL0i9ExQ?si=eGJi8DUzJWfjlyje) and submerging it in an ultrasonic bath for 5 or 10 minutes.

DVM module should be cleaned by rising solvent. Ultrasonic bath can not be used. User can also check the status of the backup ring and O-ring seal and replace them if needed. Follow DVM manual for extended instruction.



DVM Module | DV Sensing Element

©Rheonics. Rheonics confidential and proprietary information.

5 Notes/Errata:

©Rheonics. Rheonics confidential and proprietary information.

6 Revision and Approvals

Version	Nature of changes	Approvals	Date
1.2	Added Configuration DTCM-BB	SK, DB, BR	31.12.2024
1.1	Added Part index table	SK, DB, BR	03.10.2024
1.0	Original version	SK, DB, BR	25.09.2024

©Rheonics. Rheonics confidential and proprietary information.