



A Geno Technology, Inc. (USA) brand name

Dispensing Peristaltic Pump, Individually Controlled

Cat. No. BT3214, BT3215, and BT3216

Thanks for choosing the BT Lab Systems **Dispensing Peristaltic Pump, Individually Controlled**. This operational manual describes the function and operation of the instrument. To ensure proper use and to avoid serious injuries, please read this manual carefully before operating the instrument.

PERISTALTIC PUMP PRECAUTIONS

- The hose may crack due to wear, which can result in liquid leaking and cause harm to the human body and equipment. Therefore, checking the hose regularly and replacing it when necessary is essential.
- Do not touch the pump rollers or rotor while the pump is running.
- If the peristaltic pump is not working, loosen the pressure block of the hose or remove it to prevent plastic deformation and inner wall adhesion, which can block the hose and reduce its service life.
- Keep the roller of the pump head clean and dry to avoid accelerating wear and shortening the service life of the hose, which can lead to premature damage to the roller.
- Some pump heads and drive surfaces are not resistant to organic solvents and highly corrosive liquids. Take special care when using them.
- When maintenance or repair is needed, please turn off the power and unplug the unit.
- As the peristaltic pump has a metal shell, ensure that the ground wire of the power cord is reliably grounded before use to prevent leakage accidents.
- When installing an external control device, please turn off the driver power.
- If maintenance is required, remove the power cord from the device and wait at least one minute before conducting any maintenance operations.
- Before using the pump, ensure the power line has reliable grounding to guarantee personnel safety in humid environments.
- Shutdown Immediately if:
 - Liquid contacts internal electronics.
 - Abnormal noise, smell, or overheating occurs.
 - The unit requires repair or inspection.

Maintenance and repair should be performed by qualified technicians or returned to the manufacturer.

INTRODUCTION

BT Lab Systems' Dispensing Peristaltic Pump, Individually Controlled, utilizes a multi-spindle design that allows each channel to operate independently. Unlike conventional multi-channel peristaltic pumps that share a single drive shaft, each channel on this unit features independent operation, parameter settings, and calibration, reducing channel-to-channel flow variation to within 1%.

KEY FEATURES

- 800 × 480, 5-inch high-definition touchscreen that provides an intuitive interface for quick parameter configuration and operation
- Available as 2-channel, 3-channel, and 4-channel models
- Independent operation, parameter settings, and calibration for each channel
- Online adjustment of flow rate or motor speed during operation
- Real-time display of operating parameters for each channel
- Automatic display of the maximum allowable flow rate based on tubing size
- USB/RS485 communication, external control and foot switch compatibility
- Power-loss memory automatically restores the previous operating state after power is restored

TECHNICAL SPECIFICATIONS

Parameter	Specification		
Model	BT3214	BT3215	BT3216
Number of Channels	2	3	4
Operating Modes	Flow Rate, Volume/Time, Volume/Rate, Time/Rate		
Display	5-inch 800 x 480 HD Touchscreen		
Languages	English / Chinese		
Speed Range	0.1 – 150 rpm		
Speed resolution	0.01 rpm		
Tubing ID	≤3.17 mm		
Tubing Wall Thickness	0.76–1.0 mm		
Flow Range (per channel)	0.2 µL/min – 48 mL/min (water)		
Volume Range	0.1 µL – 9999.999 L		
Time Range	0.1 sec – 999.9 hr		
Cycle Count	0–30,000 (0 = continuous loop)		
Back Angle	0–999°		
Number of Rollers	10		
Power Supply	AC 90–264 V, 50/60 Hz		
Operating Temperature	0 – 40°C		
Storage Temperature	-10 – 70°C		
Operating Humidity	≤80% RH at 25°C		
Storage Humidity	20–80% RH, non-condensing		
IP Rating	IP31		
Dimensions (L x D x H)	252.5 x 126 x 165 mm		

Optional Accessories

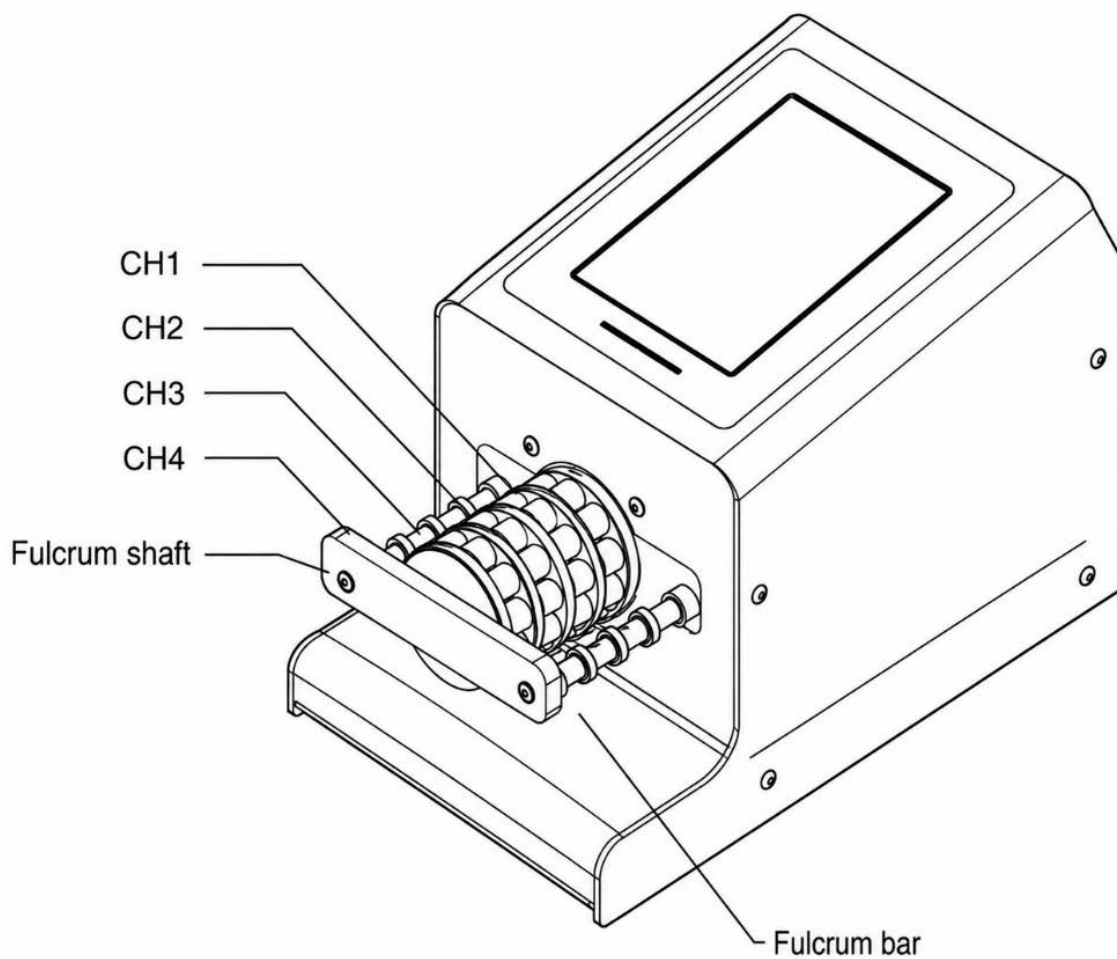
- Foot Switch
- USB-to-RS485 Communication Module
- Leak Detection Module

PRODUCT STRUCTURE

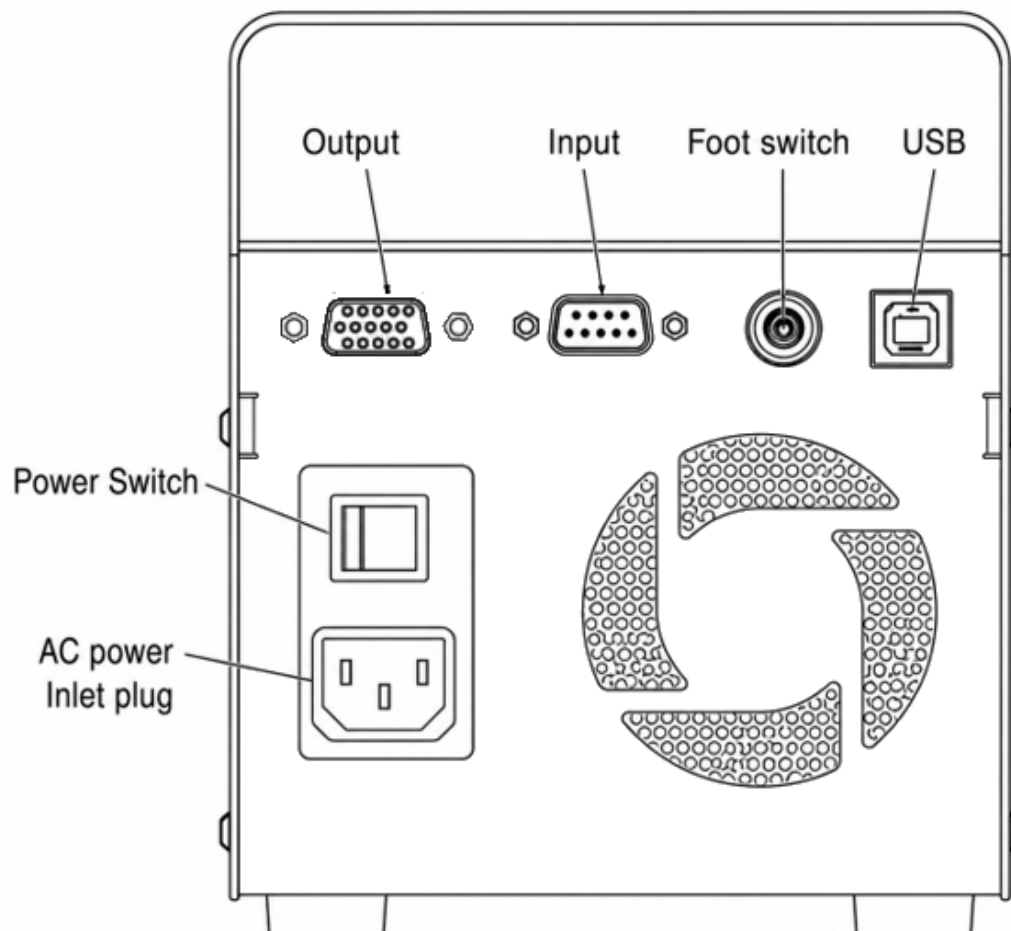
This BT Dispensing Peristaltic Pump Series is available in 2-channel, 3-channel, and 4-channel configurations. All models share the same overall design, with the only difference being the number of independently controlled pump channels.

Each pump channel is equipped with a 10-roller pump head, providing smooth fluid delivery and improved dispensing accuracy.

Overview



Rear Panel



EXTERNAL CONTROL INPUT (DB9)

The DB9 connector provides external control of each pump channel, allowing remote start/stop operation and communication via RS485. Refer to Table 1 for the pin definitions.

TABLE 1

Pin	Function	Description
1	Channel 1 Start Signal	External start/stop input for Channel 1
2	Channel 2 Start Signal	External start/stop input for Channel 2
3	Channel 3 Start Signal	External start/stop input for Channel 3
4	Channel 4 Start Signal	External start/stop input for Channel 4
5	GND	Signal ground
6	NC	Not connected
7	RS485-A	RS485 communication (A)
8	RS485-B	RS485 communication (B)
9	GND	Signal ground

External Start Signal Modes

Each channel can be configured to operate in one of three external control modes.

1. High-Level Trigger

A high-level input (5-24V) starts the pump.

Input Signal	Pump Status
High (5-24 V)	Running
Low (0 V)	Stopped

2. Low-Level Trigger

A low-level (0 V) input starts the pump.

Input Signal	Pump Status
Low (0 V)	Running
High (5-24 V)	Stopped

3. Pulse Trigger

Each received pulse toggles the operating state.

Pulse Received	Pump Action
First pulse	Start
Second pulse	Stop
Third pulse	Start
Fourth pulse	Stop

Only one external control mode (High-Level, Low-Level, or Pulse) can be active at a time. The desired control mode is selected from the System Settings menu.

EXTERNAL CONTROL OUTPUT (DB15)

The DB15 output interface provides real-time status outputs for each pump channel. Refer to Table 2 for the pin definitions.

TABLE 2

Pin	Signal	Description
1	CH1 Start/Stop Status	Outputs the operating status of Channel 1
2	CH1 Direction	Outputs the rotation direction of Channel 1
3	CH2 Start/Stop Status	Outputs the operating status of Channel 2
4	CH2 Direction	Outputs the rotation direction of Channel 2
5	CH3 Start/Stop Status	Outputs the operating status of Channel 3
6	CH3 Direction	Outputs the rotation direction of Channel 3
7	CH4 Start/Stop Status	Outputs the operating status of Channel 4
8	CH4 Direction	Outputs the rotation direction of Channel 4
9	GND	Signal ground
10-15	NC	No connection

Output Signal Definitions

The start/stop status output uses TTL-level signals to indicate whether a channel is operating.

Output Level	Channel Status
High	Running
Low	Stopped

Direction Status Output

The direction output uses TTL-level signals to indicate the motor rotation direction.

Output Level	Rotation Direction
High	Clockwise (CW)
Low	Counterclockwise (CCW)

PUMP HEAD CARD INSTALLATION

Install the tubing and pump head card as follows:

Step 1 – Install the Tubing

1. Insert one tubing stop into the left stop slot of the pump head card.
2. Straighten the tubing.
3. Insert the opposite tubing stop into the right stop slot.
4. Verify that the tubing is properly seated in the card before installation.

Step 2 – Install the Pump Head Card

1. Position the pump head card onto the fulcrum shaft of the desired channel.
2. Press the upper portion of the card toward the pump.
3. Ensure the fulcrum bar slot engages securely with the fulcrum bar until the card locks into place.

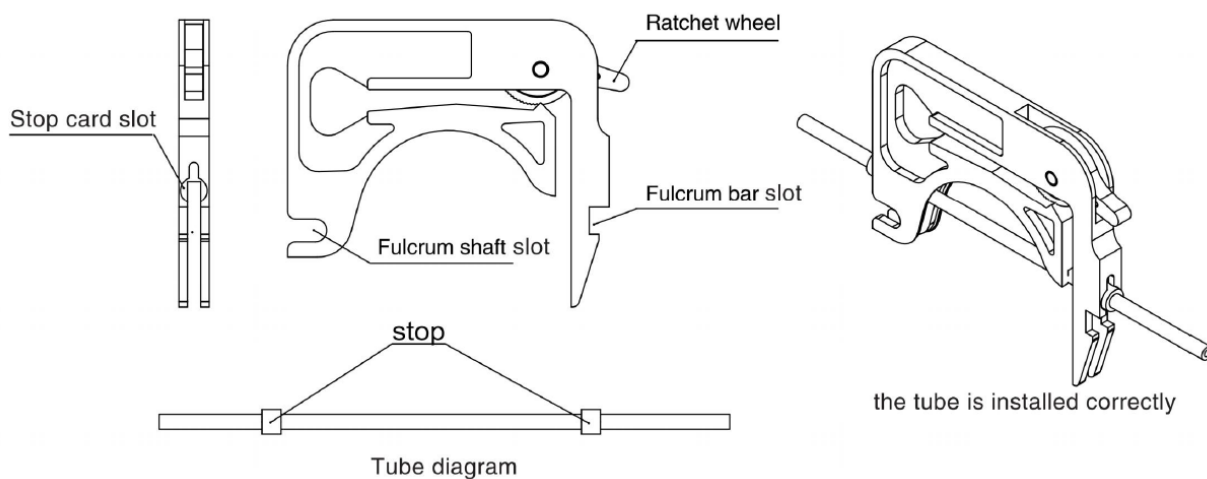
Step 3 – Install Additional Channels

Repeat the installation procedure for each remaining channel.

Step 4 – Adjust Tubing Compression

The ratchet wheel provides multiple compression positions to accommodate different tubing sizes.

Select the appropriate ratchet position to ensure proper tubing compression for the installed tubing specification.



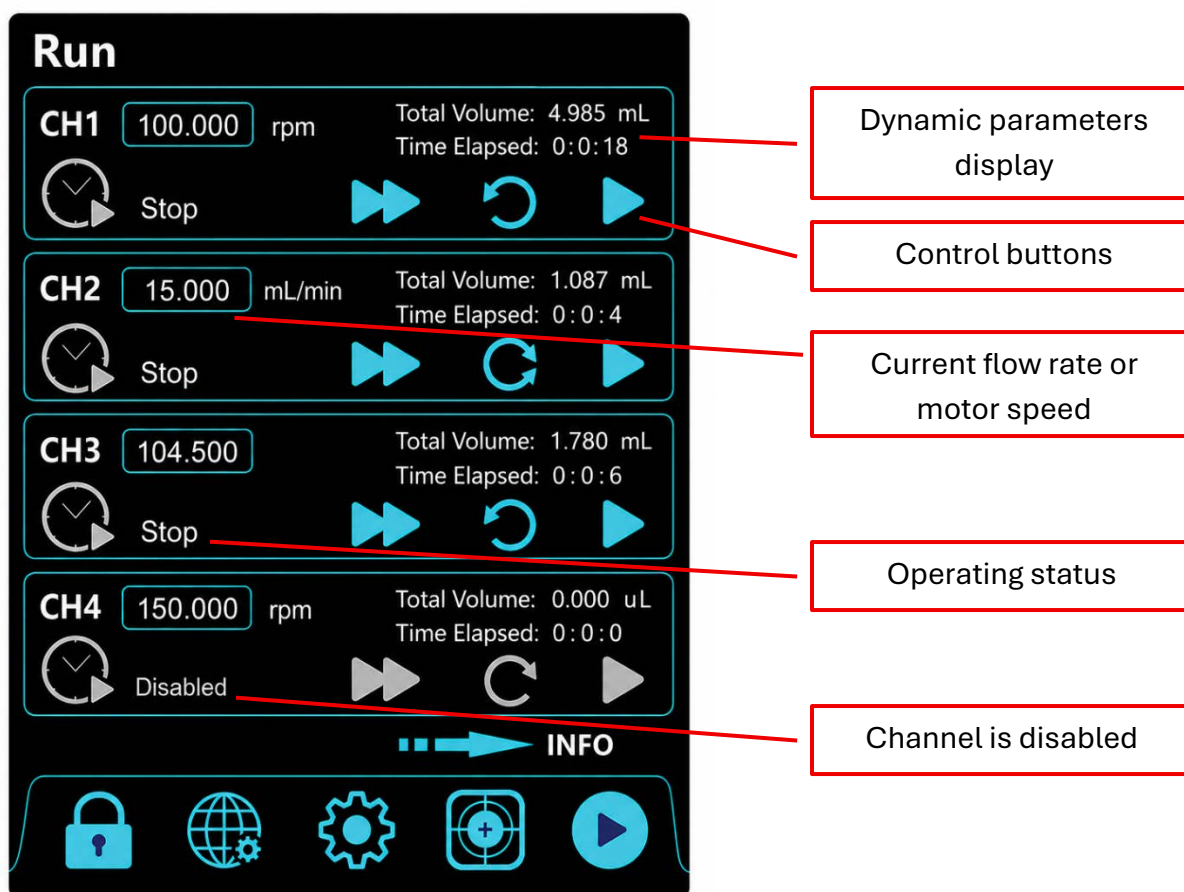
TOUCHSCREEN INTERFACE

The touchscreen provides access to all operating, monitoring, calibration, and system configuration functions.

After the pump is powered on, the system automatically enters the Run Interface, which serves as the primary operating screen.

Run Interface

The Run Interface displays the operating status of each channel independently.



Key Functions

Icon		Function
		Starts or stops the selected channel independently without affecting other channels.
		Changes the motor rotation direction between clockwise and counterclockwise.
		Runs the selected channel at 100 rpm for rapid tubing priming or emptying while maintaining the currently selected rotation direction.
		Opens the system setup interface.

	Opens the parameter settings for the selected channel. Each channel can be configured independently without affecting other channels.
	Opens the calibration interface for the selected channel. Calibration can be performed independently for each channel.
	Locks the touchscreen to prevent unintended operation. To unlock the screen, enter the user password.
 	Starts or stops all enabled channels simultaneously.
	Displays the detailed operating parameters for each channel.
	Pre-Start Delay Indicator

Operation During Pumping

During operation, each channel continues to function independently.

The operator can:

- Start or stop individual channels
- Change the rotation direction
- Activate full-speed operation
- Adjust parameters on channels that are not currently running
- Calibrate idle channels while other channels continue operating

This independent-channel design minimizes interruptions and allows multiple dispensing tasks to run simultaneously.

Online Flow Rate Adjustment

This pump series supports online flow rate adjustment, allowing the flow rate or motor speed to be modified while the pump is operating.

To adjust the value:

1. Select the highlighted flow rate or speed field.
2. Enter the desired value using the on-screen keypad.
3. Press **Enter** to save the new setting.

If the entered value exceeds the allowable operating range, the current value will remain unchanged.

Online adjustment is unavailable when:

- The channel is disabled.
- The channel is operating in **Volume/Time Mode**, where the flow rate is automatically calculated by the system.

Parameter Settings Interface

The Parameter Settings interface consists of two selection levels:

- **Channel Selection** – Select the channel (CH1–CH4) to configure.
- **Operating Mode Selection** – Select the desired operating mode for the selected channel.

Each channel is configured independently. Tubing specifications, operating mode, and all operating parameters are stored separately for each channel.

The screenshot displays the 'Parameter Settings' window. At the top, there are five tabs: 'Flow Rate', 'Vol/Rate with Pause' (selected), 'Vol/Time with Pause', 'Time/Rate with Pause', and 'Disabled'. Below the tabs, four channels (CH1, CH2, CH3, CH4) are listed on the left. CH1 is selected and highlighted in blue. To the right of the channel list, parameters are displayed for the selected channel: 'Tube I.D.' (2.00 mm), 'Back Angle' (0 °), 'Volume' (10.000 mL), 'Rate' (100.000 rpm), 'Interval' (5.0 Sec), and 'Cycle' (2). At the bottom left, summary statistics are shown: 'Max Rate: 150 rpm' and 'Max Flow Rate: 23.910 mL/min'. At the bottom right, there are two buttons: a red 'X' and a blue checkmark. To the right of the main interface, there are three columns of unit selection buttons: 'Rate Unit' (rpm, uL/min, mL/min, L/min), 'Volume Unit' (uL, mL, L), and 'Time Unit' (Sec, Min, Hour). The 'rpm' button is currently selected.

Selecting a Channel and Operating Mode

1. Select the desired channel (e.g., CH1). The selected channel is highlighted in blue.
2. Select the desired operating mode (e.g., Flow Rate Mode). The selected mode is highlighted in blue.
3. The parameters available for the selected operating mode are displayed.
4. Select a parameter field to edit its value.
5. After all parameters have been configured, select  to store the settings.

Channel Configuration

Each channel operates independently and can be configured with its own:

- Tubing specification
- Operating mode
- Flow rate
- Dispensing volume
- Dispensing time
- Cycle settings
- Interval time
- Calibration data

Changing the parameters of one channel does not affect any other channel.

Tubing Specification

Set the tubing inner diameter to match the tubing installed on each channel.

- Maximum tubing inner diameter: 3.17 mm
- The configured tubing size must match the actual tubing used.

Maximum Flow Rate

The maximum allowable flow rate depends on the selected tubing inner diameter.

When the tubing specification is changed, the maximum available flow rate is updated automatically.

The maximum motor speed is fixed at 150 rpm, regardless of tubing size.

The configured flow rate cannot exceed the maximum value displayed on the screen.

Operating Modes

Flow Rate Mode

In Flow Rate Mode, the selected channel operates continuously at the specified flow rate until it is stopped manually.

Volume/Rate Mode

In Volume/Rate Mode, the pump dispenses the programmed volume at the specified flow rate and then stops automatically. This mode also supports automatic cycling.

The following parameters can be configured:

- Dispensing volume
- Flow rate
- Interval time between cycles
- Number of cycles

When the cycle count is greater than 1, the pump pauses for the programmed interval after each dispensing cycle before automatically starting the next cycle.

When the programmed number of cycles has been completed, the operation ends automatically.

If the cycle count is set to 0, the pump operates continuously until manually stopped.

Volume/Time Mode

In Volume/Time Mode, the pump automatically calculates the required flow rate based on the programmed dispensing volume and dispensing time.

The pump stops automatically after dispensing the programmed volume within the specified time.

This mode also supports automatic cycling using the same cycle and interval settings as Volume/Rate Mode.

NOTE: The flow rate is calculated automatically in Volume/Time Mode and cannot be adjusted manually.

Time/Rate Mode

In Time/Rate Mode, the pump operates at the programmed flow rate for the specified running time.

When the programmed time has elapsed, the pump stops automatically.

This mode also supports automatic cycling using the same cycle and interval settings as Volume/Rate Mode.

Channel Disable

Unused channels can be disabled individually.

To disable a channel:

1. Select the desired channel.
2. Select Channel Disabled.
3. When the Disabled indicator changes from gray to blue, the function is enabled.
4. Select  to apply the setting.

When a channel is disabled:

- The channel cannot be started or stopped.
- Parameters cannot be edited.
- Calibration cannot be performed.
- All controls for the channel are grayed out on the Run Interface.

To re-enable the channel:

1. Select Disabled again.
2. The indicator changes from blue to gray.
3. Select  to save the setting.

The channel is now available for configuration and operation.

Unit Selection

The following units are available.

Flow Rate

- rpm
- $\mu\text{L}/\text{min}$
- mL/min
- L/min

Dispensing Volume

- μL
- mL
- L

Time

Applicable to dispensing time and cycle interval.

- Seconds (Sec)
- Minutes (min)
- Hours

Channel Information Interface

Press the  **INFO** key to view the current parameter settings for all channels.

- Select a channel to view or modify its parameter settings.
- Blue channel buttons indicate the channel is available for operation.
- Gray channel buttons indicate the channel is disabled and cannot be operated.
- Selecting a blue channel opens its Parameter Settings interface for modification.
- Press the **RUN**  key to return to the Run interface.

Channel Info

	CH1 >>>	CH2 >>>	CH3 >>>	CH4 >>>
Tube	I. D 2.00mm	I. D 1.00mm	I. D 2.00mm	I. D 2.40mm
Mode	flow Rate	Vol/Rate	Vol/Time	Disabled
Rate	15.000 mL/min	100.00 rpm	----- -----	----- -----
Volume	----- --	10.000 mL	500.000 mL	----- -----
Time	-----	-----	30.0 Min	-----
Interval	-----	5.0Sec	10.0Sec	-----
Cycles	-----	1	10	-----

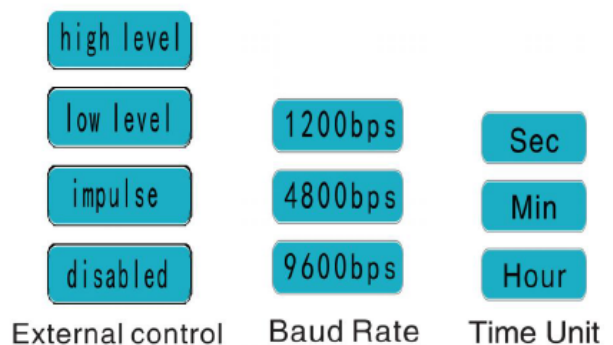
RUN 

System Setup Interface

The System Settings interface allows you to configure language, startup behavior, communication, external control, security, and other system parameters.



The screenshot shows a 'Settings' window with a dark background. At the top, there are red 'X' and blue checkmark icons. The 'Language' section has two toggle switches: 'CN' (gray) and 'EN' (orange). Below this, 'Power-up Running' is selected with a blue circle, while 'Audible Alarm After Leakage' and 'Continue to run After Leakage' are unselected with gray circles. The 'CommInterface' section has 'USB' (gray) and 'RS485' (orange) toggle switches. The 'Baud Rate' is set to '9600bps'. 'Pump Address' is '1'. 'External Start' is 'Disabled'. 'Password' is '1234'. There are four rows for prestart times: 'CH1Prestart Time' (0.0 Sec), 'CH2Prestart Time' (30.0 Sec), 'CH3Prestart Time' (1.0 Min), and 'CH4Prestart Time' (10.0 Min).



The legend shows three columns of blue buttons. The first column, 'External control', has buttons for 'high level', 'low level', 'impulse', and 'disabled'. The second column, 'Baud Rate', has buttons for '1200bps', '4800bps', and '9600bps'. The third column, 'Time Unit', has buttons for 'Sec', 'Min', and 'Hour'.

Language

Select the desired interface language.

Available languages:

- English
- Chinese

Power-Up Running

The Power-Up Running function determines whether the pump automatically resumes operation after power is restored.

- Enabled (Blue): If power is interrupted while the pump is running, the pump automatically resumes operation when power is restored.
- Disabled (Gray): The pump remains stopped after power is restored and must be started manually.

Leak Detection (Optional)

The following functions are available only when the optional Leak Detection Module is installed:

- Audible Alarm After Leakage – Sounds an alarm when a leak is detected.
- Continue Running After Leakage – Allows the pump to continue operating after a leak is detected.

Communication Interface

Select the communication interface used for external communication.

Available interfaces:

- USB
- RS485

Select the interface appropriate for your external control or communication system.

External Control

Configure the external control method used to start and stop the pump.

Available control methods include:

- External control input
- Foot switch
- Other supported external control modes

If external control is not required, select Disabled.

Password

The password is used to unlock the touchscreen after the screen lock has been activated.

- **Factory default password: 1234**
- The password can be changed by the user.

Pre-Start Delay

The Pre-Start Delay function allows a programmed delay before a channel begins dispensing.

After a channel is started, the system waits for the programmed delay time before the motor begins operating.

Calibration Interface

Each pump channel is calibrated independently to ensure accurate dispensing.

To access the Calibration interface, press  on the Run Interface.

Calibration Procedure

1. Select the channel to be calibrated. The selected channel is highlighted in blue.
2. Enter the desired Calibration Time.
 - o A calibration time of 1 minute or longer is recommended.
3. Prepare a graduated cylinder or other suitable measuring container.
4. Select  to begin the calibration.
5. The pump operates at the channel's current flow rate for the programmed calibration time and stops automatically.
6. Measure the actual volume dispensed.
7. Enter the measured volume into the Measured Volume field.
8. Select  to save the calibration data.
9. If the message "Calibration Successful" appears, the calibration has been completed successfully.

Repeat this procedure for each channel that requires calibration.

NOTE: Once calibration has started, the calibration process cannot be stopped manually. Allow the calibration cycle to be completed before entering the measured volume.

Calibration

☐ CH1 ☐ CH2 ☐ CH3 ☒ CH4

Calibration Time: min

Theoretical Volume: mL

Measured Volume: mL

Current Rate: 100.000 rpm

Δ : 15.940

Notice: Calibration is in progress and can not be stopped.

Communication Protocol

The pump supports communication through either the USB or RS485 interface.

Communication uses the Modbus RTU protocol, allowing the pump to be integrated with external control systems such as PLCs, HMIs, or computers.

Select the desired communication interface in the System Settings menu before establishing communication.

WARRANTY

Our company guarantees that this unit is warranted against defective material and workmanship for a period of one year from the date of shipment. We will repair or replace the defective equipment returned during the warranty period free if the equipment has been used under normal laboratory conditions and in accordance with the instruction in this manual. The following defects are specifically excluded:

1. Damage caused by accident, misuse, or abuse.
2. Damage caused by disaster.
3. Repair or modification by anyone else without authorization.
4. Corrosion due to the use of improper solvent or sample.
5. Defects caused by improper operation.
6. Use of fittings or other spare parts supplied by different manufacturers.

This warranty does not apply to platinum wire and all the accessories.

A return authorization must be obtained from us before returning any product for repair on a freight prepaid basis.

For any inquiry or request for repair service, please contact BT Lab Systems via the email below.

E-Mail: info@BTLabSystems.com

TECHNICAL

BT Lab Systems offers technical support for all its products. If you have any questions about the product's use or operation, please contact BT Lab Systems at the following info.

E-Mail: technical@gbiosciences.com