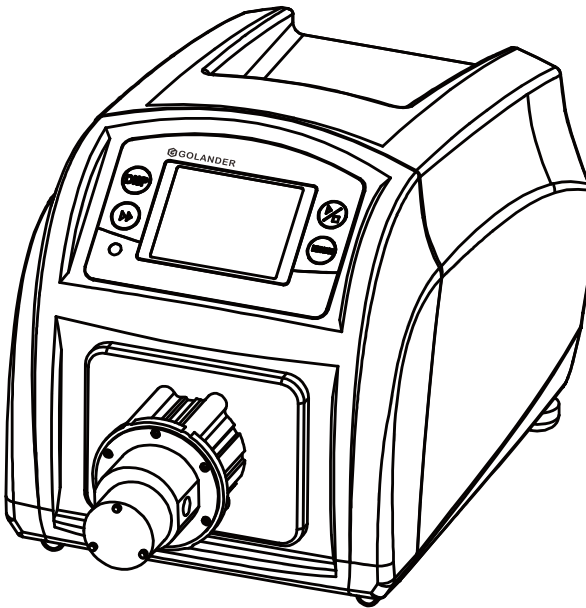




CT3001F Intelligent Dispensing Gear Pump

Operation Manual



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Safety Cautions



Danger: Please use the correct AC power voltage source shown on the sticker attached on the equipment to avoid any damage. Please do not open the case. It may cause malfunction or electric shock.

For maintenance, please contact the manufacturer or distributor directly.

Danger: To install or remove pump head, please turn off the power supply first. The flange of the pump head must be handled carefully. Please do not use pliers to clamp it. It may cause inner core displacement, or even permanent damage of the pump.



Warning: Tubing breakage may result in fluid being spayed from pump. Use appropriate measures to protect operator and equipment.

Warning: Remove power from the pump before attempting any maintenance or any cleaning operation is started.

Warning: Remove power from the pump before connecting or disconnecting the external control device or communication interface.

Warning: The pump is provided with a grounded plug, it must be well-grounded at all times.

Warning: This product is not designed for, nor intended for use in patient connected applications; including, but not limited to, medical and dental use.

Warning: Avoid any foreign bodies, including sealant or Teflon tape if they are used to seal the tubing, to get into the pump. Only remove the two covers on the pump head when installing connector or tubing,

Warning: It is strongly recommended that when using the pump, especially for the entrance, tubing size should be corresponding to the competency of pump to avoid cavitation, which are caused by inadequate fluid for abnormal wear. In any case the pressure between the inlet and outlet shall not exceed 20 bar / 290 psi.

Warning: it is strongly recommended to add a filter to the inlet of the pump to filter out the particles bigger than 10 um, to avoid the internal components to wear and tear abnormally. The filter surface area should

be large enough to avoid pressure loss in the loop. It is also important to regularly check the filter to make sure it works effectively. If a vacuum gauge is installed after the filter, when the vacuum increases more than 0.1 bar, the filter needs to be cleaned or replaced.

Warning: The gear pump can only transfer liquid in one direction.

1 Introduction

CT3001F is a high performance and low noise micro gear pump. The brushless servo motor, stainless steel magnetic drive pump head can transfer fluid continuously and smoothly. The color LCD touch screen provides intuitive and clear display. The working modes are suitable for different lab use. With standard MODBUS RS485 interface, the pump is easy to be controlled by external device, such as computer, human machine interface or PLC.

CT3001F provides speed range from 50 to 3000 rpm, with 1 rpm resolution.

2 Functions and Features

- Work with variable pump heads
- Suitable for high viscous and pressure liquid transfer
- No pulse, low noise
- Magnetic coupling drive, easy to maintain
- Brushless servo drive, high efficiency, maintenance free
- Color LCD display, touch screen
- Display and control flow rate
- Variable working modes
- Flow calibration wizard for accuracy
- Intelligent temperature control
- External signal controls start/stop/dispensing; external analog signal adjusts speed
- RS485 MODBUS interface
- Stainless steel case
- Switching power supply, 85~260VAC/50~60Hz

3 Specifications

Pump Head	MS204, MS209, MS213 (PEEK gear material)
Communication	RS485, support Modbus communication protocol
Display	Color LCD display
Flow Range	15-2700 mL/min
Speed Range	50-3000 rpm/min
Speed Resolution	1rpm
Liquid Viscosity	≤200cSt
Particle Size	≤10um
Operation	Keypad and touch screen
Control Mode	Flow Mode, Time Dispense, Volume Dispense, Copy Dispense
Display Mode	Color LCD
External Control	5V (12V/24V optional) to control Start/Stop 0-5V (0-10V,4-20mA optional) to control speed
Power Supply	AC 90-264V 50Hz/60Hz
Consumption	<50W
Working Environment	Temperature 0 -40°C, humidity <80%
Dimensions (LxWxH)	342x180x198mm (13.5x7.1x7.8inch)
Drive Weight	3.3kg (7.3lbs)
IP Standard	IP31

4 Components and Connectors

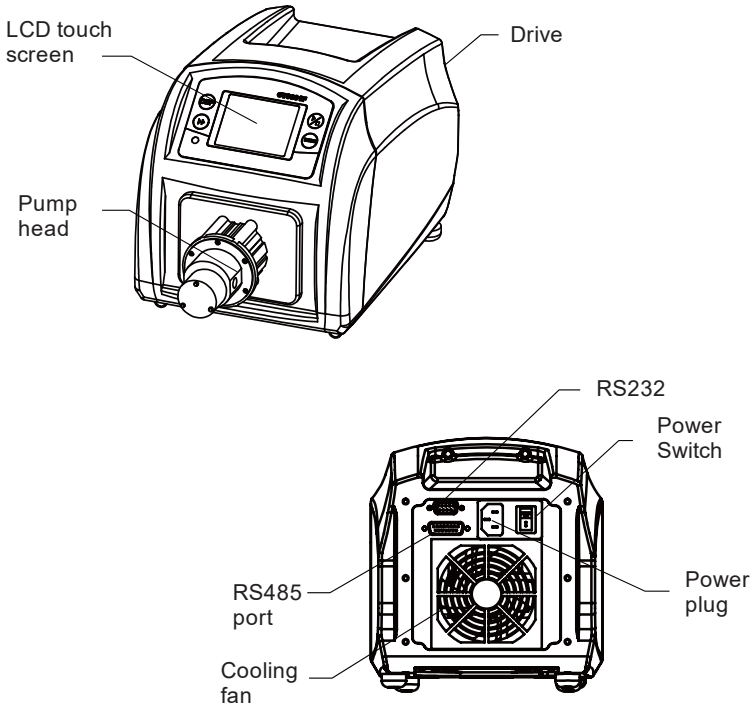


Figure 1. Components and Connectors

5 Display Panel and Operating Keypads

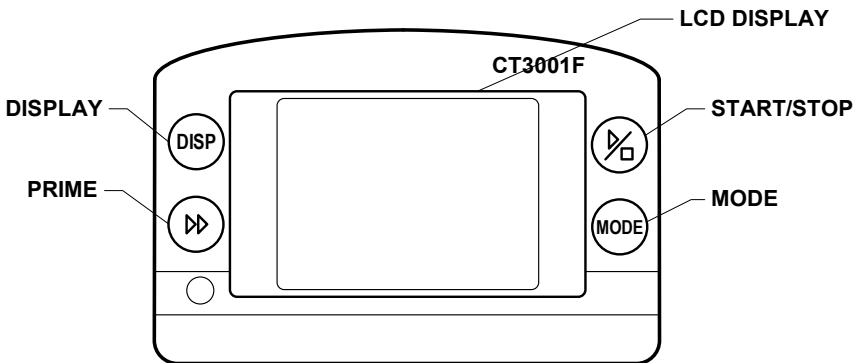


Figure 2. Display Panel

5.1 Keypad



START/STOP key. Press to start or stop drive.



DISPLAY Key. To change display mode.



PRIME key. Press the key to run pump at maximum allowed speed. Press again to return to the previous state.



MODE key. When drive is not running, use this key to change the working mode.

5.2 LCD Touch Screen Display

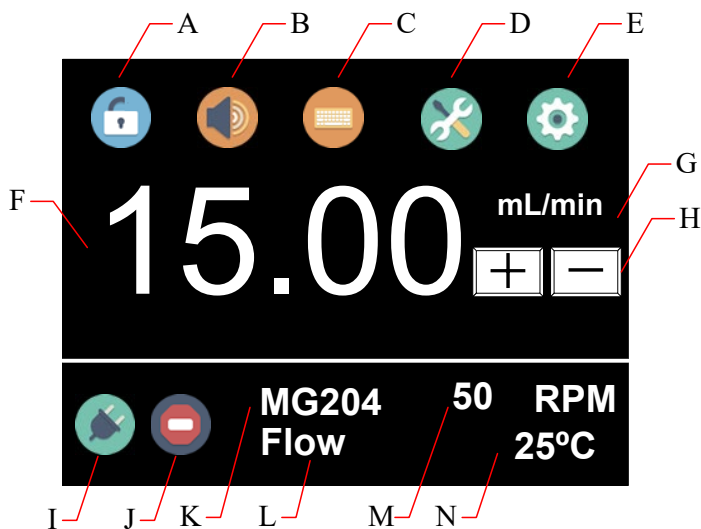



Figure 3. Main Display Screen

5.2.1 A - Keypad Lock

Press the icon  to lock/unlock the keypad. When the keyboard is locked, user can not modify the control mode and system parameters. Password can be set to unlock the keypad. It will prevent user from

changing the system parameters accidentally.



Keypad locked



Keypad unlocked

Figure 4. Keypad Lock

5.2.2 B - Tone Button

Press the icon to turn on/off the key tone.



Tone on



Tone off

Figure 5. Key Tone

5.2.3 C - Control Mode

Press the icon to enter the **Control Mode** window. There are four control modes available as shown below.

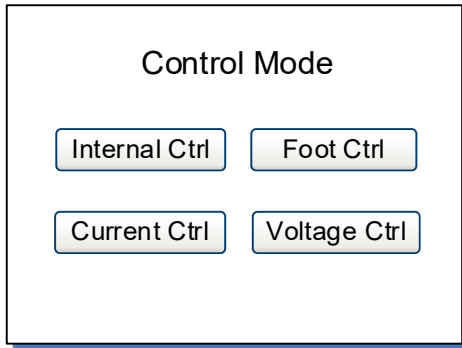


Figure 6. Control Mode

- **Internal Ctrl** - Internal Control Mode. Operate pump with keypad and touch screen.

- **Foot Ctrl** - Footswitch Control Mode. Footswitch controls start/stop. Use keypad and touch screen for the other operations.
- **Current Ctrl** - Current Control Mode. External 4-20mA analog current signal controls rotating speed; logic level signal controls start/stop. The keypad is disabled.
- **Voltage Ctrl** - Voltage Control Mode. External 0-5V or 0-10V analog voltage signal controls rotating speed; logic level signal controls start/stop. The keypad is disabled.



Internal Control
Mode



Footswitch
Control Mode



Current Control
Mode

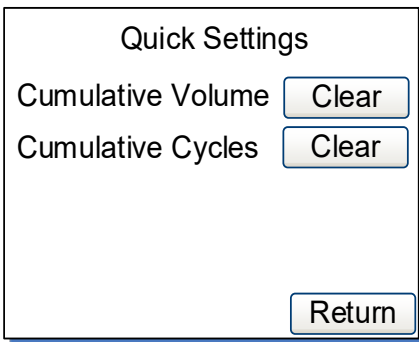


Voltage Control
Mode

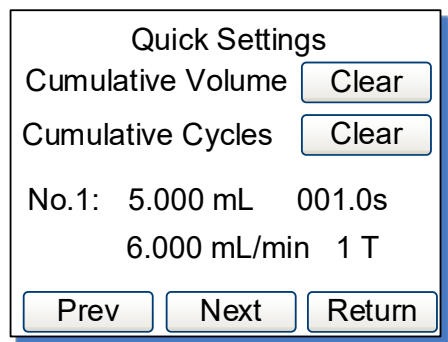
Figure 7. Control Mode Icon

5.2.4 D - Quick Settings

Press the icon to enter the quick setting interface to reset the accumulated liquid volume and the times. For fluid volume distribution mode, time distribution mode and copy distribution mode, there are five groups of preset data, press the **Prev** key and **Next** key to select. The setting on the main screen will change.



Flow Mode



Other Modes

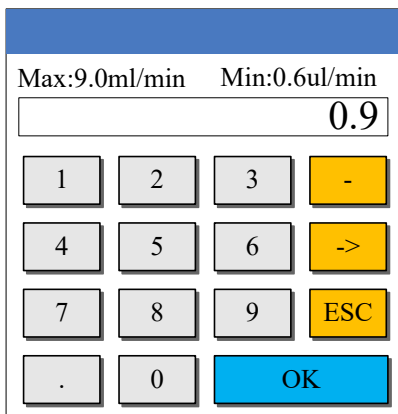
Figure 8. Quick Settings

5.2.5 E - System Settings

Press this icon to enter the System Settings menu, and then change the parameters shown on the screen.

5.2.6 F - Flow Rate Setting

It shows current flow rate setting. When the drive is not running, press it to input desired value in the pop-up window. Please pay attention to the range of the value and flow rate unit.





The image shows a pop-up window for flow rate setting. At the top, it displays 'Max:9.0ml/min' and 'Min:0.6ul/min'. Below this is a text input field containing the value '0.9'. The input field is surrounded by a grid of buttons: a 4x4 grid of numeric buttons (1-9, 0, .) and three yellow function buttons: a minus sign (-), a right arrow (->), and 'ESC'. A blue 'OK' button is positioned at the bottom right of the grid.

Figure 9. Flow Rate Setting

5.2.7 G - Flow Rate Unit

It shows current flow rate unit, mL/min.

5.2.8 H - Fine Adjustment Button

When the drive is running, press the fine adjustment button to adjust the flow rate in real time. Press the  button or  button shortly to increase or decrease the flow rate. Press and hold the buttons to change the value quickly.

5.2.9 I - Communication State

It shows current RS485 communication state.



Communication
connected



Communication
disconnected

Figure 10. Communication State

5.2.10 J - Running state

It shows current running status. When the drive is not running, it will show one of the following icon.



Figure 11. Drive Stopped

When the drive is running, it will change to an animated icon as shown below.



Figure 12. Running Animation

5.2.11 K - Pump Head Model

It shows the current configured pump head model. For example, MG204 means MSG04 pump head.

5.2.12 L - Working Mode

It shows current working mode, such as **Flow** Mode, **Volume** Dispense Mode, **Time** Dispense Mode or **Copy** Dispense Mode.

5.2.13 M - Speed or Cumulative Cycles


It shows current speed or cumulative dispense cycles, switched by pressing **MODE** key. If the speed is higher than the maximum allowed speed, it will show **U_Overflow**; if the speed is lower than the minimum allowed speed, it will show **D_Overflow**. The cumulative cycles can be

reset on Quick Settings menu.

5.2.14 N - Internal Temperature or Cumulative Volume

It shows the temperature inside the drive or cumulative volume that the pump has delivered. The cumulative volume can be reset on Quick Settings menu.

5.3 System Settings

When the drive is not running, press the icon  to enter System Settings menu.

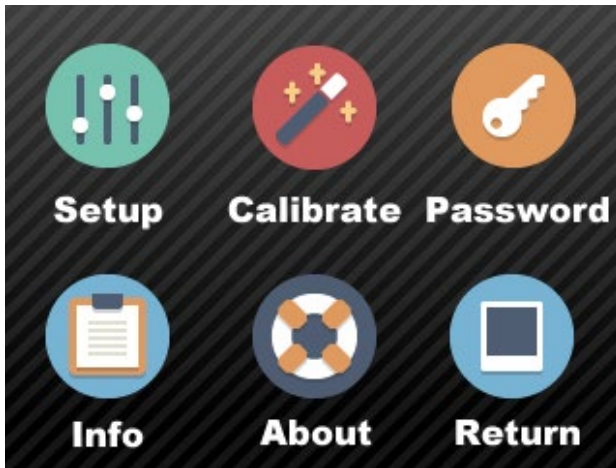


Figure 13. System Settings

5.3.1 Setup

To set the general parameters as shown below.

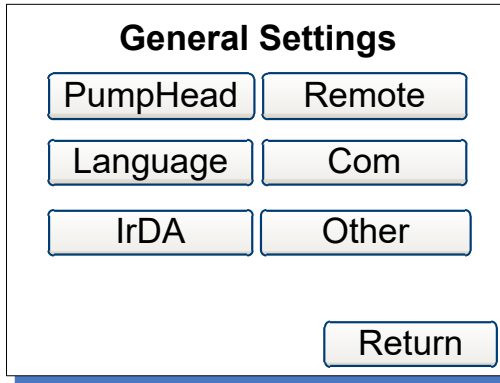


Figure 14. General Settings

- **PumpHead** - Choose the model of the installed pump head.

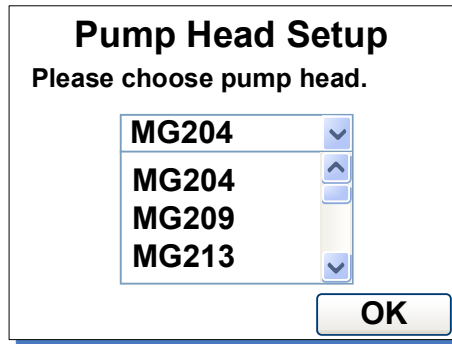


Figure 15. Pump Head Select

- **Language** - Choose display language, English only.
- **IrDA** - Turn on/off the infrared control function.

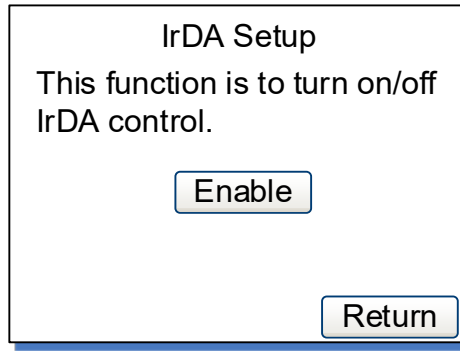


Figure 16. IrDA Setup

- **Remote**

It is the setting for external control mode: Logic Level control mode or Pulse control mode. When it is set to Logic Level, pump state will change when external switch is closed or open. It is designed for a maintained switch. When it is set to Pulse, pump state will change when the switch is closed then open again. It is designed for a normally open momentary switch.

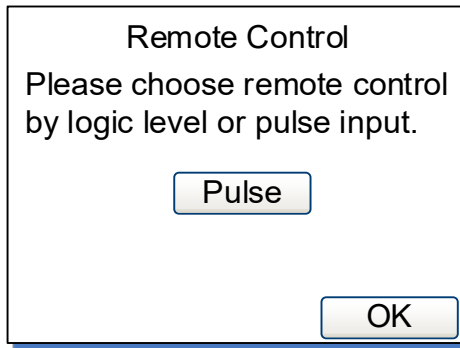


Figure 17. Remote Control Mode

- **Com**

It is the setting for RS485 MODBUS communication including baud rate, transmission mode and pump address. To change the address, click the address number on the screen, then input the value in the pop-up window. Restart the pump to apply the settings.

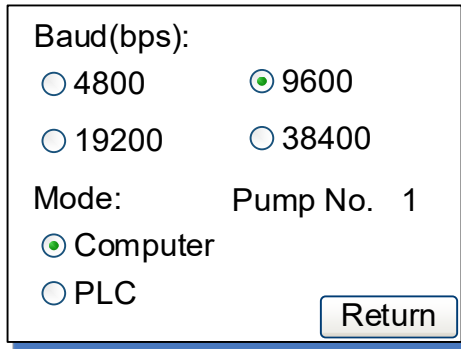


Figure 18. Communication Settings

- **Other**

Set up the acceleration time of the drive to start from 0 to max speed.

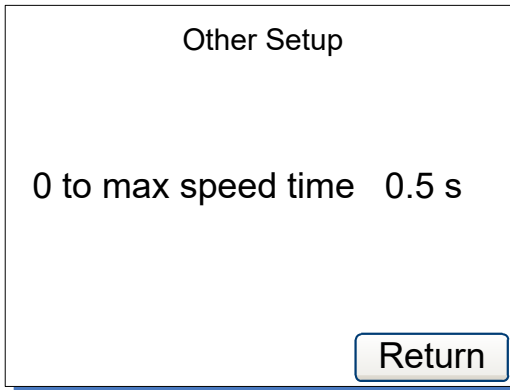


Figure 19. Anti-Drip Settings

5.3.2 Calibrate

Pump will accurately show current flow rate/volume after Flow Rate Calibration.

Note: The calibration is necessary to display flow rate precisely.

MG204 Calibration

15.00	mL/min
96.01	mL

Suggested testing vol > 96.01mL
To reach 0.5% precision.

Next	Return
------	--------

Figure 20. Flow Rate Calibration

5.3.3 Password

It is to set a password to unlock the keypad. It will prevent user from changing parameters accidentally. The default password is empty.

Please enter a password

Set	Del	Enter
-----	-----	-------

1	2	3	4	5	6	7	8
9	0	A	B	C	D	E	F

Figure 21. Password

5.3.4 Info

It is the information about the pump.

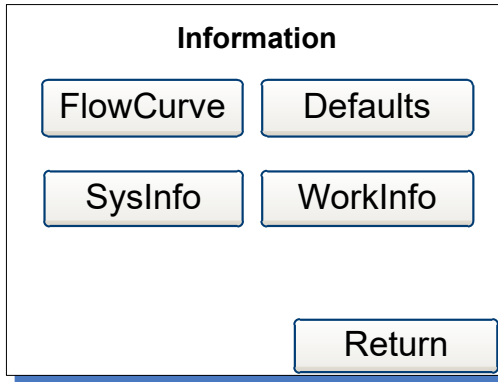


Figure 22. Information

- **Flowcurve** - To show the flow curve of the pump head (not applied).
- **SysInfo** - To display software version, memory size, operating temperature, etc It shows software version, memory size, internal temperature, etc.

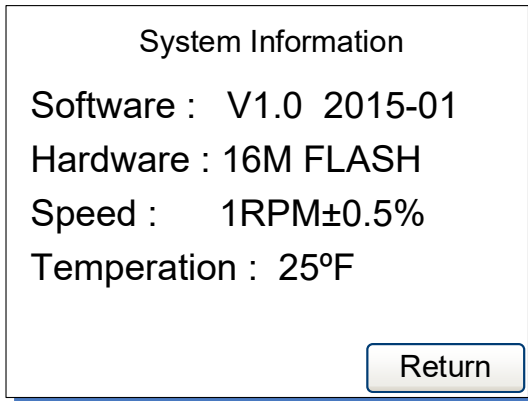


Figure 23. System Information

- **Defaults**

It is to reset the pump to factory settings. Restart pump to apply the settings. The system can also restore to factory settings by holding the **DISP** and **MODE** at the same time when pump powers on, then release the keys after the beep.

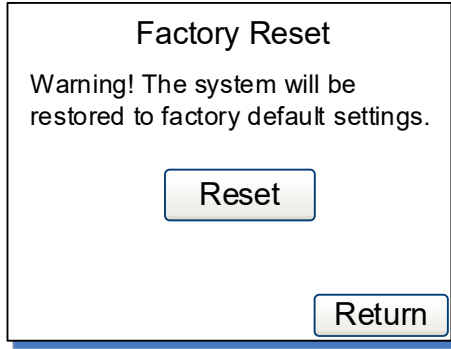


Figure 24. Factory Reset

- **Workinfo**

It shows total power on time, running time and power cycles.

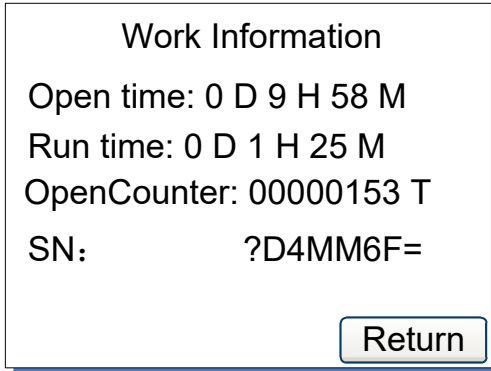
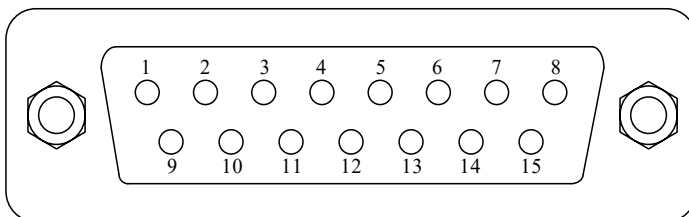


Figure 25. Work Information

5.3.5 Return

To return the main display screen.

6 External Control Interface



DB15	Mark	Note
1	ADC_W	Positive of external analog input
2	B	Communication interface, B pole of RS485
3	A	Communication interface, A pole of RS485
4	VCC_W	External DC power input
5	DAC	Analog voltage signal output
6		
7		
8	COM	Ground of external power
9	AGND	Negative of analog signal input
10	+12V	Positive of internal +12V power source
11	GND	Ground of Internal power source
12		
13	RS_W	External start/stop signal input
14		
15	RS	Start/stop signal output

7 Operation Instructions

7.1 Before Operation

- 1) Please check the packing slip to make sure nothing is wrong or damaged in the package. If there is problem, please contact the manufacturer or distributor.
- 2) Read through the instruction.
- 3) There should be more than 200 mm space for the back of the pump when it is running.

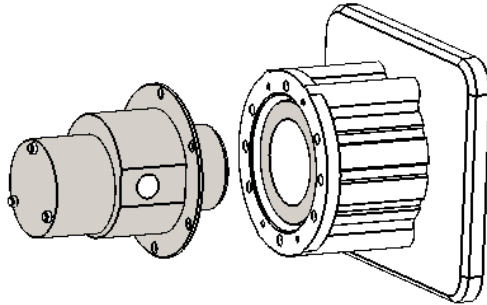
7.2 Power Connection

The voltage of the power supply should be marked on the sticker of the pump. Please make sure to use the right power source for the pump. Please plug the power cord into the power connector on the rear of the pump and plug the opposite end of the power cord into an electrical outlet. Flip the power switch located on the rear of the pump.

7.3 Install pump head and tubing

7.3.1 Install pump head

- 1) Put the pump head into the pump head holder, keep the entrance horizontal.
- 2) Align the pump head and bracket mounting holes. Use provided M3x8 mm stainless steel screws and nuts to tighten pump head on the bracket.



7.3.2 Install tubing

- 1) Screw 1/8NPT threaded stainless steel or plastic joints on the pump head. Please pay attention that the internal and external thread is in good shape and there's no residue left.



Good

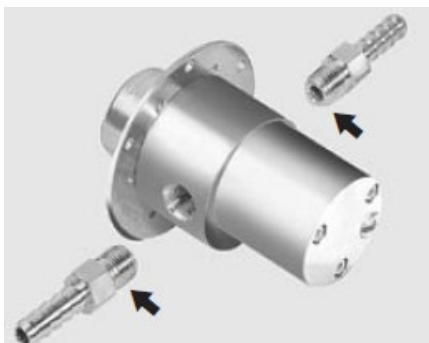


Defective

- 2) Wrap two layers Teflon tape clockwise on the threads. Make sure there will be no tape entering the inner part of the pump.

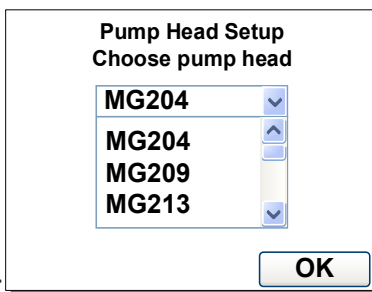
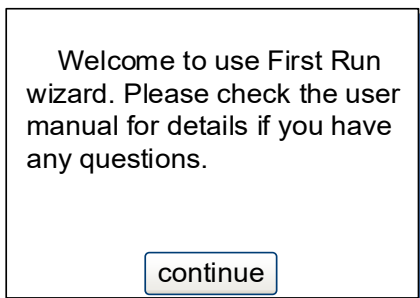


- 3) Tighten the nut with a torque wrench on the pump. Please note don't use excessive force to strip the threads.



7.4 First Run Wizard

When use the pump at the first time or after factory reset, the system will show welcome screen. The next step is to choose the model number of the pump head installed. The system will run pump head selection ->working mode setting -> calibration. in sequence. User can set the parameters and operation mode according to the requirement. The information will be saved and you only need to run the wizard once.



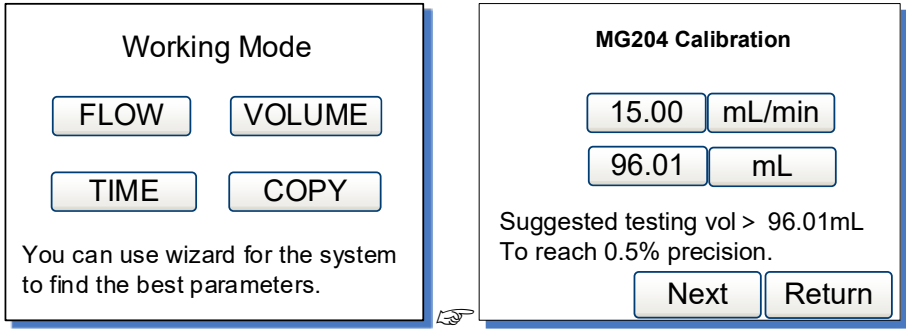




Figure 26. First Run Wizard

7.5 Flow Rate Calibration

The calibration need to be done when

- First time to use the pump
- Pump head is changed
- Transfer fluid in one channel with dual pump heads
- Tubing is reinstalled
- After continuous work for a long time

How to calibrate

- 1) Install pump head and tubing.
- 2) In the General Settings window, set the model number of the installed pump head.
- 3) When pump shows Main Display Screen, press PRIME  to prime the pump.
- 4) When the drive is not running, press System Settings icon , then select Calibrate.

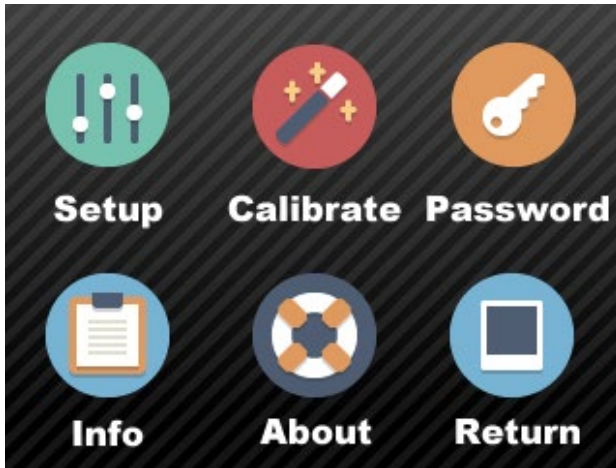


Figure 27. System Settings

- 5) In calibration wizard window, it shows the current pump head, desired flow rate and the suggested volume to test.

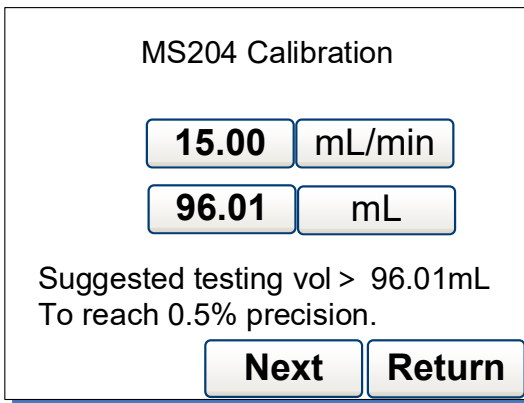
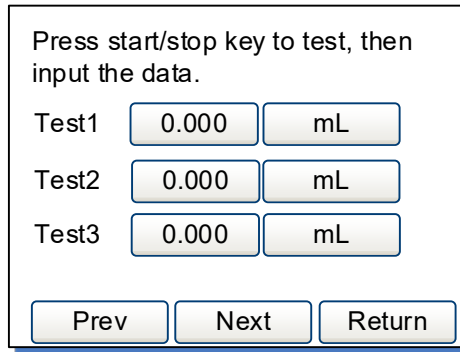


Figure 28. Flow Rate Calibration

The 15.00 mL/min is the desired flow rate and 96.01 mL is the suggested volume need to test. The values or the units can change directly when press the button. Press **Next** button to enter the calibration window, or press the **Return** button to exit the wizard to the System Settings window.

Note: The liquid volume should not be less than the suggested value.

6) Test window shown below.



Press start/stop key to test, then input the data.

Test1	0.000	mL
Test2	0.000	mL
Test3	0.000	mL

Prev Next Return

Figure 29. Calibration

Please make sure the tubing is filled with liquid, then press **START/STOP** key, pump will start transferring fluid. Wait for the pump to finish dispensing, and then measure the delivered volume. Repeat the above steps couple more times, and enter the results of the Test1, Test2 and Test3 in the calibration window. Please pay attention to the unit to make sure it is correct. Press **Next** to enter **Analyze and Calculate** window.

If you want to modify the desired flow rate and volume to test, press Prev button to re-enter the values. Then input the results to the system. The system will ignore the result of 0 and will only use the results you input to calculate the right speed for the desired flow rate.

Note: Please press **START/STOP** key to stop the test anytime when an accident occurs during the test.

7) The corrected testing scale will be calculated and the old scale is also displayed on the screen for reference.

Analyze and Calculate		
Average Vol	97.0	mL
Cal scale	6.400000	
Re scale	6.400000	
Old scale	6.400000	

Prev Return OK

Figure 30. Analyze and Calculate

The scale is a coefficient for the tubing. The calculated scale should be close to the reference scale (the “Re scale” shown on [Figure 30](#)). Otherwise, please check the following and press Prev to test again.

- The accuracy of the volume measurement
- The volume unit setting
- The model of the pump head setting

If no problem found, press **OK** button to save the new value. The pump will adjust the speed according to the calculated scale. Or press Return to exit without saving the new value and return to the System Settings window.

If there is no data input to the system, it will show the window as below. Please press Prev to test again or just press Return.

Analyze and Calculate	
No data. Please go back to re-enter the data or return to the main menu.	

Prev Return

Figure 31. No Input Data

7.6 Working Mode

When the drive is not running, press MODE key to enter Working Mode window as shown below.

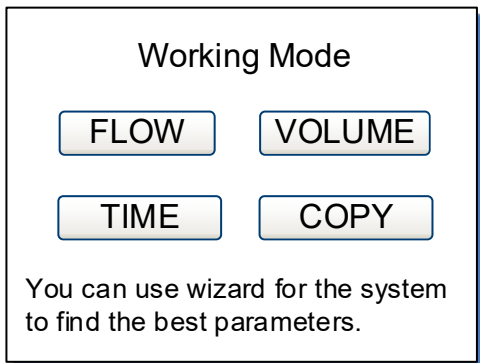


Figure 32. Working Mode

- **FLOW - Flow Mode**

On this mode, pump will be running according to the set flow rate, and record the cumulative fluid volume.

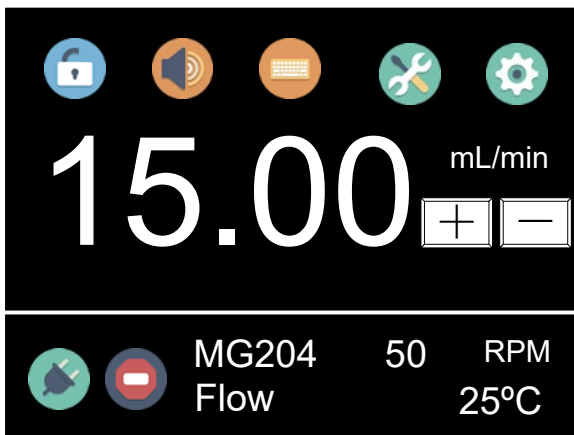


Figure 33. Flow Mode

- **VOL - Volume Dispense Mode**

On this mode, pump will dispense by setting dispense volume for each dose, lag time between doses and number of cycles. System will calculate duration time for each dose automatically.

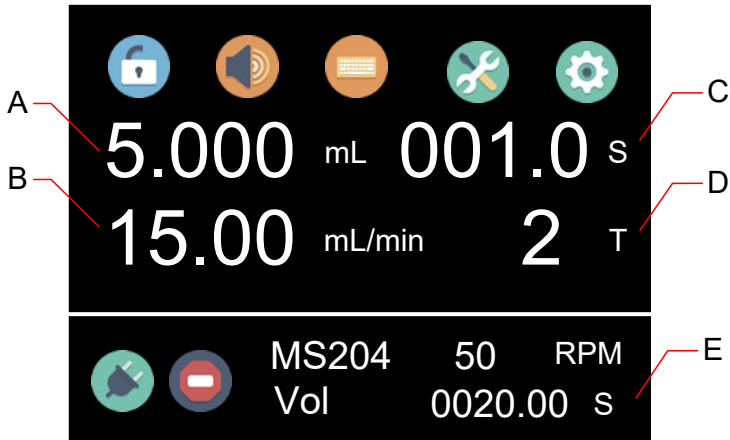


Figure 34. Volume Dispense Mode

A - Dispense volume for each dose, uL, mL or L.

B - Dispense flow rate, mL/min.

C - Lag time. The time between doses.

D - Dispense cycles. When set dispense cycles to 0, the drive will keep running until **START/STOP** key is pressed. When set dispense cycles to 1, the drive will run only once, and the lag time setting is invalid. When set dispense cycles to more than 1, the drive will run the set number of cycles then stop.

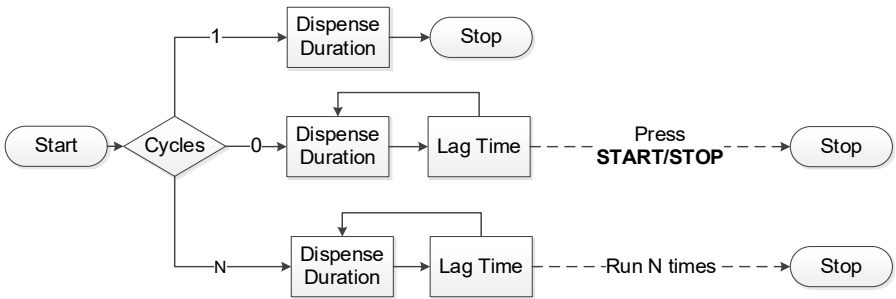


Figure 35. Dispense Cycles

E - Dispense duration for each dose. According to the dispense volume and time, system will calculate dispense duration automatically.

- **TIME - Time Dispense Mode**

Pump will dispense by setting the dispense duration for each dose, lag time between doses and number of cycles. System will calculate dispense volume for each dose automatically.

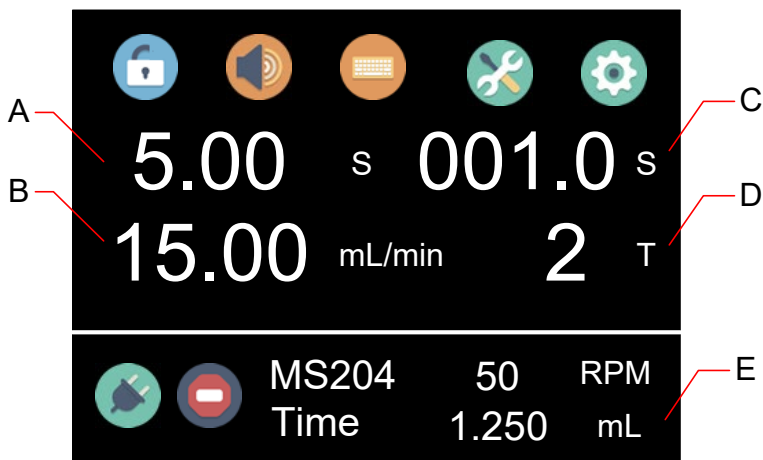


Figure 36. Time Dispense Mode

A - Dispense duration for each dose

B - Dispense flow rate, mL/min.

C - Lag time. The time between doses.

D - Dispense cycles. When set dispense cycles to 0, the drive will keep running until **START/STOP** key is pressed. When set dispense cycles to 1, the drive will run only once. The lag time setting is invalid. When set dispense cycles to more than 1, the drive will run the set number of cycles then stop.

E - Dispense volume for each dose. According to the dispense duration and flow rate, system will calculate dispense volume for each dose automatically.

- **COPY - Copy Dispense Mode**

Pump will dispense by setting total volume need to dispense, lag time between doses and number of dispense cycles. System will calculate dispense volume for each dose automatically.

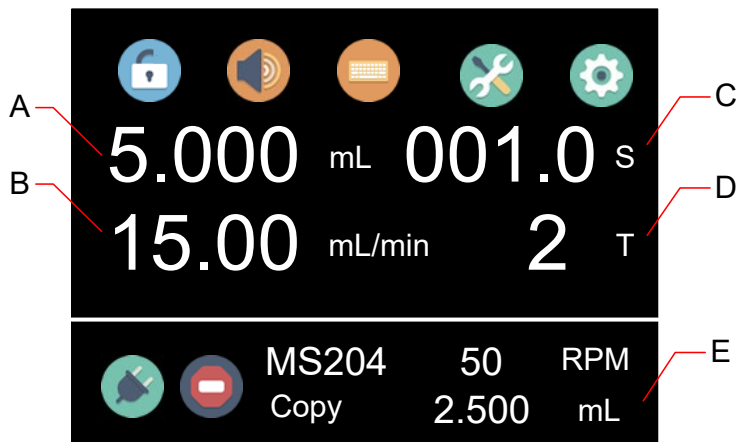


Figure 37. Copy Dispense Mode

A - Total dispense volume, uL, mL or L

B - Dispensing flow rate, mL/min

C - Lag time. The time between doses.

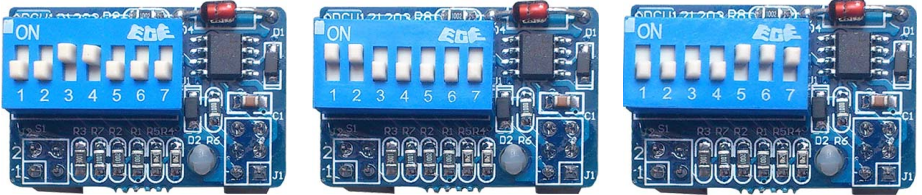
D - Dispense cycles. When set dispense cycles to 0, the drive will keep running until **START/STOP** key is pressed. When set dispense cycles to 1, the drive will run only once. The lag time setting is invalid. When set dispense cycles to more than 1, the drive will run the set number of cycles then stop.

E - Dispense volume for each dose. According to the total dispense volume and number of cycles, system will calculate the dispense volume for each dose automatically.

7.7 External Control Mode

On this mode, external logic level signal controls start/stop. External analog signal controls rotating speed. The keypad is disabled. The analog signal could be 0-5V, 0-10V or 4-20mA. By default, the signal is 0-5V. For 0-10V or 4-20mA, the jump setting on the analog signal control board has to be changed.

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0-5V (default)

0-10V

4-20mA

Figure 38. Analog Signal Control Board Setting

To control pump by external signal

- 1) Switch the power off. Wire the DB15 connector as shown on [Figure 39](#) or [Figure 40](#), and connect it to the DB15 port on the rear of the pump.

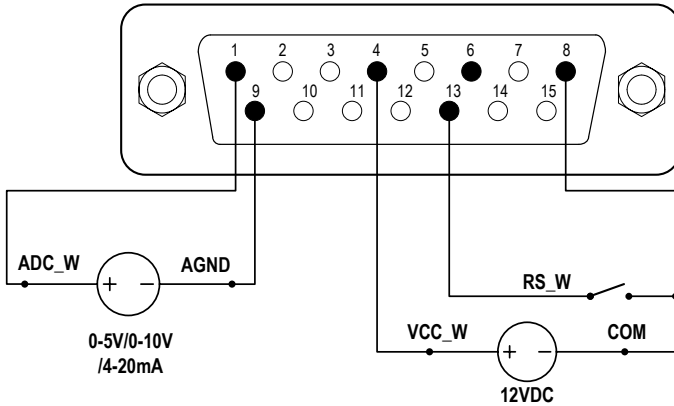


Figure 39. DB15 Wiring with External 12VDC Power Source

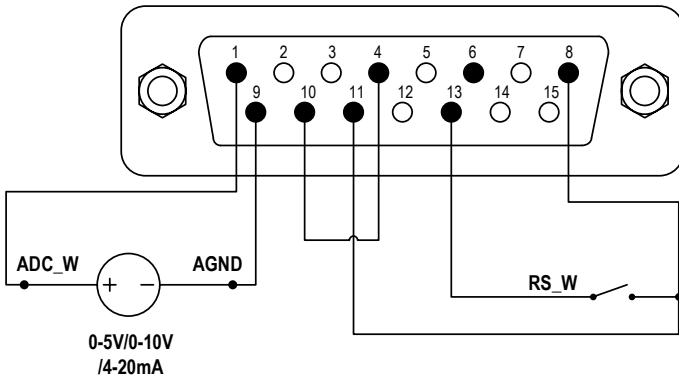





Figure 40. DB15 Wiring with Internal 12VDC Power Source

- 2) Turn on the power switch. Pump will display the main screen.
- 3) Press  to set Control Mode to voltage , or current .
- 4) Turn on the external analog signal power source.
- 5) When set the Remote Control Mode to Logic Level, close the external RS_W switch, the drive will run and the speed will change according to the intensity of the analog input signal. Open RS_W switch to stop the drive.
- 6) When set the Remote Control Mode to Pulse, close then open the external RS_W switch, the drive will run and the speed will change according to the intensity of the analog input signal. Close and open RS_W switch again to stop the drive.

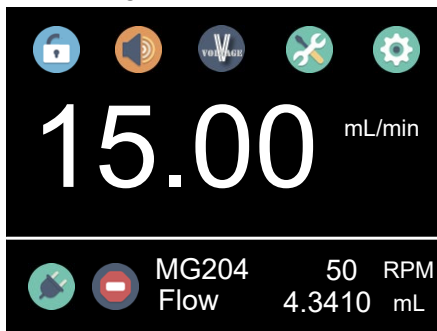


Figure 41. Voltage Control Mode

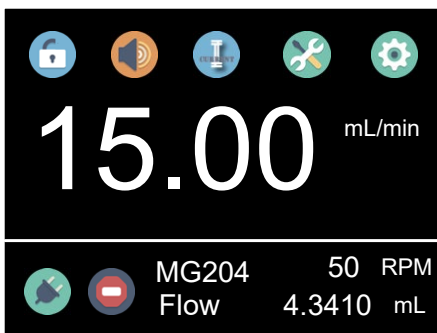


Figure 42. Current Control Mode

Note: The external DC power source can be 5V or 12V. If it is 24V, 1.5K resistor is needed to protect internal circuit.

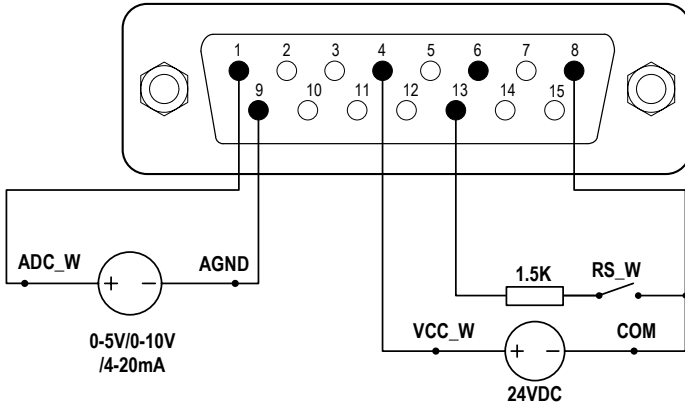


Figure 43. DB15 Wiring with External 24VDC Power Source

7.8 Communication Mode

The RS485 interface supports standard MODBUS protocol. Pump can communicate with external device via the communication port. Please refer to the [Communication Instruction manual](#) for the parameters and supported commands.

To work with communication mode

- 1) Turn the power off. Wire the DB15 connector as shown on [Figure 44](#), and connect it to the DB15 port on the rear of the pump. External DC power source is recommended to avoid electrical interference.

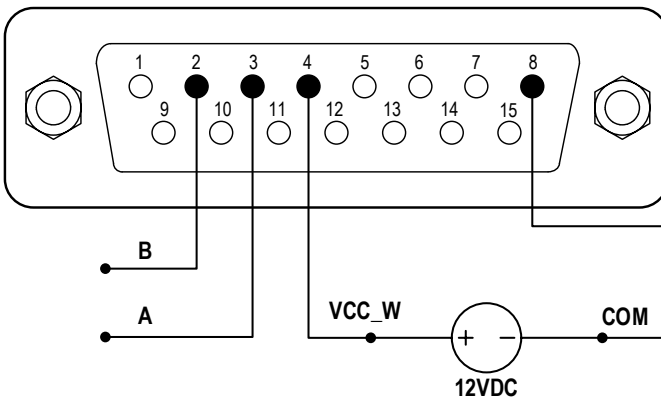




Figure 44. RS485 MODBUS Wiring

- 2) Turn the power on. Pump will display the main screen.

- 3) On Internal Control Mode, when the main screen shows  , the communication is connected. If it shows  , the communication is disconnected.
- 4) Control pump with communication interface.

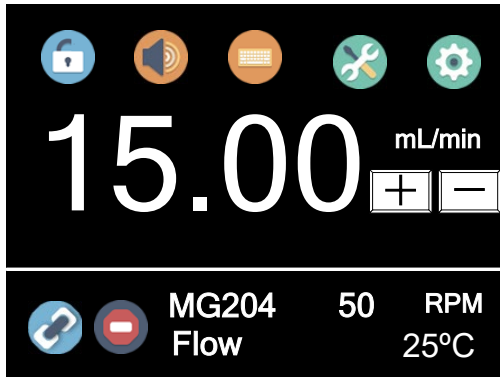


Figure 45. Communication Connected

7.9 Footswitch

To use a footswitch to control start and stop

- 1) Power pump off. Wire the DB15 connector as shown on Figure 46 or Figure 47, and connect it to the DB15 port on the rear of the pump.

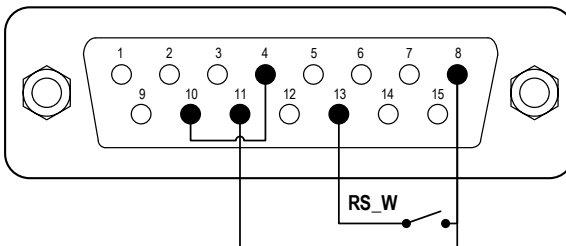


Figure 46. Control Start/Stop with Internal 12V Power Source

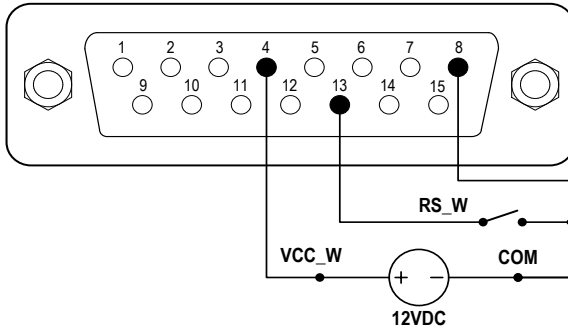


Figure 47. Control Start/Stop with External 12V Power Source

- 2) Turn the power on. Pump will display the main screen.
- 3) On Internal Control Mode, if pump is set to one of the dispense modes, when the switch RS_W is closed then open, pump will start to dispense.
- 4) On Footswitch Control Mode, if Remote Control Mode is set to Logic Level, when the switch RS_W is closed, the drive will start; when the switch is open, the drive will stop.
- 5) On Footswitch Control Mode, if Remote Control Mode is set to Pulse, when the switch RS_W is closed then open, the drive will start; when the switch is closed then open again, the drive will stop.

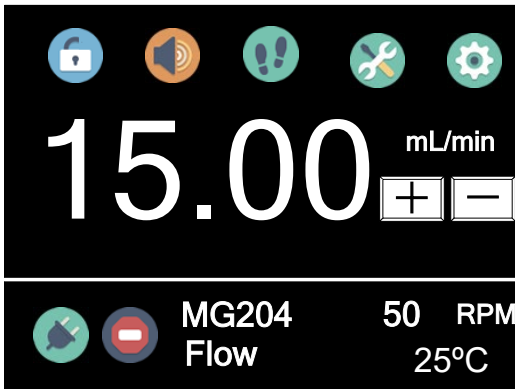


Figure 48. Footswitch Control

8 Maintenance

8.1 Warranty

The product comes with one-year labor and parts warranty. The limited warranty does not cover any damage that is caused by improper usage and handling.

8.2 Regular Maintenance

- 1) Always check the tubing and connections to make sure there is no leakage.
- 2) Do not cover the fan on the rear of the pump.
- 3) Keep pump head dry.
- 4) If a filter is used, check and replace it regularly.
- 5) Do not use chemical solvents to clean pump and pump head.

8.3 Malfunction Solutions

No	Malfunction	Description	Solution
1	Hardware	No display	<ol style="list-style-type: none"> 1. Check the power cord 2. Check the fuse. If it was blown, replace it with a 3A slow-blow fuse 3. Check the internal power cord connection inside the pump. 4. Check the wire connection between LCD and main control board.
2	Hardware	Motor does not work	<ol style="list-style-type: none"> 1. Check the indicator of the driver board. 2. Check the wire connection between motor and driver board. 3. Check the wire connection between the driver and the main board. 4. Check the power voltage for the pump.
3	Hardware	Motor is trembling	<ol style="list-style-type: none"> 1. Check the wire connection between the motor and the driver board.

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			2. The motor is overloaded. Check the mechanical connection.
4	Hardware	Keypad does not work	1. Check the wire connection between keypad and the main board. 2. Check if the key is broken.
5	Hardware	External control does not work	1. Check the wiring of the connector. 2. Check if the external control power voltage is provided. 3. Check the connections of the external control board.
6	Hardware	RS485 com does not work	1. Check the wiring of the connector. 2. Check if the external control power voltage is provided. 3. Check the connections of the communication board.
7	Software	Dispensing volume is not correct	Run calibration.
8	Software	External control does not work	Check if pump is on External Control Mode.
9	Software	RS485 does not work right	1. Check if the display shows the communication is ready. 2. Reset the address of the pump. 3. Check whether on the bus there are two pumps using the same address



If the problem can not be solved, please contact the manufacturer or distributor.

9 Dimensions

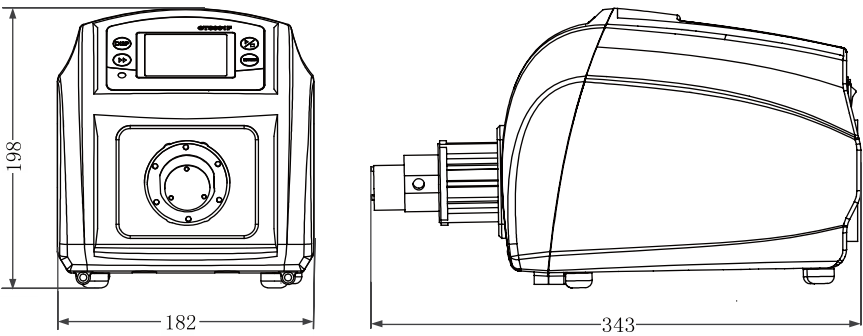
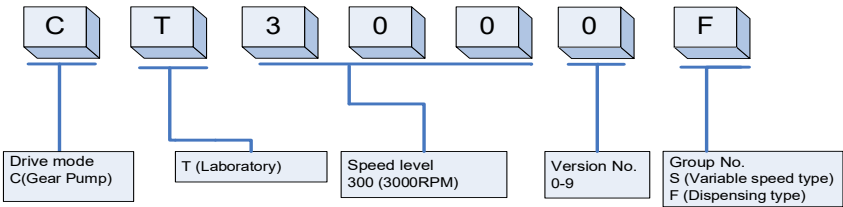


Figure 49. Dimensions (mm)

10 Naming Rule



11 Suitable Pump Heads

Pump Head	Gear Material	Max Output Pressure	Flow Range	Liquid Temperature
MG204	PEEK	0.8MPa (116psi)	15-900mL/min	-45-120°C
MG209	PEEK	0.8MPa (116psi)	30-1800mL/min	-45-120°C
MG213	PEEK	0.3MPa (44psi)	45-2700mL/min	-45-120°C