# APPLICATION NOTE

| | | |
|---|---|---|
| **TITLE:** | **Setup of Multiplex V3 with PLCs and Gateways** | **AN-103** |
| | | **REV -** |
| **CATEGORY:** | **Controller Interface** | |

## 1. DESCRIPTION

This application note describes how to setup an IVEK Multiplex V3 controller for use with PLCs and Gateways. Presently there are four methods available for interfacing the Multiplex V3 controller: a built-in Front Panel (HMI), discrete I/O, RS232, and EtherNet/IP™. Successfully integrating the Multiplex V3 with PLCs and Gateways often requires using a combination of these interfaces.

Configuring the Multiplex V3 for an application requires modifying parameters to match the physical system (pump motor type, pump size, etc.) and to create the desired fluidic movement profile (acceleration, discharge rate, etc.). Interfacing the Multiplex V3 also requires reading and writing parameters (e.g., to start operations, check status, etc.). The Multiplex V3 has over 75 parameters, many of these requiring no modification (i.e., the default values are sufficient). Also, the Multiplex V3 has non-volatile memory; modifications made to most parameters will remain across a power-cycle.

There are several ways to modify parameters; the simplest way is by using the HMI. When using a fieldbus, such as EtherNet/IP, accessing the parameters is accomplished via cyclic (implicit) data exchange or acyclic (explicit) data exchange (e.g., MSG functions). ***Not all parameters are available via cyclic data exchange; only those parameters that are important for real-time control (e.g., commands and status).***

There are trade-offs in choosing which method to use to modify parameters. The simpler methods (e.g., HMI) reduce development time, but device replacement is more difficult due to the need to manually configure a replacement controller. The more complex methods (e.g., acyclic exchange, MSG functions), require extra development time, but allow the PLC software to verify that parameters are configured to desired values before initiating pumping operations. Often, the simpler methods are used during the beginning stages of a project as the fluidic parameters are being determined and as the PLC engineer is getting familiar with the controller. The more complex methods are then employed as the PLC application matures and verification of parameters is desired.

This application note contains the following sections: Accessing the Multiplex V3 Using Rockwell Studio 5000, Connecting to the Controller with TCP/IP, Connecting with a Gateway, Connecting with Discrete I/O.

## 2. ACCESSING THE MULTIPLEX V3 USING ROCKWELL STUDIO 5000

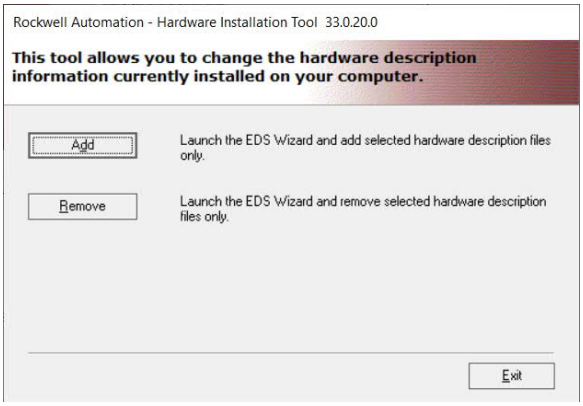
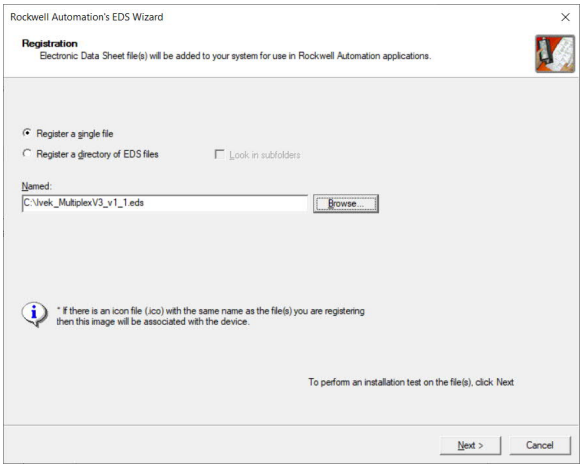
Studio 5000 is the development environment for Rockwell PLCs. Accessing the Multiplex V3 requires installing it's EDS file into Studio 5000. The EDS file provides information for Studio 5000 to communicate with the Multiplex V3.

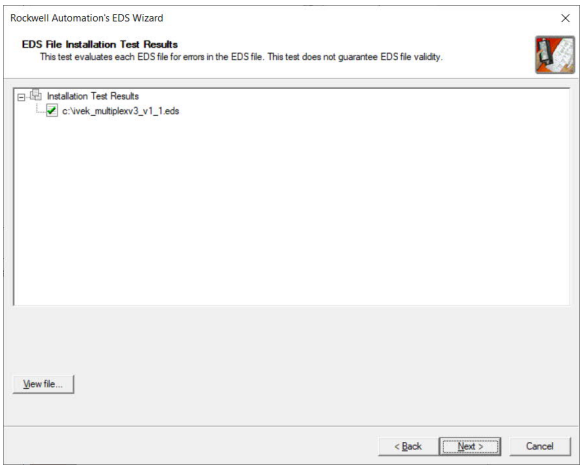
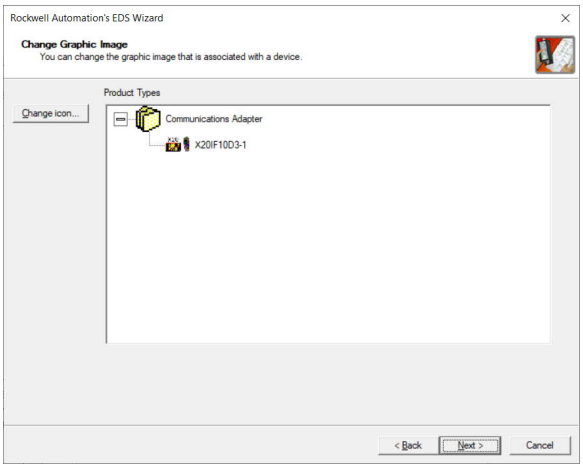
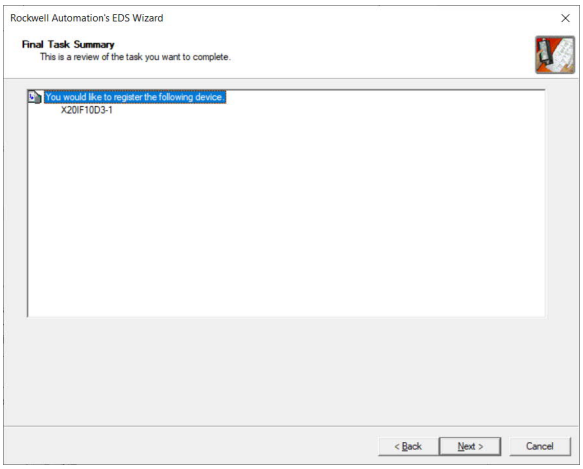
The following instructions describe how to install the Multiplex V3 in a Studio 5000 project and how to modify parameters via the MSG function block and the Cyclical I/O Controller Tags. These instructions were generated using an Allen-Bradley CompactLogix™ 5380 (5069-L306ER), an IVEK Multiplex V3, and Rockwell Automation Studio 5000 Logix Designer (version 33.00.01 – Professional Edition).

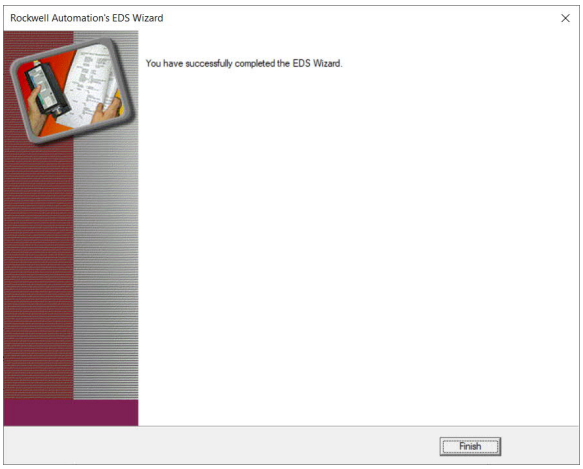
### 2.1. Adding the EDS File

The EDS file (IVEK_MultiplexV3_v1_1.eds) for the Multiplex V3 must be imported into Studio 5000 using the EDS import wizard. If upgrading the EDS file from a previous version, the previous version must first be uninstalled (see section 2.2).

The EDS file is located on the IVEK website. **Make sure the installed EDS is the correct version for the specific Multiplex V3 firmware version (560006-0101 and 560006-0102 use EDS v1.1).**

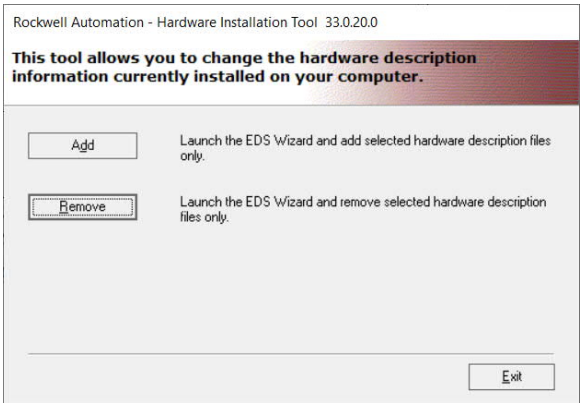
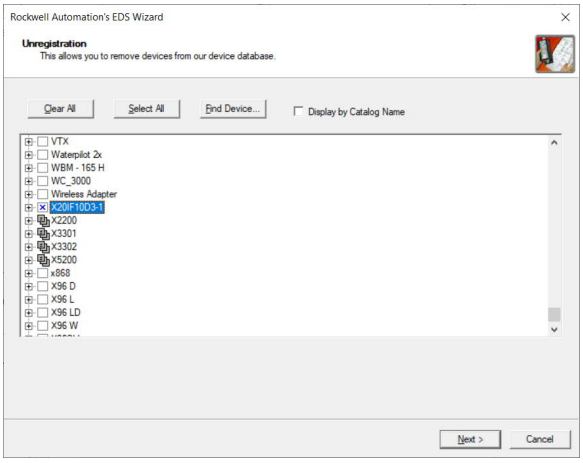
| Instruction | Image |
|---|---|
| Start the EDS installation tool. Press the Add button. |  |
| Select "Register a single file" and browse for the EDS file. Press the Next button to start installation of the EDS file. |  |

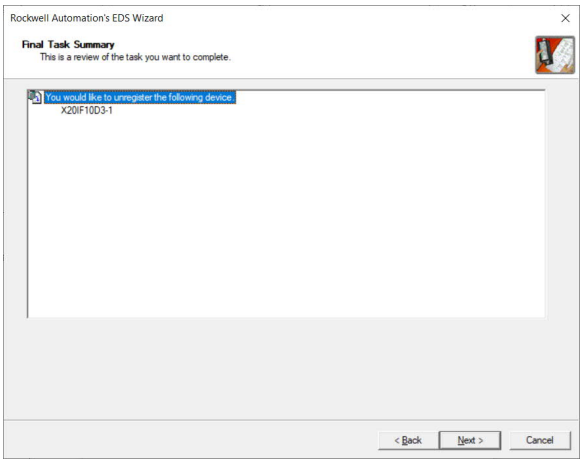
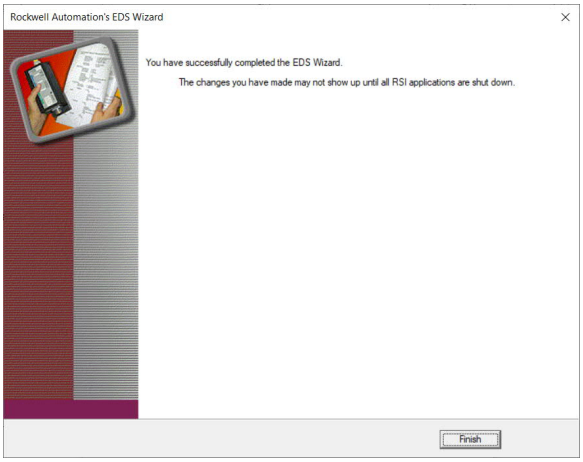
| | |
|---|---|
| Verify that the EDS file was successfully installed. Press the Next button. |  |
| Verify that the icon is shown and then press the Next button. Note that the B&R X20IF10D3-1 is the communication module used inside of the Multiplex as indicated. |  |
| Verify that the X20IF10D3-1 is the device to register and press the Next button to register the device. |  |

| | |
|---|---|
| Verify that the EDS Wizard completed successfully. Press the Finish button. |  |

## 2.2. Removing an EDS file (for upgrading purposes)

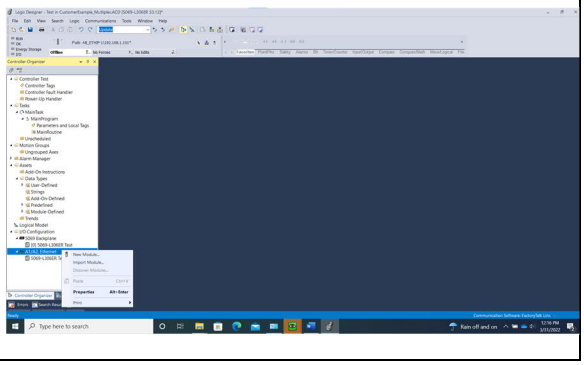
When upgrading an EDS file, it is best to first remove the previous EDS file from Studio 5000 using the EDS Wizard. After removing the previous version of the EDS file using the instructions listed below, install the new version using the instructions per section 2.1.

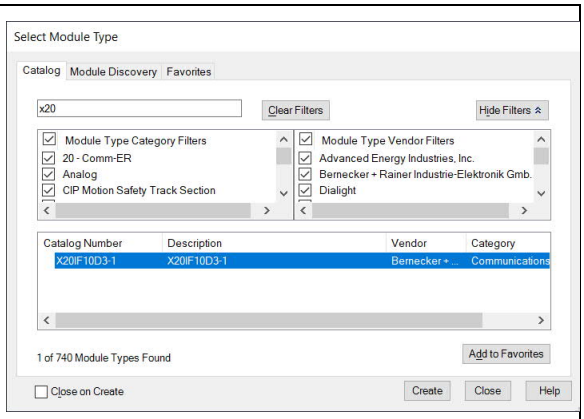
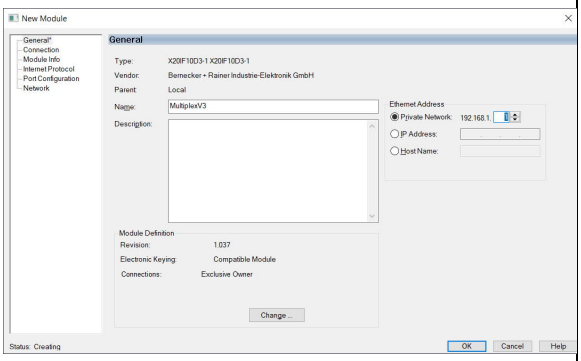
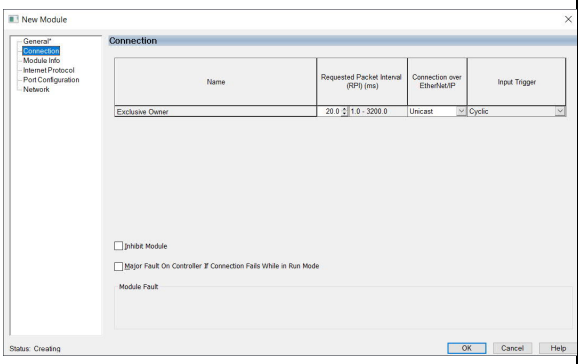
| **Instruction** | **Image** |
|---|---|
| Start the EDS Hardware Installation Tool. Press the Remove button. |  |
| Search through the list of devices and select “X20IF10D3-1” which is the communication module inside of the Multiplex V3. Press the Next button. |  |

| | |
|---|---|
| Verify the X20IF10D3-1 is the device to be unregistered. Press the Next button. |  |
| Verify the removal of the EDS file was successful. Press the Finish button. |  |

## 2.3. Adding the Multiplex V3 to a Project

After installing the EDS file of the Multiplex V3 using the EDS Wizard, the Multiplex V3 is available for addition to a project in Studio 5000. The following instructions show how to add a Multiplex V3.

| **Instruction** | **Image** |
|---|---|
| Select the Ethernet port to which the Multiplex V3 is connected. Select the “New Module” option from the popup menu. |  |

| | |
|---|---|
| Select “X20IF10D3-1 from the catalog and press the Create button. The Module Properties window should open automatically. |  |
| Select the General tab and provide a Name for the Multiplex V3. Configure the Ethernet address for the device.<br><br>**NOTE: the Multiplex V3 is configured from the factory to have DHCP enabled so you may need to use the HMI to disable DHCP and configure a static IP address.** |  |
| Select the Connection tab and verify the settings. Adjust any settings for the specific application. Press the OK button, then press the Close button on the Select Module Type window. Verify the Multiplex V3 module appears in the project. |  |

## 2.4. Using Cyclical I/O Controller Tags

Controller Tags and Module-Defined Data Types for the I/O data are automatically created when the Multiplex V3 is added to the project. The Input data type includes a Connection Faulted flag, a Run Mode flag, and a data array of type SINT. The Output data type includes a data array of type SINT. (NOTE: the number of elements of the arrays may depend on the firmware version of the Multiplex V3).

The data arrays contain several of the Multiplex V3 parameters. Not all parameters are available in the data arrays; only the subset necessary for real-time control of the pumping operations. Detailed information about each of the parameters contained in the data arrays is available in the Multiplex V3 product manual (also some information is available in section 4). The data arrays are exchanged between the PLC and the Multiplex V3 using implicit messages on the EtherNet/IP network.

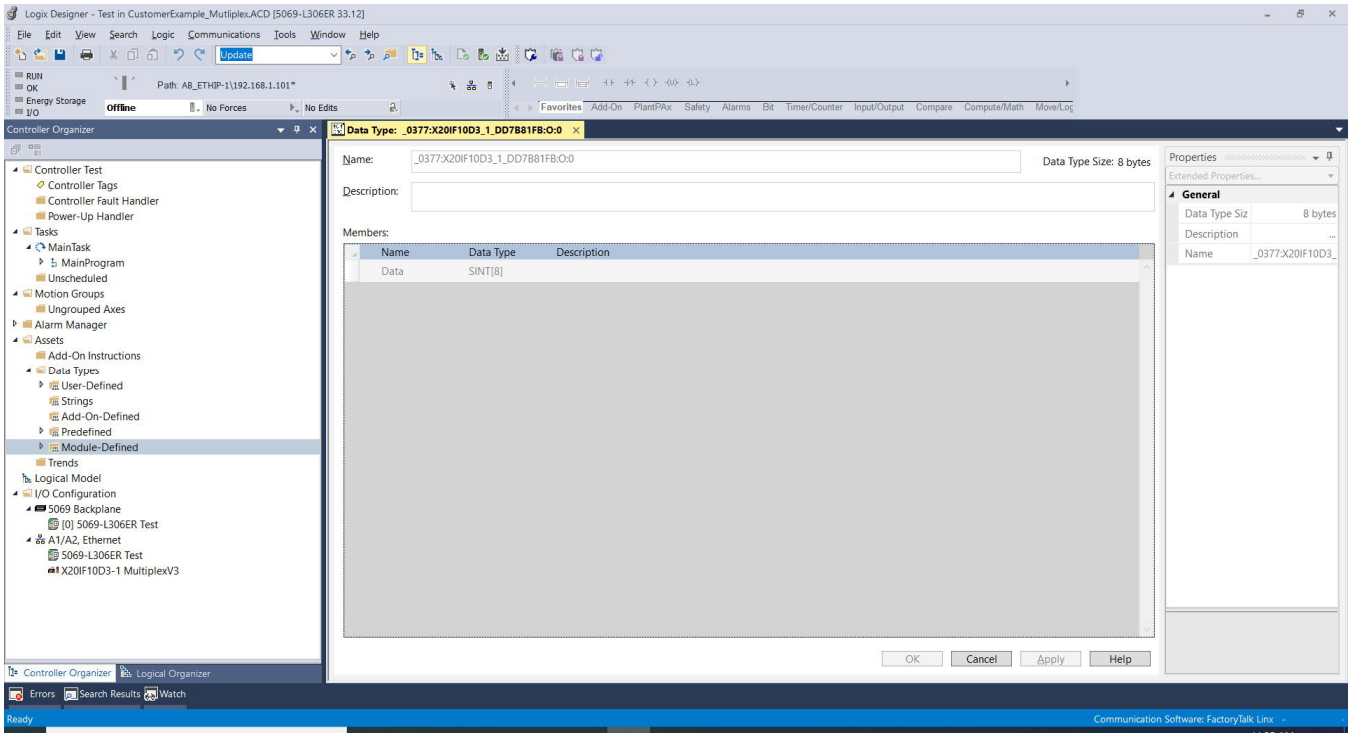



**Figure 2.1 - Module Defined Data Type (Output)**

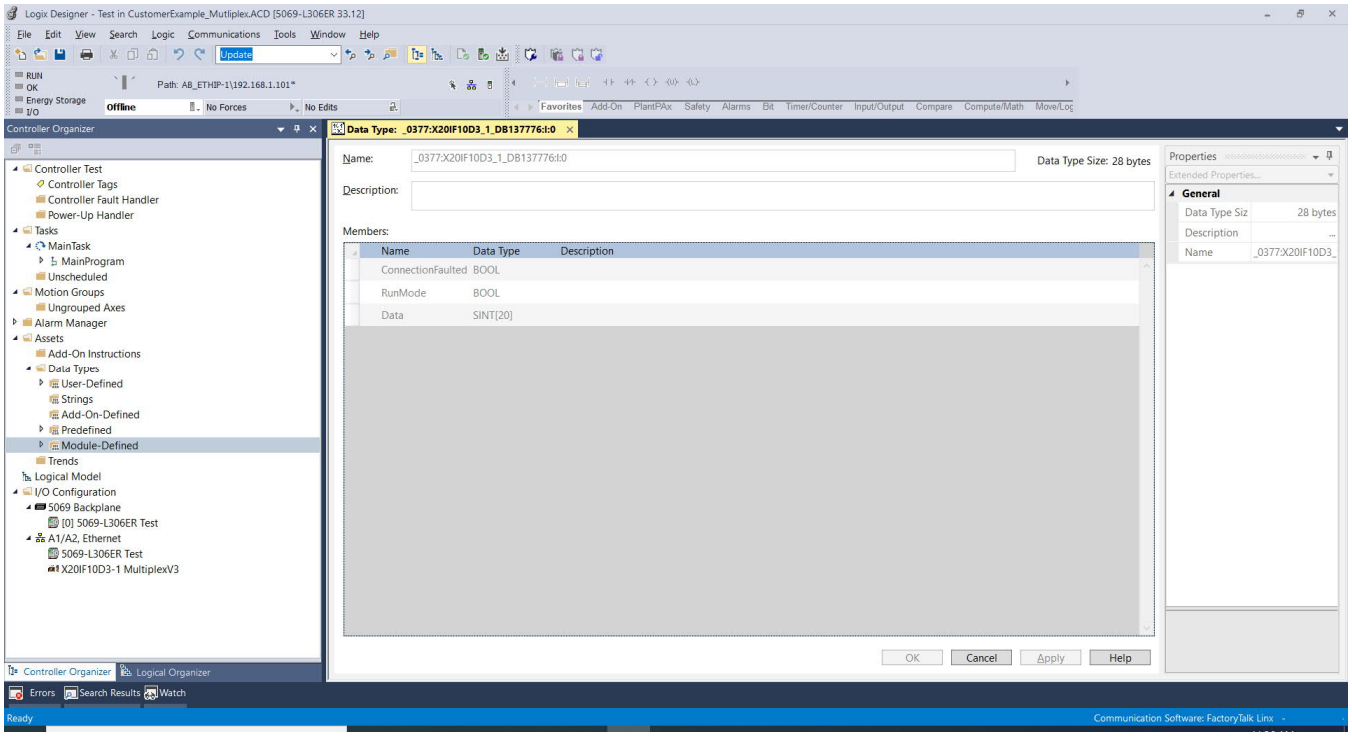



**Figure 2.2 - Module Defined Data Type (Input)**

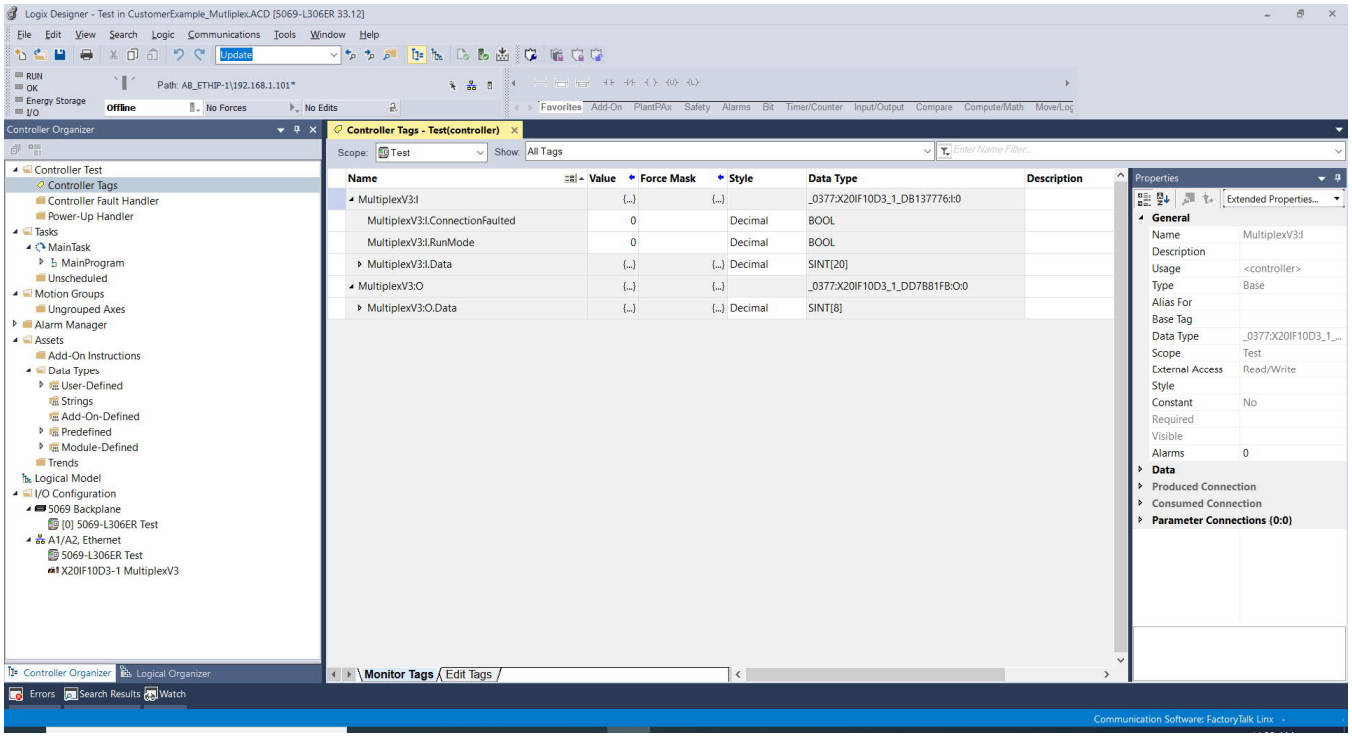



**Figure 2.3 - Cyclical I/O Controller Tags**

## 2.5. Viewing Module Parameters

The Multiplex V3 does not support viewing Module parameters.

## 2.6. Accessing Parameters using MSG Function Block

The MSG function block may be used by the PLC software to access parameters that need to be modified or read during runtime if they are not available in the cyclic I/O data exchange. All parameters reside in the CIP Parameter Object class which is a standard object in the CIP specification.

The MSG function must contain the following:

- Message Type: select CIP Generic.
- Service Type: for reading parameters select “Parameter Read; for writing parameters select “Parameter Write”. Selecting one of these Service Types will automatically populate Service Code, Class, and Attributes with the proper values.
- Service Code: “e” hex for Get Attribute Single, “10” hex for Set Attribute Single.
- Class: “f” hex which is the value for the CIP Parameter Object class.
- Instance: enter the parameter ID (decimal) for the desired parameter (see Multiplex V3 product manual for the parameter ID for each parameter).
- Attribute: “1” decimal for the Value attribute. Other attributes are available as “A” hex for Minimum Value, “B” hex for Maximum Value, and “C” hex for Default Value – see the CIP specification for more information.

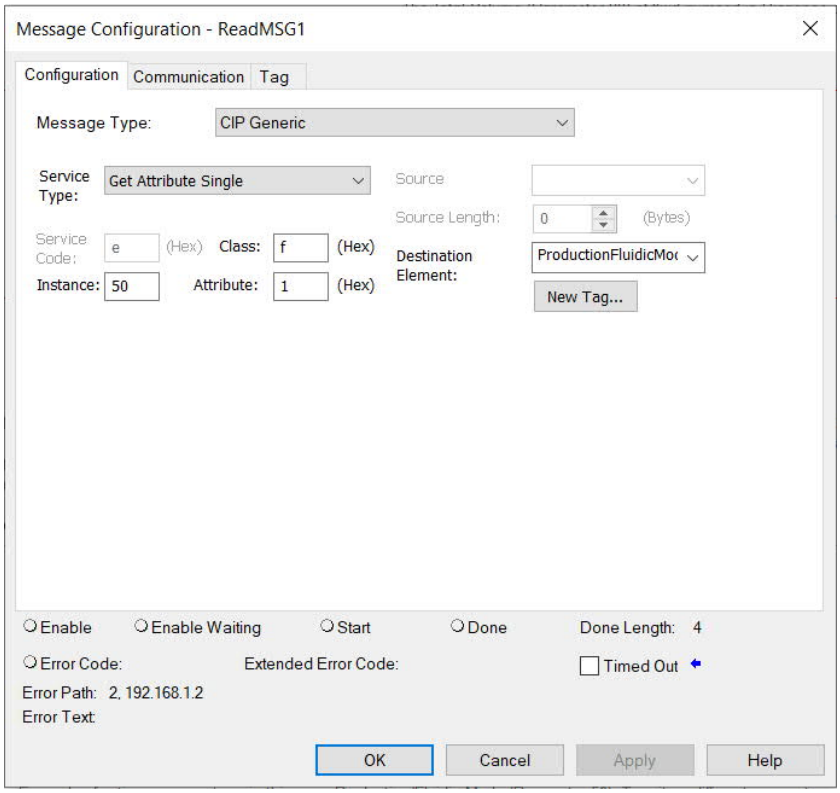



**Figure 2.4 - Reading Production/Fluidic Mode Parameter**

## 2.7. Starting with the Example Project

An example project, using Ladder Logic, is located on the IVEK website.

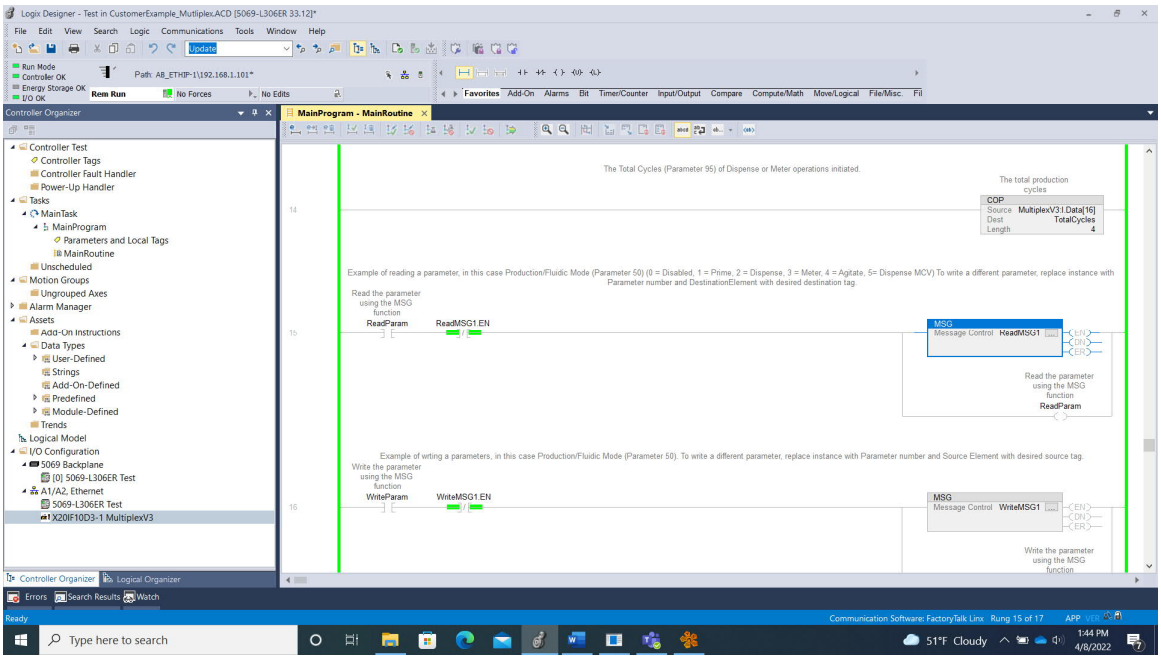


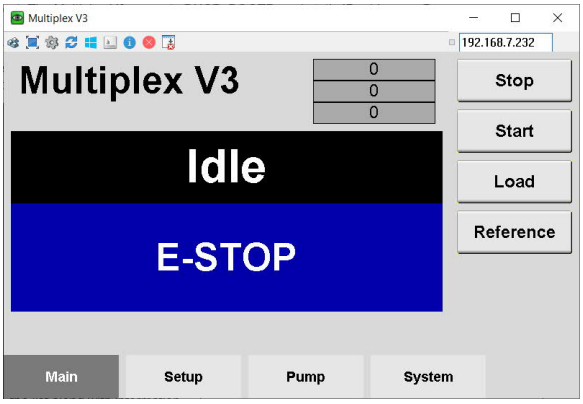
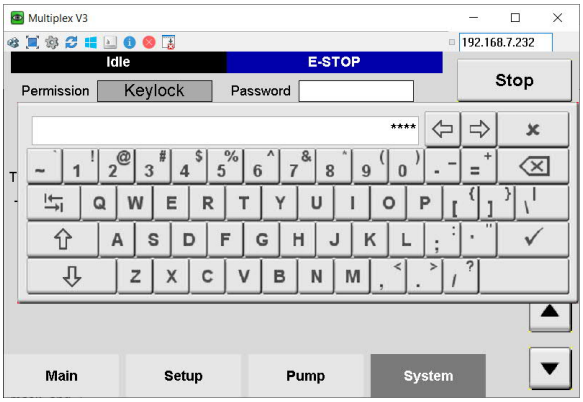
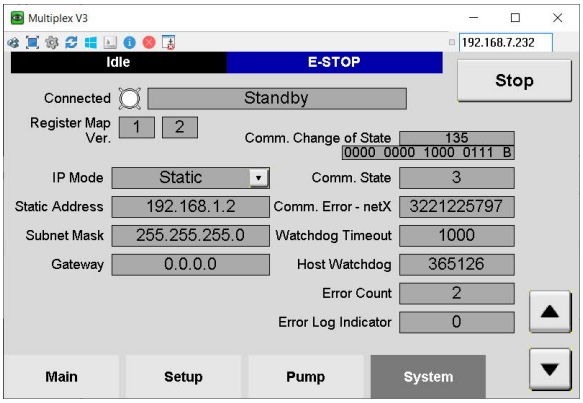

**Figure 2.5 - Example Ladder Logic Program**

# 3. CONNECTING TO THE CONTROLLER WITH TCP/IP

Multiplex V3 controllers that contain an EtherNet/IP interface module require a TCP/IP address to communicate. The Multiplex V3 allows for IP address configuration via the HMI. The Multiplex V3 supports DHCP, BOOTP, and static IP addressing modes.

## 3.1. Configuring the IP address

Configure the IP address of the Multiplex V3 by using the HMI.

| Instruction | Image |
|---|---|
| From the Main screen, press the System navigation button. |  |
| Touch inside of the Password input entry field to bring up the keyboard. Type in the password for the Keylock permission level (passwords are contained in TB-105 included with the controller shipment paperwork) and press the Checkbox key. Verify that the Permission level has changed to Keylock. |  |
| Press the Up arrow five times to get to the EtherNet/IP statistics screen.<br><br>The IP Mode may be modified here. If either DHCP mode or BOOTP mode are selected, the Static Address, Subnet Mask, and Gateway fields will not be visible.<br><br>After changing the IP Mode, it is necessary to power-cycle the controller in order for the new settings to take effect. |  |

## 4. CONNECTING WITH A GATEWAY

For PLCs that do not have an EtherNet/IP connection, a gateway (i.e., protocol converter) is necessary to convert the data from one fieldbus to the other (e.g., EtherNet/IP to PROFINET™). Also, some PLCs that provide an EtherNet/IP interface may provide more of a gateway type of interface, where cyclic data is easy to exchange but exchanging acyclic data is either more complicated or impossible.

When using a device that is only able to translate the data that is exchanged cyclically, it will be necessary to use an alternate interface (e.g., HMI) to modify the non-cyclic parameters.

Configuring a gateway involves mapping the data bytes through the gateway. To facilitate that configuration, the cyclic data is described in the following table. **The Multiplex V3 EDS and Product Manual contain the most up to date data structures and contents of the cyclic data.** Also note that there may be several mappings through the history of the Multiplex V3, so **it is important to verify that the map in the gateway matches the map in the device**.

| **Producing Data Bytes Assembly 101 (20 bytes total)** | **Contents** | **Parameter ID** |
|---|---|---|
| 0-3 | Status Flags | 12 |
| 4-7 | Status Flags Extended | 13 |
| 8-9 | Volume Position | 92 |
| 10-11 | Reserved | N/A |
| 12-15 | Total Production Volume | 90 |
| 16-19 | Cycle Count | 95 |
| **Consuming Data Bytes Assembly 100 (8 bytes total)** | **Contents** | **Parameter ID** |
| 0-3 | Command | 10 |
| 4-5 | Pumps Enabled | 44 |
| 6-7 | Use Pumps Enabled (byte 7, bit 7), rest Reserved (set to 0) | N/A |

The Command parameter contains bits, each bit representing a different command. Likewise, the Status Flags and Status Flag Extended parameters contain bits, each bit representing a different status condition or controller state. These bits generally correspond to the various configurations available for the Logic In and Logic Out signals. Therefore, reading section 5 will provide some understanding of how to use the individual Command and Status bits to interface the Multiplex V3 controller.

## 5. CONNECTING WITH DISCRETE I/O

If the HMI (or RS232) is used to configure the parameters, it is possible to control the Multiplex V3 using discrete I/O. The Multiplex V3 includes five Logic In signals and six Logic Out signals. Each signal is configurable to allow for different methods of control. Typically, these signals are used to interface a PLC, though they may be used to interface other automation equipment (e.g., robot, X-Y table, etc.) if the signals are kept within specification.

## 5.1. Logic In Hardware Interface

The Multiplex V3 Logic In hardware signals are designed for typical 24V signals (EN 61131-2 type 1) and thresholds with a typical current of 4mA and may be used in either a sinking or sourcing configuration. Activate the signals for at least 50ms to ensure the signal is detected by the Controller. Depending on the configuration, the input may be either edge-triggered (e.g., <TRIGGER>) or level-triggered (e.g., <GATE>). The controller has parameters to invert the input active logic level.

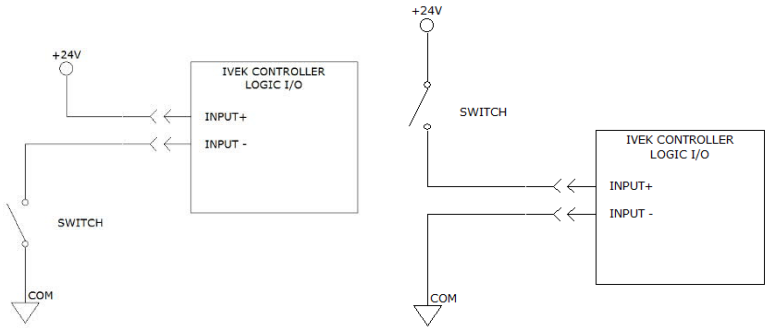



**Figure 5.1 - Logic In Wiring**

## 5.2. Logic Out Hardware Interface

The Multiplex V3 Logic Out hardware signals are optocoupler outputs. When active, the output can conduct up to 50mA; when inactive, the output can tolerate 24V. The controller has parameters to invert the active logic level for extra flexibility in matching the interface of auxiliary equipment.

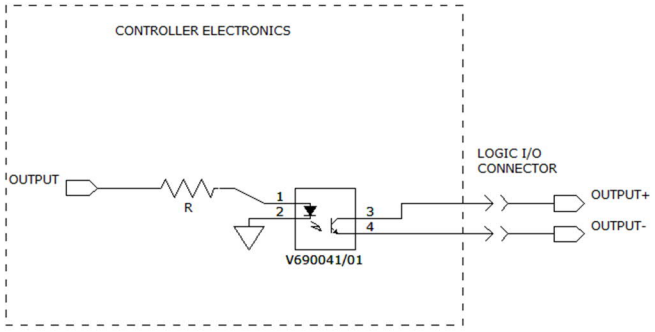



**Figure 5.2 - Logic Out Circuit**

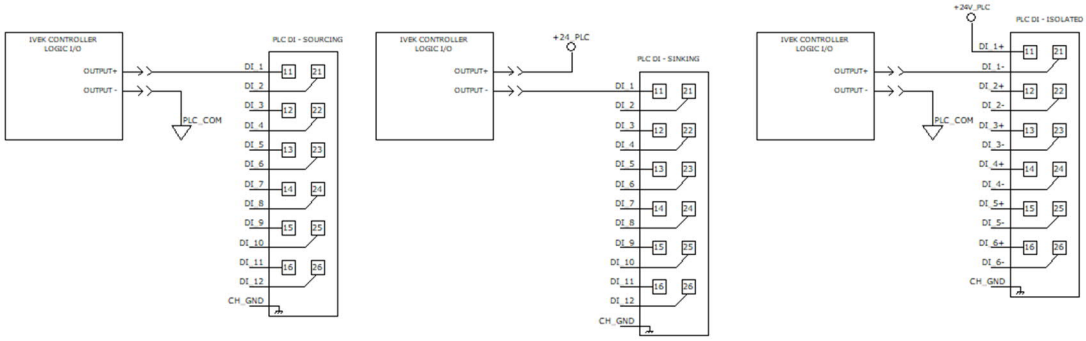



**Figure 5.3 - Logic Out Wiring**

## 5.3. Minimum Logic I/O Configuration

The Multiplex V3 contains parameters that allow for various I/O configurations, providing flexibility for various control scenarios. However, the minimum recommended I/O configuration is to connect one Logic In as Trigger Production Ops and one Logic Out as Ready Idle. It is important that the PLC monitor the Ready Idle to ensure that the Trigger Production Ops is not re-activated until the Controller has completed all other operations.

Using the minimum Logic I/O configuration requires that operations such as Referencing, Priming, Clearing Faults, etc. are initiated via other methods (e.g., HMI, EtherNet/IP, RS232, etc.). Also, the Load Mode parameter must be configured for either Empty or Every so that a Load operation is performed automatically by the controller.

**IVEK does not recommend using discrete I/O open-loop (i.e., it is important to monitor at least one of the Ready or Busy signals). Also, it is important to monitor the <STATUS> FAULT signal unless other methods (e.g., RS232) are used to detect Fault conditions.**

### 5.3.1. Triggering a Dispense Operation

The following diagram shows an example of triggering a Dispense operation. The controller detects the rising edge of Trigger Production Ops within 50ms, followed by a slight delay as the controller state machine transitions from the Idle state to the Dispensing state. As the controller leaves the Idle state, it deactivates Ready Idle. The PLC should monitor Ready Idle (or Busy Production Ops) to verify that the Dispense operation starts successfully and then deactivate Trigger Production Ops after Ready Idle deactivates (or Busy Production Ops activates). Once the Dispensing operation completes, the controller enters the Idle state and re-activates Ready Idle (and deactivates Busy Production Ops). Once Ready Idle is active (or Busy Production Ops is inactive), the PLC may re-activate Trigger Production Ops to start the next Dispense operation.

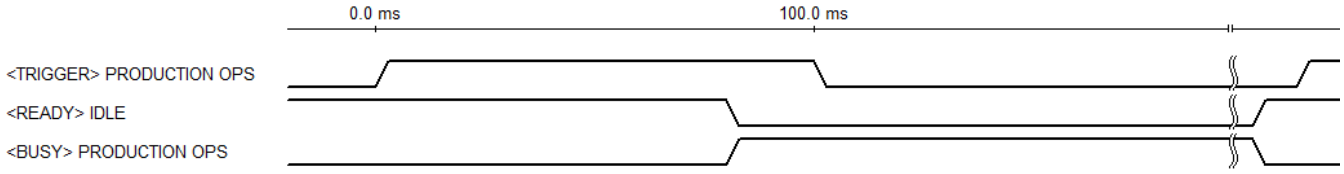



**Figure 5.4 - Triggering Dispense Operations**

*Note: the Mode parameter must be configured for Dispense Mode or MCV Mode for Trigger Production Ops to initiate a Dispense operation.*

### 5.3.2. Gating a Meter operation

The following diagram shows an example of gating a Meter operation. The Gate Production Ops signal determines the length of time that the controller operates in Meter mode and hence the volume of fluid that is dispensed (limited by the amount of fluid in the pump chamber). The controller detects the rising edge of Gate Production Ops within 50ms, followed by a slight delay as the controller state machine transitions form the Idle state to the Metering state. As the controller leaves the Idle state, it deactivates Ready Idle (or activates Busy Production Ops). The PLC should monitor Ready Idle (or Busy Production Ops) to verify that the Meter operation starts successfully. The length of the Metering operation is determined by the length of Gate Production Ops. When Gate Production Ops is deactivated by the PLC and detected by the controller, the controller state machine works on ending the Meter operation and transitioning to the Idle state. As the controller enters the Idle state, Ready Idle is activated (or Busy Production Ops is deactivated).

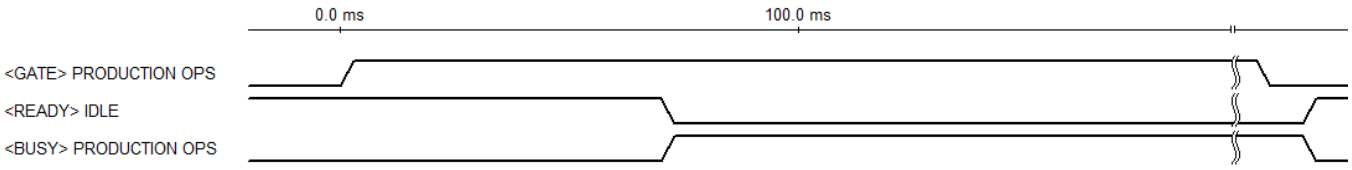



**Figure 5.5 Gating a Meter Operation**

*Note: the Mode parameter must be configured for Meter Mode for Trigger Production Ops to initiate a Meter operation.*

## 5.4. Recommended Logic I/O Configuration

In addition to Trigger Production Ops (or Gate Production Ops) and Ready Idle (or Busy Production Ops), other Logic I/O signal connections are recommended to monitor status (e.g., Reference Required, Load Required, Fault, etc.) and initiate other operations (e.g., Reference, Load, Clear Fault, Prime, etc.). The signals that need to be connected to the PLC depends on whether operations are controlled by the PLC or by the Operator using the Multiplex V3 HMI.

### 5.4.1. Triggering a Reference Operation

A Reference operation is required after a power cycle or after clearing a Fault. Status Ref Required indicates when a Reference is blocking other operations. To initiate a Reference operation, the PLC activates Trigger Reference for at least 50ms. The controller detects Trigger Reference within 50ms and there is a slight delay as the controller state machine transitions from the Idle state to the Referencing state. When the state machine exits the Idle state and enters the Referencing state, Ready Idle deactivates and Busy Reference activates. The PLC should monitor either Ready Idle or Busy Reference to verify that the controller accepts Trigger Reference and to determine when the Reference operation is complete.

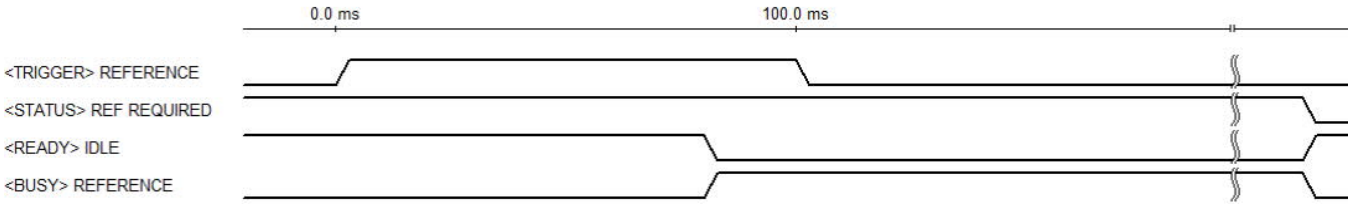



**Figure 5.6 - Triggering a Reference Operation**

### 5.4.2. Trigger a Load Operation

A Load operation is required when there is not enough fluid left in the pump chamber to perform the next Dispense operation (or when the pump chamber is empty in the case of a Meter operation). Status Load Required indicates when a Load operation is blocking further Dispense (or Meter) operations. To initiate a Load operation, the PLC activates Trigger Load for at least 50ms. The controller detects Trigger Load within 50ms and then there is a slight delay as the controller state machine transitions from the Idle state to the Loading state. When the state machine exits the Idle state and enters the Loading state, Ready Idle deactivates and Busy Load activates. The PLC should monitor either Ready Idle or Busy Reference to verify that the controller accepts Trigger Load and to determine when the Load operation is complete.

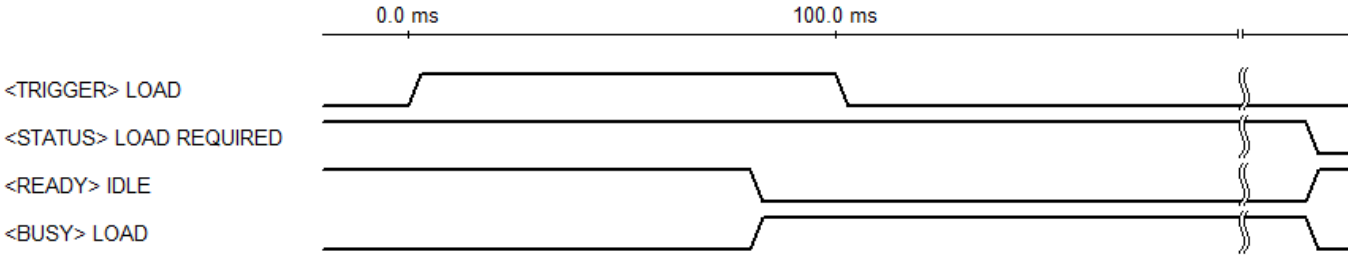



**Figure 5.7 - Triggering a Load Operation**

*Note: many applications use the Autoload feature of the Multiplex V3, allowing for automatic loading to be performed at the end of either Dispense or Meter operations. These applications do not require the use of the Load signals as Loading will be performed automatically by the Multiplex V3.*

### 5.4.3. Clearing a Fault

A Fault condition may occur at any time; therefore, Status Fault should always be monitored. The most often Fault conditions occur during an operation (e.g., a stall fault due to a seized piston or valve). When a Fault condition exists, it blocks all other operations until the Fault condition is cleared both physically (e.g., cleaning the seized pump) and logically (e.g., activating Trigger Clear Fault or power-cycling the controller).

Once a fault is detected, it must be logically cleared by activating Trigger Clear Fault (or cycling power). Some Fault scenarios may create multiple Faults in the Controller logic and hence may require multiple clearing attempts to return the Controller to the Idle state. Trigger Clear Fault should be activated for at least 50ms to ensure the Controller accepts the signal.

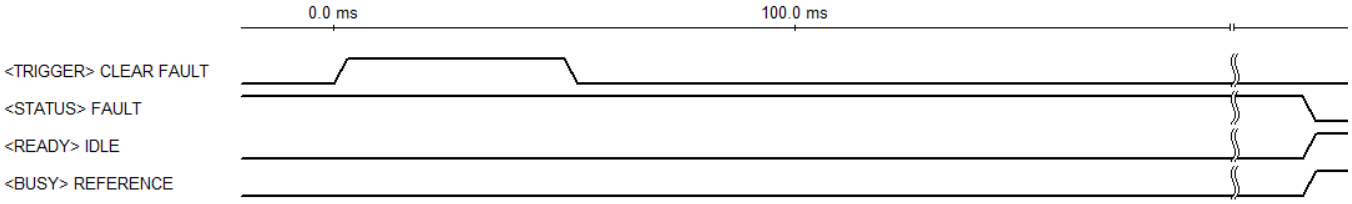



**Figure 5.8 - Clearing a Fault**

### 5.4.4. Triggering a Required Operation

Logic Out configuration Status Op Required is basically the OR'd combination of Status Ref Required, Status Load Required and Status Fault. Logic In configuration Trigger Clear Required basically activates all three signals: Trigger Reference, Trigger Load, and Trigger Clear Fault. These combinations are useful to reduce the amount of discrete I/O connections between the PLC and the Multiplex V3. The function of the signal depends on the present state of the Controller. If the present state is Faulted, Status Op Required acts as Status Fault and Trigger Clear Required acts as Trigger Clear Fault. If the present state is Reference Required, Status Op Required acts as Status Ref Required and Trigger Clear Required acts as Trigger Reference. If the present state is Load Required, Status Op Required acts as Status Load Required and Trigger Clear Required acts as Trigger Load. If the Controller is any other state, Status Op Required is inactive and Trigger Clear Required is ignored.

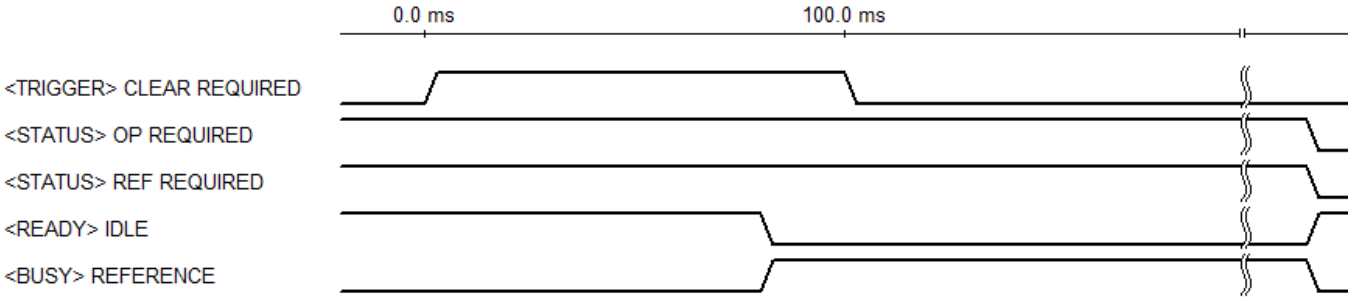



**Figure 5.9 – Triggering a Reference using Trigger Clear Required**

### 5.4.5. Triggering a Prime operation

Typically, it is not known beforehand how long a Prime operation should run in order to fill the entire fluidic path with fluid. The typical solution for this is to provide the Operator with a Start and Stop button on an HMI (e.g., Multiplex V3 HMI) to allow the Operator to control the total length of time. Once initiated, the Prime operation will run until either the Stop button is pressed, or the Prime Time timer expires (whichever happens first). If the Prime Time is not long enough to fill the tubing, additional Prime operations will be necessary.

A Logic In signal may be configured to start and/or stop Prime operations. Configuring a Logic In as Trigger Fluidic Ops provides a signal to start, but not stop, Prime operations. In this case, the Prime operation will run for the time determined by the Prime Time parameter. Configuring a Logic In as Gate Fluidic Ops provides a signal to both start and stop a Prime operation. In this case, the Prime operation will run for the time determined by the Gate Fluidic Ops signal; though, it will still be limited by the Prime Time parameter to a maximum operating time.

To initiate a Prime operation using Gate Fluidic Ops, the PLC activates Gate Fluidic Ops, which is detected by the controller within 50ms, followed by a slight delay as the controller state machine transitions from the Idle state to the Priming state. As the controller leaves the Idle state, it deactivates Ready Idle (or activates Busy Fluidic Setup Ops). The Prime operation continues until the Prime Time timer expires at which point the controller state machine finishes the Priming operation and enters the Idle state, activating Ready Idle (or deactivating Busy Fluidic Setup Ops). Alternatively, the Priming operation may be ended before the Prime Time timer expires by pressing the Stop button on the Multiplex V3 HMI, or by activating Trigger Stop Operations.

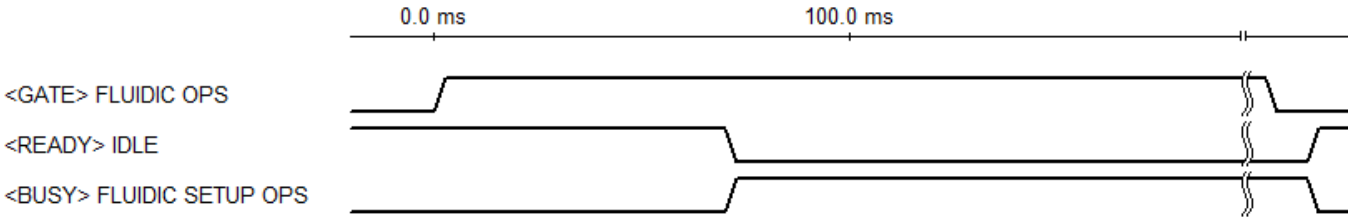



**Figure 5.10 Gating a Prime operation**

Alternatively, to initiate a Prime operation using Trigger Fluidic Ops, the PLC activates Trigger Fluidic Ops, which is detected by the controller within 50ms, followed by a slight delay as the controller state machine transitions from the Idle state to the Priming state. As the controller leaves the Idle state, it deactivates Ready Idle (or activates Busy Fluidic Setup Ops). The Prime operation continues until Gate Fluidic ops is deactivated (or the Prime Time timer expires) at which point the controller state machine finishes the Priming operation and enters the Idle state, activating Ready Idle (or deactivating Busy

Fluidic Setup Ops). Alternatively, the Priming operation may be ended before the Prime Time timer expires by pressing the Stop button on the Multiplex V3 HMI, or by activating Trigger Stop Operations.

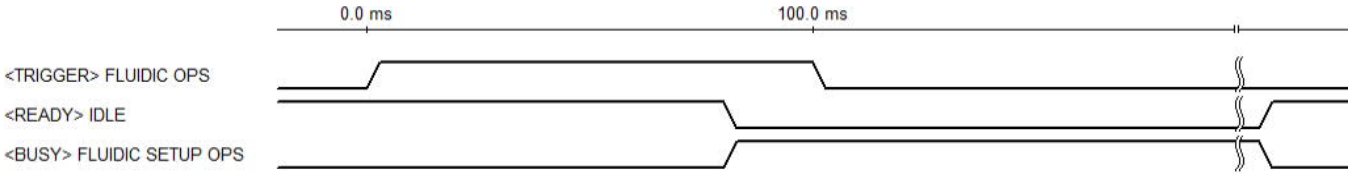



**Figure 5.11 - Triggering Prime operation with Prime Time expiration**

## 5.5. Other Useful Logic I/O Configuration

There are many other possible configurations of the Logic Ins and Logic Outs to interface various automation equipment.

### 5.5.1. Using Load status for machine indexing

In some applications, the Load Mode parameter is configured for either Empty or Every. This causes the Multiplex V3 to initiate a Load operation automatically after a Dispense or Meter operation. Some applications use the Busy Load signal to index other machine operations during the Load operation.

### 5.5.2. Using Discharge status and Dwells for auxiliary equipment

Some applications use auxiliary equipment such as valves or sonic nozzles that need to be synchronized with the fluid movement out of the dispense tip. Busy Production Ops activates during either a Dispense or Meter operation. Busy Discharge is a similar signal that activates during either a Dispense or Meter operation; the difference being that it only activates during the portion of the operation in which fluid is moving out of the dispense tip. Busy Production Ops, on the other hand, includes the following additional portions of the operation: Pre-Op Dwell, Drawback Dwell, Drawback, and Post-Op Dwell.

Pre-Op Dwell provides a configurable length of time in which the Busy Production Ops signal will activate before fluid starts moving. This allows auxiliary equipment to activate and settle before fluid begins to move.

Post-Op Dwell provides a configurable length of time in which the Busy Production Ops signal will stay active after the pump stops moving. This allows auxiliary equipment to stay active until fluid movement has settled after the pump has stopped moving.

The following timing diagram shows how the different Busy signals are activated during an example 500ms Dispense or Meter operation that includes the following portions: 100ms Pre-op Dwell, 150ms Discharge, 50ms Drawback Dwell, 100ms Drawback, 100ms Post-op Dwell.

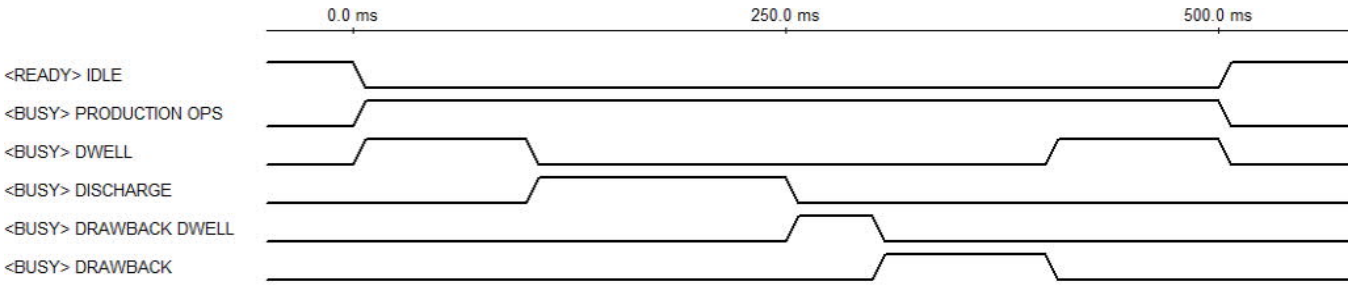



**Figure 5.12 - Busy signals during a Dispense or Meter operation**

### 5.5.3. Difference between Ready signals

Ready Idle is the most generic Ready signal available in the Multiplex V3. Ready Idle indicates that there are no operations in progress and that there are no Faults present in the controller.

Ready Production is different than Ready Idle in that it only indicates Ready when the controller is able to initiate a Production Operation. There are some states of the controller that prohibit initiation of a Production Operation. For example, it is not possible to initiate a Dispense or Meter operation whenever a Reference or Load are required. When a Reference or Load are required, Ready Production is inactive.

Ready Fluidic Setup is similar to Ready Production. The main difference is that Fluidic Setup operations are not blocked by Load Required; therefore, Ready Fluidic Setup is active even when a Load is required. Like Ready Production, Ready Fluidic Setup is inactive when a Reference is required.

### 5.5.4. Using a Logic In as a Front Panel lock

The Front Panel Lock parameter allows locking of different portions of the Front Panel HMI. This allows the PLC to lockout operator access to certain features. This lock is configured using the Front Panel Lock parameter. The Front Panel Lock parameter is a bitfield with each bit locking out a different portion of the Front Panel. Setting Bit 0 of the Front Panel Lock prohibits the Operator from being able to change most of the parameters on the Front Panel. Setting Bit 1 of the Front Panel Lock prohibits the Operator from being able to use the pushbuttons on the Front Panel. Setting Bit 2 of the Front Panel Lock prohibits the Operator from being able to modify the Fluid Direction parameter. Setting Bit 3 of the Front Panel Lock prohibits the operator from being able to modify the Mode parameter.

Once the Front Panel Lock bits are configured, one of the Logic Ins may be configured for <LOCK> FRONT PANEL. The Lock Front Panel signal will then be able to enable and disable access to the Front Panel based on the Front Panel Lock configuration.

**Occasionally, using the Front Panel Lock results in the PLC Engineer being locked out of the Front Panel. To unlock the Front Panel, enter the Keylock password (passwords are contained in TB-105 included with the controller shipment paperwork) to change to the Keylock permission level and then modify the Front Panel Lock parameter to a less restrictive configuration.**