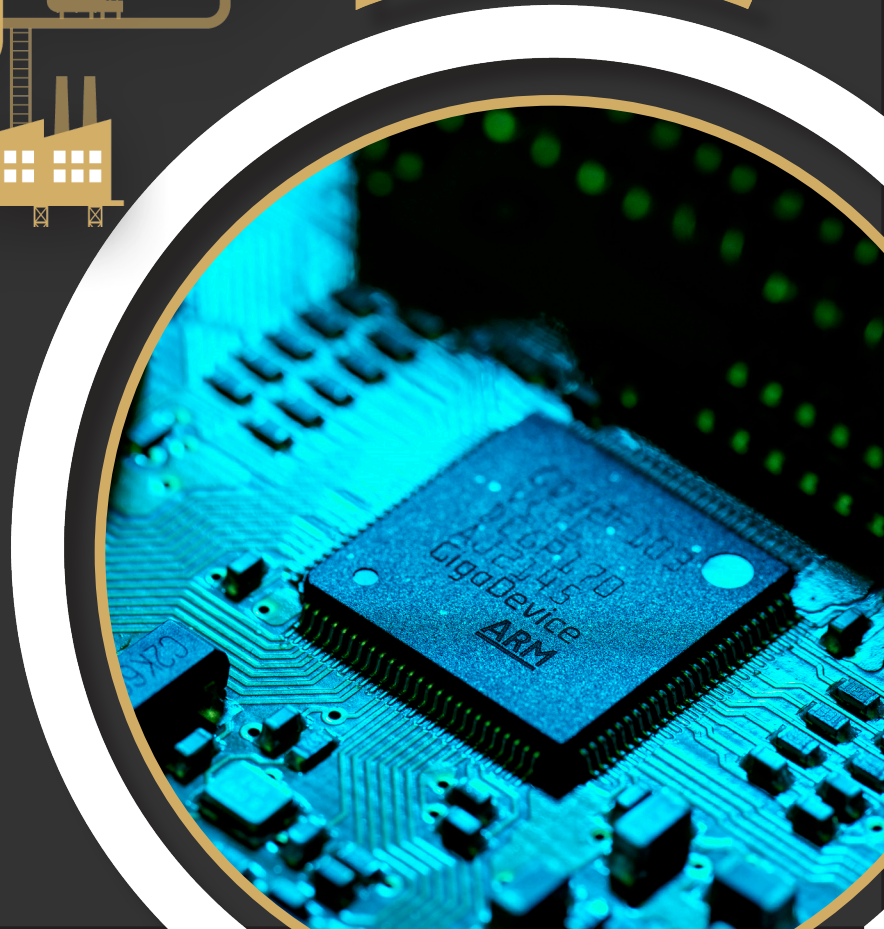
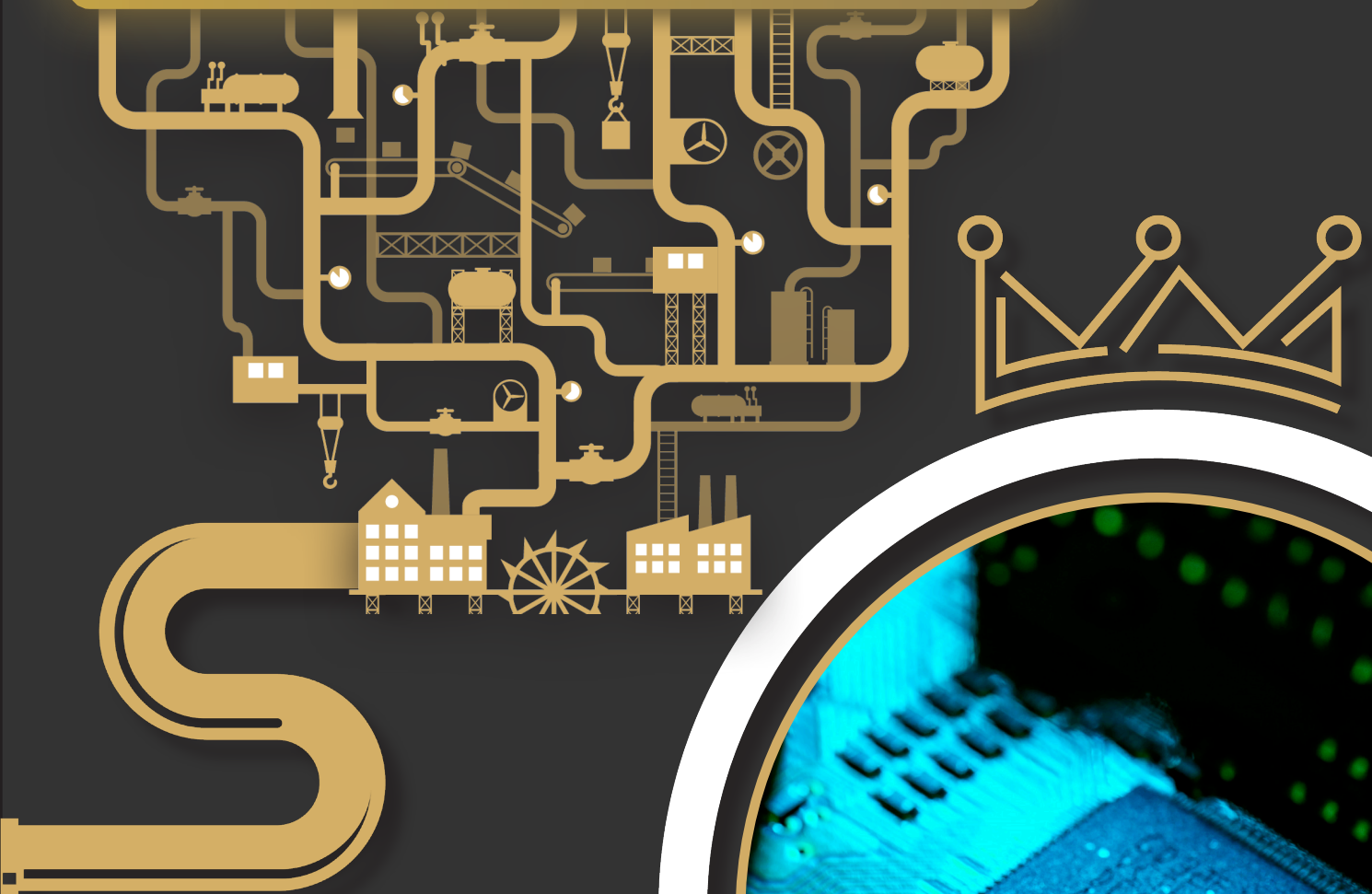


The attachment Booster pump controller

BPC-02





Congratulations on your selection and welcome to the largest automation family in Iran.

Before using this product, please take the time to carefully read this guide. Incorrect settings could potentially harm any devices connected to this product.

Please note that this guide may be subject to changes without prior notice, as we continuously strive to enhance system performance.

The primary purpose of this controller is to ensure the stability of fluid pressure through the sampling of fluid pressures and the application of preset parameters. This controller finds extensive application in water supply systems, particularly within building water supply systems.

Notably, one of the key advantages of this controller is its scalability. It accommodates an unlimited number of consumers and can be applied across any number of building floors for water supply purposes.

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In many urban areas, particularly on the upper floors of tall buildings, water pressure tends to be insufficient. To address this issue, a booster pump system has been meticulously designed and manufactured. These systems are professionally installed and commissioned by experts in the respective buildings.

The booster pump system comprises a reservoir that stores municipal water, serving as a buffer for the city's incoming water supply. This stored water is efficiently pumped into the building's plumbing system as needed, thanks to a set of pumps. Additionally, the system incorporates a pressurized tank, which holds a reserve of water to maintain consistent pressure within the pipes. It's worth noting that booster pumps equipped with a pressurized tank experience less wear and tear compared to those without one.

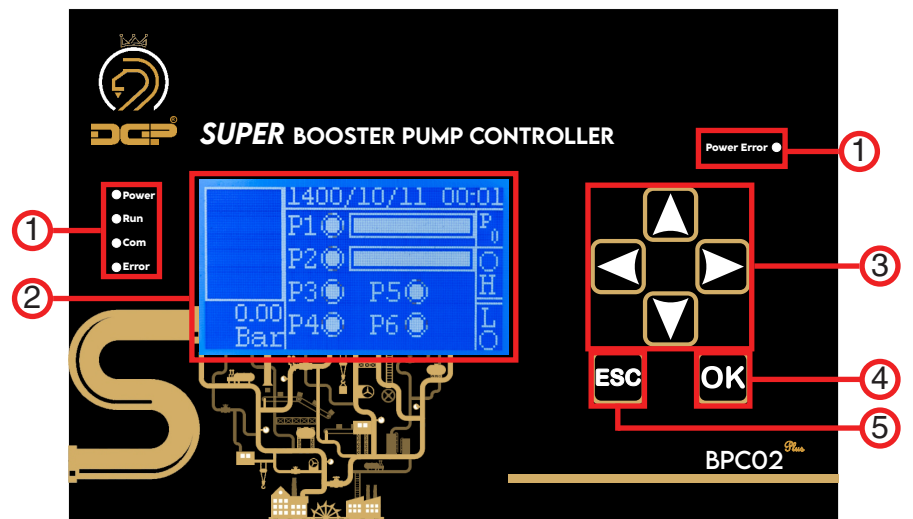
This water pumping station, known as the booster pump system, possesses the capability to generate and regulate water pressure within the building's plumbing. To initiate and optimize this water pressure control, the system relies on a controller. This controller is responsible for monitoring water pressure and adjusting the number of active pumps based on consumption and preset parameters. This guide provides a comprehensive overview of this controller's functionalities.

Key Features of this Controller:

- 1.Support for 3-phase and single-phase pumps: The controller can initiate both types of pumps.
- 2.LCD Screen Displaying City Power Waveform (R, S, T): The LCD screen provides real-time information on the city's power supply.
- 3.Internal Phase Control and External Phase Control Compatibility: The controller offers internal phase control and can be connected to an external phase control system.
- 4.Adjustable City Voltage and Sensitivity: Users can fine-tune high and low city voltage levels and sensitivity settings directly from the LCD interface.
- 5.Selectable Single-Phase or Three-Phase Operation: The device can be configured for either single-phase or three-phase operation.
- 6.On-Delay and Off-Delay Timers: Separate timers are available to manage pump activation and deactivation in the event of errors.
- 7.Protection Against Incorrect Phase Connections: The system safeguards against the accidental connection of two phases instead of a neutral connection.
- 8.Digital Display of Frequency and Voltage: The controller displays phase-to-phase and phase-to-neutral voltage and frequency digitally.
- 9.Pump and Float Status Display: It provides real-time status updates for pumps and floats, along with graphical pressure and drive frequency displays, date, and time information on the main screen.
- 10.Internal and External Float Integration: The controller includes an internal float and supports external float connections.
- 11.Float Delay Timers: Separate timers for float operation during errors are available, with adjustable sensitivity settings.
- 12.Three Operating Modes: Three modes cater to various preferences:
 - Mode 1: Control of up to 6 pumps with fixed speed.
 - Mode 1: Control of up to 4 pumps with fixed speed and 2 pumps with variable speed.
 - Mode 2: Control of up to 4 pumps with fixed speed and 1 pump with variable speed.
 - Mode 3: Control of up to 4 pumps with variable speed using just one drive.

13. **Internal Auto-Service:** The controller includes an internal auto-service feature.
14. **Variable Speed Pump Control via PID:** The system offers variable speed pump control through PID (Proportional-Integral-Derivative) algorithms with adjustable parameters.
15. **High-Resolution LCD:** Equipped with an 8000-pixel resolution LCD screen.
16. **RS-485 Network Connectivity:** It supports an RS-485 network for information display and device parameter adjustment.
17. **Multiple External Inputs:** Four separate inputs cater to external phase control, external float, emergency button, MAX Pressure input, and Pressure Switches.
18. **Pressure Sensor Compatibility:** The controller can connect to pressure sensors with various output types (4-20mA, 0-20mA, 0-5V, 0-10V, 2-10V).
19. **Calibration Capability:** It allows calibration of the displayed pressure value on the controller and the pressure gauge on the collector.
20. **Alarm and Fan Outputs:** Separate outputs are available for alarms and fans.
21. **24V DC Output:** Equipped with a 24V DC output with a maximum current of 100mA for sensor activation and command feedback.
22. **Dual Analog Outputs:** Two separate analog outputs for controlling two drives are provided.
23. **Change Over Feature:** Enables the operation of identical pumps (fixed speed or variable speed) as needed.
24. **Manual Startup:** You can manually start the system when needed.
25. **Error Alarm:** It activates an audible alarm (buzzer) to alert you in case of errors.
26. **Max Pressure Setting:** You can set maximum pressure to protect the connections.
27. **Start Frequency:** Define the start frequency to prevent initial pressure drops.
28. **Stop Frequency:** Define the stop frequency.
29. **Full Load Detection:** Detects collector inlet closure, pump suction/discharge closure, air entrainment in pumps, and collector outlet pipe bursts under full load conditions.
30. **Pump Timing:** Set the time for bringing a pump into or out of the circuit.
31. **Access Control:** Define user access levels and passwords for settings.
32. **Faulty Pump Detection:** It can detect and facilitate the replacement of faulty pumps.
33. **User-Removable Pumps:** Users can easily remove faulty pumps (Pump Service).
34. **Error History:** View all errors and their timestamps on the Error History page.
35. **BMS Compatibility:** Connect with the Building Management System (BMS).
36. **Network Communication:** Communicate via the RS-485 port.
37. **Programmable Pump Schedule:** Program pump activities throughout the week with up to six custom scenarios.
38. **Proven Track Record:** Successfully implemented in thousands of projects annually.
39. **Efficiency and Savings:** Used in over 80% of water supply projects, reducing energy consumption and maintenance costs.
40. **IP65 Compliance:** Meets IP65 standards for protection against dust and water.
41. **Extended Pump Lifespan:** Offers a significantly longer service life for pumps compared to similar models.
42. **Simplified Circuit:** Simplifies the control circuit.
43. **User-Friendly:** Offers easier usability compared to similar models.
44. **Warranty:** Includes a two-year warranty for peace of mind.

Introduction to the Controller's Front Panel:



1. Status Indicator LEDs: Strategically placed at the top, these LEDs provide a visual representation of the controller's current status.

| | |
|-------------|---------------------------------------------------------------------------------------------------------------------|
| Power | When the system power is connected, this LED will be on. |
| RUN | When the controller starts operating, this LED will be on. |
| Com | When the controller establishes communication with the 485-RS network, this LED will blink. |
| Error | If the controller encounters an error, this LED will be on. |
| Phase Error | If the controller is connected to 380 volts instead of 220 volts at the power supply terminal, this LED will be on. |

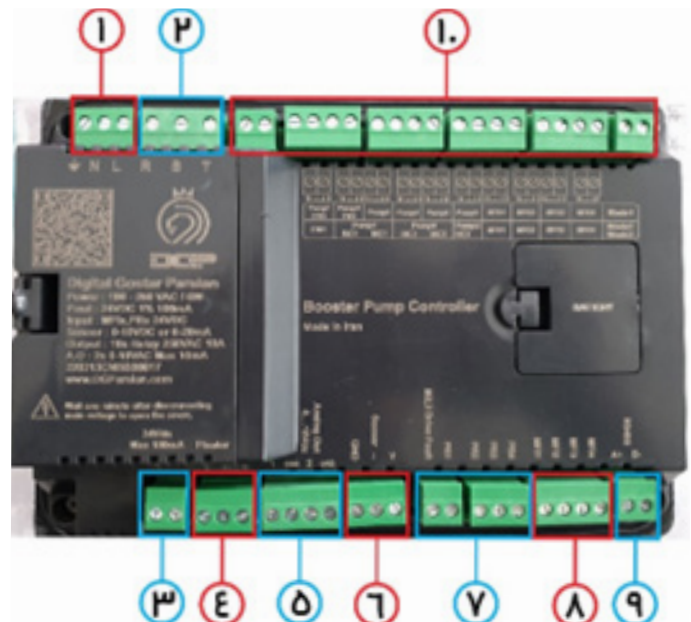
2. Controller Display: This screen serves as the central hub for monitoring and implementing changes within the controller, offering a user-friendly interface for interaction.

3. Directional Keys: Navigate seamlessly through menu pages and adjust values effortlessly with these intuitive keys.

4. ESC Key: A versatile tool, the ESC key allows users to revert to the previous menu with a simple click. For more advanced control, holding the key down for three seconds will halt the controller's operations.

5. OK Key: Securely save your data with a quick tap, or delve into the controller's menu by pressing and holding for three seconds—this key does it all.

Controller's Rear Panel Overview:



1. **Power Supply Input (L - N):** This is where you connect the power supply to the controller.
2. **Control Input Phase (T - S - R):** These terminals are designated for the control input phase connections.
3. **24V Output Power Supply (up to 100 mA max):** Provides a 24V output, suitable for low-power applications with a maximum current draw of 100 mA.
4. **Liquid Level Control (C=Com, H=High, L=Low):** Connect here for liquid level control, with terminals for common, high, and low.
5. **Two Analog Outputs (0-10V):** Designed for connecting to a drive, these outputs provide a variable signal ranging from 0-10V.
6. **Pressure Sensor Connection:**
Voltage Pressure Sensor: Connect to the V and GND terminals.
Current Pressure Sensor: Connect one end to 24+ and the other end to the I terminal. Remember to use a jumper between V and I for current pressure sensors.
7. **Feedback Returns:** This section helps in detecting faulty pumps, and ensuring proper functioning of the booster pump controller.
 - M2.3 Drive Fault: Drive fault relay in modes 2 and 3
 - PR1: NO/NC Contactor for direct pump one
 - PR2: NO/NC Contactor for direct pump two
 - PR3: NO/NC Contactor for direct pump three
 - PR4: NO/NC Contactor for direct pump four
8. **MFI Configurable Inputs:** Four inputs that can be customized based on requirements, with options including PS, MP, EMG, CP, FL, and PR.
9. **RS-485 Terminal:** Utilize this for network connections, enabling the display of controller data on an external screen according to the addressing table.
10. **Controller Outputs:** Here, you find the relay outputs of the controller. Their wiring depends on the operating mode you choose, and there are three modes available, each detailed below.

Operating Modes:

To initiate variable speed operation of the pumps, a drive is indispensable. These drives necessitate a 0-10V input to regulate the pump's speed. The booster pump controller boasts the capability to independently manage two drives, with the controller providing two analog outputs for this purpose.

Mode 1:

In Mode 1, the controller can activate up to six pumps. Among these six pumps, the first two can be set to variable speed mode, utilizing a drive, while the subsequent four pumps can be activated directly. It's important to note that in this mode, there is an option to forego the use of a drive if circumstances dictate.

Mode 2:

In Mode 2, the controller can activate a maximum of four pumps. Through the Off Changing feature, power consumption is evenly distributed among the pumps. In this mode, when the first pump reaches its maximum speed with the drive, the subsequent pumps are seamlessly integrated into the system without delay. In the event of a drive malfunction or if the drive is powered off in Mode 2, the controller will connect the pumps to the circuit via a fixed-speed contactor.

Mode 3:

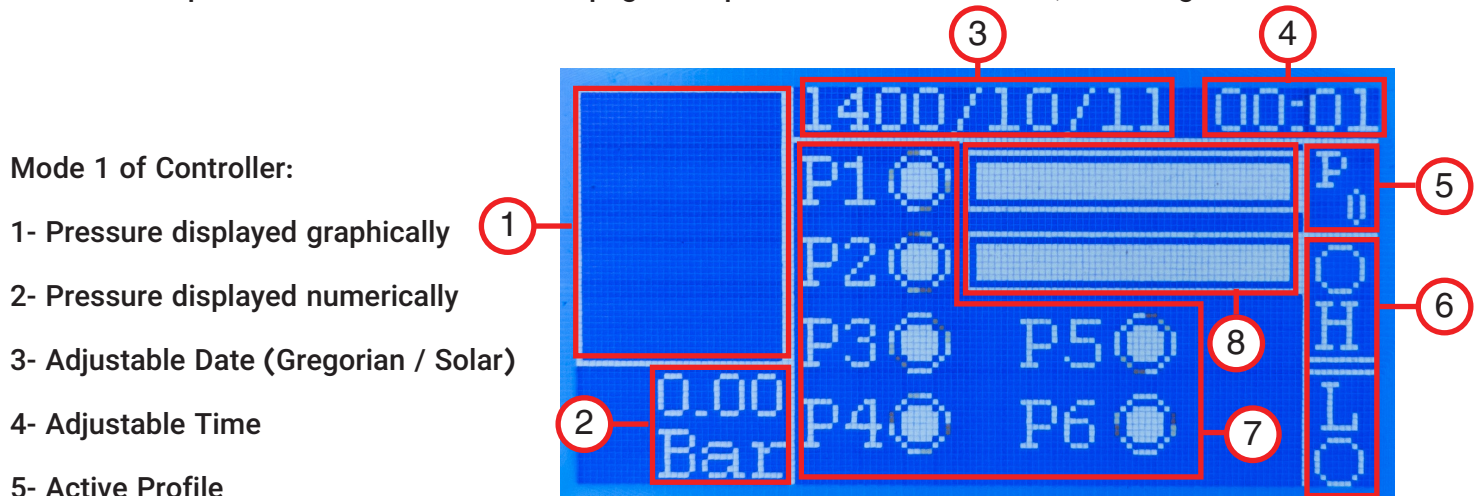
In Mode 3, the controller possesses the capability to activate a maximum of four pumps. Similar to Mode 2, the Off Changing feature is employed to equitably distribute power consumption among these pumps. In this specific mode, when the first pump attains its maximum speed with the drive, it disengages from the drive and connects directly to the mains electricity supply. Subsequently, the next pump is initiated with the drive. Mode 3 is intentionally designed to enable all pumps to integrate into the system with just one drive. This mode proves particularly advantageous for heavy-duty pumps, offering potential cost savings.

When you opt for Mode 3, you will notice an option for pumps exceeding 7.5 kilowatts. If your pumps have a power rating above 7.5 kilowatts, it is advisable to enable this option. By doing so, even in the event of a drive malfunction or disconnection from the circuit, your heavy pumps will not rely on direct contactors for integration. However, if your pumps have a power rating below 7.5 kilowatts, you have the flexibility to disable this option. In such a scenario, with the option unchecked, your pumps will seamlessly enter the circuit directly in the event of a pressure drop caused by a drive fault or disconnection.

Menus

Home Page:

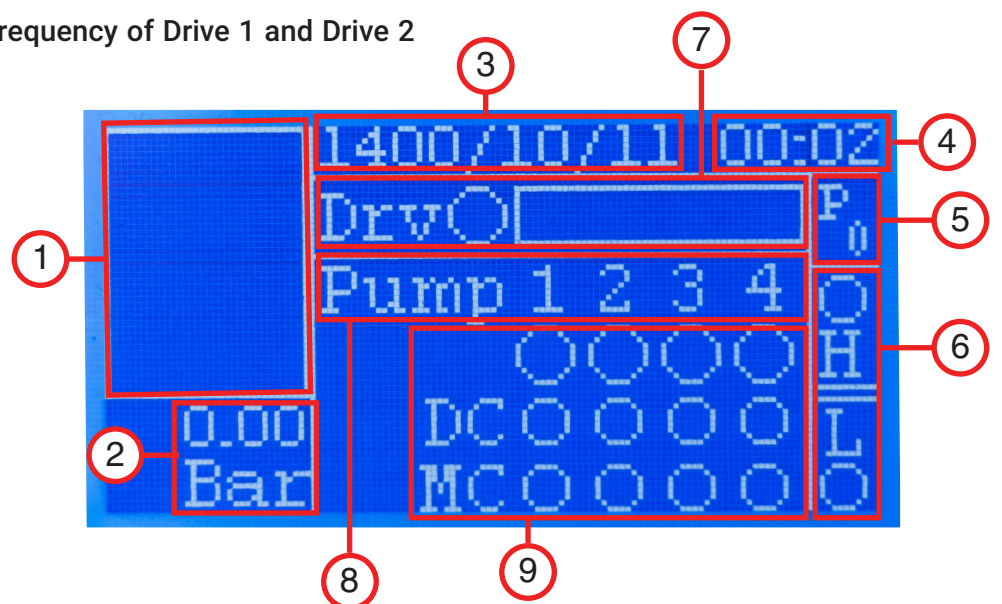
The home page of the controller displays parameters measured by the controller, providing insight into the controller's operational trends. The home page comprises different sections, including:



6- Electrode status inside the tank (L=LOW, H=HIGH)

7- Number of pumps used in Mode 1

8- Graphical representation of the frequency of Drive 1 and Drive 2



Modes 2 and 3 of Controller:

1- Pressure displayed graphically

2- Pressure displayed numerically

3- Adjustable Date (Gregorian / Solar)

4- Adjustable Time

5- Active Profile

6- Electrode status inside the tank (L=LOW, H=HIGH)

7- Graphical representation of the drive frequency

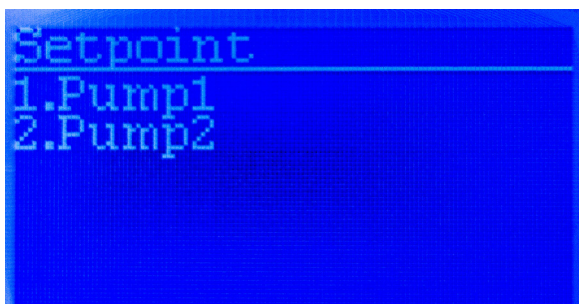
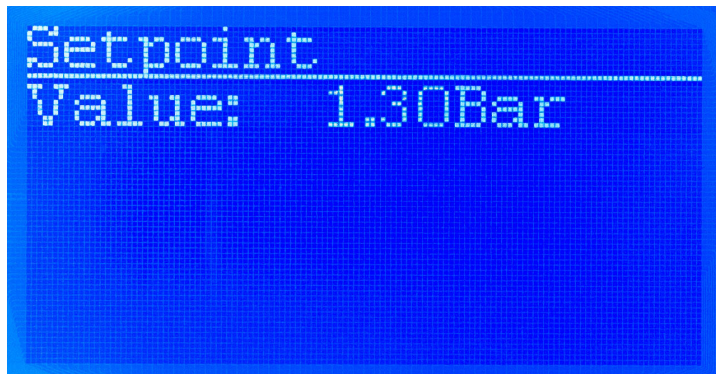
8- Pumps configured for Modes 2 and 3

9- Display of pump activity with Drive Contactor or Main Contactor

Up Button:

Explanation: When the controller is in PID mode, pressing the Up button allows access to the SetPoint menu. In the SetPoint menu, the number of SetPoints can be adjusted by selecting the Value option and using the directional buttons (up or down) to set the desired pressure. In On/Off mode, SetPoint settings

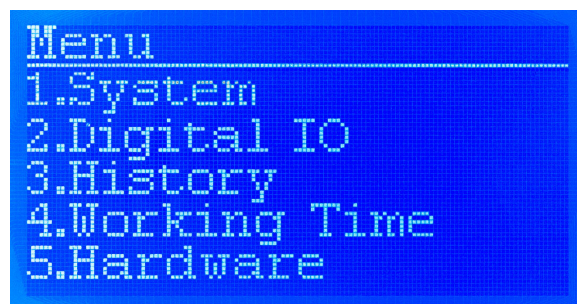
should be configured individually for each pump. to control 2 pumps in On/Off mode, settings related to pressure, cut-off, and connection times must be adjusted for each pump.



Introduction to the Controller's Main Menus:

Booster Pump Controller – Main Menu

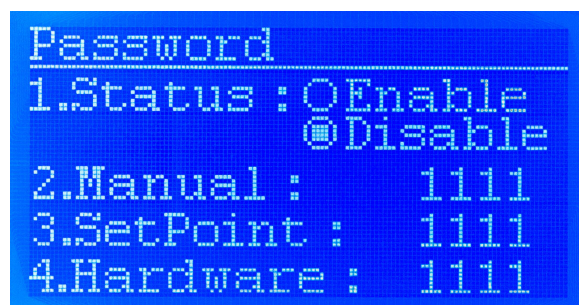
Upon accessing the main page, hold the OK button for 3 seconds to enter the controller menu, as shown in the image below.



Main Menu – System – Password

When you select "Password" in the System menu, the following page is presented:

- 1.Status: Active/Inactive
- 2.Set Password for Manual Page
- 3.Set Password for SetPoint Page
- 4.Set Password for Hardware Page

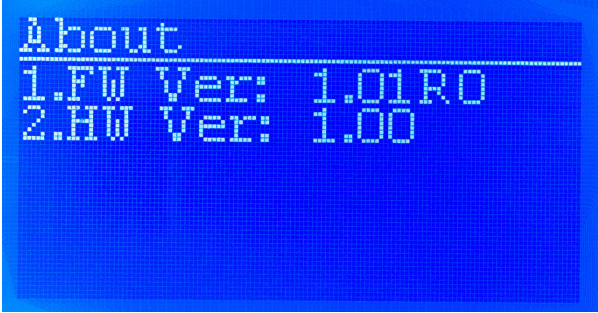


Description: By choosing the "Enable" option, the controller will prompt you for the default password (which is 1111). Once you confirm whether the password is active or inactive, you can establish separate custom passwords for the SetPoint, Manual, and Hardware sections. To do so, create your desired password using the arrow keys, press OK, and exit the page to save the new password. Please remember the password, as once confirmed and exited, it will be stored.

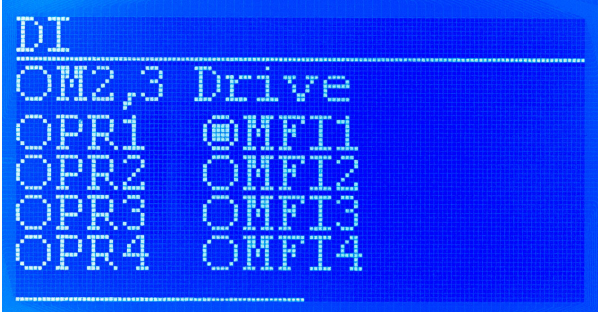
Main Menu – System – Timing

Description:

- 1.Scan Time: The duration during which the controller reads inputs, processes logic, and updates outputs (not user-adjustable).
- 2.On-Time: Indicates the controller’s active duration.



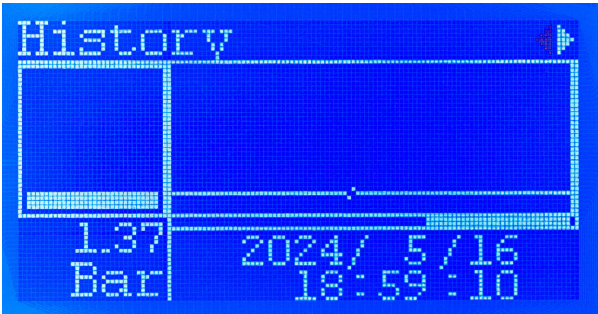
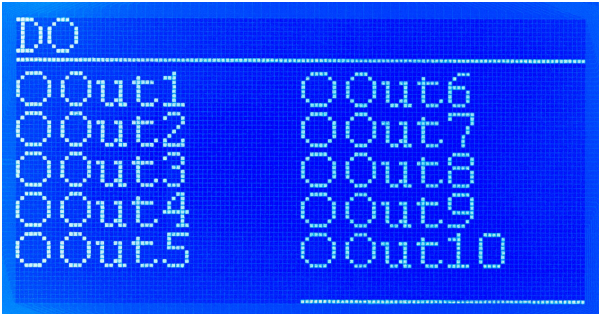
- Main Menu – System – About**
- 1.FW Ver.: Firmware Version
 - 2.HW Ver.: Hardware Version



- Main Menu – Digital I/O – Page One – Digital Input**
- Description: In this section, you can test the system’s inputs by triggering them, helping to identify any wiring issues. Refer to sections 7 and 8 on pages 19 and 20 for information on available inputs.

Main Menu – Digital I/O – Page Two – Digital Output

Description: On this page, you can monitor the status of digital outputs, determining whether they are active or inactive. Outputs 1 to 6 are associated with the pumps, while outputs 7 to 10 relate to the MFOs. Refer to sections 7 and 8 on pages 20 and 21 for details on available outputs.



- Main Menu – History**
- Description: In this section, you can access the pressure graph. Use the OK button in combination with the left and right keys to navigate the graph horizontally. This page displays pressure numerically and provides the date and time corresponding to the displayed pressure.

Main Menu – Working Time

Operation Description: Displays the working duration of each pump.

| Working Time | | |
|--------------|-----|-------|
| P1 : | 16: | 52:58 |
| P2 : | 13: | 24: 8 |
| P3 : | 0: | 0: 0 |
| P4 : | 0: | 0:29 |
| P5 : | 0: | 0: 0 |
| P6 : | 0: | 0: 0 |

Main Menu – Hardware

| Hardware | |
|----------|---------------|
| 1. | Control Phase |
| 2. | Floater |
| 3. | Sensor |
| 4. | Control |
| 5. | PID |

| Hardware | |
|----------|------------------|
| 6. | MFx |
| 7. | Serial Number |
| 8. | Network |
| 9. | Profile |
| 10. | Reset to Factory |

| Control Phase | |
|---------------|-----------------------------------------------------------------------------------------------------------------------|
| 1. | Status : <input checked="" type="radio"/> Disable <input type="radio"/> Internal <input type="radio"/> External |
| 2. | Type : <input checked="" type="radio"/> 1P <input type="radio"/> 3P |

Main Menu – Hardware – First Page – Phase Control – First Page

- 1.Phase Control Status:
- Deactivate system phase control
 - Utilize internal phase control of the controller
 - Employ external phase control
- 2.Type of Phase Control
- Single phase
- Three phase

Main Menu – Hardware – First Page – Sensor – First Page

- 1.Type of Pressure Sensor:
- Pressure Switch
 - Pressure Transmitter
 - RS-485
- 2.Register the minimum pressure measurable by the sensor
- 3.Register the maximum pressure measurable by the sensor
- (Note: Depending on the sensor type, you need to configure items 1 to 3.)

| Sensor | |
|--------|-------------------------------------------------------------------------------------------------------|
| 1. | Type : <input type="radio"/> PS <input checked="" type="radio"/> PT <input type="radio"/> RS485 |
| 2. | Min : 0.0Bar |
| 3. | Max : 10.0Bar |

Operation Description:

- 1.A difference exists between the Max Pressure and SetPoint.
- 2.Calibration: If there's any variation between the pressure displayed by the controller and the gauge on the collector, you can eliminate this difference through the calibration option.

```
Sensor      1.45Bar
5.Limit Diff:2.00Bar
6.Calib :    1.00
```

```
Sleep
1.Frq :      30.00Hz
2.Gap :      0.30Bar
3.Delay :    1Sec
4.Ramp Down : 2Sec
5.Finish Diff:0.5Bar
```

Main Menu – Hardware – First Page – Control – Sixth Page – Sleep

- 1.Set Sleep Frequency: Frq.
- 2.Gap: Pressure oscillation range from SetPoint
- 3.Delay: Set the delay time for Sleep mode execution
- 4.Ramp Down: Shutdown time of the system from Sleep frequency to zero frequency
- 5.Finish Diff: After meeting the Sleep process requirements, the controller increases the pressure to Set Point + Finish Diff and then initiates the pump shutdown.

Operation Description:

(The Start frequency is explained in the next paragraph)

Executing Sleep with four conditions:

- 1.The presence of an active pump in the system
- 2.Reaching the minimum frequency for pressure generation by the pump and achieving the Set Point
- 3.Pressure changes in the collector being less than the Gap value
- 4.Expiry of the Off Delay timer

Gap: One of the conditions for Sleep involves the Gap option. If pressure fluctuations around your SetPoint are lower than the specified Gap value, the controller initiates Sleep. Set the Gap to 0.2 bar.

Delay: Once the Sleep conditions are met, the controller activates Sleep after the specified Delay time.

Sleep frequency = Start frequency + 2Hz

Main Menu – Hardware – Page One – Control – Page Nine – Reserve Automatic

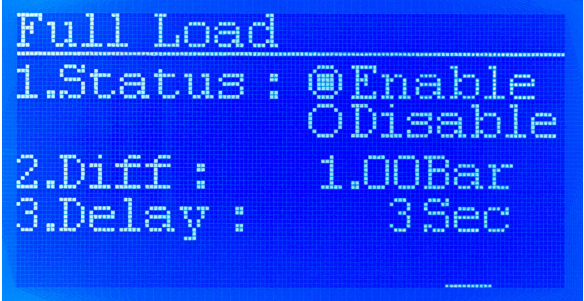
- 1.Status: Allows you to enable or disable automatic reserve functionality.
- 2.Type: Specifies the type of contact used.
- 3.PRx Delay: Sets the maximum time for activation of the PR input.

```
Reserve Automatic
1.Status : @Enable
           ODisable
2.Type :   @NO
           ONC
3.PRx Delay : 2.0Sec
```

Operation Description: The booster pump controller possesses a feature that can detect malfunctioning pumps. You can activate this option to enable automatic reserve functionality. When activated, a backup pump takes over if a pump malfunctions and an error related to the faulty pump is displayed. In the Type option, you can define the return contact type for the contactor. If you're using the normally closed (NC) blade of the contactor, set it to NC, but if you're using the normally open (NO) blade, set it to NO. It's advisable to use the NO blade.

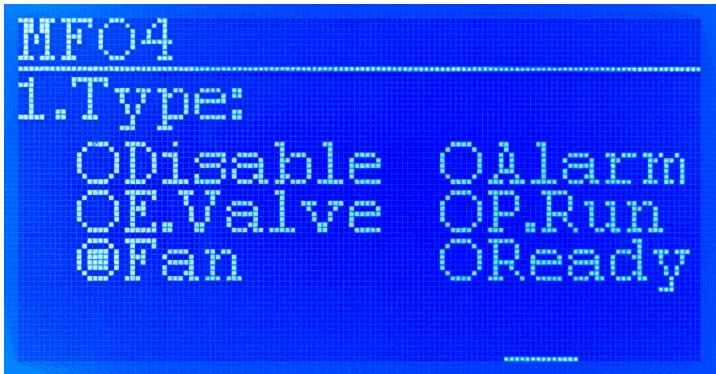
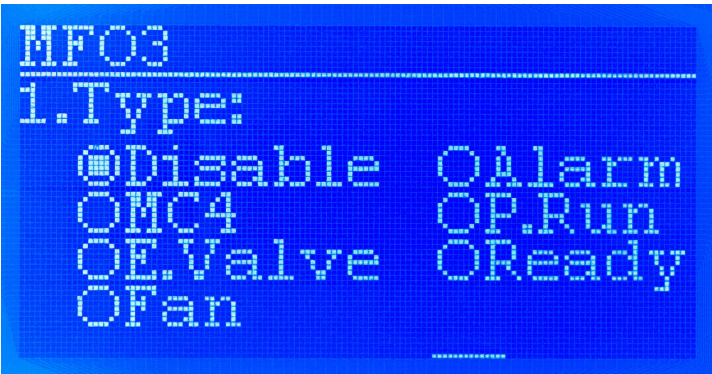
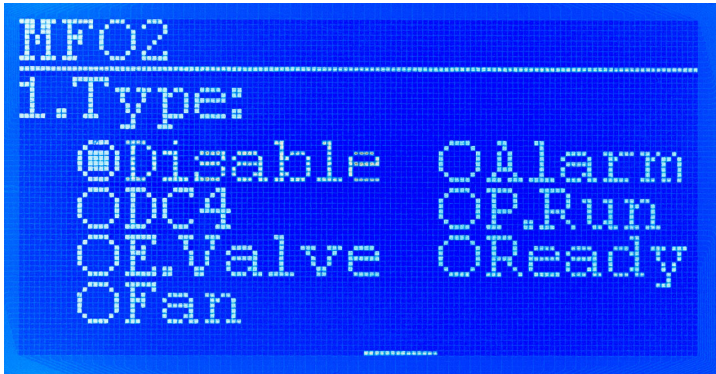
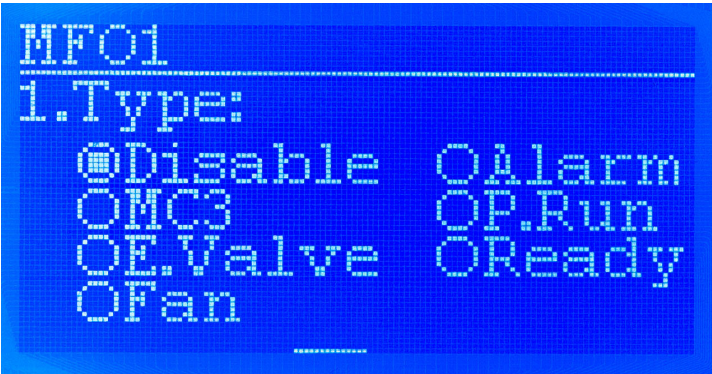
Main Menu – Hardware – Page One – Control – Page Ten
– Full Load

- 1.Status: Allows you to activate or deactivate Full Load protection.
- 2.Diff: Adjusts the protective pressure difference, which is the difference between the SetPoint pressure and the maximum operating pressure for Full Load.
- 3.Delay: Sets the delay duration for Full Load operation.



Operation Description: Activating Full Load is an effective pump protection mechanism that prevents pump damage. Full Load is triggered when pumps draw in air, experience reverse rotation, encounter closed suction lines or water storage tanks, or when there’s no water in the storage tank. When Full Load is active, you can configure a protective pressure difference in the Diff option. If the last pump in the system reaches its maximum rotation, and the momentary pressure difference, along with the SetPoint pressure, exceeds the Diff value after the time specified in Delay, the controller will shut down the system. It is recommended to set Diff to 1.5 bar and the Delay time to 40 seconds.

Main Menu – Hardware – Page Two – MFx – Pages Five to Eight (MFO)



Operation Description: The multi-function outputs (MFOs) are versatile relay outputs that can be configured for various purposes, such as controlling fans, triggering alarms, or, in Mode 3 with three or four pumps, serving as power network contractors for specific pumps (e.g., MC3(3)), and in the case of four pumps, as drive contractors for a designated pump (e.g., DC4(4)) and power network contractors for another pump (e.g., MC4(4)).

This controller offers four configurable MFOs that can be customized based on your specific requirements:

MC: Setting the MFO to MC allows control over motor power contactors.

DC: Setting the MFO to DC provides control over motor drive contactors.

Fan: Configuring the MFO as Fan activates the output concurrently with turning on the drive.

Alarm: Setting the MFO to Alarm triggers the output when the controller detects an error.

E.Valve: When auto service is activated, the MFO set to E.Valve (electric valve) becomes active.

Ready: This output is activated when the controller is in active mode.

To receive status feedback from the drive, a wire from the drive's Ready relay is connected to the controller, allowing the system to be stopped in case of drive failure. Two connection modes are available for linking the Ready relay to the controller:

Mode 1: In projects utilizing Mode 1, connect the drive's Ready relay to PR1. For systems with two drives, connect the second drive to PR2.

Mode 2: In projects using Mode 2 or 3, connect the drive's Ready relay to the terminal M2.3 Drive Fault.

P. Run: This output becomes active when the first pump is turned on.

```
AO1
1.Type:
  @Drive 1 Frq
  ODrive 2 Frq
2.Calibration:1.000
```

Main Menu – Hardware – Page 2 – MFx – Pages 9 and 10 (AO):

1.Type: Select the drive

Drive 1

Drive 2

2.Calibration: Adjust the drive's frequency calibration

Operation Description: The drive requires an analog input for control, which should come from the controller's analog output (which includes two analog outputs). Consequently, this controller (BPC02) can control up to two drives. In case the first analog experiences issues, you can activate the second analog and reconfigure it to AO2 to resolve system problems. To calibrate the frequency displayed by the controller and the drive's frequency shown on the keypad, divide the controller's frequency by the drive's frequency and input the result in this section.

```
AO2
1.Type:
  ODrive 1 Frq
  @Drive 2 Frq
2.Calibration:1.000
```

```
Network
1.Address : 1
2.Dir : @Master
      OSlave
3.Protocol : @ASCII
            ORTU
```

Main Menu – Hardware – Page 2 – Network – Page 1:

1.Address: Set the controller's address

2.Dir:

•Master

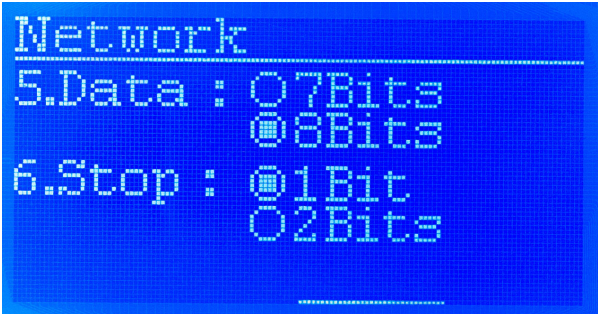
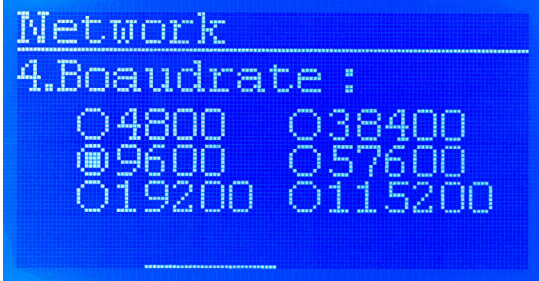
•Slave

3.Protocol:

•ASCII

•RTU

Baudrate: This setting controls the speed at which data is transmitted during communication.



Data Length:

- 7 Bits
- 8 Bits

Number of Stop Bits:

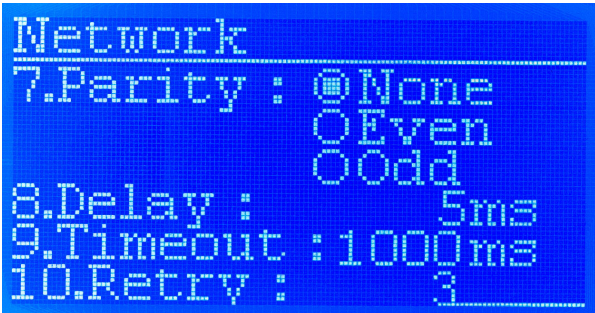
- 1 Bit
- 2 Bits

Parity:

- None
- Even
- Odd

Delay: Use this setting to establish a time delay between sending requests.

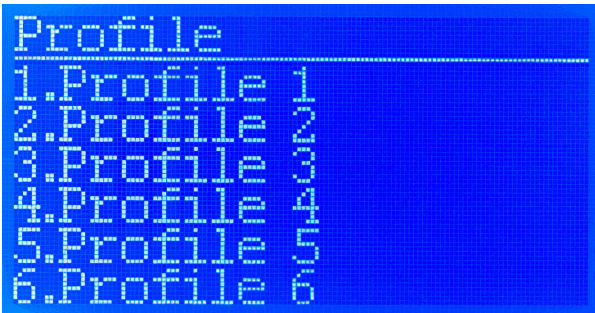
Timeout: This parameter determines the maximum waiting time for receiving a response.



Retry: Set the number of times to resend the request.

Operation Explanation: When making requests, they are sent at intervals defined by the Delay setting. If the Master does not receive a response within the Timeout period, it will automatically resend the request. If there is still no response after the specified number of retry attempts set in Retry, the request-sending process will be halted.

Operation Description: On the Profile page, you can create up to six custom scenarios for operating pumps based on specific timing parameters set for each scenario. It's important to note that Profile 1 holds the highest priority, while Profile 6 has the lowest. For example, if both the third and fifth profiles are active and a timing conflict arises, the third profile takes precedence due to its higher priority. If none of these profiles are active, P0 (the main system profile) becomes active.



```

Profile 1
☒Enable
☒Sat☒Mon☐Wed☐Fri
☒Sun☐Tue☐Thu
1.Start:      18:14
2.Duration:   0:10

```

Main Menu - Hardware - Page Two - Profile - Profile 1-6

First Page – Settings

Operation Description: When you check the "Enable" box for a Profile, it becomes active. On this page, you can create your desired scenario. To select specific days of the week, simply check the corresponding boxes. In the "Start" section, specify the time when the controller should commence its activity, and in the "Duration" section, set the length of time the controller will remain active.

```

Profile 1 Setting
Sys Status: @Stop
              ORun

```

Main Menu -Hardware - Page Two - Profile 1-1 - Profile

Second Page – Settings

System Status:

- Deactivate the controller

- Activate the controller in Run mode with the SetPoint and Sleep Frequency (Sleep Frq) settings

Operation Description: If you select "Stop," the controller will be deactivated during the specified time interval within the related profile. On the other hand, if you choose "Run," the controller will operate the system during the specified timing within the related profile, following the settings for SetPoint and Sleep Frequency (Sleep Frq) in the Run section. In Run mode, you have the flexibility to enable or disable both the SetPoint and Sleep Frequency settings as needed.

```

Profile 1 Setting
Sys Status: OStop
              @Run
☒Stpoint:  1.80Bar
☒Slep Frq: 26.00Hz

```


Note

[illegible]

Note

[illegible]

Note

[illegible]



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