

MASTERflex[®]

MasterSense[™]
Communications
Protocols
Guide

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EtherNet/IP

EtherNet/IP Mode

In EtherNet/IP mode the pump can be operated in Continuous, Volume, or Time modes. Drive-pumps are equipped with EtherNet/IP for real-time control by a programmable logic controller (PLC). An electronic data sheet (EDS) command file is available for download by emailing Masterflex technical support at techsupport@masterflex.com.

Verify that your drive-pump, PLC, along with an operator's computer are **all** connected to the **same** network. Also, verify the computer's IP address is within the **subnet mask range** of the PLC and the drive-pump. The default addressing method for the drive-pump is a dynamic host configuration protocol (DHCP), see Figures 1 below. A **static IP address** (see below) may be assigned through the **EtherNet Settings** menu.

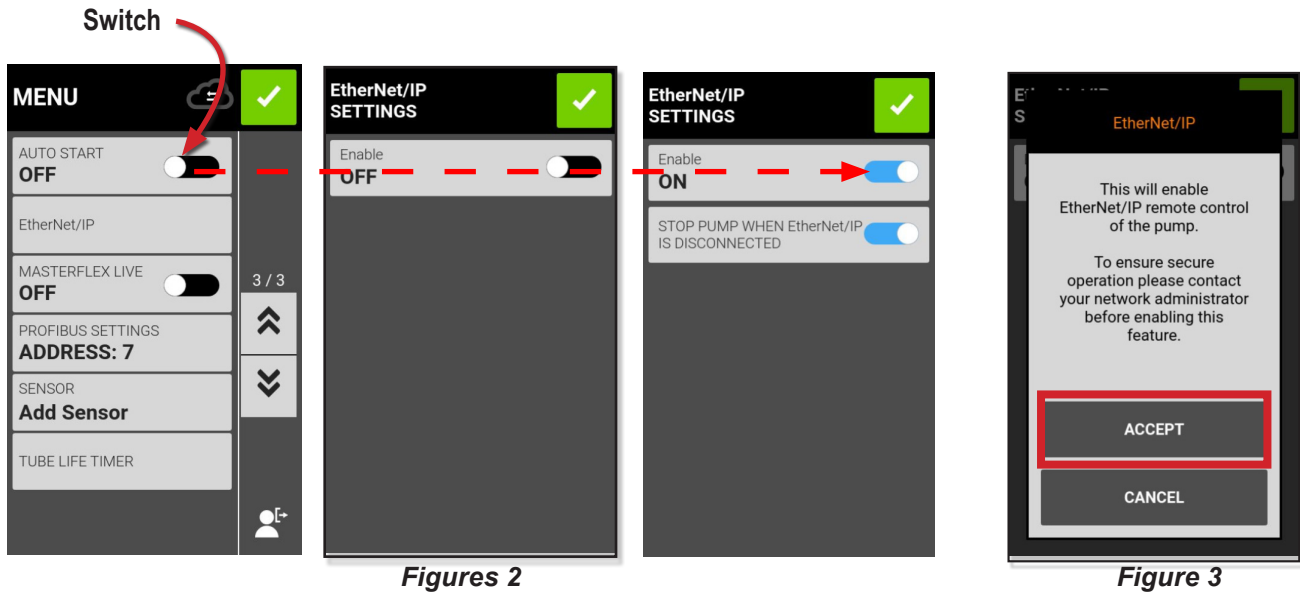
The figure consists of two side-by-side screenshots of the 'ETHERNET SETTINGS' menu. Both screens have a title bar with 'ETHERNET SETTINGS', a close button (X), and a confirm button (checkmark). The left screen shows the 'DHCP' option selected with a green dot, and the 'STATIC' option is unselected. The right screen shows the 'STATIC' option selected with a green dot, and the 'DHCP' option is unselected. Below the selection buttons, the right screen displays fields for 'IP ADDRESS' (10.35.62.38), 'SUBNET MASK' (255.255.255.0), 'ROUTER' (10.35.62.253), 'DNS 1' (10.35.62.253), and 'DNS 2'. At the bottom of the right screen is a numeric keypad with digits 1-9, 0, and a 'CLEAR' button.

Figures 1

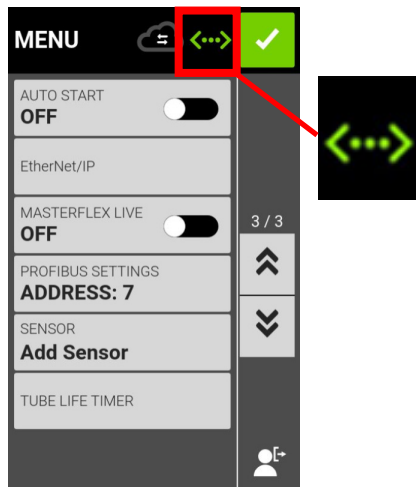
EtherNet/IP Mode (Cont.)

Enabling EtherNet/IP Mode

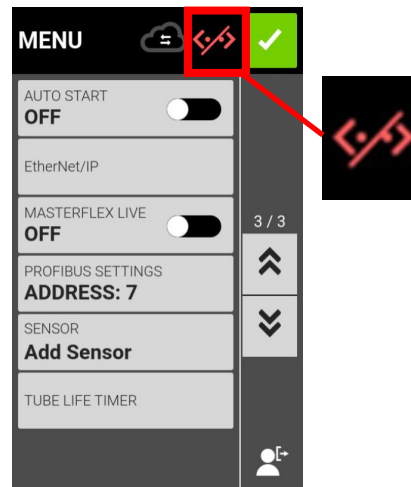
- On the **Menu** touchscreen tap the EtherNet/IP **switch** moving it from **OFF** to **ON** (see Figures 2 below)
- The EtherNet/IP message **screen** displays, tap its **Accept** button (see Figure 3 below)



Successful Connection



Unsuccessful Connection



EtherNet/IP Mode (Cont.)

Once the EtherNet/IP is enabled and configured (see Figure 4 below), an operator can view the drive-pump from a PLC. To enable remote control, configure the drive-pump from a PLC using the bit **Pump1:0.Toggle_Remote_Local_Control_1_to_0**.

NOTE: The bit changes state from Local to Remote on a 1-to-0 transition. Once enabled, the **EtherNet/IP banner** will appear at the top of the drive-pump touchscreen (see below).

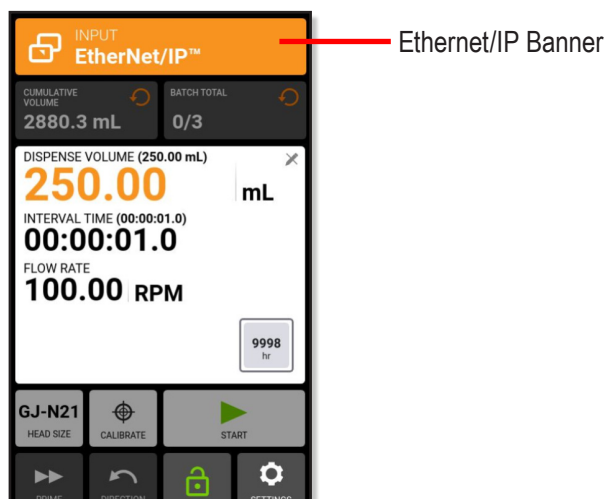


Figure 4

EtherNet/IP Input Data

Input Data: 56 Bytes of Input Data from Pump to Master

Bytes	Data Type	Description
0–3	32-bit INT	Pump Status Bit 0: Status OK Bit 1: Pump Running Bit 2: Dispense Running Bit 3: Tube Uncalibrated Bit 4: Head Open Bit 5: Reserved Bit 6: Flow Direction CCW Bit 7: Remote Control Bit 8–31: Reserved
4	Byte	Dispense Mode
5	Byte	Tube Size
6	Byte	Flow Units
7	Byte	Reserved Pad
8–11	Float	Cumulative Volume
12–15	Float	Remaining Dispense Volume
16–19	Float	Remaining Dispense On Seconds
20–23	Float	Remaining Dispense Off Seconds
24–27	32-bit INT	Batch Count Current
28–31	32-bit INT	Batch Count Total
32–35	Float	Minimum Flow Rate
36–39	Float	Current Flow Rate
40–43	Float	Maximum Flow Rate
44–45	16-bit INT	Remaining Dispense On Time Days
46	Byte	Remaining Dispense On Time Hours
47	Byte	Remaining Dispense On Time Minutes
48	Byte	Remaining Dispense On Time Seconds
49	Byte	Remaining Dispense On Time Tenths
50–51	16-bit INT	Remaining Dispense Off Time Days
52	Byte	Remaining Dispense Off Time Hours
53	Byte	Remaining Dispense Off Time Minutes
54	Byte	Remaining Dispense Off Time Seconds
55	Byte	Remaining Dispense Off Time Tenths

EtherNet/IP Input Data (Cont.)

Input Data: 124 Bytes of Input Data from Pump to Master

Assembly 101–Extended Input Assembly

Bytes	Data Type	Description
0–1	16-bit INT	Anti Drip Degrees
2	Byte	Alarm ID
3	Byte	Alarm Type Index
4	Byte	Alarm Severity Index
5–7		Reserved Pad
8–11	32-bit INT	Alarm Triggered At
12–15	32-bit INT	Status Error Timestamp
16–17	16-bit INT	Status Error Code
18–19	16-bit INT	Bit 0: Dispense Paused Bit 1–15: Reserved
20	Byte	Bit 0: Network Loss Shutoff Bit 1–7
21	Byte	Pump Head Selection (Indexed)
22–23	16-bit INT	Reserved Pad
24–87	128-bit INT	Currently Logged In User
88–89	16-bit INT	Bit 0: User Management Enabled Bit 1–15: Reserved
90–91	16-bit INT	User Role
92–95	Float	Speed Set Point in RPM
96–99	Float	Actual Speed in RPM
100–103	Float	Actual Flow Rate
104–119	16-Byte STR	Loaded Program Name
120–123	Float	Calibration Factor

EtherNet/IP Input Data (Cont.)

Input Data: 316 Bytes of Input Data from Pump to Master

Assembly 102–Device Information

Bytes	Data Type	Description
0–39	40-Byte STR	Software Version
40–71	32-Byte STR	Model Number
72–103	32-Byte STR	Pump System
104–135	32-Byte STR	SKU
136–151	16-Byte STR	Serial Number
152–159	64- bit INT	MAC Address
160–173	14-Byte STR	Device ID
174 –175	16- bit INT	Coreboard Hardware Version
176–215	40-Byte STR	Coreboard Firmware Version
216–255	40-Byte STR	Motor Control Firmware Version
256–272	17-Byte STR	IPv4 Address (Ethernet)
273–275		Reserved Pad
276–292	17-Byte STR	IPv4 Address (WiFi)
293	Byte	Bit 0: Software Update Available Bit 1–7: Reserved
294–295		Reserved Pad
296–315	20-Byte STR	MAC Address String

EtherNet/IP Input Data (Cont.)

Input Data: 303 Bytes of Input Data from Pump to Master

Sensor data only applicable for available models: MasterSense

Applicable EDS file: Masterflex_v4.1_vendorid1440_ls_ip_bt_pumps.eds

Assembly 101–Extended Input Assembly

Bytes	Data Type	Description
0–3	32-bit INT	Threshold Details
		Bit 0: High Shutoff Threshold Enabled
		Bit 1: High Warning Threshold Enabled
		Bit 2: Low Warning Threshold Enabled
		Bit 3 Low Shutoff Threshold Warning
		Bit 4: Sensor Alarm Enabled
		Bit 5–31: Reserved
4–7	Float	High Shutoff Threshold
8–11	Float	High Warning Threshold
12–15	Float	Low Warning Threshold
16 –19	Float	Low Shutoff Threshold
20–21	16-bit INT	Sensor Type (Indexed: 0=Reserved, 1=MP30, 2=MP1, 3=PMAT, 4=Universal)
22–23	16-bit INT	Sensor Unit (Indexed: 0=PSI, 1=bar, 2=kPa, 3=mbar)
24–27	Float	Sensor Range Minimum
28–31	Float	Sensor Range Maximum
32–33	16- bit INT	Delay Alarm from Start (Seconds)
34–35	16- bit INT	Sensor Input Type Range (Indexed)
36–39	Float	Sensor Reading
40–43	Float	Zero Offset Valve
44–47	16- bit INT	Bit 0: Sensor Installed
		Bit 1: Sensor Detected
		Bit 2: Control Enabled
		Bit 3–31: Reserved
48–302	Float	Actual Flow Rate
104–119	255-Byte STR	Sensor Status String

EtherNet/IP Output Data

Output Data: 28 Bytes of Output Data from Pump to Master

Assembly 112—Legacy Output Assembly (legacy EDS v1.14)

Bytes	Data Type	Description
0	Byte	Pump Control
		Bit 0: Run/Pause (1 = RUN; 0 = PAUSE)
		Bit 1: Stop and Reset Dispense (1 to 0 transition)
		Bit 2: Toggle Remote/Local Control (1 to 0 transition)
		Bit 3: Clear Cumulative Volume (1 to 0 transition)
		Bit 4: Reserved
		Bit 5: Reserved
		Bit 6: Set Flow Direction CCW (1 = CCW, 0 = CW)
		Bit 7: Reserved
1	Byte	Reserved Pad
2	Byte	Reserved Pad
3	Byte	Reserved Pad
4	Byte	Set Dispense Mode (0 = CONT, 1 = TIME, 2 = VOL)
5	Byte	Reserved Pad
6	Byte	Set Flow Units (see Table 3, page 19)
7	Byte	Reserved pad
8–11	Float	Set Flow Rate
12–15	Float	Set Dispense Volume
16–19	Float	Set Dispense On Seconds
20–23	Float	Set Dispense Off Seconds
24–27	32-bit INT	Set Batch Count Total (0 = infinite)

EtherNet/IP Output Data (Cont.)

Output Data: 12 Bytes of Output Data from Pump to Master

Assembly 113–Extended Input Assembly

Bytes	Data Type	Description
0- 1	16-bit INT	Set Anti Drip Degrees
2	Byte	Bit 0: Enable Network Shutoff Bit: 1–7: Reserved
3	Byte	Bit 0: Reset Batch Count 1 to 0 Bit: 1–7: Reserved
4	Byte	Set Pump Head Selection (Indexed)
5	Byte	Bit 0: Set Tube Calibration 1 to 0 bit 1: Clear Calibration 1 to 0 Bit: 2–7: Reserved
6–7	16-bit INT	Reserved Pad
8–11	32-bit INT	Calibration Factor

EtherNet/IP Output Data (Cont.)

Output Data: 44 Bytes of Output Data from Pump to Master

Sensor data only applicable for available models: MasterSense

Applicable EDS file: Masterflex_v4.1_vendorid1440_ls_ip_bt_pumps.eds

Assembly 114–Sensor Control

Bytes	Data Type	Description
0–3	32-bit INT	Bit 0: Enable High Shutoff Threshold Bit 1: Enable High Warning Threshold Bit 2: Enable Low Warning Threshold Bit 3: Enable Low Shutoff Threshold Bit 4: Enable Global Alarms Bit 5–31: Reserved
4–7	Float	Set High Shutoff Threshold
8–11	Float	Set High Warning Threshold
12–15	Float	Set Low Warning Threshold
16–19	Float	Set Low Shutoff Threshold
20–21	16-bit INT	Set Sensor Type (Indexed: 0=Reserved, 1=MP30, 2=MP1, 3=PMAT, 4=Universal)
22–23	16-bit INT	Set Sensor Unit (Indexed: 0=PSI, 1=bar, 2=kPa, 3=mbar)
24–25	16-bit INT	Set Alarm Delay From Start (Seconds)
26–27	16-bit INT	Set Universal Sensor Input Range (Indexed)
28–31		Reserved Pad
32–35	Float	Set Universal Sensor Range Minimum
36–39	Float	Set Universal Sensor Range Maximum
40–41	16-bit INT	Bit 0: Add Sensor Configuration 1 to 0 Bit 1: Remove Sensor 1 to 0 Bit 2: Zero Sensor 1 to 0 Bit 3: Remove Zero Offset 1 to 0 Bit 4: Set Thresholds 1 to 0 Bit 5–15: Reserved
40–41	16-bit INT	Sensor Indexed

PROFINET

PROFINET Mode (Cont.)

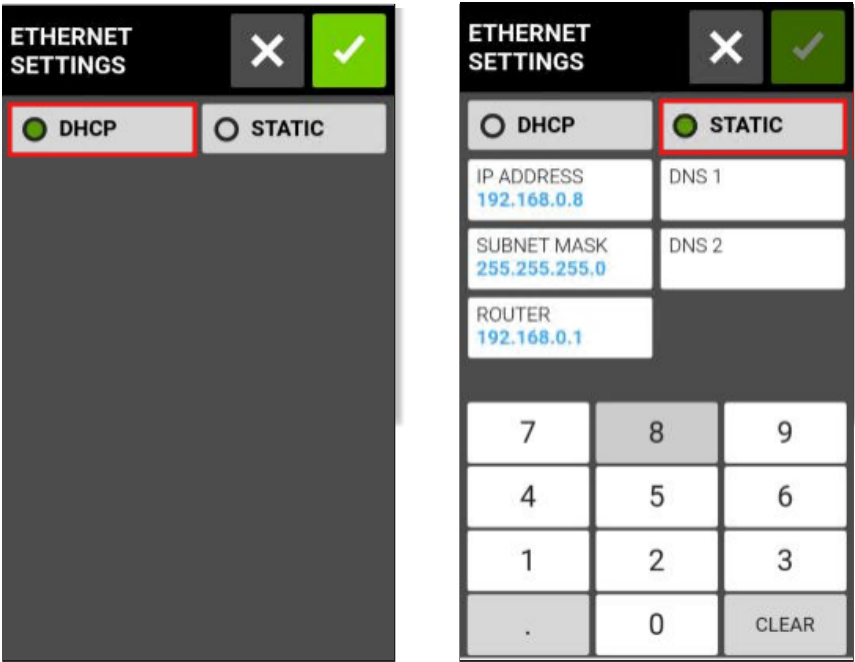
In PROFINET mode, the pump can be operated in Continuous, Volume, or Time modes. Drive-pumps are equipped with PROFINET for real-time control by a Programmable Logic Controller (PLC).

A General Station Description Markup Language (GSDML) file is available for download by emailing Masterflex technical support at techsupport@masterflex.com. This file allows your PLC software to properly recognize and configure the drive-pump within the PROFINET network.

Network Configuration

Before operating the drive-pump in PROFINET mode, ensure that the drive-pump, PLC and operator's computer are all connected to the same network.

- Verify that the computer's IP address falls within the same subnet mask range as the PLC and drive-pump.
- By default, the drive-pump uses Dynamic Host Configuration Protocol (DHCP) to automatically obtain an IP address (see Figure 1). Once PROFINET is enabled, the **Ethernet Settings** will be switched to **STATIC**.



Figures 1

PROFINET Mode (Cont.)

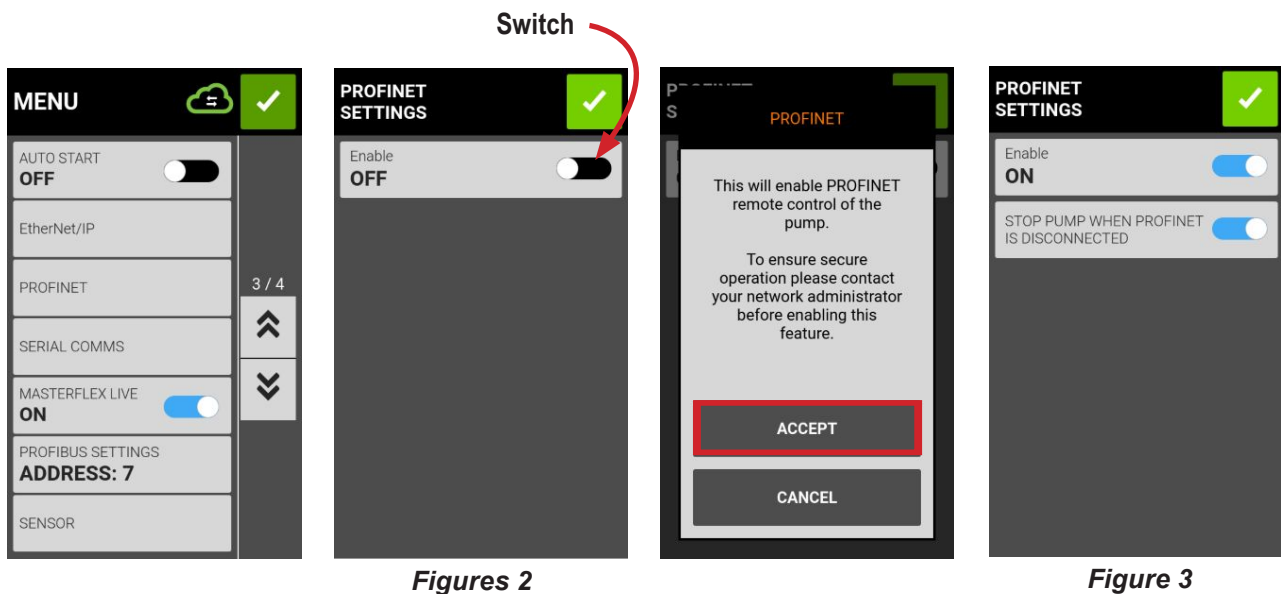
Enabling PROFINET Mode

1. On the **Menu** screen, tap **PROFINET** to open the PROFINET Settings screen (see *Figure 2* below).
2. Move the **Enable** switch from **OFF** to **ON**.
3. A confirmation message appears, informing you that PROFINET remote control will be enabled.
 - a. Tap **Accept** to proceed (see *Figure 3* below).
4. Once enabled, the PROFINET status will display **ON**.
5. Navigate to the **Ethernet Settings** page
6. Verify setting is set to **STATIC** and the **IP Address** contains the same subnet as the PLC
7. The pump is now ready for control by a connected PLC.

ETHERNET SETTINGS		
☐ DHCP	☒ STATIC	
IP ADDRESS 192.168.0.8	DNS 1	
SUBNET MASK 255.255.255.0	DNS 2	
ROUTER 192.168.0.254		
7	8	9
4	5	6
1	2	3
.	0	CLEAR

Notes

- To disable PROFINET, return to the same menu and switch **Enable** to **OFF**.
- When PROFINET is active, the pump may be remotely controlled through the PLC; local touchscreen controls may be limited.
- PROFINET cannot be enabled if Serial Communication or EtherNet/IP is enabled. Only one remote communication protocol may be enabled at a time.



PROFINET Mode (Cont.)

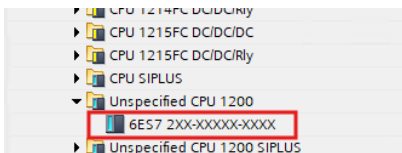
Using TIA Portal to Configure Your Setup

Once PROFINET is enabled on the pump and the device is connected to the network, it can be added and controlled within Siemens TIA Portal.

Add the PLC to the project

Verify your **PLC device model** before continuing. **This procedure uses automatic hardware detection. If the exact PLC model is already known, steps 5-6 may be skipped.*

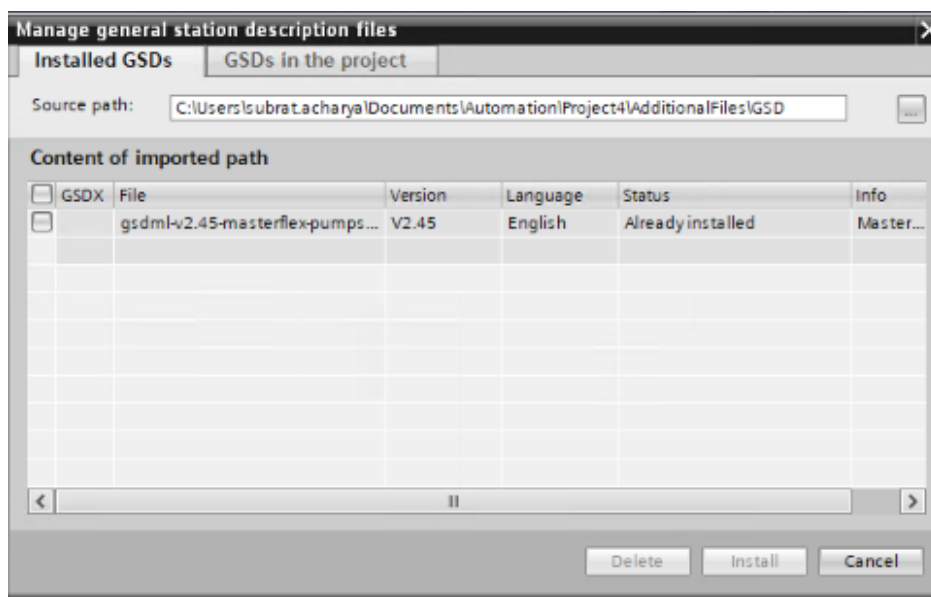
1. In the left-hand menu, double-click **Devices & networks**.
2. In **Hardware catalog** (right-hand menu), expand **Controllers**.
3. Select and add the correct **PLC** to your project.



4. Double-click the **PLC** in the **Devices & networks** view.
5. Select **detect** and **Start search**.
6. Once the search is completed, select **Detect**.

Import the GSDML File

1. Open **TIA Portal**.
2. **Create** a project and select **Project view** on the bottom-left corner.
3. From the menu, go to **Options** → **Manage general station description files (GSD)**.
4. In the **Source Path** field, browse to the location of the pump's GSDML file.
5. **Select** the GSDML file from the list and click **Install**.



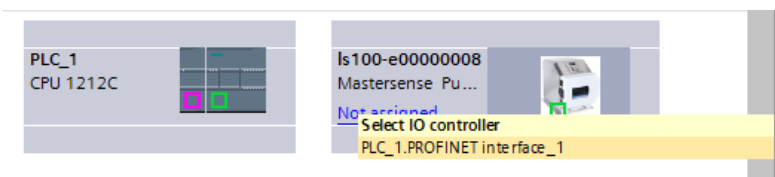
PROFINET Mode (Cont.)

Add the Pump to the Project

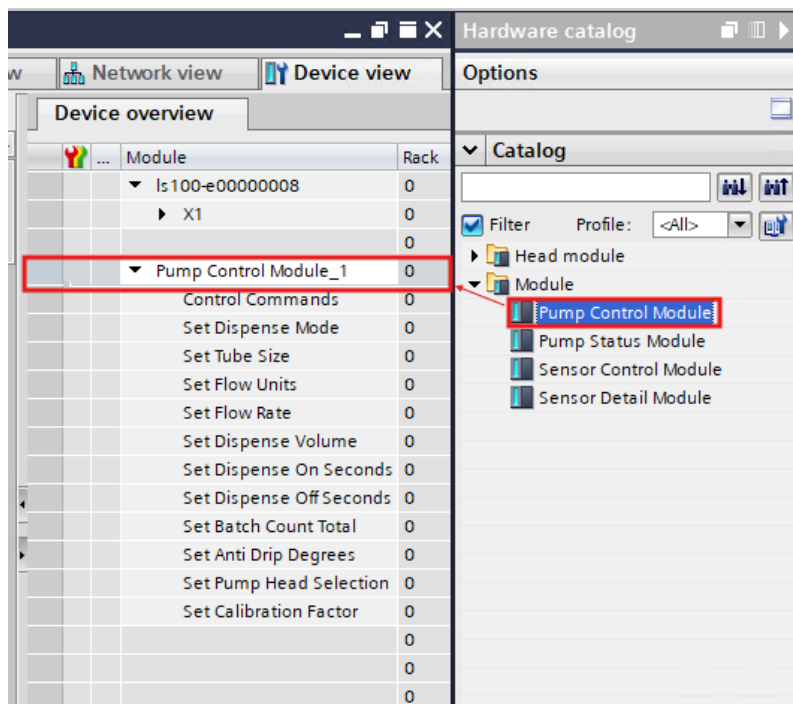
1. In the **Project Tree**, select **Devices & networks**.
2. In the top menu, select **Online > Hardware Detection > PROFINET devices from Network**
3. In the **Hardware detection of PROFINET devices** pop-up, select the following:
 - a. **Type of the PG/PC interface:** PN/IE
 - b. **PG/PC interface:** Realtek USB GbE Family Controller <3>

Note: The available **PG/PC interface** options may vary by system. Select the network interface that is connected to the same subnet as the PROFINET device.
4. Select **Start search**.

Tip : If no devices are found, verify that the correct **PG/PC interface** is selected and that **PROFINET is enabled on the pump**.
5. Check the correct device and select **Add devices**.
6. Assign the **IO controller** to the pump-device.



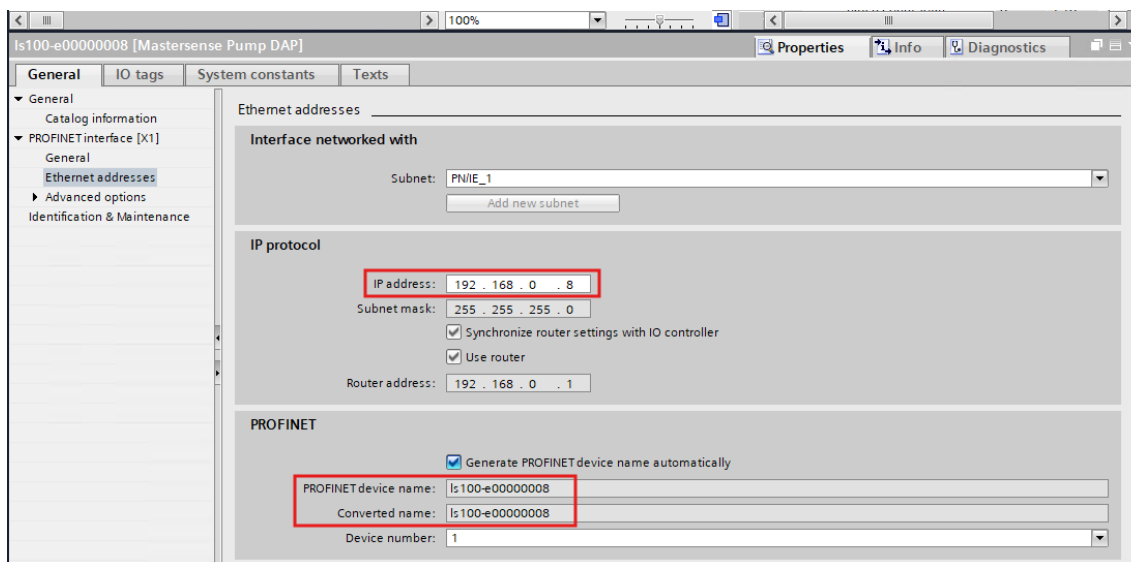
7. In the **Devices & networks** view, double-click the pump-device.
8. On the right-hand side in **Hardware catalog**, expand the **Module**.
9. Double-click to **add** the modules. (e.g., Pump Control Module and Pump Status Module)



PROFINET Mode (Cont.)

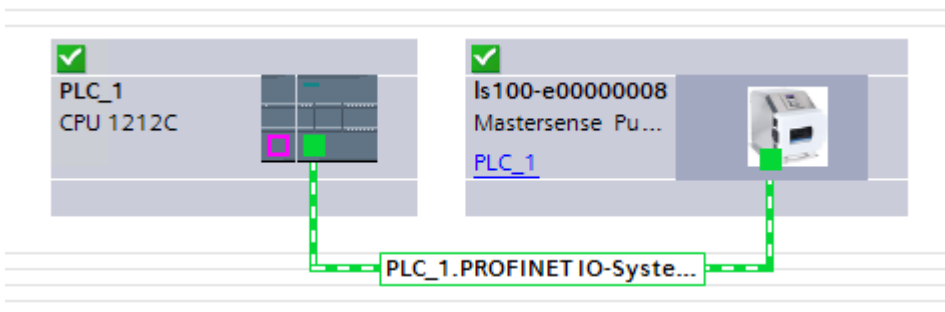
10. Confirm and verify the following on the **General** page of the device:

- a. IP address
- b. PROFINET device name (case-sensitive)
- c. Converted name (case-sensitive)



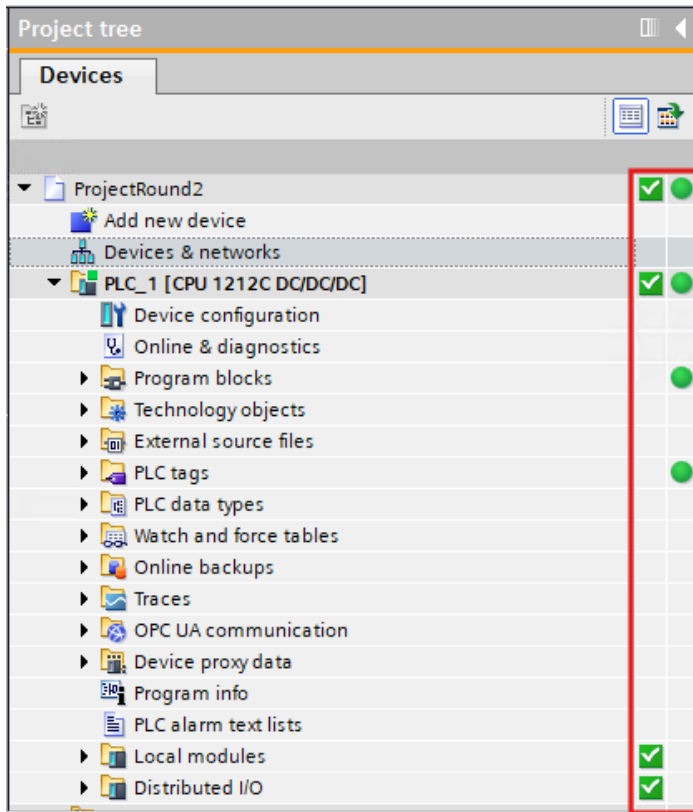
Download and Go Online

1. Double-click **Devices & networks** on the left-hand menu.
2. Right-click on the **PLC**.
3. Hover over **Compile** and select **Hardware and software (only changes)**.
4. Right-click on the **PLC** again.
5. Hover over **Download to device** and select **Hardware and software (only changes)**.
6. Verify field **Connect to interface/subnet** is set to **PN/IE_1**.
7. Select **Start search**, select the **PLC** and select **Load**.
8. Select **Finish**.
9. Once the download is complete, select **Go online** to verify communication.



PROFINET Mode (Cont.)

- The pump should appear as an active PROFINET device.
- In the **Project tree**, confirm that all indicators next to the PLC and its components are **green**, indicating the device is online and operating correctly.



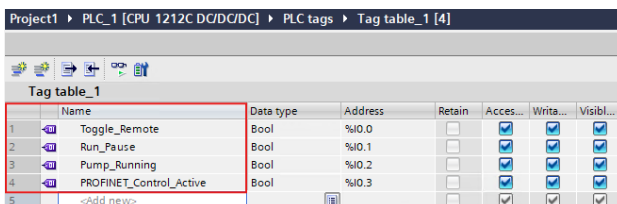
- You can now monitor and control the pump through TIA Portal or your PLC logic .

Example: Controlling the Pump via TIA Portal using the PROFINET I/O Module

The following example demonstrates how to configure the pump for **PROFINET mode** and **start-ing/stopping** the pump. *Note: Please reference the I/O mapping tables below to determine bit value.*

Step-by-Step Example

- In the **Project Tree**, expand **PLC tags** and double-click **Add new tag table**.
- Create the following tags:
 - Toggle_Remote
 - Run_Pause
 - Pump_Running
 - PROFINET_Control_Active

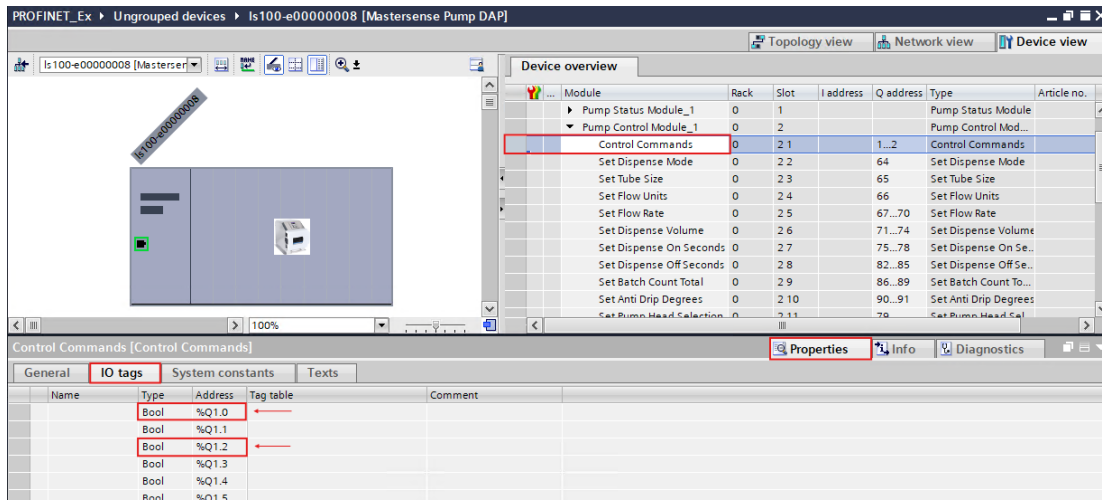


- Select **Devices & networks** in the **Project Tree**, and double-click the pump-device.
- Expand the **Pump Control Module_1** and select **Control Commands**
- Select the **Properties** tab and then **IO tags** tab.

PROFINET Mode (Cont.)

6. Note the **Addresses** of the Toggle_Remote_Local and Run_Pause bits. For example:
 - a. Toggle Remote/Local = bit 2 = **%Q1.2**
 - b. Run Pause = bit 0 = **%Q1.0**

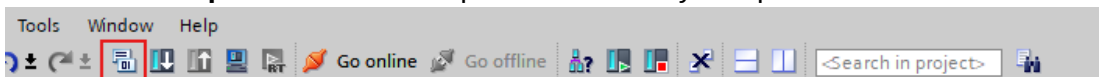
Note: Address assignments may differ by user configuration - adjust accordingly.



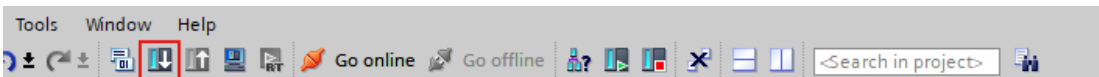
7. Navigate to the **PLC tags table**.
8. Update and assign the **Address** of the Toggle_Remote and Run_Pause respectively.

Name	Data type	Address	Retain	Access...	Write...	Visibl...
1 Toggle_Remote	Bool	%Q1.2		☒	☒	☒
2 Run_Pause	Bool	%Q1.0		☒	☒	☒
3 Pump_Running	Bool	%I0.2		☒	☒	☒
4 PROFINET_Control_Active	Bool	%I0.3		☒	☒	☒
5 <Add new>				☒	☒	☒

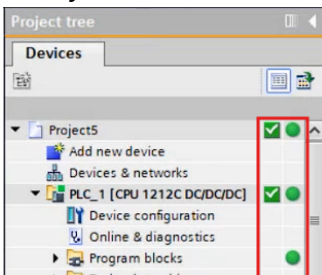
9. Repeat steps 3 - 8 with the **Pump Status Module_1** and the **Pump Status Flags** for the Pump_Running and PROFINET_Control_Active tags.
10. In the **Project Tree**, expand **Watch and force table** and double-click **Add new watch table**.
11. **Add** in the four (4) tags: Toggle_Remote, Run_Pause, Pump_Running, and PROFINET_Control_Active.
12. Select the option to **Go offline** in the top menu.
13. Navigate to **Devices & networks**
14. Select the **PLC**
15. Select the **Compile** button in the top menu and verify completion in the terminal.



16. Select the **Download to device** button in the top menu.

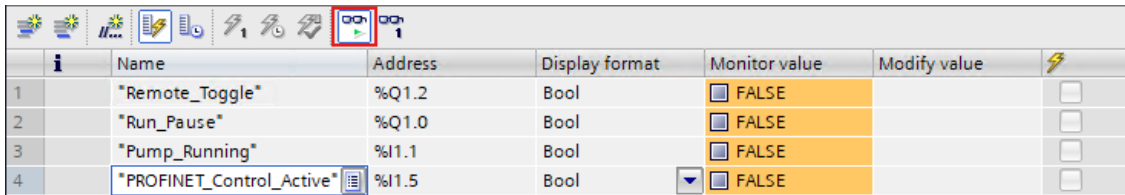


17. Select **Load** and then select option **Go Online**.
18. Verify all status icons are **Green**.



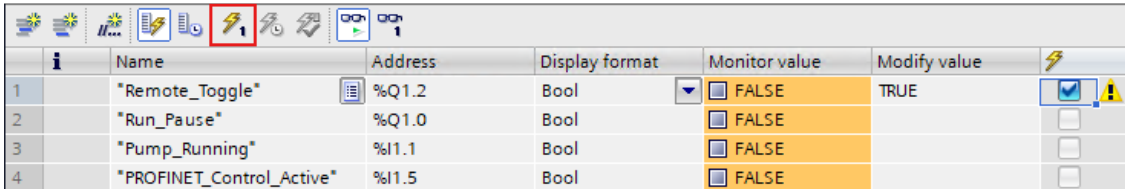
PROFINET Mode (Cont.)

19. In the **Project Tree**, select the **Watch table_1**.
20. Select the **Monitor all** button.



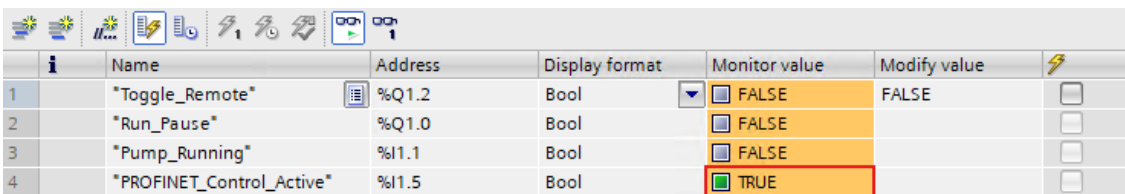
	i	Name	Address	Display format	Monitor value	Modify value	
1		*Remote_Toggle*	%Q1.2	Bool	☐ FALSE		☐
2		*Run_Pause*	%Q1.0	Bool	☐ FALSE		☐
3		*Pump_Running*	%I1.1	Bool	☐ FALSE		☐
4		*PROFINET_Control_Active*	%I1.5	Bool	☐ FALSE		☐

21. For the **Remote_Toggle** row, set the **Modify value** column to **TRUE**.
22. Select the **Modify** button.



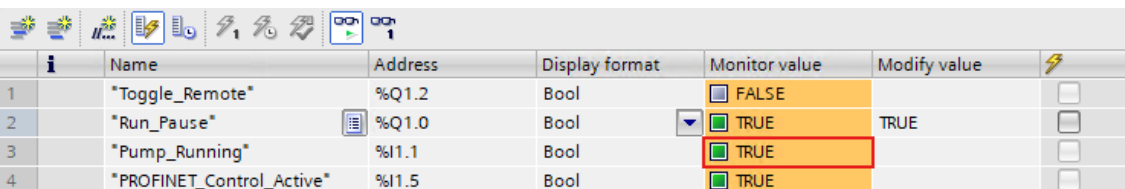
	i	Name	Address	Display format	Monitor value	Modify value	
1		*Remote_Toggle*	%Q1.2	Bool	☐ FALSE	TRUE	☒ ⚠
2		*Run_Pause*	%Q1.0	Bool	☐ FALSE		☐
3		*Pump_Running*	%I1.1	Bool	☐ FALSE		☐
4		*PROFINET_Control_Active*	%I1.5	Bool	☐ FALSE		☐

23. For the **Remote_Toggle** row, set the **Modify value** column to **FALSE**.
24. Select the **Modify** button.
25. Verify **PROFINET_Control_Active** is **TRUE** in the **Monitor value** column.



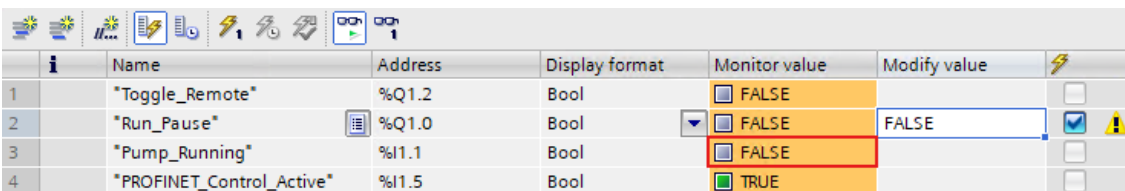
	i	Name	Address	Display format	Monitor value	Modify value	
1		*Toggle_Remote*	%Q1.2	Bool	☐ FALSE	FALSE	☐
2		*Run_Pause*	%Q1.0	Bool	☐ FALSE		☐
3		*Pump_Running*	%I1.1	Bool	☐ FALSE		☐
4		*PROFINET_Control_Active*	%I1.5	Bool	☒ TRUE		☐

26. For the **Run_Pause** row, set the **Modify value** column to **TRUE**.
27. Select the **Modify** button.
28. Verify **Pump_Running** is **TRUE** in the **Monitor value** column.



	i	Name	Address	Display format	Monitor value	Modify value	
1		*Toggle_Remote*	%Q1.2	Bool	☐ FALSE		☐
2		*Run_Pause*	%Q1.0	Bool	☒ TRUE	TRUE	☐
3		*Pump_Running*	%I1.1	Bool	☒ TRUE		☐
4		*PROFINET_Control_Active*	%I1.5	Bool	☒ TRUE		☐

29. To **STOP** the pump, set the **Run_Pause** row to **FALSE** and select the **Modify** button.
30. Verify **Pump_Running** is **FALSE** in the **Monitor value** column.



	i	Name	Address	Display format	Monitor value	Modify value	
1		*Toggle_Remote*	%Q1.2	Bool	☐ FALSE		☐
2		*Run_Pause*	%Q1.0	Bool	☐ FALSE	FALSE	☒ ⚠
3		*Pump_Running*	%I1.1	Bool	☐ FALSE		☐
4		*PROFINET_Control_Active*	%I1.5	Bool	☒ TRUE		☐

PROFINET Input Data

Pump Status Module: Input Data from Pump to Master

Subslot	Name	Data Type	Description
1	Status Flags	Unsigned16	Bit 0 : Status OK Bit 1 : Pump Running Bit 2 : Dispense On Bit 3 : Tube Uncalibrated Bit 4 : Head Open Bit 5 : PROFINET Control Active Bit 6 : Flow Direction CCW Bit 7 : Remote Control Mode Bit 8 : Priming Active Bit 9 : Dispense Paused Bit 10 : Network Loss Shutoff Enabled Bit 11 - 15 : Reserved
2	Dispense Mode Index	Unsigned8	Current dispense mode index
3	Tube Size Index	Unsigned8	Selected tube size index
4	Flow Unit Index	Unsigned8	Selected flowrate unit index
5	Cumulative Volume	Float32	Total volume dispense
6	Remaining Dispense Volume	Float32	Volume remaining in current dispense
7	Total Remaining Dispense On (Seconds)	Float32	Seconds remaining in dispense on cycle
8	Total Remaining Dispense Off (Seconds)	Float32	Seconds remaining in dispense off cycle
9	Batch Count Current	Unsigned32	Current batch count value
10	Batch Count Total	Unsigned32	Total batch count target
11	Minimum Flow Rate Setpoint	Float32	Minimum allowed flowrate for current configuration
12	Flow Rate Setpoint	Float32	Commanded flowrate setpoint
13	Maximum Flow Rate Setpoint	Float32	Maximum allowed flowrate for current configuration
14	Remaining On Time - Days	Unsigned16	Remaining dispense on time in days
15	Remaining On Time - Hours	Unsigned8	Remaining dispense on time in hours
16	Remaining On Time - Minutes	Unsigned8	Remaining dispense on time in minutes
17	Remaining On Time - Seconds	Unsigned8	Remaining dispense on time in seconds
18	Remaining On Time - Tenths	Unsigned8	Remaining dispense on time in tenths of seconds
19	Remaining Off Time - Days	Unsigned16	Remaining dispense off time in days
20	Remaining Off Time - Hours	Unsigned8	Remaining dispense off time in hours
21	Remaining Off Time - Minutes	Unsigned8	Remaining dispense off time in minutes
22	Remaining Off Time - Seconds	Unsigned8	Remaining dispense off time in seconds
23	Remaining Off Time - Tenths	Unsigned8	Remaining dispense off time in tenths of seconds
24	Anti Drip Degrees	Unsigned16	Anti-drip rotation angle in degrees
25	Pump Head Selection	Unsigned8	Currently selected pump head index
26	Speed Setpoint (RPM)	Float32	Motor speed setpoint in RPM
27	Actual Speed (RPM)	Float32	Actual motor speed in RPM
28	Actual Flow Rate	Float32	Measured actual flowrate
29	Loaded Program Name	OctetString	Name of currently loaded program
30	Calibration Factor	Float32	Tube calibration factor

PROFINET Input Data

Sensor Detail Module: Input Data from Pump to Master

Subslot	Name	Data Type	Description
1	Sensor Status Flags	Unsigned8	Bit 0 : High Shutoff Threshold Enabled Bit 1 : High Warning Threshold Enabled Bit 2 : Low Warning Threshold Enabled Bit 3 : Low Shutoff Threshold Enabled Bit 4 : Global Alarms Enabled Bit 5 : Sensor Installed Bit 6 : Sensor Auto-Detected Bit 7 : Control Enabled
2	High Shutoff Threshold	Float32	High shutoff threshold value
3	High Warning Threshold	Float32	High warning threshold value
4	Low Warning Threshold	Float32	Low warning threshold value
5	Low Shutoff Threshold	Float32	Low shutoff threshold value
6	Sensor Type	Unsigned16	Current sensor type
7	Sensor Unit	Unsigned16	Current sensor unit
8	Sensor Range Minimum	Float32	Sensor range minimum value
9	Sensor Range Maximum	Float32	Sensor range maximum value
10	Delay Alarm From Start (Seconds)	Unsigned16	Alarm delay from start in seconds
11	Sensor Input Type Range	Unsigned16	Universal sensor input type range
12	Sensor Reading	Float32	Current sensor reading value
13	Zero Offset Value	Float32	Current zero offset value
14	Sensor Status String	OctetString	Sensor status description string

PROFINET Output Data

Pump Control Module: Output Data from Pump to Master

Subslot	Name	Data Type	Description
1	Pump Control Commands	Unsigned16	Bit 0 : Run (1) / Pause (0) Bit 1 : Stop and Reset Dispense (1 → 0) Bit 2 : Toggle Remote/Local (1 → 0) Bit 3 : Clear Cumulative Volume (1 → 0) Bit 4 : Set Flow Direction CCW Bit 5 : Enable Network Shutoff Bit 6 : Reset Batch Count (1 → 0) Bit 7 : Set Tube Calibration (1 → 0) Bit 8 : Clear Calibration (1 → 0) Bit 9 - 15 : Reserved
2	Set Dispense Mode	Unsigned8	Configure dispense mode (0 = Cont., 1 = Time, 2 = Volume)
3	Set Tube Size	Unsigned8	Configure tube size
4	Set Flow Units	Unsigned8	Configure flowrate units
5	Set Flow Rate	Float32	Set flowrate setpoint
6	Set Dispense Volume	Float32	Set dispense volume setpoint
7	Set Dispense On Seconds	Float32	Set dispense on time in seconds
8	Set Dispense Off Seconds	Float32	Set dispense off time in seconds
9	Set Batch Count Total	Integer32	Set total batch count target
10	Set Anti Drip Degrees	Integer16	Set anti-drip rotation angle
11	Set Pump Head Selection	Unsigned8	Select pump head configuration
12	Calibration Factor	Float32	Set calibration factor value

PROFINET Output Data

Sensor Control Module: Output Data from Pump to Master

Subslot	Name	Data Type	Description
1	Sensor Control Flags	Unsigned16	Bit 0 : Enable High Shutoff Threshold Bit 1 : Enable High Warning Threshold Bit 2 : Enable Low Warning Threshold Bit 3 : Enable Low Shutoff Threshold Bit 4 : Enable Global Alarms Bit 5 : Add Sensor Configuration (1 → 0) Bit 6 : Remove Sensor (1 → 0) Bit 7 : Zero Sensor (1 → 0) Bit 8 : Remove Zero Offset (1 → 0) Bit 9 : Set Thresholds (1 → 0) Bit 10 - 15 : Reserved
2	Set High Shutoff Threshold	Float32	Set high shutoff threshold value
3	Set High Warning Threshold	Float32	Set high warning threshold value
4	Set Low Warning Threshold	Float32	Set low warning threshold value
5	Set Low Shutoff Threshold	Float32	Set low shutoff threshold value
6	Set Sensor Type	Unsigned16	Configure sensor type
7	Set Sensor Unit	Unsigned16	Configure sensor unit
8	Set Alarm Delay From Start	Unsigned16	Configure alarm delay from start
9	Set Universal Sensor Input Range	Unsigned16	Configure universal sensor input range
10	Set Universal Sensor Range Minimum	Float32	Set universal sensor range minimum
11	Set Universal Sensor Range Maximum	Float32	Set universal sensor range maximum
12	Sensor Index	Unsigned16	Target sensor index for operations

Profibus

Profibus

In Profibus mode the drive-pump will operate remotely in Continuous, Volume, or Time mode.

Profibus Mode

Verify an operator computer and the PLC are **both** connected to the **same** network switch. Also, verify the pump can send/receive ping commands from the computer. In addition, verify the **process control** is running and connected to the network.

Connect the 9-pin Profibus cable to the drive-pump's side connector, or to the Profibus connector which is either on the Profibus module or on a process controller itself.

Profibus Settings



Settings



Scroll

NOTE: Verify the drive-pump is connected to a PLC and is in Profibus mode.

Selecting Profibus Settings

1. Tap **Settings**.
2. The **Menu** screen displays (see Figure 5 below).
3. Scroll to **Profibus Settings**.
4. Verify the drive-pump and the PLC user interface are configured for the **same address**; confirm by pressing the **green** Confirm checkmark at the top of the screen (see below).

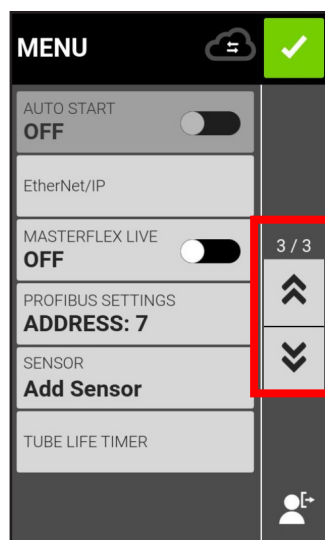


Figure 5

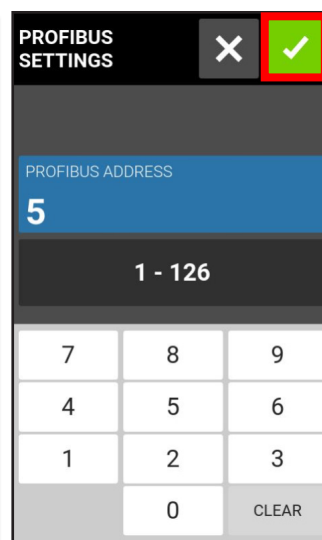


Figure 6

Profibus Data

The MASTERFLEX drive-pump operates as a DP-V0 Slave.

GSD File: CPMP0FF8.GSD

ID Number: 0FF8 HEX

Default Slave Address: 7

Cyclic Input Data: 56 Bytes

Cyclic Output Data: 28 Bytes

Table 1 below lists the 56 Bytes of cyclic input data, from pump to master.

Table 1

Cyclic Input (pump → master, 56 Bytes)		
Data	Size in Bytes	Data Type
Pump Status	4	unsigned integer
Dispense Mode	1	unsigned integer
Tube Size	1	unsigned integer
Flow Units	1	unsigned integer
Padding (not used)	1	unsigned integer
Cumulative Volume	4	decimal Floating-point
Remaining Dispense Volume	4	decimal Floating-point
Remaining Dispense On Seconds	4	decimal Floating-point
Remaining Dispense Off Seconds	4	decimal Floating-point
Current Batch Count	4	unsigned integer
Total Batch Count	4	unsigned integer
Minimum Flow Rate	4	decimal Floating-point
Current Flow Rate	4	decimal Floating-point
Maximum Flow Rate	4	decimal Floating-point
Remaining Dispense On Days	2	unsigned integer
Remaining Dispense On Hours	1	unsigned integer
Remaining Dispense On Minutes	1	unsigned integer
Remaining Dispense On Seconds	1	unsigned integer
Remaining Dispense On Tenths	1	unsigned integer
Remaining Dispense Off Days	2	unsigned integer
Remaining Dispense Off Hours	1	unsigned integer
Remaining Dispense Off Minutes	1	unsigned integer
Remaining Dispense Off Seconds	1	unsigned integer
Remaining Dispense Off Tenths	1	unsigned integer

Profibus Data (Cont.)

NOTE: Converting multi-Byte data correctly **will** depend on the Byte order configuration of the master. The 4-Byte decimal Floating-point values are represented in IEEE-754 Floating point format. Pump Status, a 4-Byte unsigned integer as shown in **Table 1** (previous page), indicates the pump's operation in separate bits. See **Table 2** below for the description of each bit in Pump Status.

Table 2

Pump Status	
Status OK	bit 0
Pump Running	bit 1
Dispense On	bit 2
Tube Uncalibrated	bit 3
Head Open	bit 4
Profibus Control	bit 5
Flow Direction CCW	bit 6
Remote Control	bit 7

Profibus Data (Cont.)

Table 3 below lists the 28 Bytes of cyclic output data, from master to pump.

Cyclic Input (pump master, 28 Bytes)		
Data	Size in Bytes	Data Type
Pump Control	4	unsigned integer
Set Dispense Mode	1	unsigned integer
Set Tube Size	1	unsigned integer
Set Flow Units	1	unsigned integer
Padding (not used)	1	unsigned integer
Set Flow Rate	4	decimal Floating-point
Set Dispense Volume	4	decimal Floating-point
Set Dispense On Seconds	4	decimal Floating-point
Set Dispense Off Seconds	4	decimal Floating-point
Set Total Batch Count	4	unsigned integer

Pump Control, a 4-Byte unsigned integer as shown in **Table 3** (above), controls the pump's operation in separate bits. See **Table 4** (below) for the description of each bit in Pump Control.

Table 4

Pump Control	
Run (1) Pause (0)	bit 0
Stop and Reset Dispense (1 to 0)	bit 1
Toggle Remote/Local Control (1 to 0)	bit 2
Clear Cumulative Volume (1 to 0)	bit 3
Set Flow Direction CCW (1=CCW, 0=CW)	bit 6

Profibus Data (Cont.)

A transition on bit 2 of Pump Control will toggle between Local and Remote control of the drive-pump. For example, if the drive-pump is in Local mode, then a 1-to-0 transition will put the drive-pump into Profibus Remote Control mode; only in this mode can any change in the cyclic output data influence the drive-pump and be reflected in the cyclic input data.

By setting Dispense mode, the operating mode can be one of the following:

- Continuous
- Time Dispense
- Volume Dispense

Set Tube Size and Set Flow Units are integer numbers, beginning with 1. Entered numbers corresponding to the drive-pump's Local menu list on the touchscreen interface. For example, if tube size is listed as "13" on the Local menu list, then "13" corresponds to a value "1" for tube size output value flow units in "gal/hr." The Local menu list then corresponds to a value of "9" for the Flow Units output value.

- Set Flow Rate is a decimal Floating-point number. This value must be between the minimum flow rate and maximum flow rate values from the input data
- Set Dispense Volume is the amount of volume that is dispensed in Volume Dispense mode
- Set Dispense On Seconds is the amount of pump dispense time in Time Dispense mode
- Set Dispense Off Seconds is used for both Time and Volume dispense modes, setting the amount of time the pump will pause between dispenses

Serial Communications

Serial Communications Mode

Masterflex Touchscreen Serial Control, RS-232 V2.20.0 or Later

SerialComms Models

- Masterflex Ismatec® Reglo touchscreen pump systems.
- Masterflex MasterSense Drive-Pumps (MasterSense L/S®, I/P®, and B/T®).

Requirements

RS232 Serial communication is available via virtual com port utilizing the USB port on the back panel of the drive-pump. An adapter cable is required for communication (see Figure 7 below).

- If a host PC operating on Windows®, Mac®, or Linux® is being used to control the pump through serial communication, the Masterflex **MFLX08006-90** serial cable is needed (see Figure 7 below).
- If a microcontroller or PLC-based system that accepts UART TTL 3.3V signal is used to control the pump, the Masterflex **MFLX08006-91** serial cable is needed (see Figure 2, next page). Alternatively, a FTDI USB to UART TTL 3.3V cable can also be used; three wires—TXD, RXD, and GND—are needed.

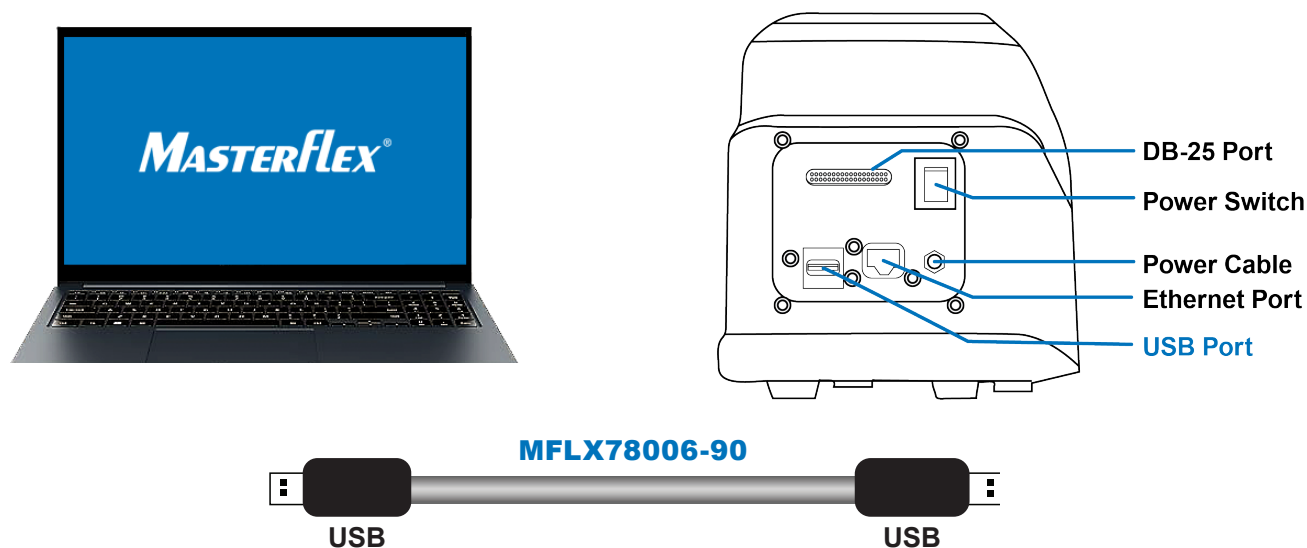


Figure 7. Adapter cable for PC Host interface for Pump Serial Communication control.

PC Host Interface

NOTE: The appearance of the drive back panels may vary from the illustration above. Nonetheless, the USB port is a common feature on the back of all drives.

When a Windows PC is connected to the cable, a virtual **COMx** port is automatically assigned. The value of **X** will vary depending on the number of USB devices currently connected to the PC. For Mac or Linux systems connected to the cable, the corresponding port designation should be **/dev/ttyUSBx**, where the **X** value is determined by the number of connected USB devices.

Serial Communications Mode (Cont.)

Microcontroller or Process Controller (PLC, DCS) Interface

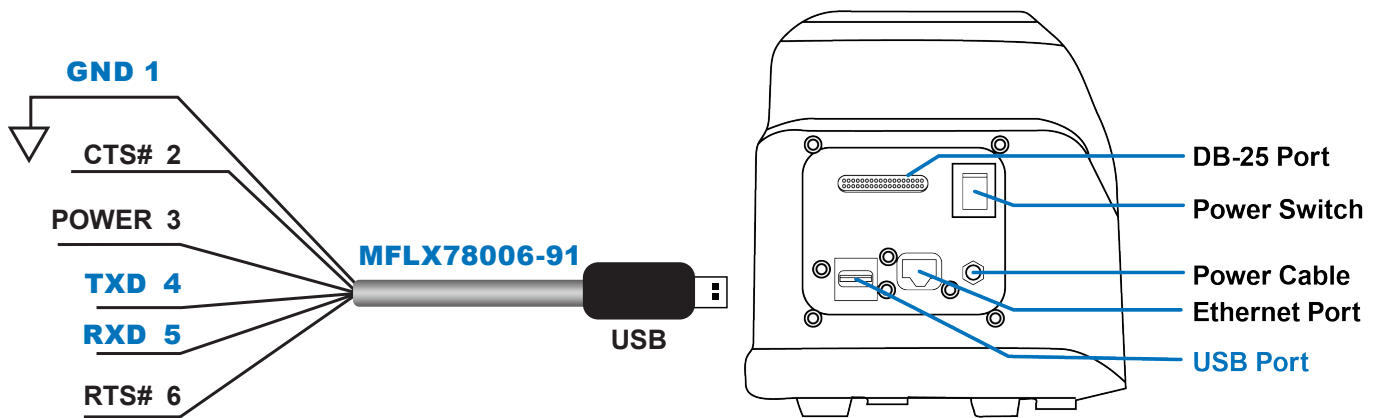


Figure 8: Microcontroller or PLC Host Interface for Pump Serial Control.

On the pump side, a USB connector is used. On the microcontroller or process controller side, only three out of six wires are needed; **GND**, **TXD**, and **RXD**. The CTS, RTS, and Power wires (see Figure 8 above) are not used.

To use this option, you will need to develop your own software tailored to your specific platform and programming language requirements.

Serial Communication Settings

- Baud Rate: 115200
- Bits: 8 bits
- Stopbits: 1
- Parity: no parity

Software Prerequisites

To effectively utilize this software requires a terminal program capable of transmitting and receiving serial commands. There are several options available depending on your operating system: for **Windows** users, popular programs like **PuTTY** or **TeraTerm** can be used. If you are using **Linux** or **iOS**, you can opt for terminal programs like **Minicom**[®], **iTerm**[®], or the **built-in terminals**. Alternatively, Masterflex offers an **open-source Python**[®] terminal program called masterflex-serial on **GitHub**[®], freely available, it can serve as a valuable starting point for your project. Visit <https://github.com/masterflexbp/masterflex-serial>

Serial Communications Mode (Cont.)

Setting the Pump Address

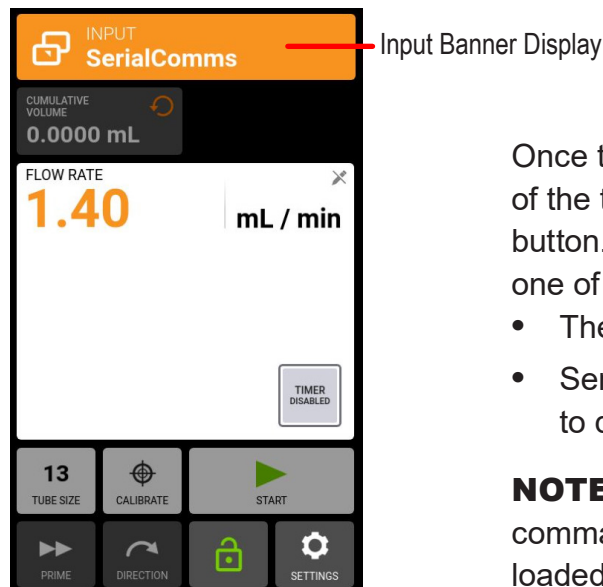
Each command string begins with the pump address (1-8). It is factory-set to 1 and can be changed with the @ command.

Structure of the Commands

The address is followed by a character. Some commands have an additional parameter which always consists of 2-5 figures.

- **Command strings** are completed by a carriage return ASCII 13 **13**. The pump confirms most of the commands with an asterisk (*). Yes/No inquiries are answered by + (yes) or — (no)
- **Multi-digit replies** are concluded by (CR) ASCII 13 and (LF) ASCII 10 **13 10**.
- **Incorrect command strings** are answered by #
- **Numerical values** are confirmed as 3- to 5-digit figures. Four of the five digits are numerals, one digit is either a decimal point or a preceding blank space

Once serial control is enabled by sending the command 1RE1 **13** (see reference on the next page), the **Input SerialComms** banner will appear at the top of the touchscreen display (see Figure 9 below).



Once the pump is in Serial Communication mode, most of the touchscreen is disabled except for the Start/Stop button. The pump will stay in SerialComms mode until one of the following events happens:

- The pump reboots
- SerialComms client sends the command 1RE0 **13** to disable Serial Communication mode

NOTE: When switching on the drive-pump the serial command will only respond after the system has fully loaded; the process may take several minutes.

Figure 9: SerialComms Banner

Serial Communications Mode (Cont.)

SerialComm Lock Mode

SerialComm Toggle enables or disables the pump's serial communication mode. When disabled, the pump will not accept any serial commands and remains inoperative. Enabling this mode allows control of the pump through designated serial commands.

Lock Serial Communication Mode provides an additional layer of configuration stability for applications requiring consistent communication modes. When this feature is enabled:

- The pump will automatically switch to **SerialComm Mode**
- If the pump is power-cycled, it will boot up directly into SerialComm Mode, ensuring seamless operation
- Serial commands for toggling SerialComm Mode (1RE1 or 1RE0) will be ignored
- No other remote modes or inputs can override the locked SerialComm state

User Interface Integration:

- Activating **Lock Serial Communication Mode** restricts interactions with the pumps touch screen, ensuring the configurations remain fixed (see Figure 10)
- To enable locked mode, toggle the setting and tap **Accept** on the popup (see Figure 11)
- Selecting the orange **SerialComms Mode banner** provides quick access to SerialComm settings, simplifying navigation for the user (see Figure 12)

This feature is ideal for processes where maintaining uninterrupted SerialComm operations is critical, ensuring the pump behavior remains consistent and secure under various operating conditions.

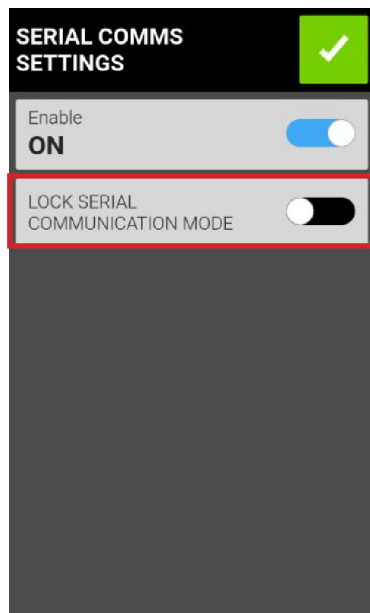


Figure 10: Lock Serial Communication Mode

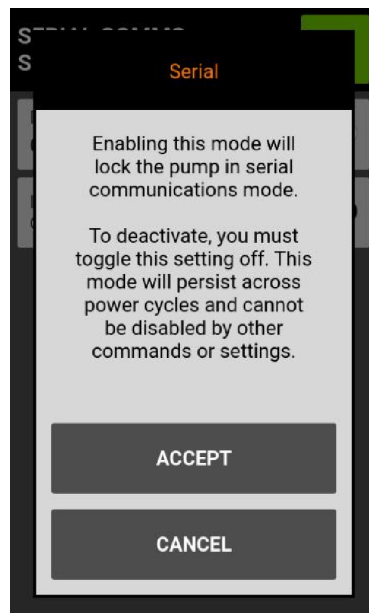


Figure 11: Serial screen

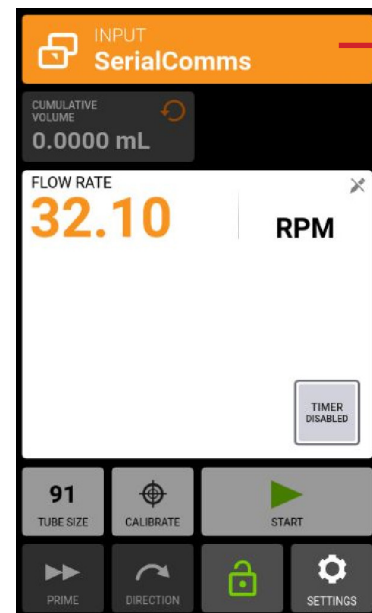


Figure 12: SerialComms Banner

Serial Communications Mode (Cont.)

Serial Interface Command Set, Software Release v2.20.0 and Later

General Information	Example	Response	Note
Each command string must begin with the pump address from 1 to 8, (factory-set to 1) except for the set address command @.	1xxxx	13	
Aside from set address command, two types of supported commands are get and set. • get command will query for the current pump parameters • set command will set the pump to a certain operating condition Each command string sent from the client side must be completed with the character ASCII (13, carriage return).	@ 3	13	*
The response from the pump will be: • * for valid set command • # for invalid set command • ~ for valid command but not in Serial Mode • {value} + 13 10 for get command			

NOTE: *See page 37 for Serial Communications Commands details.

Serial Communications Mode (Cont.)

SerialComm Run Screen



In Serial Communications Mode the pump can be operated in Continuous Mode. Masterflex Ismatec IPC pumps-drives are equipped with a USB-A port and a 9-pin RS232 DB-9 port for real-time control through serial commands using a computer (see above).

NOTE: A Masterflex [MFLX78006-90](#) serial cable is required if using USB-A.

On the touchscreen the **SerialComms Run** screen displays during serial communications input operation (see Figure 13 below), as well as displays the currently selected settings from an external remote control device.

NOTE: Not all touchscreen options are available during Remote Mode operation.

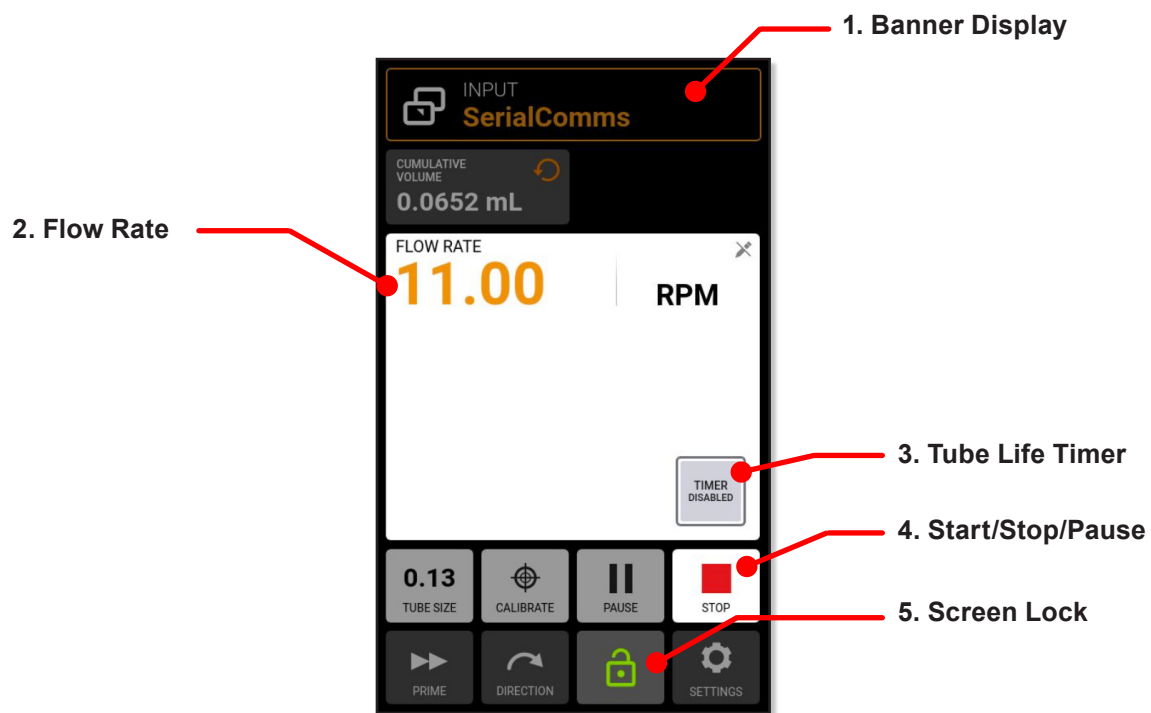


Figure 13: SerialComms Run

Serial Communications Mode (Cont.)

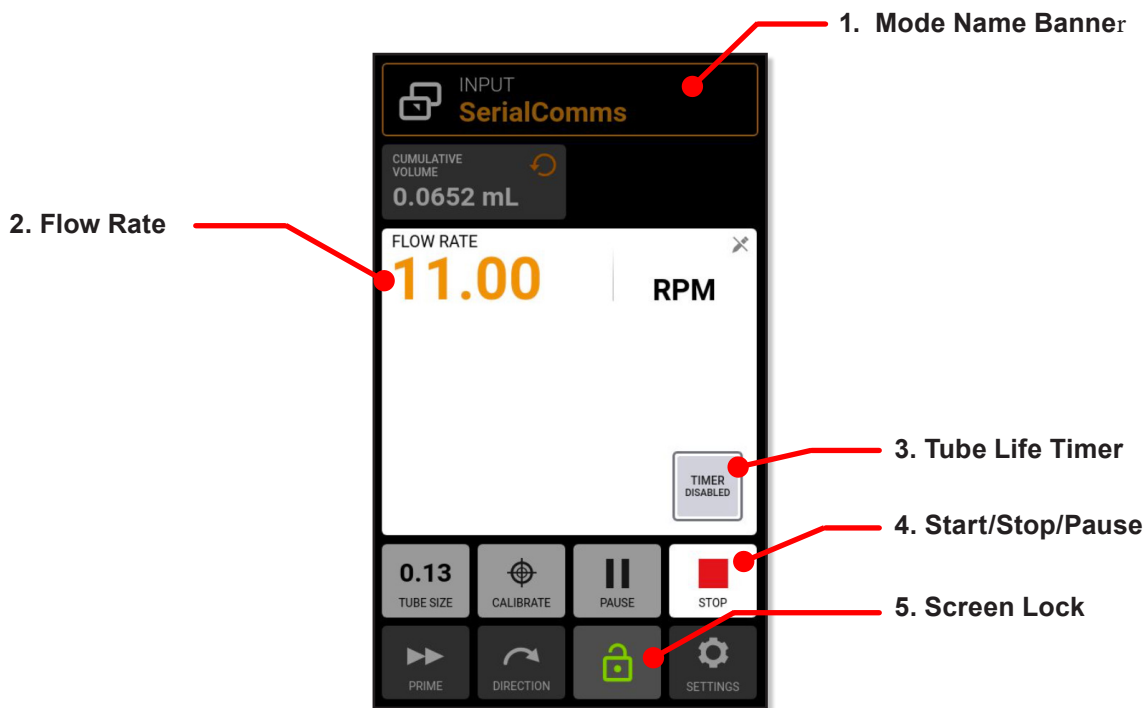


Figure 14: SerialComms Run

1. **Mode Name Banner.** Displays currently selected input type (see Figure 14 above).
2. **Flow Rate.** Displays current flow rate in an operator-selected unit of measurement.
3. **Tube Life Timer.** If enabled, Tube Life Timer displays a countdown timer that tracks operational life of the pump tubes. Tap to access the Tube Life Timer screen.
4. **Start/Stop/Pause.** During operation, the display will change from **Start** to **Stop**.
5. **Screen Lock.** Locking the screen disables all touchscreen functions.
6. To lock the screen: tap **Unlocked**—the icon changes to **Locked**.
7. To unlock the screen tap **Locked** and then tap **Confirm** (not shown)—the icon changes to **Unlocked**.

Serial Communications Mode (Cont.)

Serial Communication Setup

General Preparation

- Download and install a suitable terminal application such as PuTTY onto the system controlling computer
- Verify the drive-pump and computer are connected through either the USB port using a USB-A-to-USB-A serial cable or, for PC models, connected through the exclusive 9-pin DB-9 port using an RS232 DB-9 modem cable
- Verify the computer is configured to send ASCII serial messages at a 115200 baud rate

Setting the Drive-pump Address

Each command string must begin with the drive-pump address (1-8). It is factory-set at 1 and can be changed using the address change command @ (see upcoming Serial Interface Command Table). The address will be stored permanently (even after the pump has been switched off). The assignment of the address enables an operator to control up to 8 pumps with only one interface.

Enabling/Disabling Serial Communications Remote Mode

When not in Serial Communications Remote mode the pump will only respond to the address set (@) and Serial Remote mode enable commands (RE). To enter Serial Communications Remote Mode, the control device needs to send an enable command (see upcoming the Serial Interface Command table upcoming pages 30–33), this triggers the Serial Communications Mode on the SerialComms Run touchscreen display.

Serial Communications Mode (Cont.)

Serial Communications Commands

Command Structure

Example Command	1 R 20 13
Command Structure	(Address) (Serial Command) (Command Parameter) (ASCII 13 Carriage Return)

The first character of the ASCII serial command string is the address, this is followed by the characters for the serial command (see the Serial Interface Command table, next). Some commands have an additional parameter following the command character for setting values. The command string is completed by a carriage return (ASCII 13) 13 which initiates the processing of the command. The serial commands settings are at 115200 baud rate, 8 bit, 1 stop bit, no parity.

Command acknowledgment:

- The pump confirms valid serial commands by returning an asterisk (*)
- Incorrect serial command strings will be returned with a hash mark (#)
- If the pump is not in Serial Communications mode the pump responds with tilde key (~); value + 13 10 for getting command responses

Example

Objective: To configure the pump to run 20 batches, each with a 1-minute dispense time at 50% flow rate, with a 10-second interval between batches. Assumption: Pump address is 1.

1. Connect the PC to the Masterflex device via RS-232 cable.
2. Set up the correct communication settings (baud rate, COM port, etc.)
3. In the terminal send these commands to achieve the following:
 - a. Enable Serial Communication: 1RE1
 - b. Enable Time mode: 1N
 - c. Reset Batch Count to zero: 1R"
 - d. Set Batch Total to 20: 1"00020
 - e. Set On-Time to to one minute: 1VM001
 - f. Set Flow Rate to run at 50%: 1S005000
 - g. Set Off-Time to 10 seconds: 1RT0000100
 - h. Start the pump: 1H

Note: After each command is sent, a '*' response should be received, indicating that the command was successfully processed.

Serial Communications Mode (Cont.)

Serial Command Interface Table

Command	Function / Description	Example (NOTE: 13 is carriage return ASCII 13)	Response	Note
Serial Communications Setup				
@	- Set serial communications address for pump, from 1 to 8. The default serial address is 1. - Each pump must be allocated an individual address, this address is used as the first character in serial commands.	Set current address to 2: @2 13		
RE_	- Enable/Disable serial remote mode. - Toggle serial communications remote mode, use 1 = enable and 0 = disable after the RE command.	Enable: 1RE1 13 Disable: 1RE0 13		When SerialComm mode is enabled, any previously stored configurations (*) will be retrieved.
Controlling the Pump				
H	Start Pump (Response (-) under command G, in case of error message).	1H 13	*	Valid
I	Stop pump dispensing.	1I 13	*	
J	Change pump revolution to clockwise direction.	1J 13	*	
K	Change pump revolution to counterclockwise direction.	1K 13	*	
RC	- Display current pump status. - Returns three integers (0,0,0); pump serial address, running status 1 = dispensing and 0 = not dispensing, pump direction 1 = counterclockwise and 0 = clockwise.	1RC 13	1, 0, 1 13 10	
Inquiring and Setting Parameters				
S	Get speed in % of max rotation speed.	1S 13	53.2 13 10	
S_ _ _(_)	- Set speed in % of max rotation speed. - To set a pump speed in percent, enter S followed by 5 digits that represent the percent to one decimal point, for example, 00500 is 50.0%.	1S00500 13	*	XX.X%
R_ _ _(_)	- Set pump speed in RPM. - To set a pump speed RPM within the pump range, enter R followed by 3 or more digits that represent the RPM with two decimal points, for example, 10000 is 100.00.	1R030050 13	*	Divide by 100 to get the 2 digit decimal => 300.50.
R	Display pump speed in RPM.	1R 13	4000.12 13 10	

Continued

Serial Communications Mode (Cont.)

Serial Command Interface Table (Cont.)

RA	- Set flow unit index table 00-32. - To set a flow rate unit index add the two digit index after the RA command. To display the current index just enter RA. - See Flow Units Index Correlation Table below.	1RA00 ¹³	*	
RA	Display flow unit return unit index from 00 to 32.	1RA ¹³	01 ¹³ ¹⁰	
RB	Display current cumulative volume in revolutions.	1RB ¹³	4.983 rev ¹³ ¹⁰	
:	Display current cumulative volume.	1: ¹³	4.983 ml ¹³ ¹⁰	
W	Reset cumulative volume.	1W ¹³	*	
A	Sets control panel to manual operation.	1A ¹³	*	
B	Sets control panel to inactive.	1B ¹³	*	
L	Sets dispense mode to Continuous Mode in RPM.	1L ¹³	*	
N	Sets dispense mode to Time Dispense Mode Single Dispense.	1N ¹³	*	
(	Gets software version.	1(¹³	2.23.0 ¹³ ¹⁰	
V	Gets 'On Time' in 1/10 sec.	1V ¹³	130 ¹³ ¹⁰	
V_____	Sets 'On Time' in 1/10 sec.	1V0130 ¹³	*	
VM____	Sets 'On Time' in minutes.	1VM015 ¹³	*	
VH__	Sets 'On Time' in hours.	1VH026 ¹³	*	
*	Store current configurations.	1* ¹³	*	To retrieve stored configurations, disable and re-enable SerialComm mode.
0	Set default values.	10 ¹³	*	
RV_____	Sets 'On-Time' in hrs., min., sec. and 1/10 sec. in format HHMMSSX.	1RV2430150 ¹³	*	0 < X < 359,999.9 sec. where X is 'On-Time' in sec.
RV	Gets "On-Time" in hrs., min., sec., and 1/0 sec.	1RV ¹³	24:30:15.0 ¹³ ¹⁰	
RT_____	Sets 'Off-Time' in hrs., min., sec. and 1/10 sec. in the format HHMMSSX.	1RV2430150 ¹³	*	0 < X < 359,999.9 sec. where X is 'On-Time' in sec.
RT	Gets 'Off-Time' in hrs., min., sec. and 1/10 sec.	1RT ¹³	03:00:05.0 ¹³ ¹⁰	
"	Gets number of batch count/batch total.	1" ¹³	6/15 ¹³ ¹⁰	
"_____	Sets the number of batch total.	1"00150 ¹³	*	Zero value = Infinity
R"	Resets current batch total to zero.	1R" ¹³	*	

Continued on next page

Serial Communications Mode (Cont.)

Serial Command Interface Table (Cont.)

#	Gets model and serial communication version.	#1 (13)	IPC 521 13 10	
E	Gets pumps dispense status.	1E 13	+	Running returns +, Paused returns + and Stopped returns -

Flow Units Index Correlation Table

Masterflex MasterSense Flow Units							
Index	IP650	L/S100	L/S600	L/S250	B/T321	Gear6000	PistonQ1800
1	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min
2	mL/hr	mL/hr	mL/hr	mL/hr	L/min	mL/hr	mL/hr
3	L/min	L/min	L/min	L/min	L/min	L/min	L/min
4	L/hr	L/hr	L/hr	L/hr	L/hr	L/hr	L/hr
5	L/day	L/day	L/day	L/day	L/day	L/day	L/day
6	gal/min	μL/min	μL/min	μL/min	gal/min	μL/min	μL/min
7	gal/hr	μL/hr	μL/hr	μL/hr	gal/hr	μL/hr	μL/hr
8	gal/day	gal/min	gal/min	gal/min	gal/day	gal/min	gal/min
9	oz/min	gal/hr	gal/hr	gal/hr	cu m/hr	gal/hr	gal/hr
10	oz/hr	gal/hr	gal/day	gal/day	RPM	gal/day	gal/day
11	cu m/hr	oz/min	oz/min	oz/min	%	oz/min	oz/min
12	RPM	oz/hr	oz/hr	oz/hr		oz/hr	oz/hr
13	%	cu m/hr	cu m/hr	cu m/hr		cu m/hr	cu m/hr
14		RPM	RPM	RPM		RPM	RPM
15		%	%	%		%	%

Continued on next page

Flow Units Index Correlation Table (Cont.)

Masterflex MasterSense Flow Units						
Index	ISM160	ISM3521	ISM352	ISM4000	ISM1800	IPC
1	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min
2	mL/hr	mL/hr	mL/hr	mL/hr	mL/hr	mL/hr
3	L/day	L/day	L/day	L/day	L/day	L/day
4	oz/min	oz/min	oz/min	oz/min	oz/min	oz/min
5	oz/hr	oz/hr	oz/hr	oz/hr	oz/hr	oz/hr
6	μL/min	μL/min	μL/min	μL/min	μL/min	μL/min
7	μL/hr	μL/hr	μL/hr	μL/hr	μL/hr	μL/hr
8	RPM	RPM	RPM	RPM	RPM	RPM
9	%	%	%	%	%	%

NOTES

This image shows a full page of blank white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for writing or drawing. There are no margins, text, or other markings present.

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