30 YEARS OF ORIGINAL THINKING

POLMON Vesnfer Pvt. Ltd.
Measure. Control. Automate.

INSTRUCTION MANUAL

POLSTAT3500-X

DOC: PPC/POLSTAT3500 INSTRUCTION MANUAL

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1. GENERAL INFORMATION

Polstat3500 is a compact & easy to use parallel synthesizer, designed to increase R&D productivity. Polstat3500 is specially designed for precise temperature control of small reaction vessels, capacity ranging from 0.5ml to 400ml over wide working temperature range.

Polstat3500 instrument allows the chemist to run experiments with different vessel shapes (Vials, Tubes, Round bottom Flasks and process vessels). Polstat 3500 has built-in electrical heaters for heating application and Thermo electric coolers (Peltiers) for cooling application.

Polstat 3500 can be controlled remotely over ethernet network with PiLab and can also monitored/controlled through Control pad.

2. FEATURES AND SPECIFICATIONS

2.1 Temperature Range: (-)30ºC to 150ºC
2.2 Temperature Control: Mass Control & Block Control
2.3 Vessel Capacity Range: 0.5ml to 400ml
2.4 Vessel Shapes : Vials, Test tubes, Round bottom flasks & Process vessels
2.5 Removable Insert : Suitable to vessel size and shape
2.6 Controlling and Data logging: PiLab Software
2.7 Control pad with 7'' LCD display
2.8 Temperature Stability : ±0.1ºC
2.9 Stirring : Internal Magnetic Stirrer & External Overhead Stirrer control
2.10 Coolant supply temperature: Water at +5ºC
2.11 Communication interfaces : Ethernet & RS485
2.12 Power supply: 230VAC,16A,50Hz

3. UNPACKING AND INSPECTION

Unpack the Polstat3500 instrument and accessories and inspect them for possible transport damage. Take care while unpacking the material, as most of the packing material will contain glass items in it.

Damage should be reported to the responsible carrier, railway or postal authority, and a damage report should be requested. These instructions must be followed fully for us to guarantee our full support of your claim for protecting against loss from concealed damage.

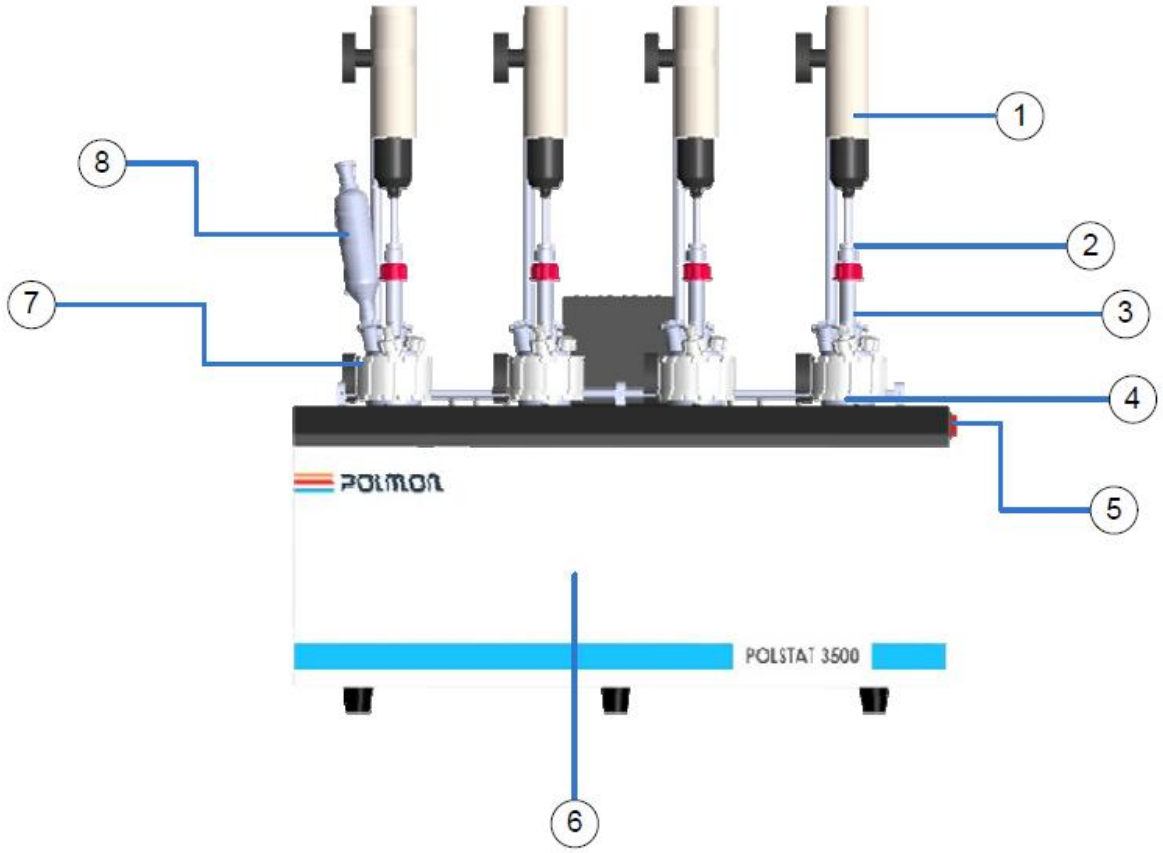
The form required for filing such a claim will be provided by the carrier.
Verify all the accessories are available as per the below list

Accessories:

Sl. No.	Description	Quantity(No's)
1	Insert 50ml	1
2	Insert 100ml	1
3	Insert 150ml	1
4	Insert 250ml	1
5	Process glass vessel set, 50ml	1
6	Process glass vessel set, 100ml	1
7	Process glass vessel set, 150ml	1
8	Process glass vessel set, 250ml	1
9	Vessel Mounting Clamp	4
10	Mass Sensor, PT100, Length:200mm	4
11	Mass Sensor PTFE adapter	4
12	Glass condenser	4
13	N2 Connector with quick coupling connectors & tubing	4
14	Magnetic capsule 20mmX15mm, Type: Ova	4
15	Overhead Stirrer	4
16	PBT Agitator	4
17	Silicon Tube with Insulation	2
18	Power Cable	2
19	Control Pad	1
20	Female to Female DB9 Cable	1
21	Emergency stop switch	1

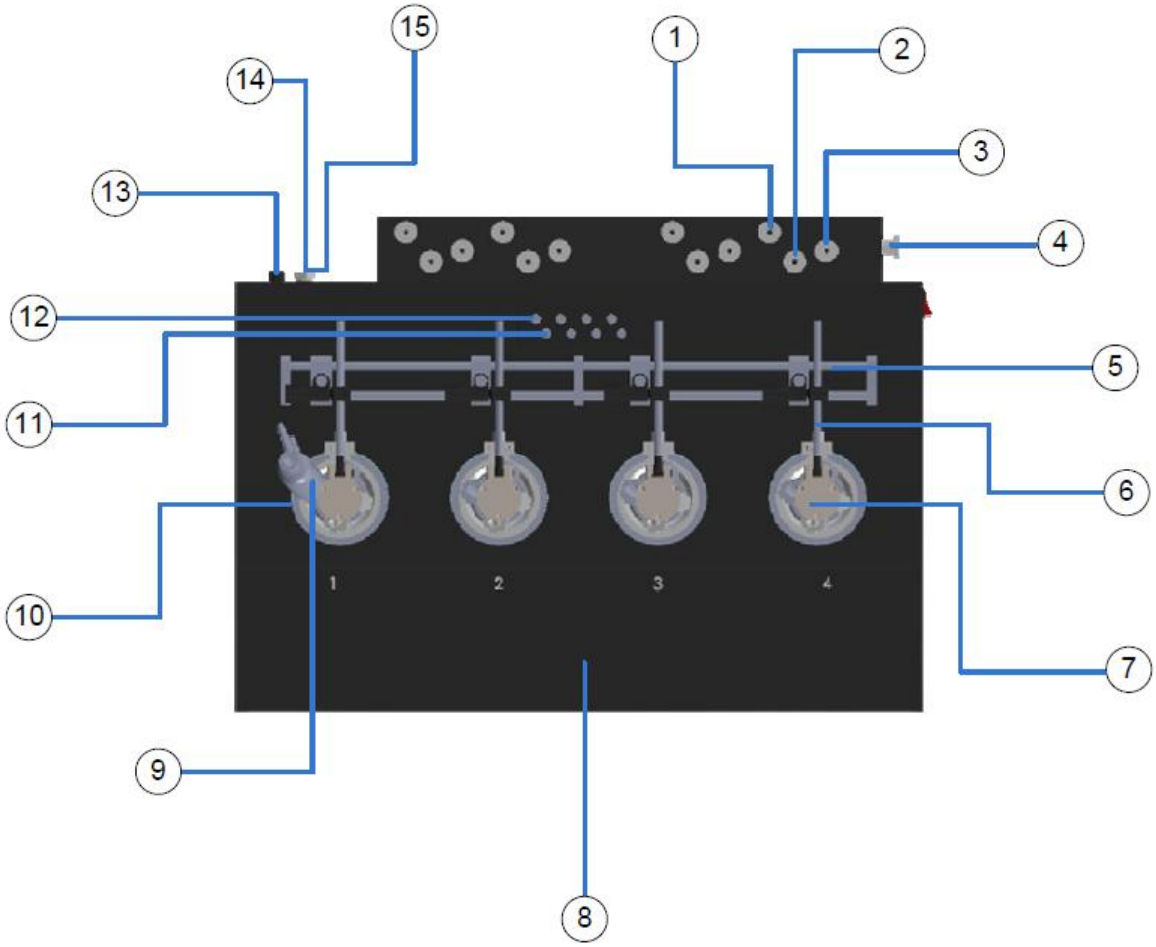
4. COMPONENT GUIDE

4.1. FRONT VIEW



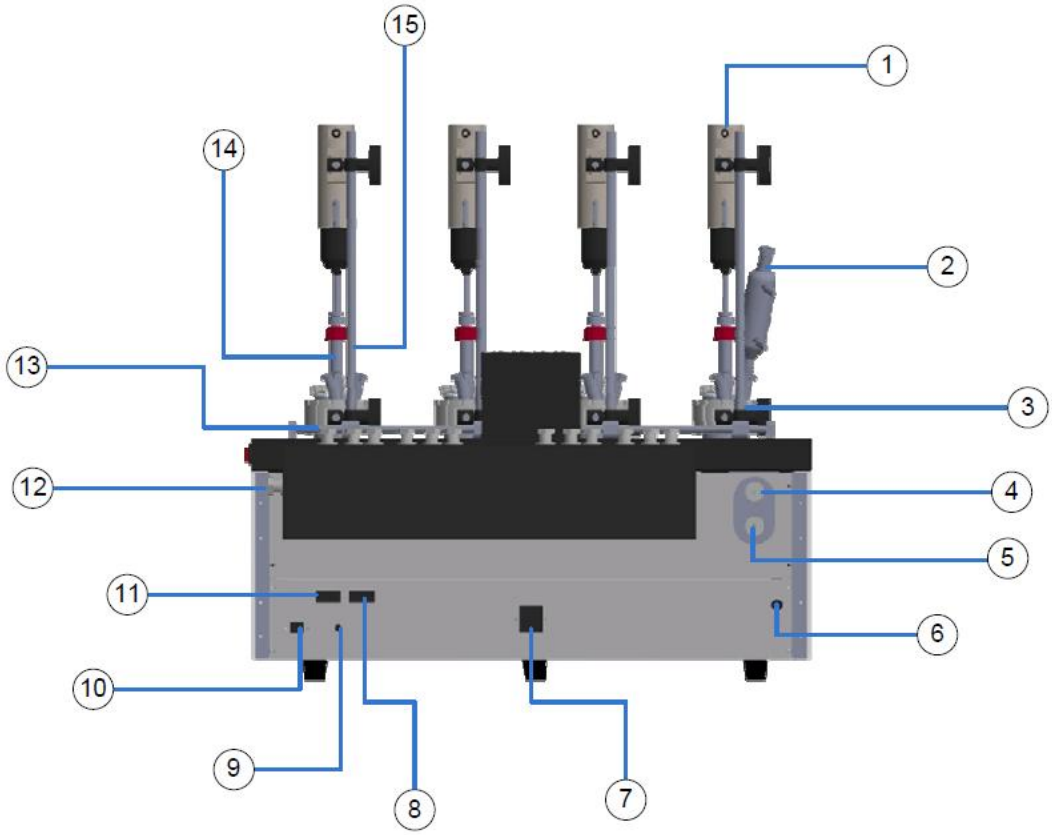
1	**Over Head Stirrer**	**5**	**Power Switch**
2	**Stirrer Gland**	**6**	**Polstat 3500 Product**
3	**Glass Vessel Top Lid, 5neck**	**7**	**Vessel Fixing Cap**
4	**Process Vessel**	**8**	**Glass Condenser**

4.2. TOP VIEW



1	Inert Gas Port for Block4	9	Glass Condenser
2	Coolant Inlet for Block4 Condenser	10	Removable Insert
3	Coolant Outlet for Block4 Condenser	11	Mass Sensor Connector
4	Inert Gas Port	12	Over head stirrer Connector
5	Mounting Bar	13	Drain Port
6	Vessel Mounting Rod	14	Coolant Inlet
7	Over Head stirrer	15	Coolant Outlet
8	Polstat 3500 Product		

4.3. BACK VIEW



1	Over Head stirrer	9	EMPB Connector
2	Glass Condenser	10	Ethernet Port
3	Vessel Mounting Rod	11	Control Pad Connector
4	Coolant Inlet	12	Inert Gas Port
5	Coolant Outlet	13	Process Vessel
6	Drain Port	14	Glass Vessel Top Lid, 5neck
7	Power Supply Connector	15	Vertical Mounting Rod
8	RS485 Connector		

5. SAFETY INFORMATION

The safety information in this instruction manual is designed to protect the operating company, the operator and the equipment from damage.

5.1. DEFINITION OF SIGNAL WARNINGS AND SYMBOLS

Safety instructions are marked by the below combinations of pictograms and signal words. Ignoring safety notes can lead to personal injury, damage to the instrument, malfunctions and erroneous results.

WARNING: A hazardous situation with medium risk, possibly resulting in death or severe injury if not avoided.

CAUTION: A hazardous situation with low risk, resulting in minor or moderate injury if not avoided.

NOTICE: A hazardous situation with low risk, resulting in damage to the instrument, other material damage, malfunctions and erroneous results, or loss of data.

Meaning of each safety symbol given below

	Electrical hazard		Burns/Hot surface
	Rotating parts		General note
	Explosion		

⚠ WARNING

Risk of electric shock

1. Make sure to plug the power cable supplied into a power supply outlet that is grounded.
2. Only use the POLMON power supply cable and AC power adapter designed for the instrument

⚠ WARNING

Risk of explosion due to damaged reactors

1. Explosion of a reactor could cause serious injury.
2. Check the reactor before each use for damage (scratches, formation of cracks).

⚠ CAUTION

Hot parts when working above 50 °C

1. Touching of hot parts can cause burns
2. Do not touch the top plate of the device, the fixing ring, vessel covers, if you works above 50 °C.

⚠ CAUTION

Rotating parts of external stirrer

Rotating parts of a running stirrer may lead to injuries.

1. Do not touch rotating parts of a stirrer
2. Do not remove the stirrer connector during running condition

NOTICE

A wrong connection or disconnection of cables during operation could lead to instrument damage

1. Before switching the device on, connect the cables of stirrers and sensors to their respective inputs and outputs.
2. Do not disconnect the cables while the instrument is operating rotating parts of external stirrer.

6. INSTALLATION

Before going for installation of Polstat3500 & Chiller choose a place for chiller. If the chiller is not available make sure that the Chiller water supply is available at the fume hood.

6.1 CHILLER INSTALLATION

6.1.1 Chiller should be installed on a level floor for smooth operations of the compressor.

6.1.2 Make sure that the temperature of the room is not more than 30ºC.

6.1.3 Ensure the area of installation should be non hazardous.

6.1.4 After placement of the chiller connect the power cable to chiller

6.1.5 Fill the mineral water in the chiller tank.

6.1.6 Now install the Polstat3500 before starting the chiller water circulation.

6.1.7 After placing the chiller at its position, lock the wheels of the chiller

6.2 POLSTAT3500 INSTALLATION

6.2.1 Unpack the Polstat3500 instrument and accessories, place the instrument in fume hood.

6.2.2 Make sure that the right and left fan exhaust of the Polstat3500 are unobstructed.

6.2.3 Ensure the area of installation should be non flame proof zone.

6.2.4 It is strictly recommended to have 500mm space all around the Polstat3500 for maintenance/service purpose.

6.2.5 Make sure that below are available at fume hood

4.2.5.1. Power socket

4.2.5.2. Coolant (water at 5ºC)

4.2.5.3. Inert gas supply

4.2.5.4. Drain connection to evacuate condensed water inside the Polstat3500

6.2.6 Connect the Hose pipe quick coupling connector at Polstat3500 back side and other end to chiller Water inlet and outlet ports at backside.

6.2.7 Connect the control pad at back side of the instrument with DB9 female to female cable

6.2.8 Connect the Emergency stop switch at the back side of the instrument **(NOTE:** while connecting the emergency stop switch matches the red dot of both male and female connectors and press slightly).

6.2.9 Insert the power cable into power inlet module at back side of Polstat3500.

6.2.10 Connect the Inert gas supply to the inert gas port at back side of Polstat3500.

6.2.11 Connect the drain tube to the port provided at back side of Polstat3500.

6.2.12 Take the Aluminum inserts of capacity 50ml, 100ml, 150ml & 250ml and insert them in specified insert holes on the Polstat3500.

6.2.13 Take the glass vessels setup of capacity 50ml, 100ml, 150ml & 250ml and put them in the inserts with reference to their sizes.

6.2.14 Insert the agitator shaft (PBT, Anchor, Retreat curve etc.) based on the requirement into the glass vessel top lid.

6.2.15 Fix the PTFE coupling to vessel and Vessel top lid with washer at the joint.

6.2.16 Adjust the agitator shaft based on the minimum stirring volume and tighten the stirrer with PTFE adaptor cap.

6.2.17 While tightening the cap, make sure the stirrer is dipped inside the solution and doesn't touch the bottom of the glass vessel.

6.2.18 Fix the vertical rods to the sliders provided with the horizontal rods on top of Polstat3500.

6.2.19 Fix the glass vessel with the vessel mounting clamp and make sure that the vessel is not inclined position.

6.2.20 Now take overhead stirrer and fix it to vertical rod with help of clamp and stirrer mounting rod.

6.2.21 Adjust the height of the over head stirrer such that the chuck of the stirrer is overlapped with agitator shaft at the top.

6.2.22 Now insert the shaft into the stirrer chuck and tighten it.

6.2.23 Again adjust the stirrer height and make sure that the overhead stirrer will not vibrate during the running condition.

6.2.24 Now connect the motor male connector to the female connector provided at the back of the each block. **(NOTE:** while connecting the connector match the red dot of both male and female connectors and press slightly).

6.2.25 Repeat the same to remaining vessels.

6.2.26 Take mass sensor and insert it into the mass sensor PTFE adapter.

6.2.27 Adjust the mass sensor height based on the height requirement.

6.2.28 Insert the mass sensor into vessel top lid port and bend the mass sensor to dip in the mass.

6.2.29 Make sure that the mass sensor is not touching the agitator shaft.

6.2.30 Also connect the mass sensor connector to its female connector in the same as overhead stirrer connector.

6.2.31 Repeat the same to remaining vessels.

6.2.32 Now take the condensers with pipe connection on both ends.

6.2.33 Connect the pipes inlet and outlet of condenser to the connector provide at the back of sensor connectors.

6.2.34 Make sure that the bottom port of the condenser is connected to outlet port of the condenser manifold.

6.2.35 Condenser top port should be connected to inlet port of the condenser manifold.

6.2.36 While connecting hose don't apply more pressure on it just presses slightly.

6.2.37 Now switch on the chiller.

6.2.38 Observe that the chiller pump start circulating the water through the Polstat3500.

6.2.39 In sequence both chiller condenser fan and compressor will start.

6.2.40 Observe the water temperature is reducing and will reach to set point of 5ºC.

6.2.41 Now switch on the Polstat3500 and wait till the Polstat3500 control pad to boot up.

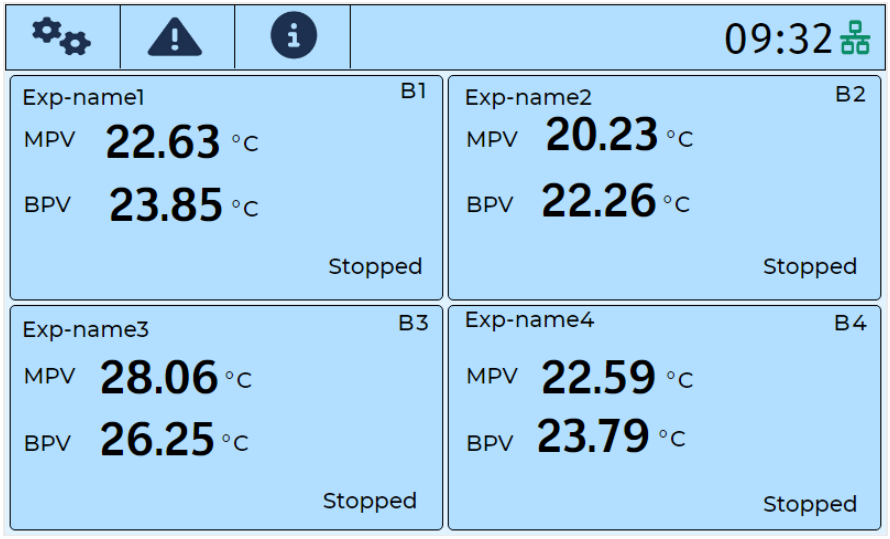
6.2.42 After boot up is completed you can see the Mass and block temperatures of all block in the home page of the control pad.

6.2.43 To run the experiments proceed to operate the system as per below(Operational procedure)

7. OPERATIONAL PROCEDURE

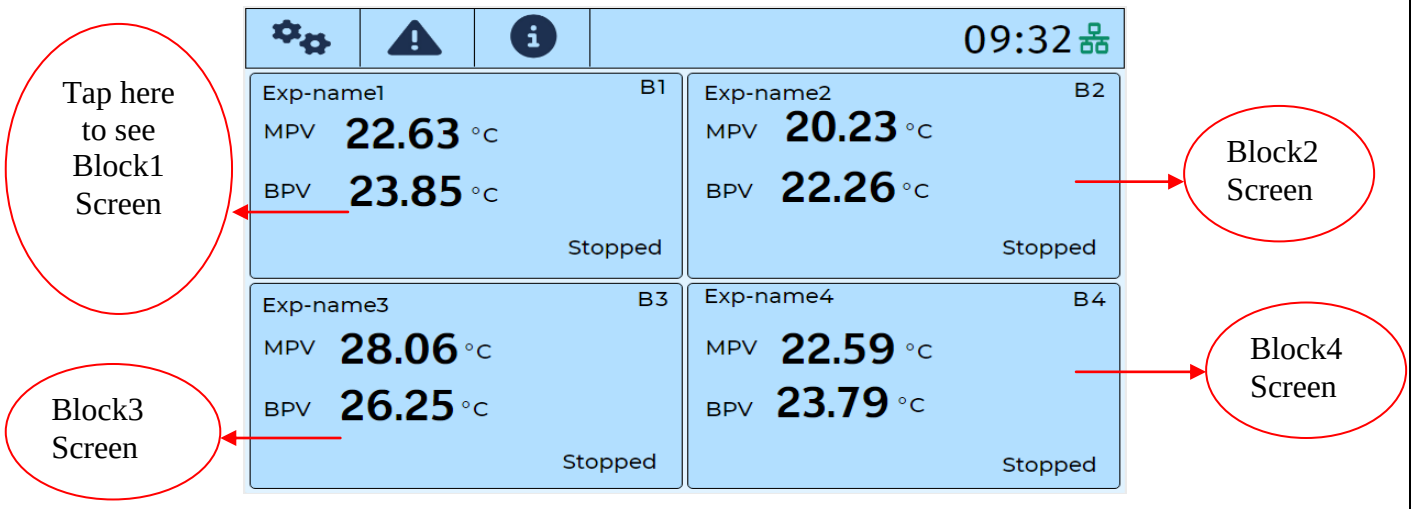
Before going to start the heating or cooling process make sure system setup is completed as per the section 6. Installation of Polstat3500 & Chiller. Switch ON the Chiller and wait till the water temperature reaches to set point of +5ºC.

Switch on the Polstat3500 instrument, Control pad will be turned ON automatically. Now user can see the control pad home screen as below

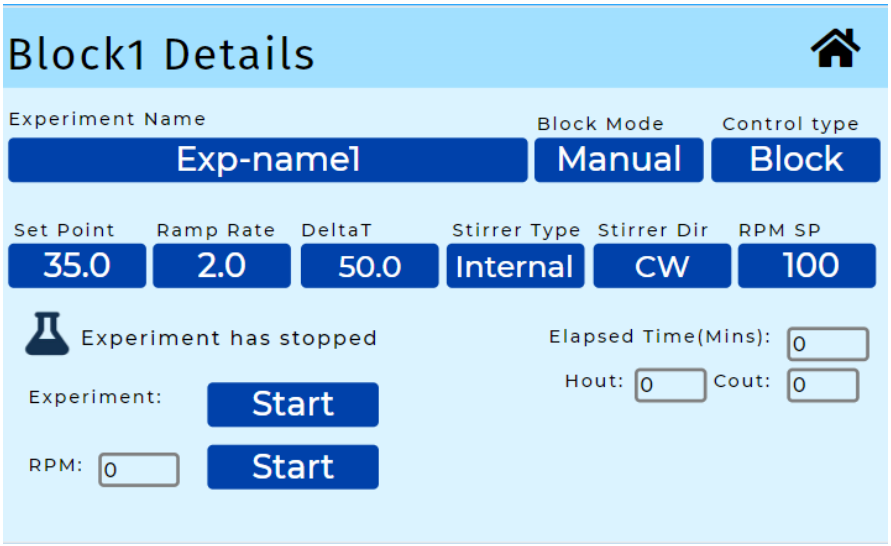


In the home screen, on top right you will see network symbol with green in color, indicates that RS485 communication established between POLSTAT3500 instrument and Control Pad. If user finds network symbol with red in color, indicates that there will be a communication problem between POLSTAT3500 instrument and Control Pad.

Main screen will have temperatures of four blocks. To start the experiment, tap on each block parameters then user will be navigates to next screen of that particular block.



After tap on block1 screen, user navigates to block1 detailed screen as shown in below image



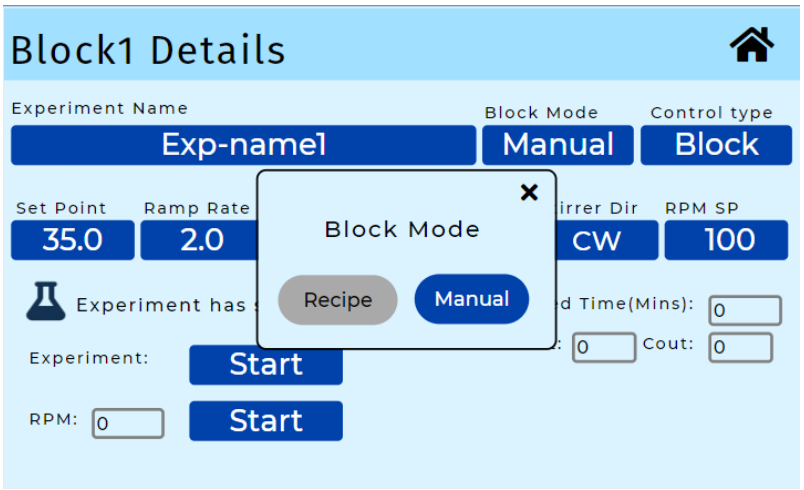
In block1 screen, below are the editable fields to start the process.

7.1. EXPERIMENT NAME

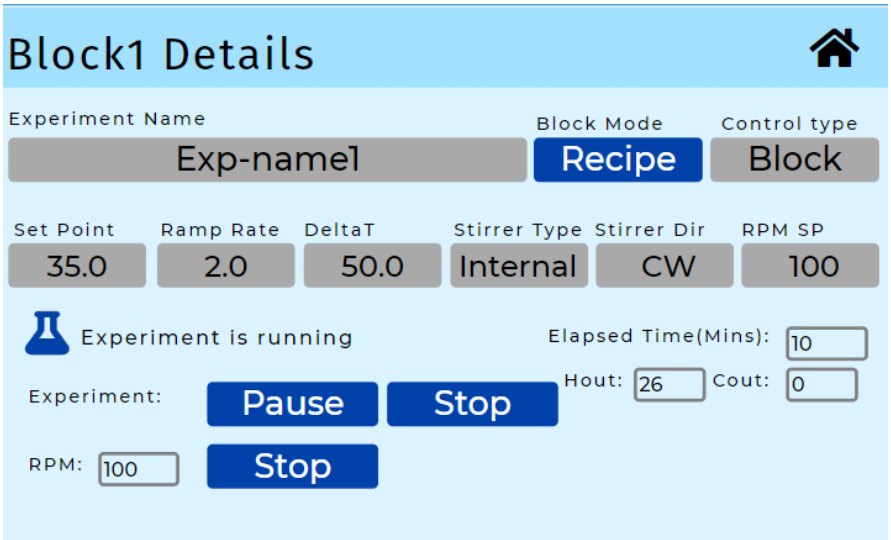
7.1.1 In this field, user needs to enter the experiment name. Please note that maximum number of characters will be limited up to 23 in this experiment name field.

7.2. BLOCK MODE

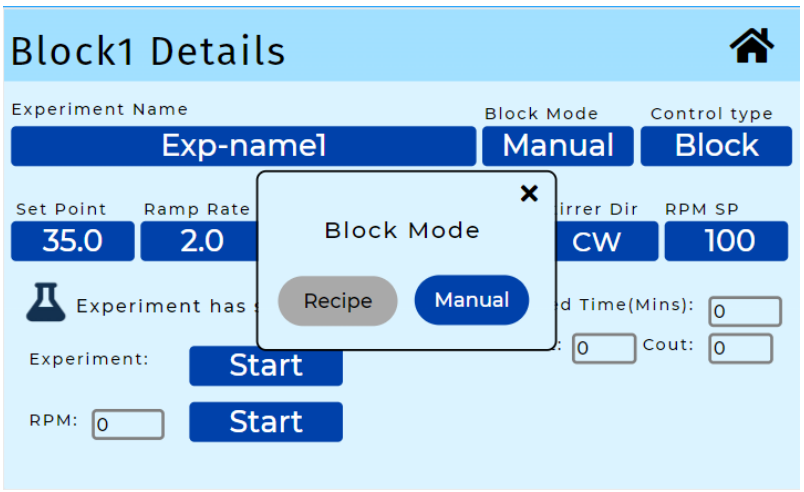
7.2.1 In this field, user has to select the block mode as either “Manual” mode or “Recipe” mode as shown in the below image.



7.2.2 Experiments in recipe mode can be performed only from the PiLab software, user cannot perform the experiments in recipe mode from the Control pad, but user can be pause/stop experiment in recipe mode from the Control pad . Stop/start of stirrer during recipe running process can be done from control pad. In the recipe mode, all editable fields will be deactivated and block1 detailed screen will be appeared as below.



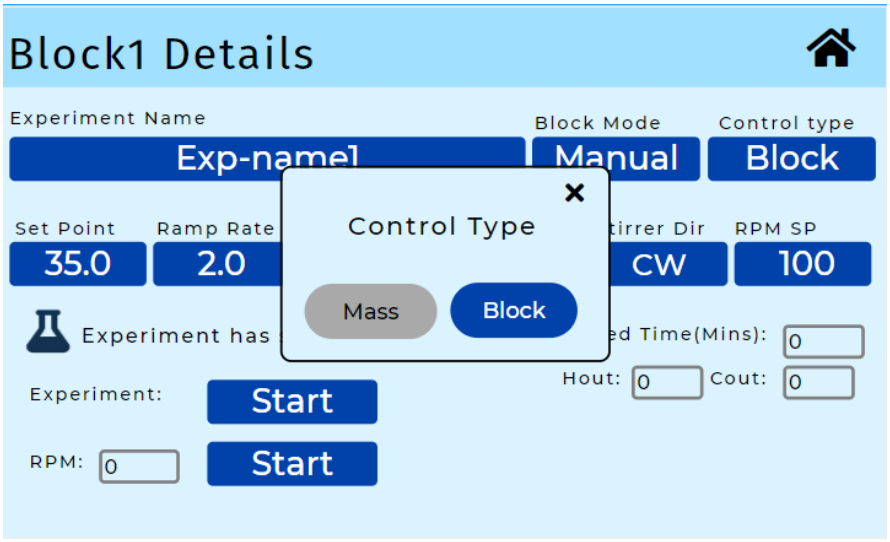
7.2.3 If user selects block mode as Manual, then all editable fields will be activated as below



7.3. CONTROL TYPE

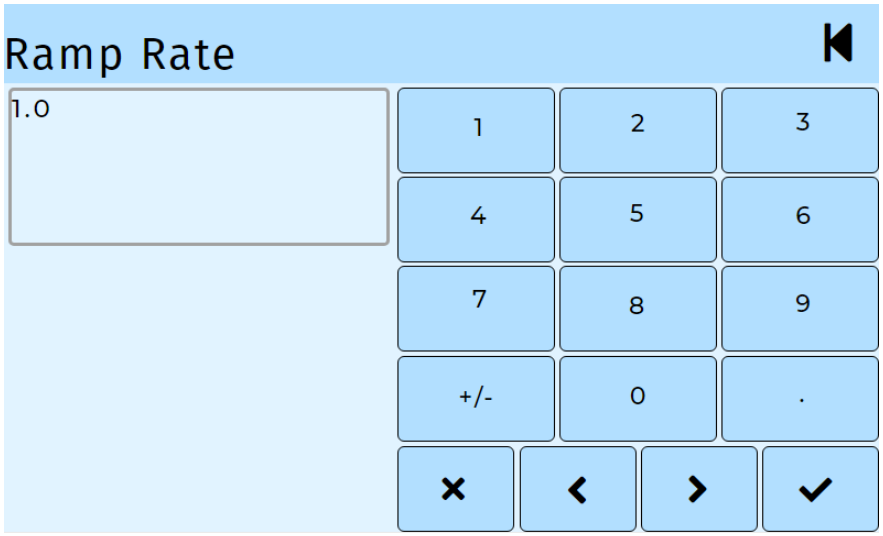
In this field, user needs to select either “mass control” or “block control”.

After selection, mode of the control can be seen in the control type entry field.



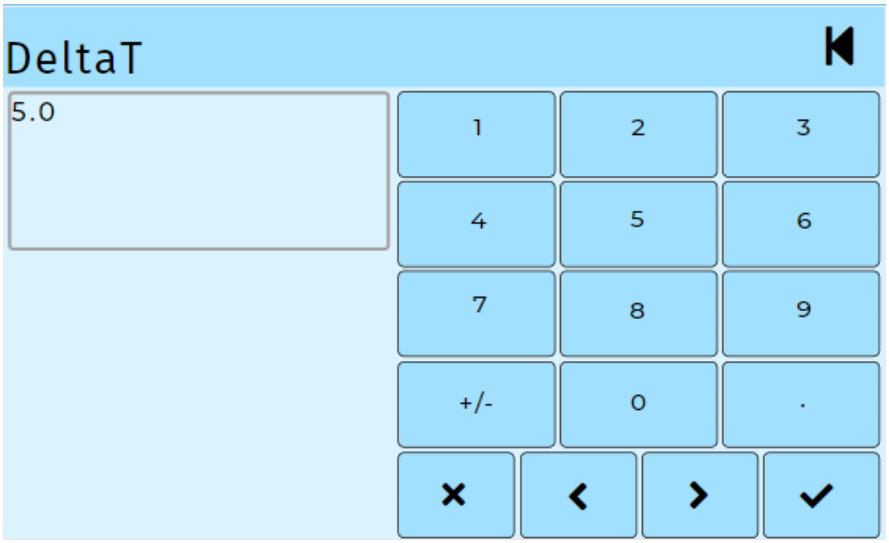
7.4. RAMP RATE

In this field, user has to enter ramp rate (ºC/min) as per the process requirement. User can enter the value from 0.1ºC/min to 2ºC/min.



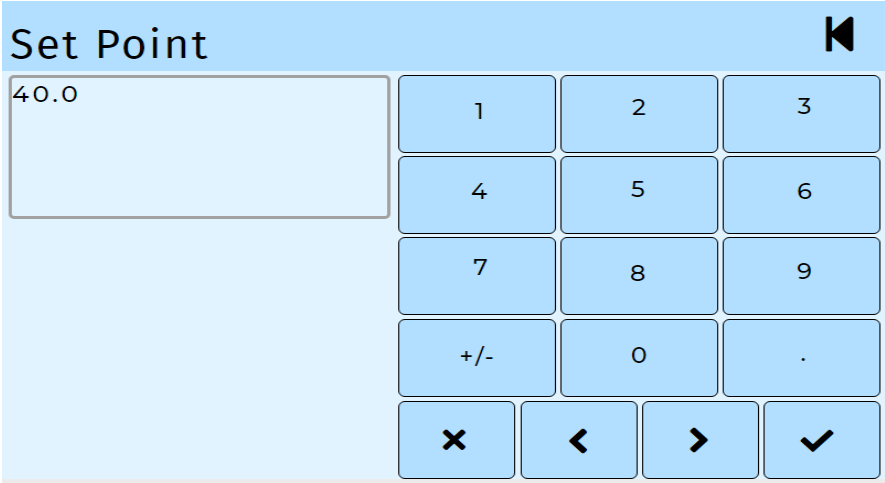
7.5. Delta T

Delta T is the difference between block temperature(BPV) and mass temperature(MPV).User can enter the required value in this field. This parameter is applicable to mass control only,but it is not applicable to block control.



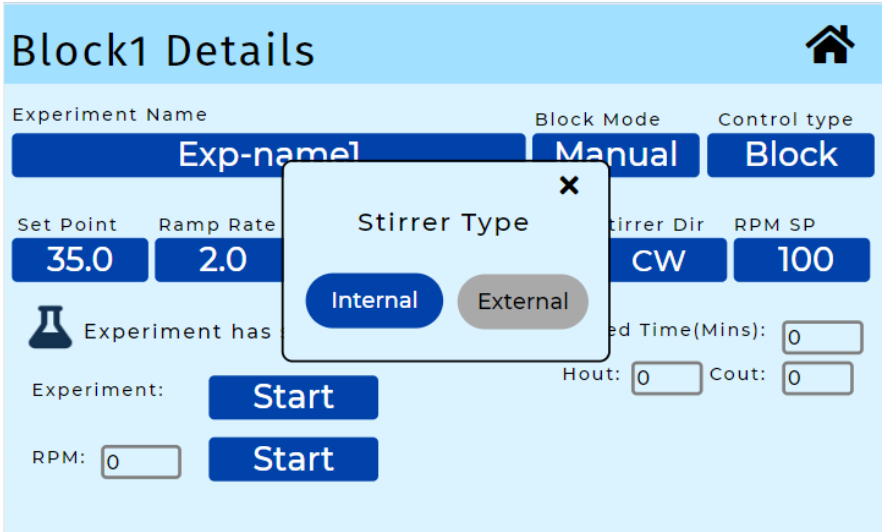
7.6. TEMPERATURE SET POINT

In this field, user need to enter the temperature set point as per the process requirement ranging from (-) 30ºC to 150ºC.

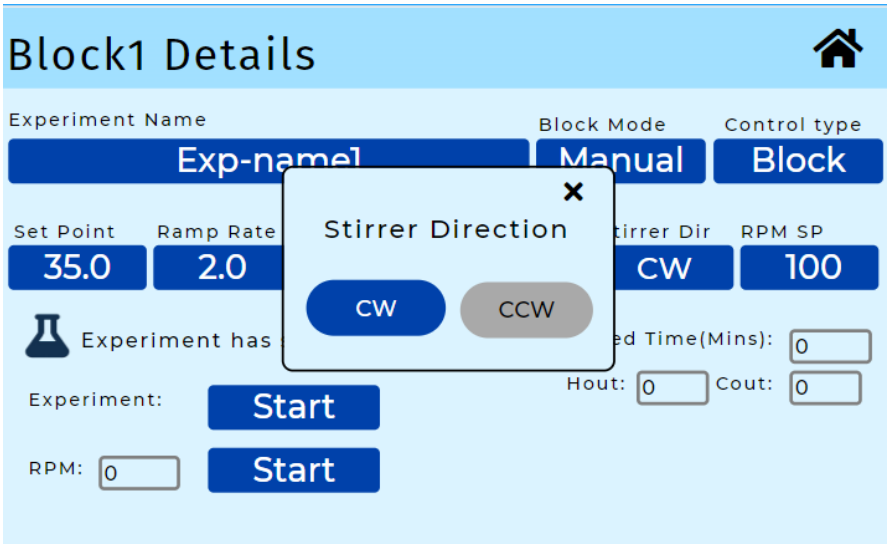


7.7. STIRRER TYPE

In this field, user need to select either “Internal” or “External” based on process requirement.



7.8. STIRRER DIRECTION

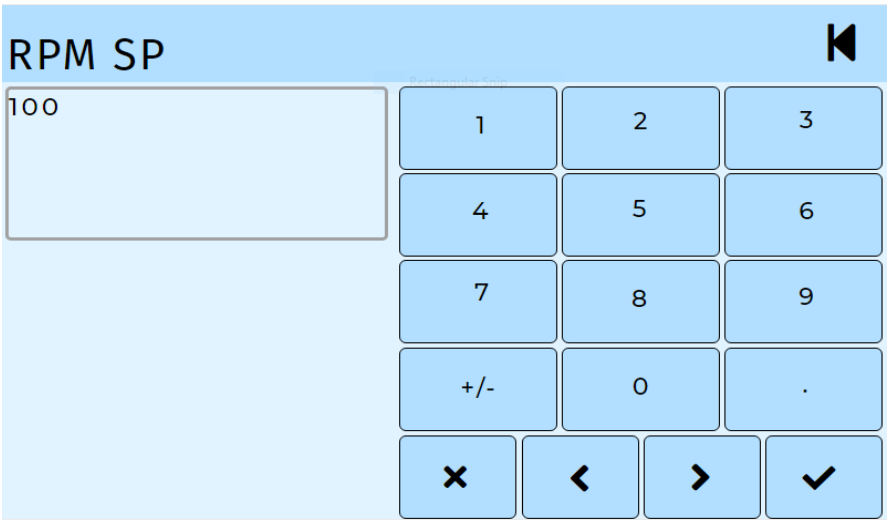


7.9 RPM SET POINT

7.8.1 In this field, user should enter the required RPM value.

7.8.2 For internal stirrer, enter the value between 100 to 1000

7.8.3 For external stirrer, enter the value between 100 to 1000



7.10 EXPERIMENT MONITORING FIELDS

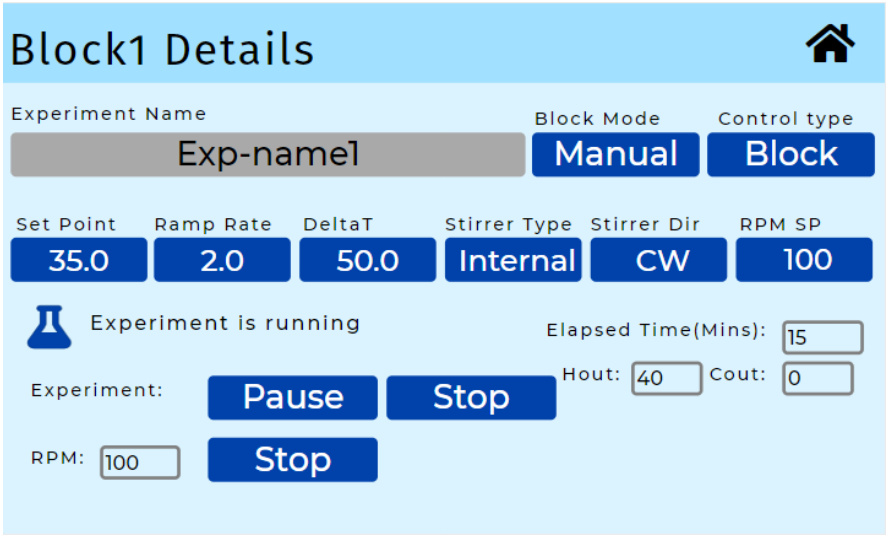
In Block1 screen, below are the monitoring fields.

Experiment Status: In this field experiment status can be seen as stopped or running or paused or halted

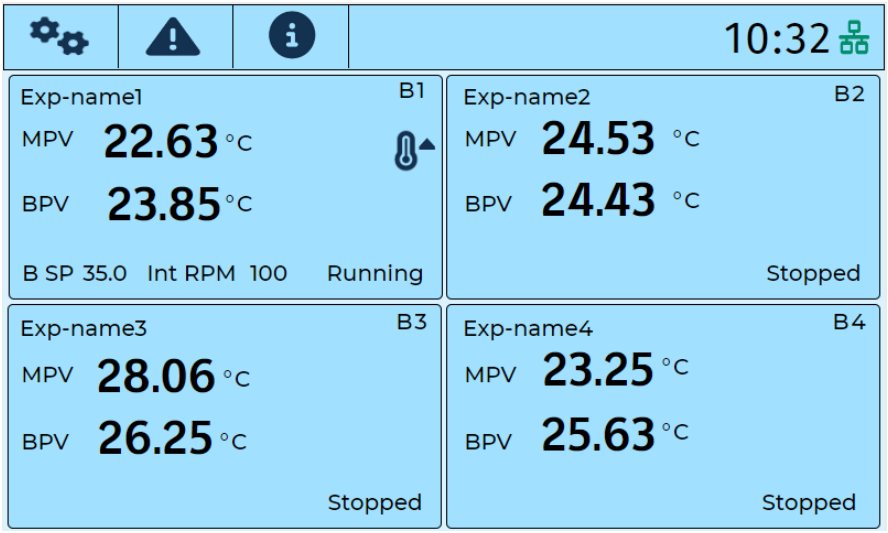
Experiment: Here user can start the process by clicking on the start button

RPM: In this field user can see the stirring RPM process value after stirring starts.

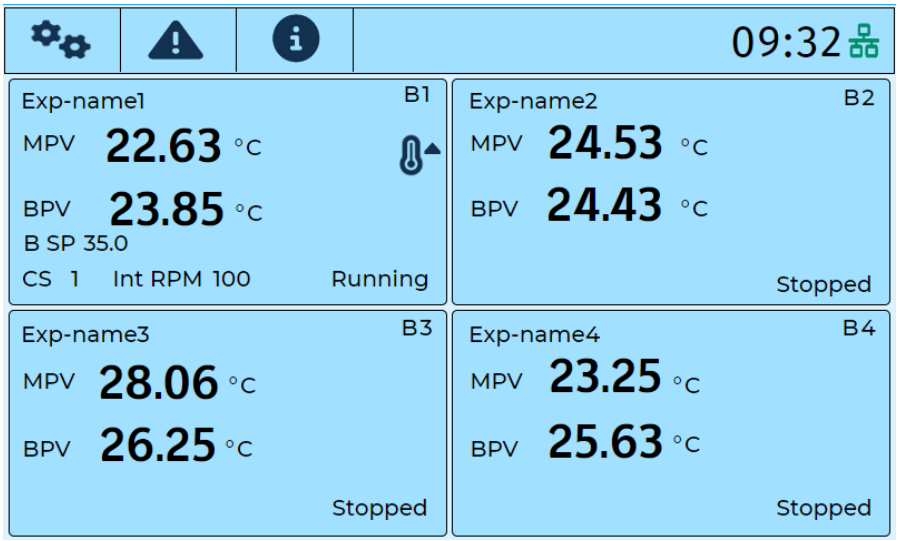
7.10.1 After entering all these parameters and click on the start button, user can observe "**Pause**" and "**Stop**" buttons at experiment and also user can observe RPM value and "**Stop**" button at RPM field.



7.10.2 Now click on the home button at top right it will navigate to home screen. Observe temperature set point, RPM and process status as "**Running**" is updated below BPV field in Block1. Note that in the block1 screen ,B SP means block set poit in block control, M SP means mass set point in mass control.Also note that Int RPM means internal magntic stirrer RPM and Ext RPM means external stirrer RPM.



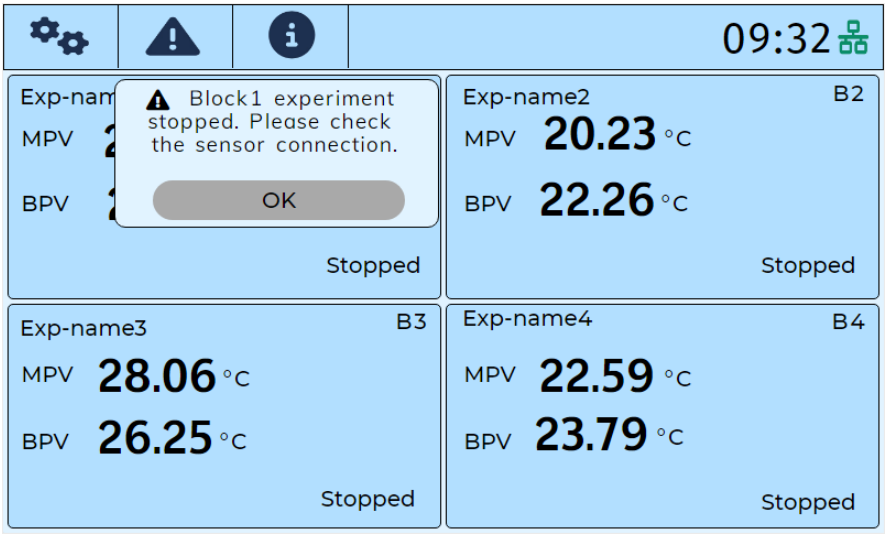
7.10.3 If user starts experiment in recipe mode from pilab, then in the home screen current step(CS) number will be appeared as shown in the below image.



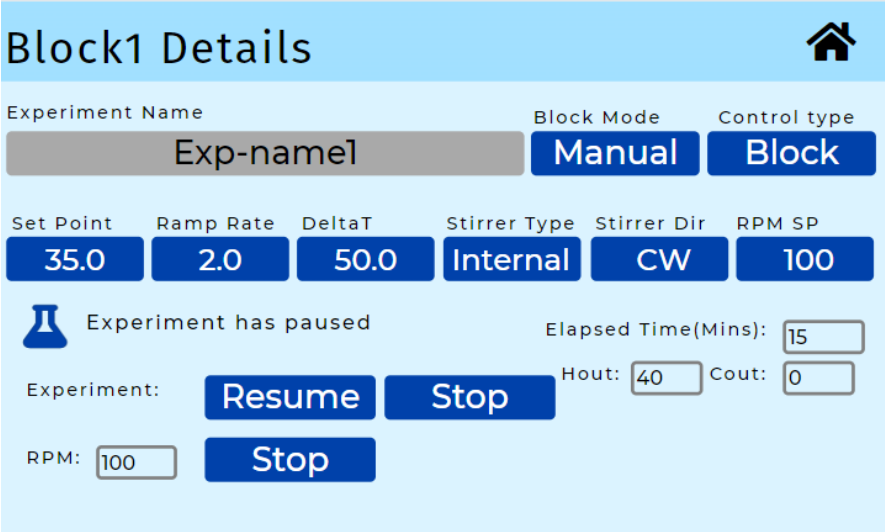
7.10.4 Follow the above section7, to run the heating or cooling processes in block2, in block3, and in block4.

7.10.5 When user performing the experiment in mass control in particular block, if

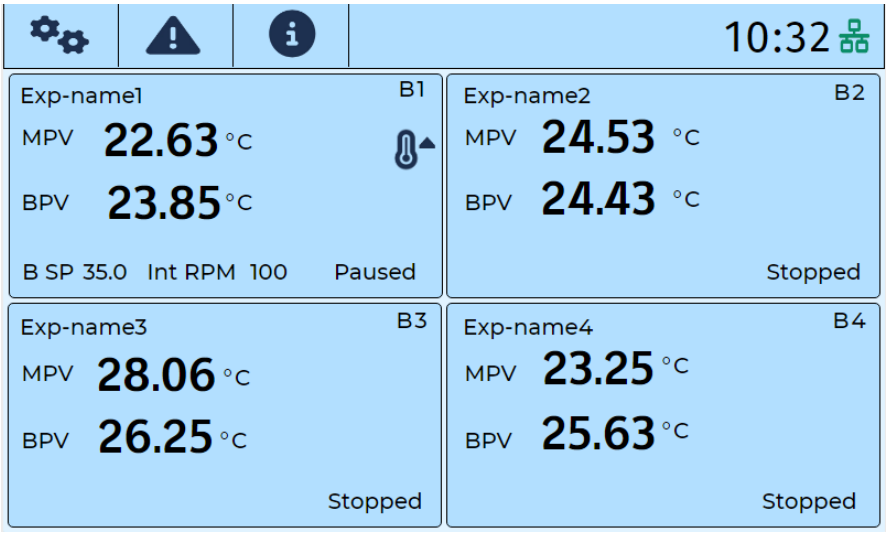
mass sensor suddenly got disconnected then experiment in that particular block will be stopped and pop up message will appears on the main screen as "**Block1 experiment stopped, please check the sensor connection**", shown in below image.



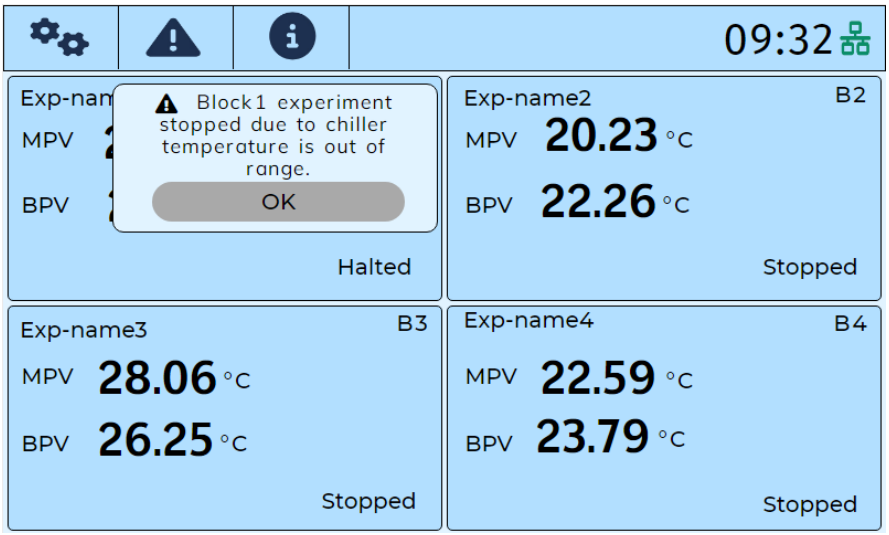
7.10.6 If user wants to pause the experiment, then tap on the "**Pause**" button to maintain the temperature at that pause temperature value and if user want to resume experiment then tap on the "**Resume**" button. Block1 detailed screen will appears as below.



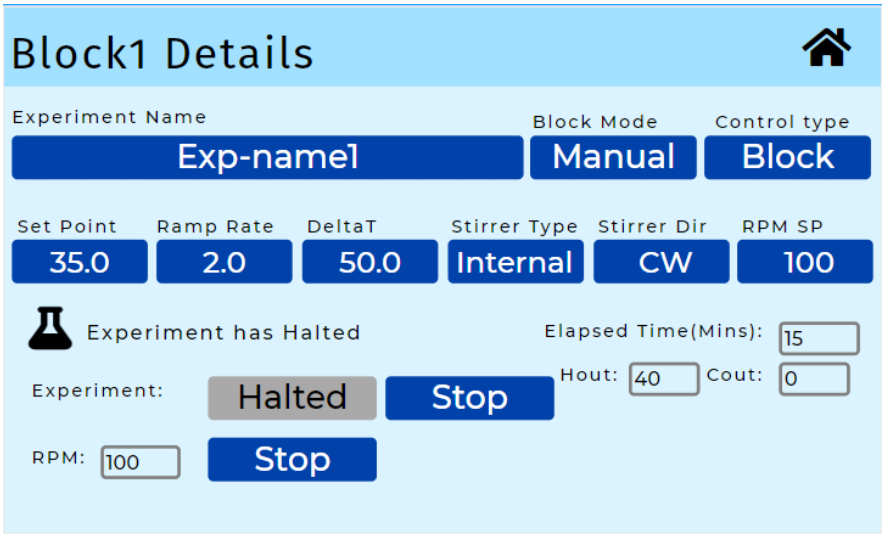
7.10.7 Now tap on the home button at top right, then it will navigates to home screen. User will see temperature "set point" and process status as "Paused" is updated below the BPV field in Block1, shown in below image



7.10.8 During experiments running time, If the chiller temperature is not within the specified range, then experiments will be halted temporarily, experiment status is updated as "Halted", and popup message will appears on the main screen as "**Block1 experiment halted due to chiller temperature is out of range",** shown in the below image.

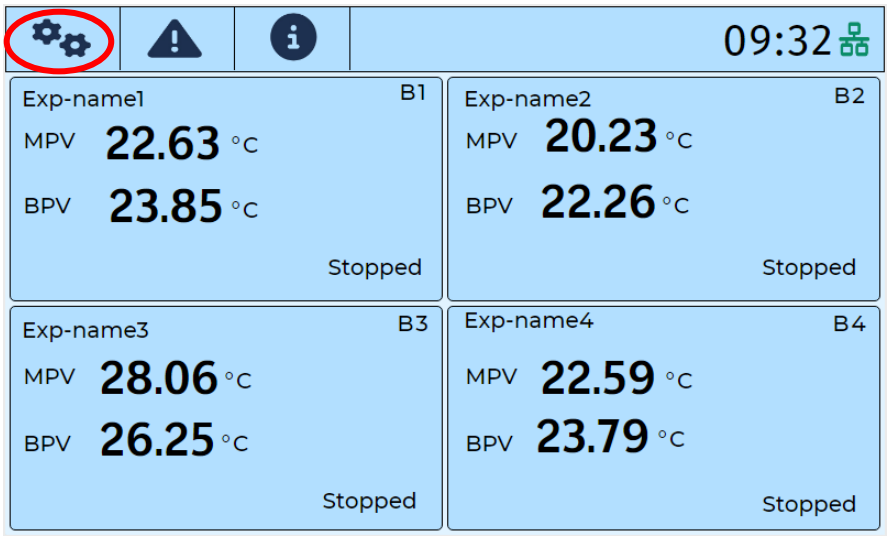


7.10.9 In the block1 detailed screen, user will see experiment status as "Halted", shown in below image

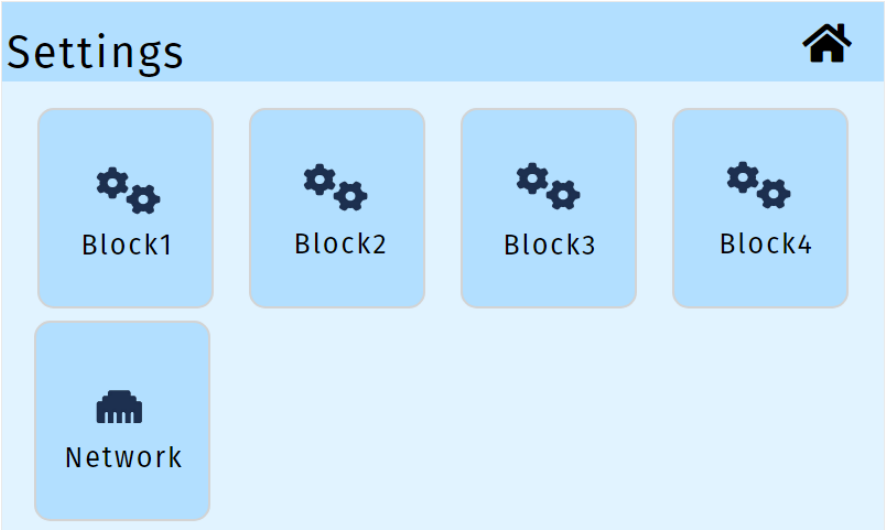


7.10.10 Experiments will resume automatically when the chiller temperature again falls within the specified temperature range.

7.10.11 For system configurations, network settings, and PID configurations tap on the "**Settings**" button as shown in the below image.

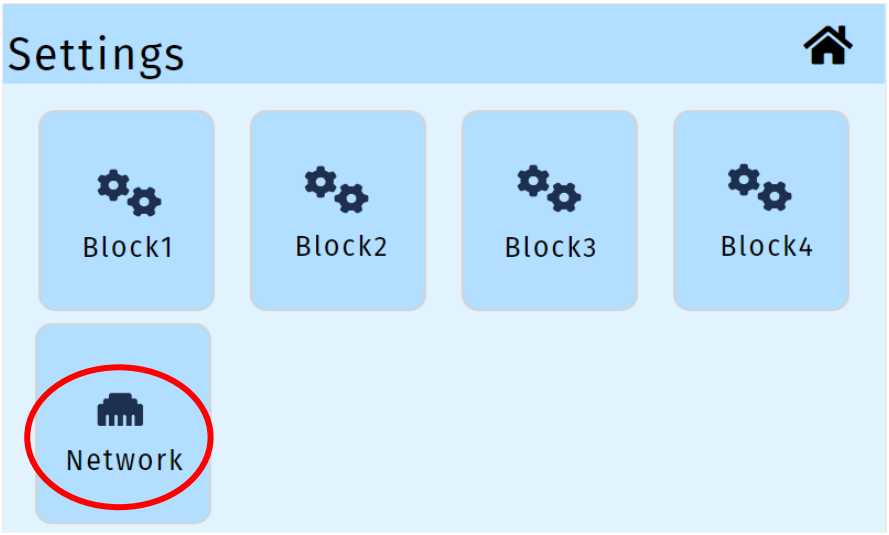


7.10.12 After tap on Settings button, Settings screen will be appears as below

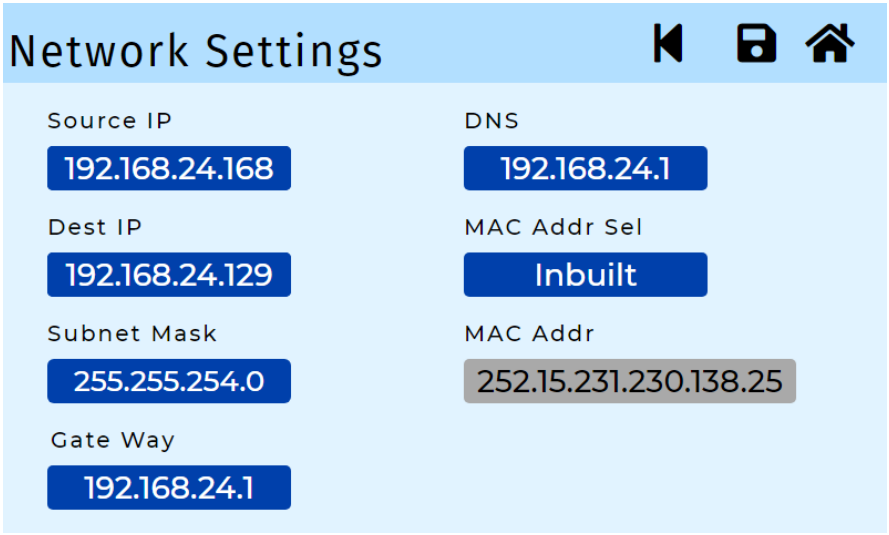


7.8. NETWORK SETTINGS

7.8.1 Tap on the Network symbol, shown in below image to configure the Network parameters.

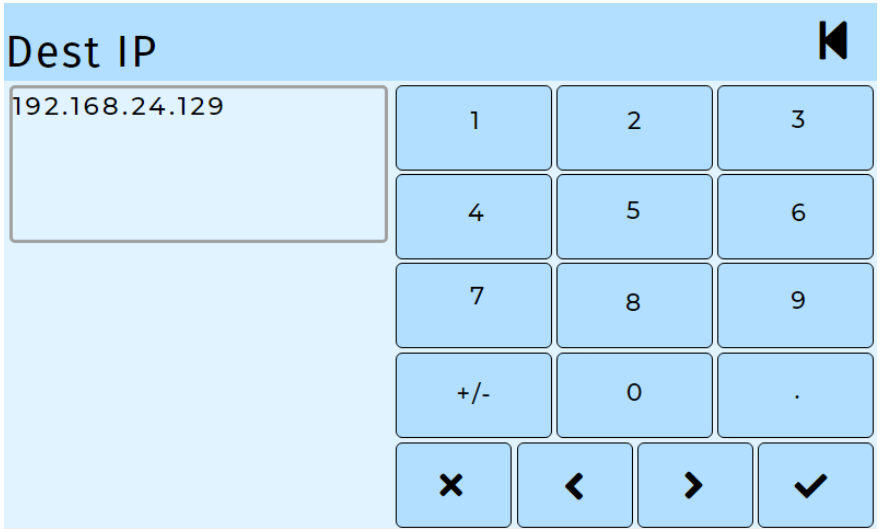


7.8.2 Now user can see network Settings screen as below

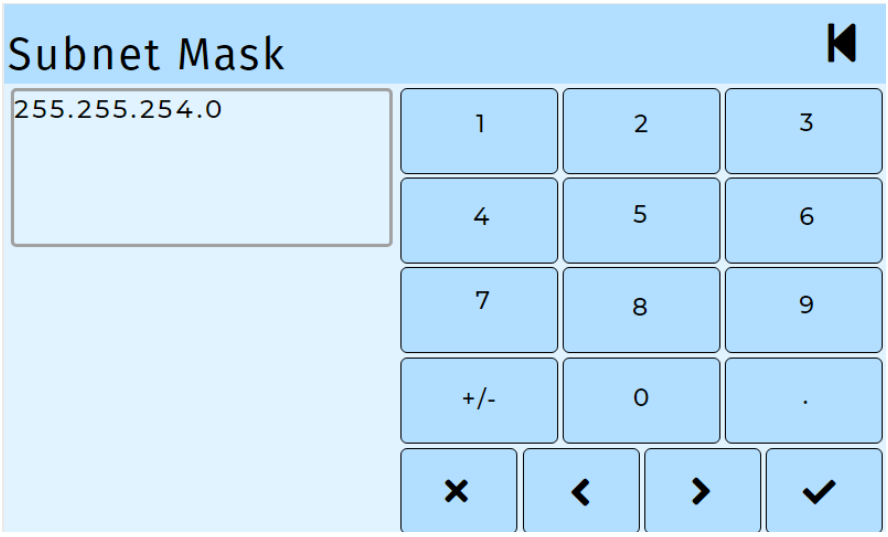


7.8.3 Tap on the source IP field and configure the source IP as per below image. After editing click on tick mark in the key pad to have the new value

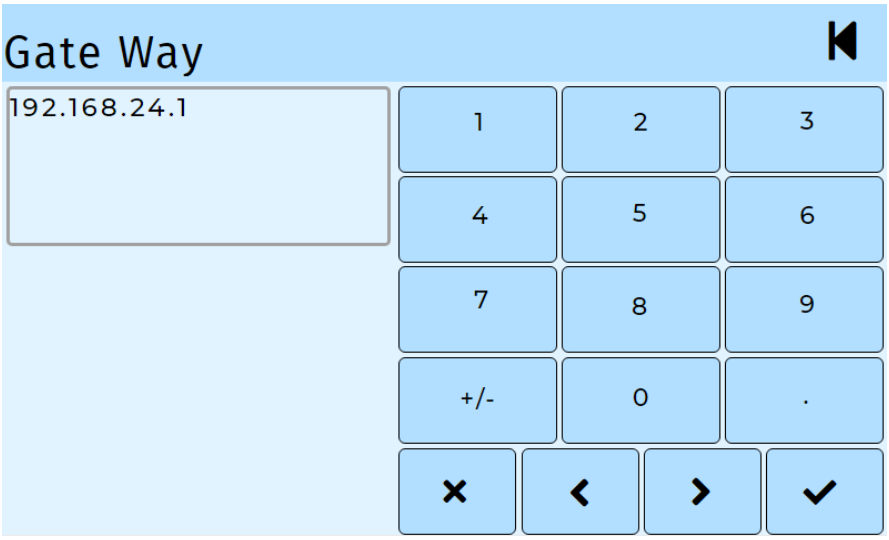
7.8.4 Click on the destination IP field and configure the destination IP as per the below image.



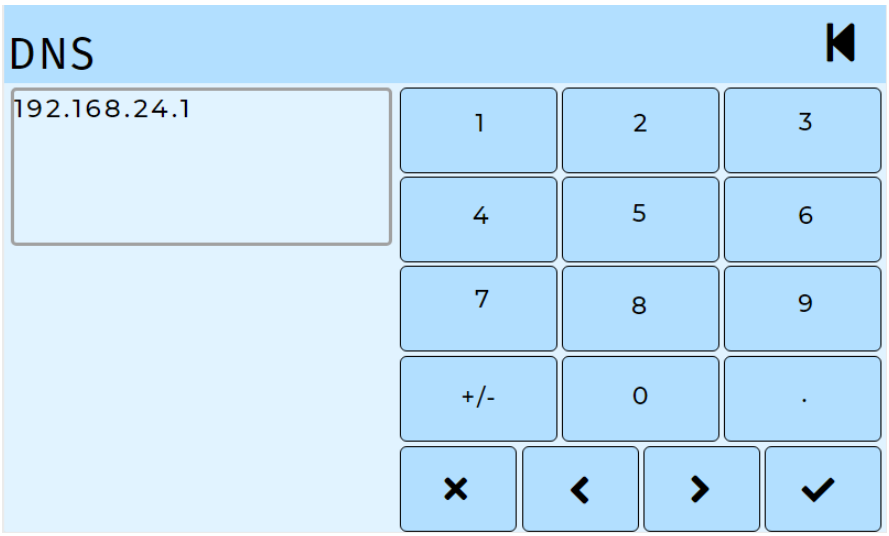
7.8.5 Click on the Subnet mask field and configure the subnet mask as per the below image.



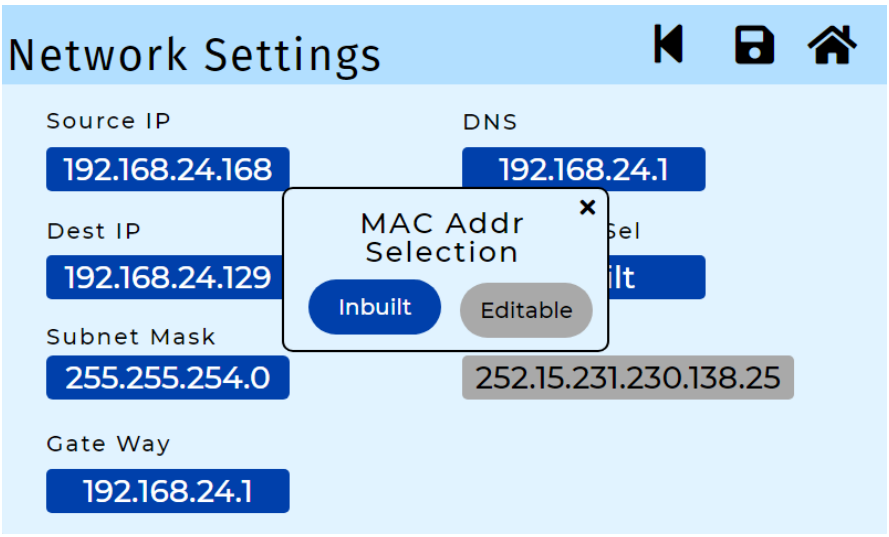
7.8.6 Click on the Gateway field and configure the gateway as per the below image.



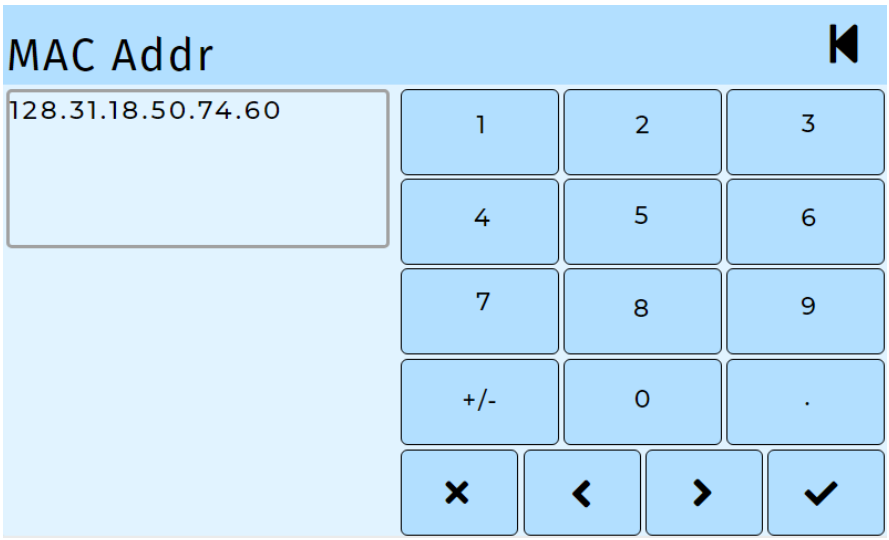
7.8.7 Click on the DNS field and configure the DNS as per the below image.



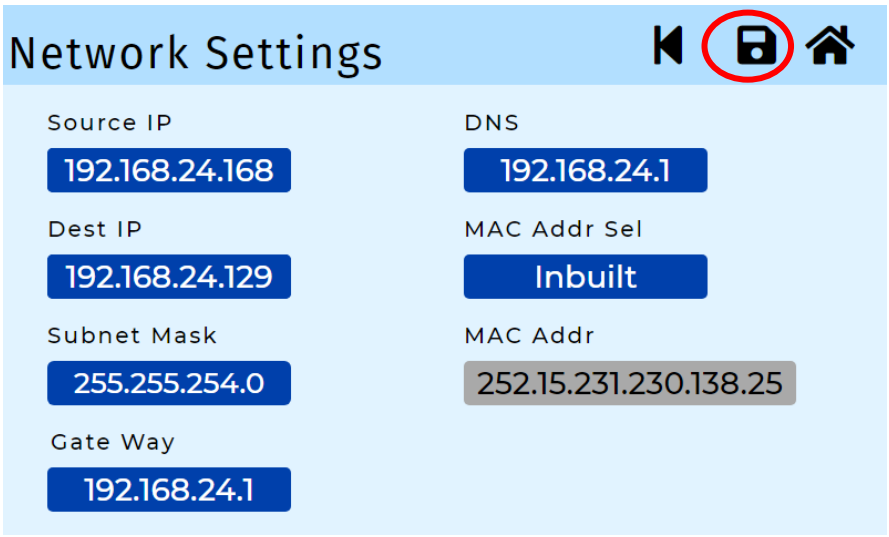
7.8.8 Default MAC address will be provided, and if user wants to configure MAC address, then select editable option as shown in the below image.



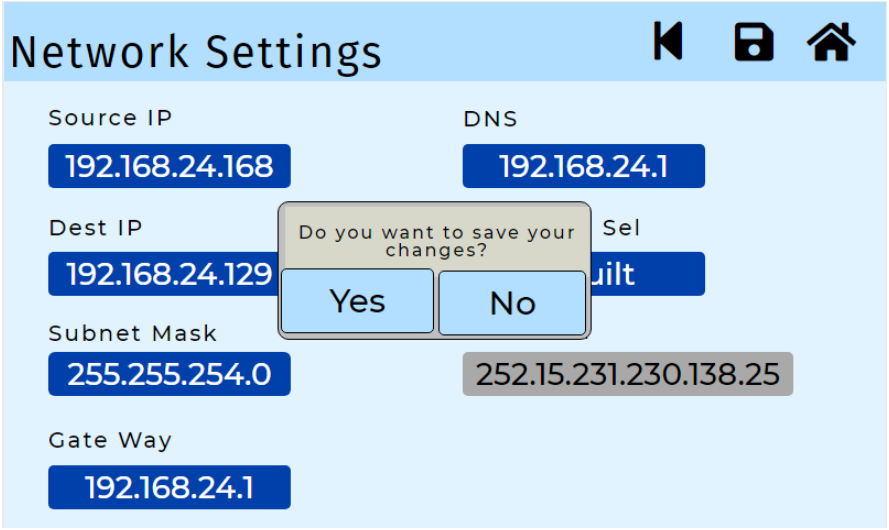
7.8.9 Click on MAC address field and configure the MAC address as shown in the below image.



7.8.10 After filling all configurations click on the save button, shown in the below image.

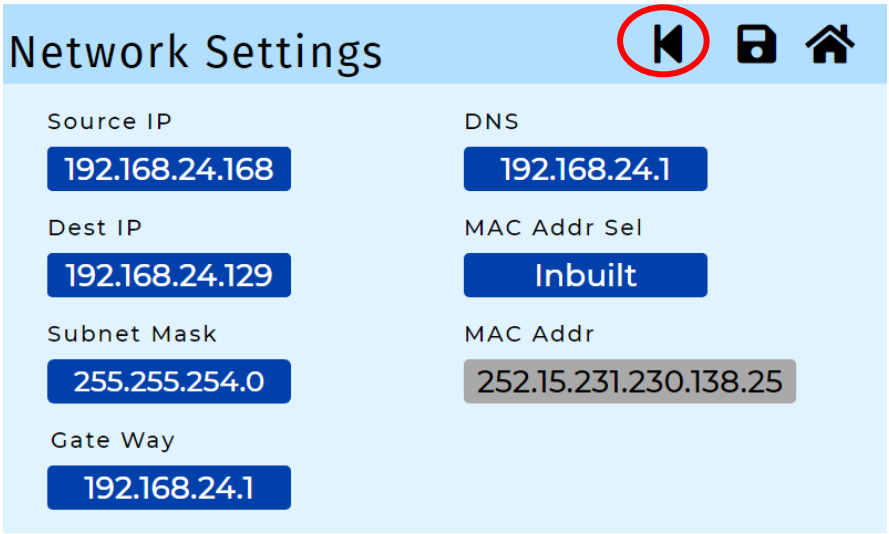


7.8.11 tap on the “YES” button to apply the save changes ,shown in the below image.



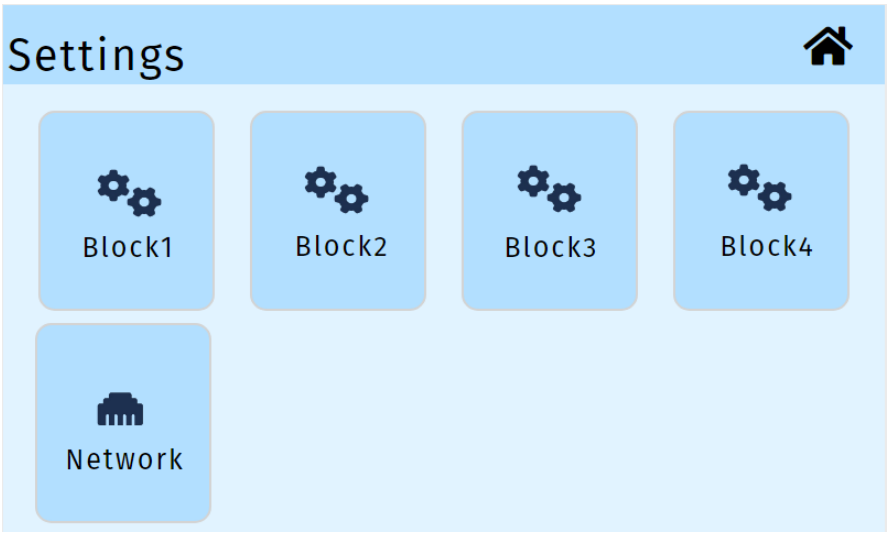
7.8.12 If user taps on “NO” then the network parameters will not be saved into the system.

7.8.13 Now tap on the left arrow button to go back to previous screen, shown in below image.

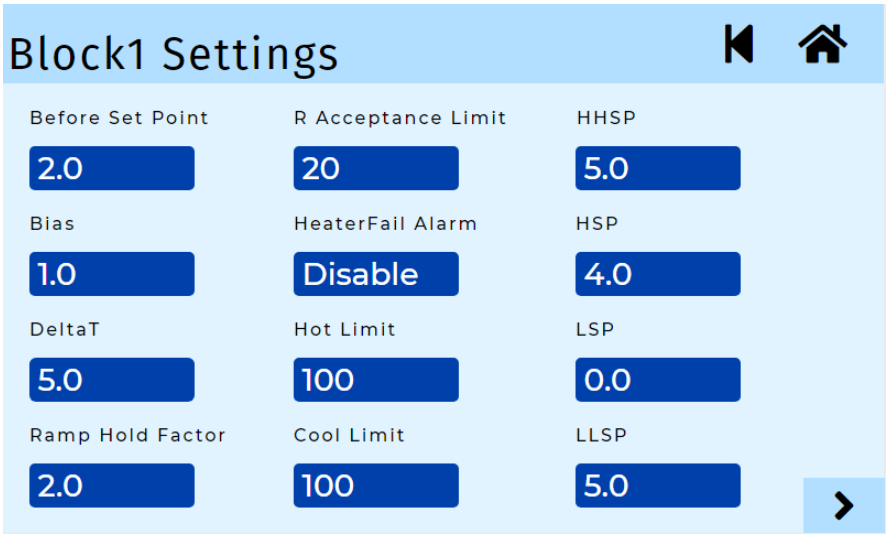


7.9. BLOCK SETTINGS

7.9.1 Now user can see settings screen and click on the “Block1”, shown in the below image.



7.9.2 After tap on “Block1”settings, user will see the PID parameters, shown in below image.



Note: Block settings fields in the above screen are editable, these values will be fixed during the commissioning of Polstat3500 instrument.

7.9.3 Below is the detailing about each field

Before set point: At this point, the mass ramp rate will be tapered irrespective of given ramp rate

Ramp Rate: Same as section 7.3

Ramp Hold Factor: This configuration will give the stop the increment of error during the process

Ramp acceptance limit: This is maximum ramp that can allow us to enter for any process

Heater Fail Alarm Enable: we need to select enable or disable

Hot Limit: Hot limit is used to define the maximum of heater percentage allowed in the cooling operation

Cool Limit: Cool limit is used to define the maximum of cooling percentage allowed in the heating operation

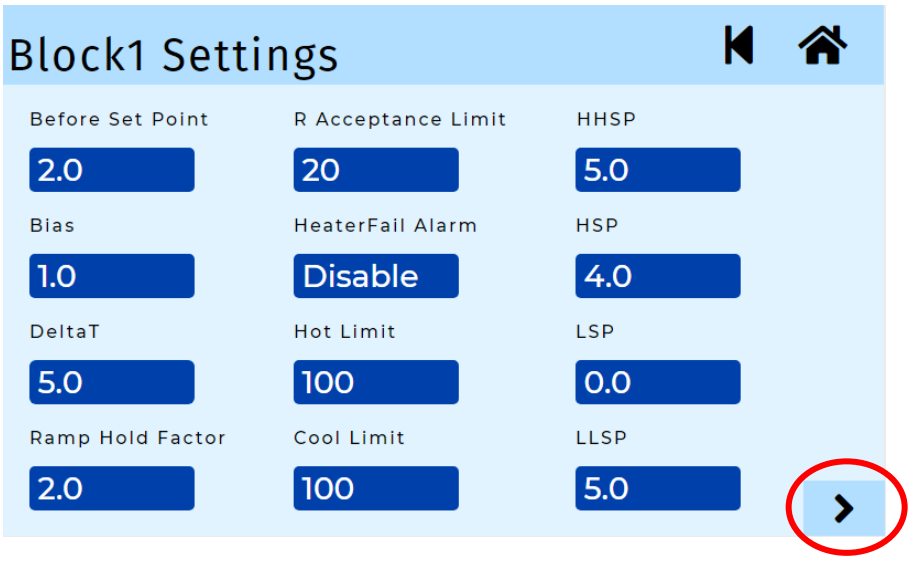
HHSP: This is the set point where an alarm generated and process will be stopped when the PV≥SP+HHSP in heating process

HSP: This is the set point where an alarm is generated when the PV=SP+HSP in heating process

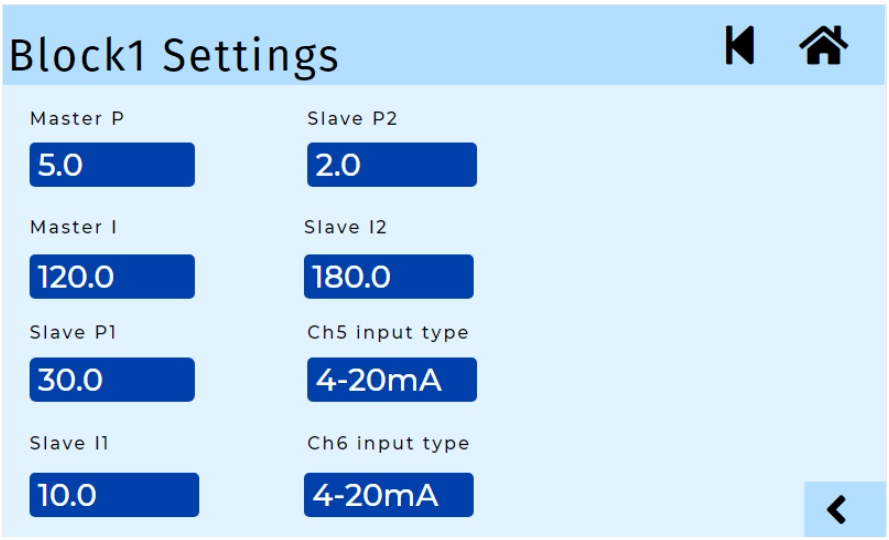
LSP: This is the set point where an alarm is generated when the PV=SP-LSP in cooling process

LLSP: This is the set point where as alarm is generated and process will be stopped when the PV≤SP-LLSP in cooling process

7.9.4 Now tap on the right arrow button to see the next screen, marked in the below image.



7.9.5 Now user will see Block1 PID Parameters, shown in below image.



Note: PID parameters shown in the above screen are editable, these values will be fixed during the commissioning of Polstat3500 instrument.

7.9.6 Below is the detailing about each field.

Master P: P term value in mass control

Master I: I term value in mass control

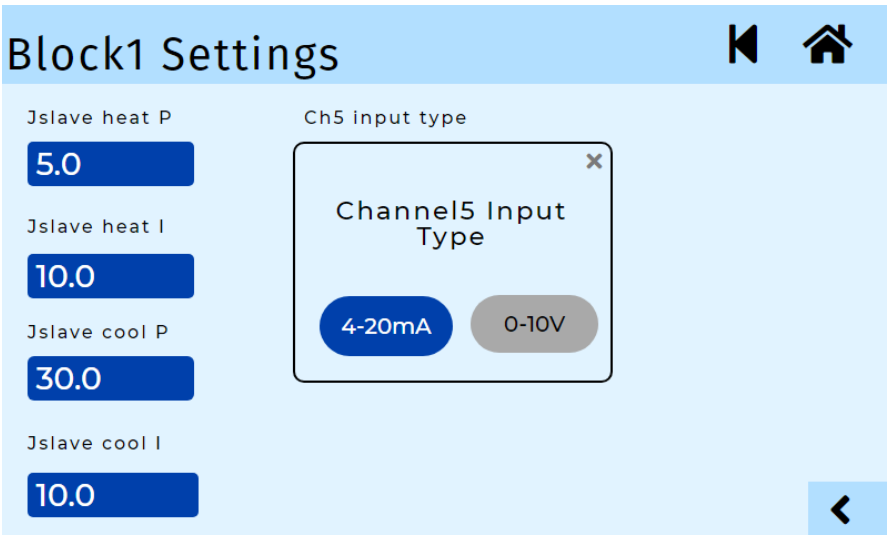
Slave P1: Slave P term value in mass heating process

Slave I1: Slave I term value in mass heating process

Slave P2: Slave P term value in cooling process

Slave I2: Slave I term value in cooling process

7.9.7 If user selects the control type as “block” in section 7.2 and navigate to block1 settings Second screen, then user will see PID parameters corresponding to Block control.



7.9.8 Below is the detailing of each field

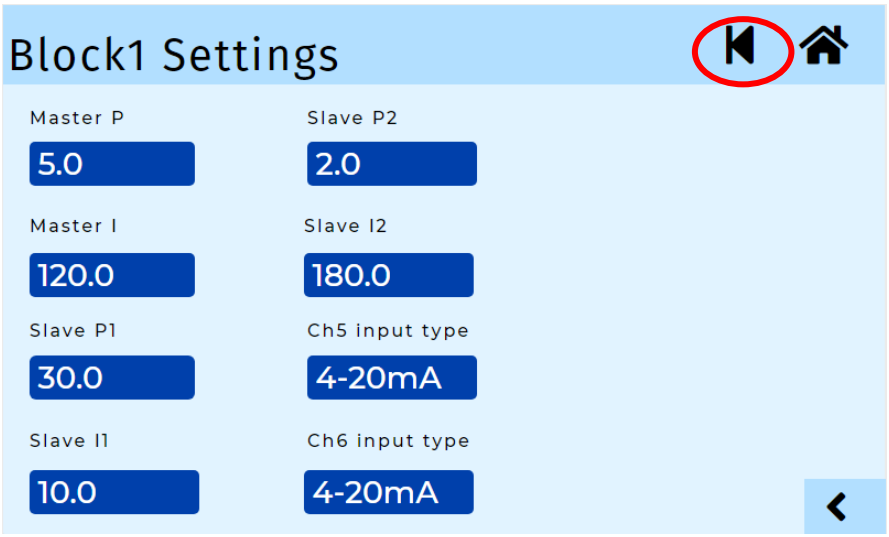
Jslave Heat P : P term value in heating process

Jslave Heat I : I temp value in heating process

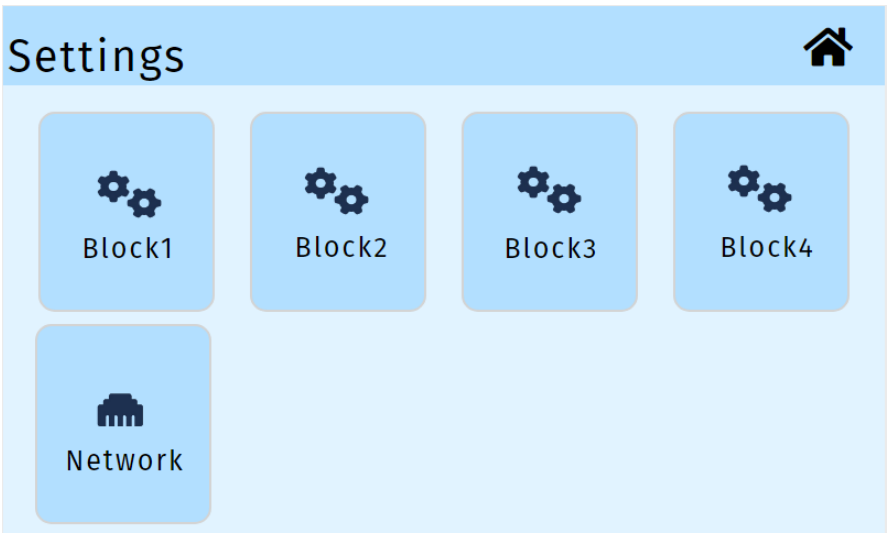
Jslave Cool P : P term value in cooling process

Jslave Cool I : I term value in cooling process

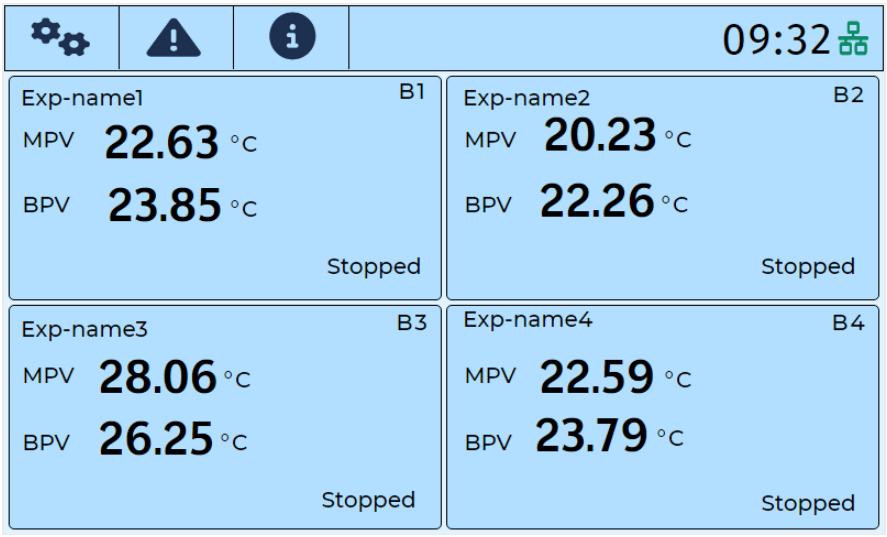
7.9.9 Now tap on the left arrow button as shown in the below image to navigate to settings screen.



7.9.10 Now follow the section 7.8 for the remaining block settings, shown in the below image.

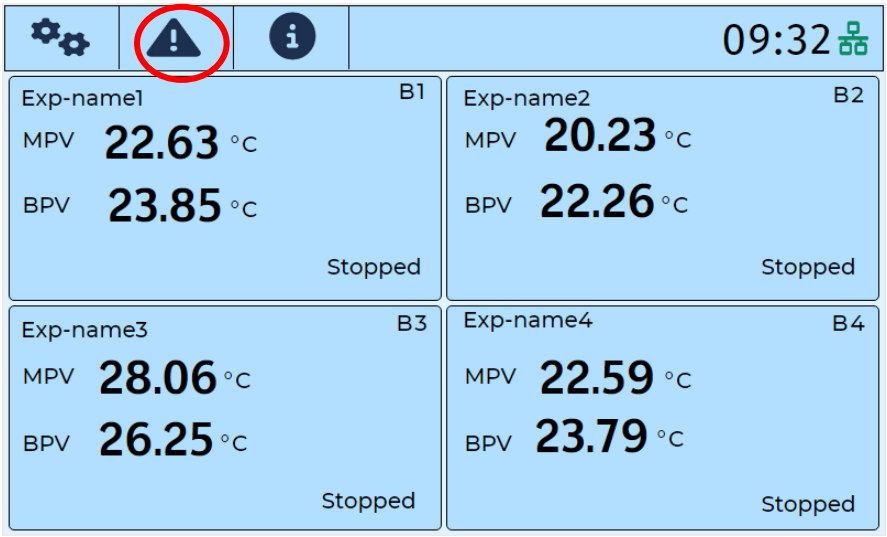


7.9.11 Now tap on the home button, it will navigates to home screen as shown in below image.

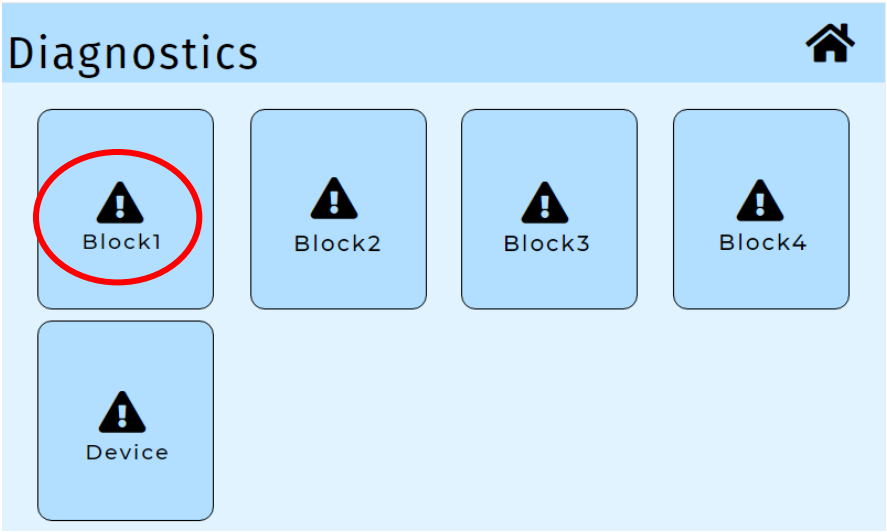


7.10 BLOCK DIAGNOSTICS

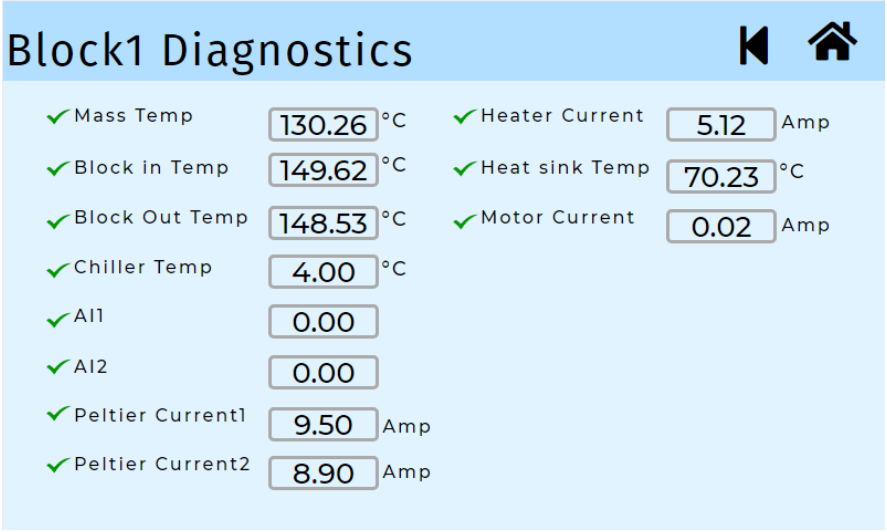
7.10.1 Now tap on the “Diagnostics” symbol as shown in below image



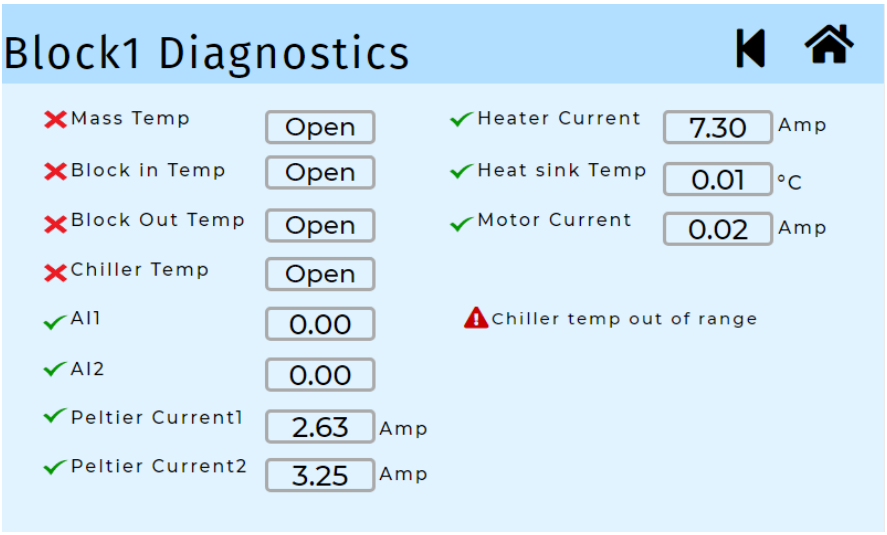
7.10.2 Now user will see the below screen, and click on the Block1 button in below image.



7.10.3 Now user can see the screen as below and ✓ symbols in green color shows that all parameters are healthy.



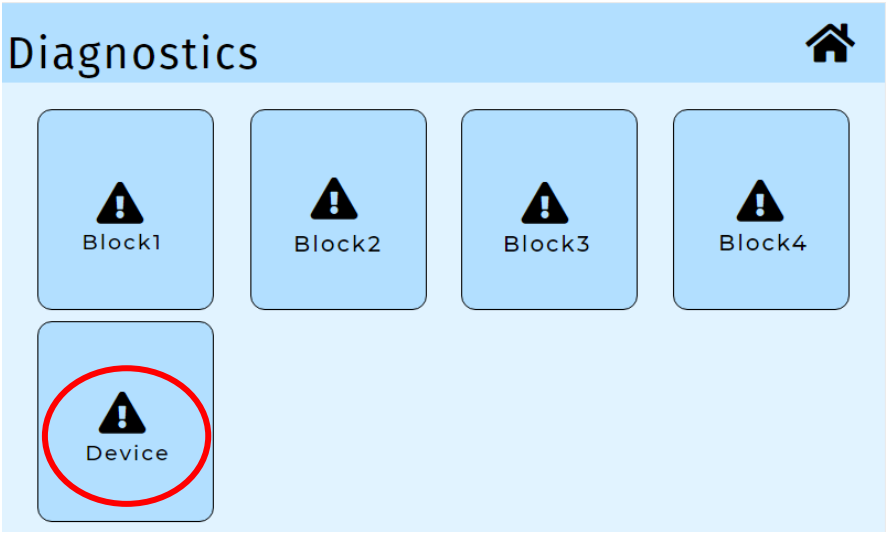
7.10.4 If any parameter is not healthy then it will be represented with ✗ symbol with red in color as shown in the below image.



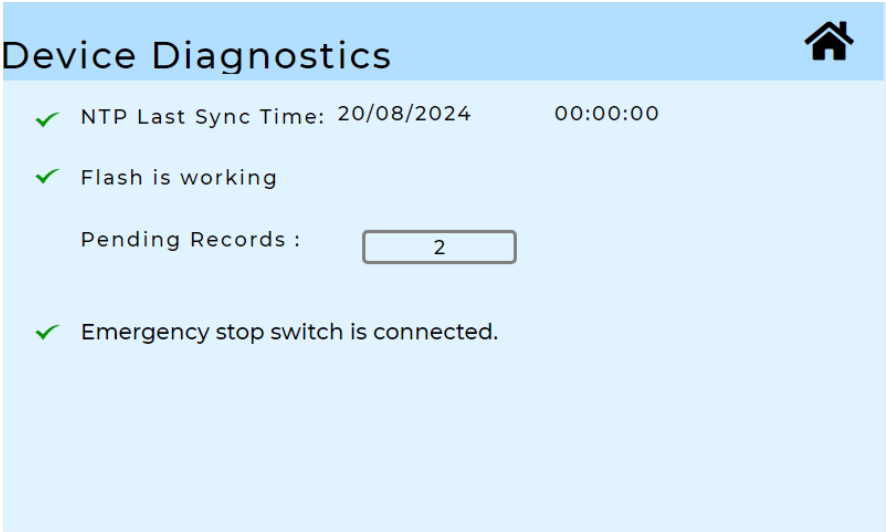
7.10.5 Now click on left arrow and click on block2, block3 and block4 to see the diagnostic parameters for each block. Each block will have the same screen with statuses of diagnostic parameters

7.11 DEVICE DIAGNOSTICS

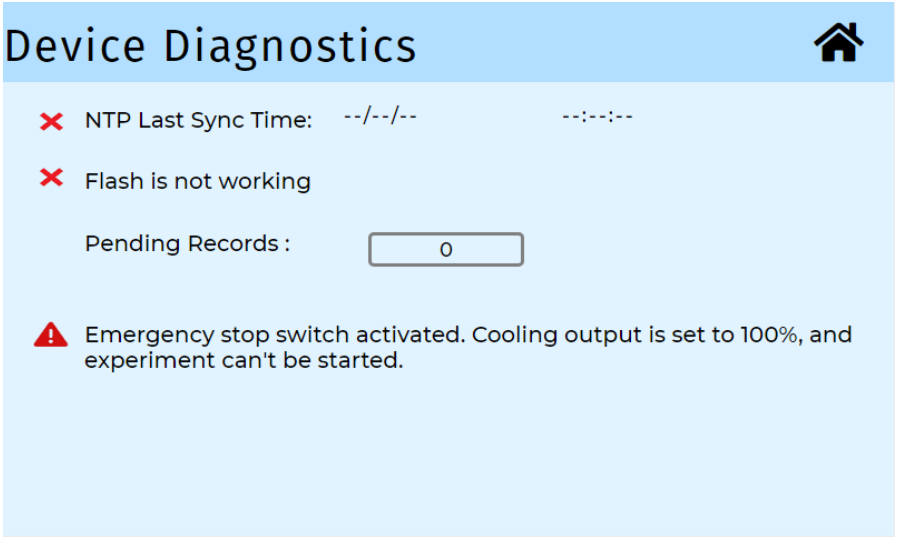
7.11.1 Now tap on “Device” icon in diagnostics screen as shown in below image.



7.11.2 In the device diagnostic screen you can see the NTP last synchronizing time, flash working status and emergency stop switch status. ✓ Symbol with green color indicates that particular parameter is healthy as shown in the below image.

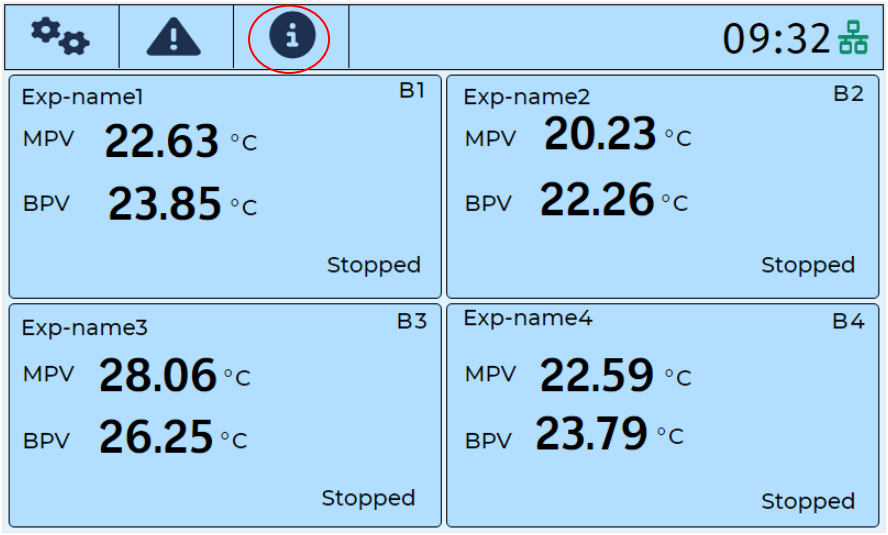


7.11.3 If any device diagnostics parameter is not healthy, then it will be represented with ✗ symbol with red in color.



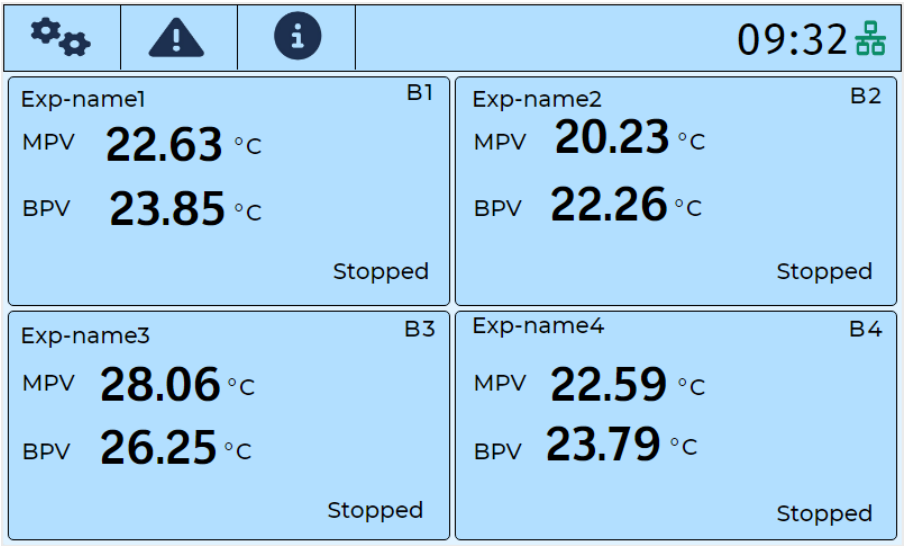
8. DEVICE INFORMATION

8.1 Now tap on the home button and then click on “Device info” icon, in the below image.



8.2 In the device info screen, user can see the model number, instrument serial number and software version number for Polstat3500 and Control Pad , shown in the below image.

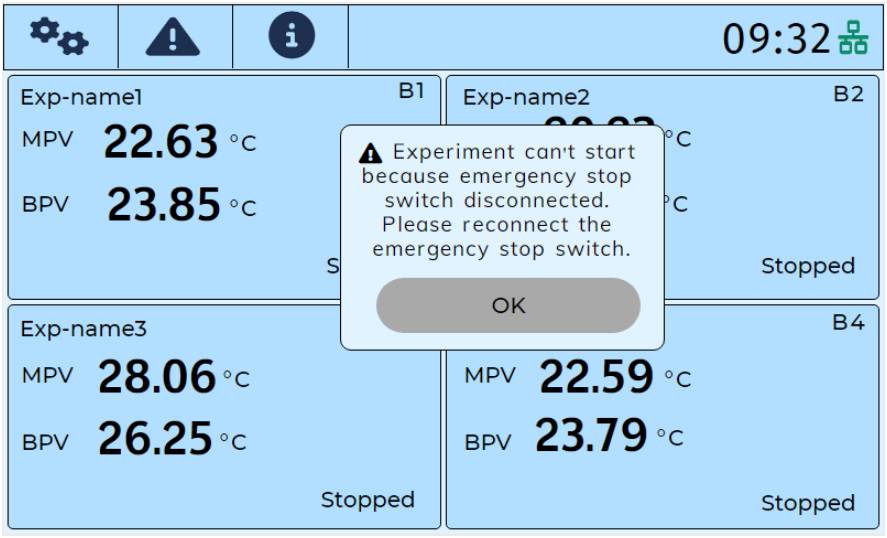
8.3 Now click on home button to navigate to home screen,shown in the below image



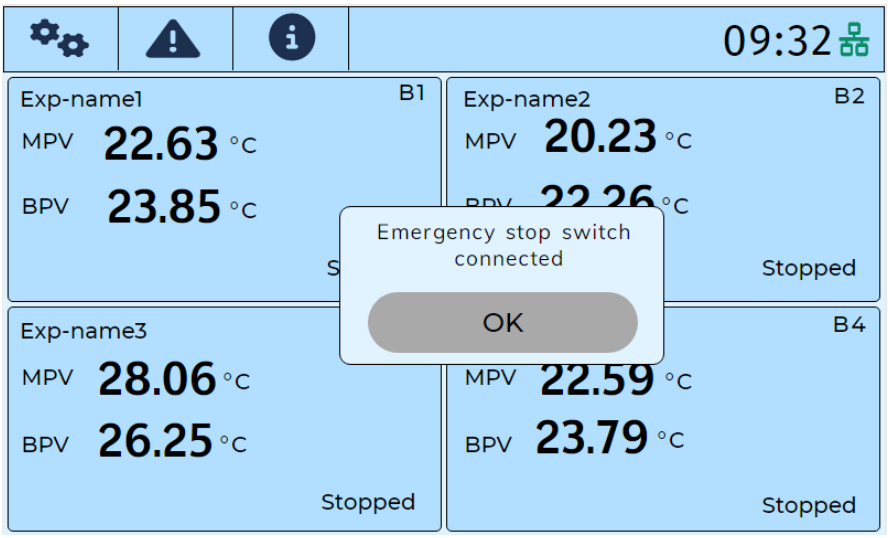
9. EMERGENCY STOP SWITCH

While doing experiments, if any abnormal situation happens with the chemical reactions, then press the emergency stop switch, shown in the below image. It will be located at either foot of the user or it will be mounted on the fume hood wall. When user presses the emergency stop switch, experiments will be stopped in all four blocks and 100% cooling will be turned ON in all four blocks to cool down the blocks, and user should release the emergency stop switch after recovering of instrument from the abnormal situation.

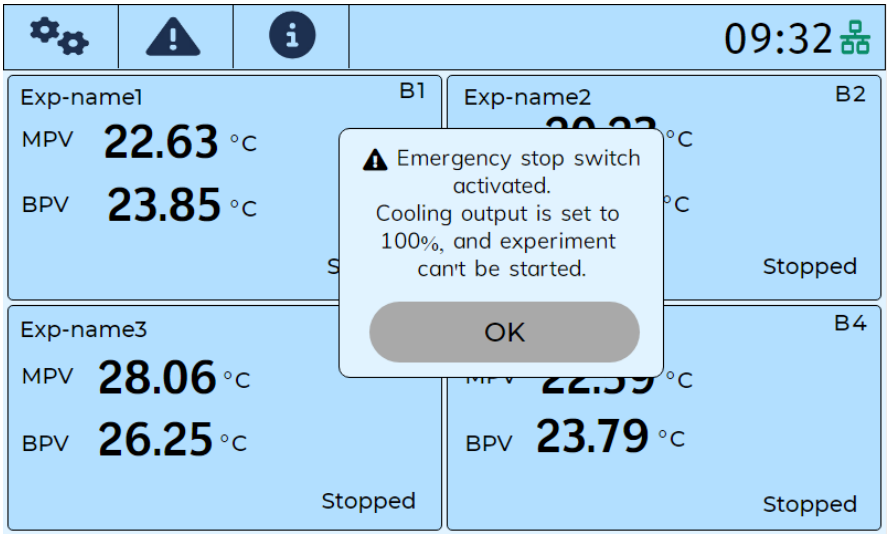
9.1 If the emergency stop switch is not connected to the system, then pop up message will come on the main screen as "**Experiment can't start because emergency stop switch disconnected, Please reconnect the emergency stop switch**", shown in the below image.



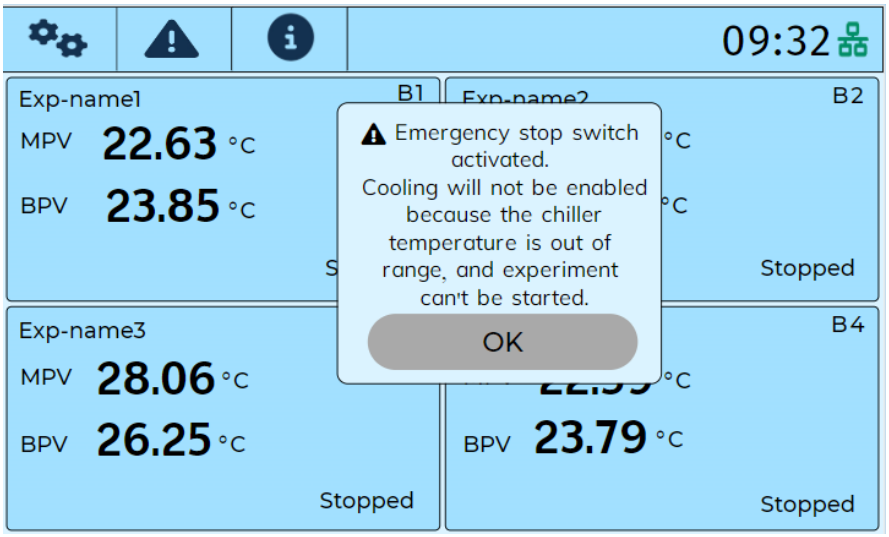
9.2 If the emergency stop switch is connected again then pop up message will come on the main screen as "**Emergency stop connected**", shown in below image.



9.3 If the emergency stop switch is pressed, then pop up message will come on main screen as "**Emergency stop switch activated, cooling output is set to 100%, and experiment can't be started**" , shown in below image.

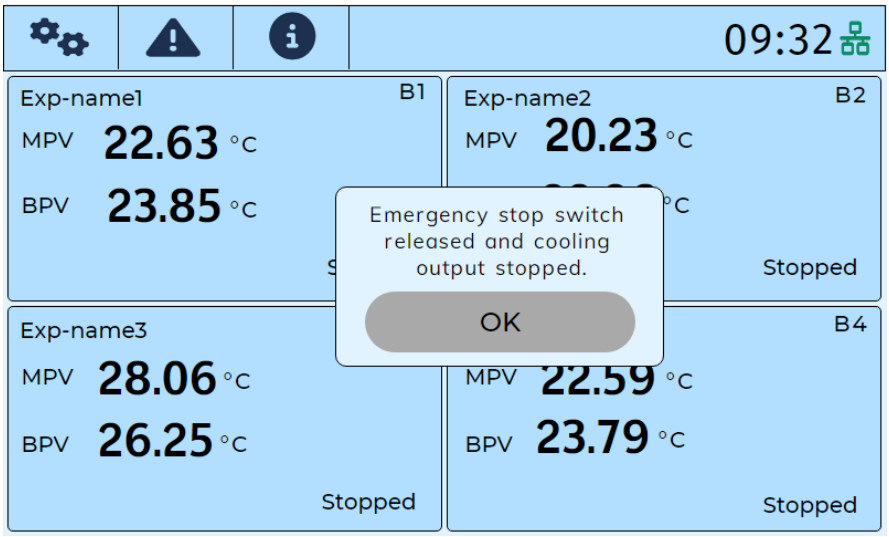


9.4 If experiments are not run in any of the block, if chiller temperature is not within the specified range and if user presses emergency stop switch, then it will be activated but cooling output will not be enabled. A pop up message will come on main screen as "**Emergency stop switch activated. Cooling will not be enabled because chiller temperature is out of range, experiment cannot be started**"



9.5 If the emergency stop switch is released then popup message will come on main screen as

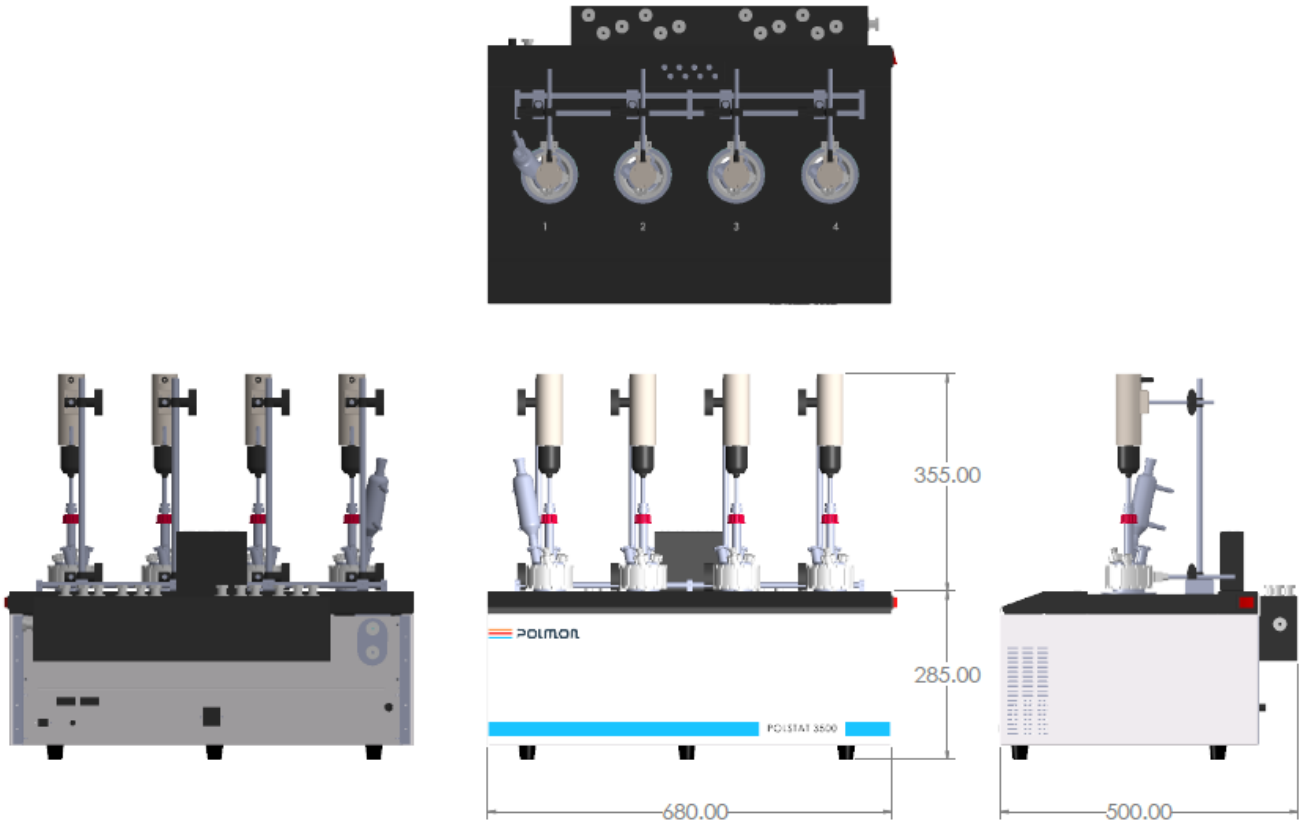
"**Emergency stop switch released and cooling output stopped**", shown in below image



10. ERROR CODES

Error codes	Description
Err0	Sensor is not connected to POLSTAT3500
Err1	Power is ON
Err3	ADC malfunction
Err4	Power is OFF
Err13	Internal error

11. PRODUCT DIMENSIONS



**All dimensions are in mm